

**A NEW SPECIES OF *PAGURITTA*
(CRUSTACEA: DECAPODA: ANOMURA: PAGURIDAE)
FROM THE WESTERN PACIFIC, PREVIOUSLY CONFUSED
WITH *P. HARMSI* OR *P. GRACILIPES***

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ABSTRACT.—A comparison of specimens from Kushimoto (Kii Peninsula, Honshu mainland, Japan), Okinawa-jima Island (Ryukyu Archipelago), Ogasawara (=Bonin) Islands, and Philippine Archipelago, has revealed that McLaughlin & Lemaitre (1993) mixed two species under the name *Paguritta gracilipes*. One of them is described and illustrated as new species, *Paguritta vittata*. *Paguritta gracilipes* Melin, 1939 s. str., appears to be restricted to Ogasawara Islands. While the new species is considered to be distributed from southern Japan to Philippines, it does not occur in Ogasawara Islands. The new species shows a strong sexual dimorphism in morphology of the palm of the right cheliped and relative stoutness of the ambulatory pereopods. Its closest relative is *P. harmsi* (Gordon, 1935), and characters distinguishing the two species are discussed. An emended key to the species of the genus is provided.

INTRODUCTION

Melin (1939) described a new taxon, *Paguritta gracilipes* based on two specimens, one male and one female, from Takinoura, Ogasawara Islands (=Bonin Islands). Although the species long had been considered to be a synonym of *P. harmsi* (Gordon, 1935) (see Forest, 1961; Miyake, 1978; Lewinsohn, 1978), McLaughlin & Lemaitre (1993) concluded that *P. gracilipes* was a species distinct from *P. harmsi*. Lewinsohn (1978) and McLaughlin & Lemaitre (1993) indicated that differences of coloration were sufficiently reliable to recognition of closely related species of *Paguritta*. Without confirmation of the coloration of true *P. gracilipes*, however, McLaughlin & Lemaitre (1993) assumed that a single specimen from Philippines, examined by Schumacher (1977) and Lewinsohn (1978), represented *P. gracilipes*. McLaughlin & Lemaitre (1993) considered that the striped color patterns of the chelipeds reported by Lewinsohn (1978) and figured by Schumacher (1977) applied to *P. gracilipes* as a diagnostic character of that species.

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We had an opportunity to compare 15 specimens of a species, which showed coloration agreeing well with the description of *P. gracilipes* given by McLaughlin & Lemaitre (1993), from Okinawa-jima Island and Kushimoto, Kii Peninsula, Japan, with three topotypic specimens of *P. gracilipes* from Ogasawara Islands, which closely agree with the detailed accounts of the syntypes of that species provided by McLaughlin & Lemaitre (1993) in morphological characters. The former have brown stripes on the chelipeds, ocular peduncles and body, while the topotypic material of *P. gracilipes* had an entirely different coloration: the chelipeds are mottled with orange, light purple and cream, and the ocular peduncles and body are uniformly cream yellow. Furthermore, it was found that the number of ventral spines on the ambulatory dactyls was fewer in the striped specimens than in the Ogasawara specimens (three to five versus six or seven). This character was used by McLaughlin & Lemaitre (1993) to separate it from all other members of the genus. Our observations indicate that the species with the striped color pattern represents an undescribed taxon. The Philippine specimen reported by Schumacher (1977) and Lewinsohn (1978) has been reexamined and is referred to the new species.

The specimens examined, including the type series of the new species, are deposited in the Natural History Museum and Institute, Chiba, with a code of CBM-ZC, and the Nationaal Natuurhistorisch Museum, Leiden, The Netherlands (RMNH). The abbreviation SL is used for shield length, as measured from the tip of the rostrum to the midpoint of the posterior margin of the shield. Illustrations were made with the aid of drawing tube mounted on a OLYMPUS SZH. Terminology follows that of McLaughlin & Lemaitre (1993) in general, but Lemaitre (1995) is referred to for the posterior carapace structure.

Data of the comparative specimens of *P. gracilipes* are as follows: CBM-ZC 2276, 1 male (SL 2.7 mm), 2 females (SL 3.5, 3.8 mm), Tsurihama, Chichi-jima Island, Ogasawara Islands, 1.5-3 m, SCUBA diving, coll. E. Nishi, 27 Jun.1995.

DESCRIPTION

Paguritta vittata, new species

(Figs. 1-5)

Orthopaguropsis harmsi: Serène, 1957: 107, figs. 1-3.

Paguritta harmsi: Forest, 1961: 238 (in part); Schumacher, 1977: 371, figs. 1, 2; Lewinsohn, 1978: 245 (in part); Miyake, 1982: 121 (in part), pl. 41 fig. 2 left (male); Takeda, 1986: 124, unnumbered color fig.; Kamezaki et al., 1988: 124, unnumbered color fig.; Imafuku, 1992: 235, unnumbered color fig.

Paguritta gracilipes: McLaughlin & Lemaitre, 1993: 5 (in part); Takeda, 1994: 198, fig. 1; Asakura, 1995: 367 (in part), pl. 97 fig. 14.

Material examined.-Holotype- ovig. female (SL 2.8 mm) (CBM-ZC 2168), Zanpa-misaki, Okinawa-jima Island, Ryukyus, 26°26.3'N, 124°27.8'E, 1-2 m, coll. E. Nishi (SCUBA diving), 23 Mar.1995.

Paratypes- 1 male (SL 2.1 mm), 1 female (SL 2.2 mm) (CBM-ZC 2169), data as for holotype; 1 ovig. female (SL 2.1 mm) (CBM-ZC 2170), Zanpa-misaki, Okinawa-jima Island, 1-2 m, coll. E. Nishi (SCUBA diving), 3 Aug.1992; 2 females (SL 2.3, 3.2 mm), 1 juv. (SL 1.0 mm) (CBM-ZC 2264), Maeda-misaki, Okinawa-jima Island, 26°26.3'N, 124°31.4'E, 1-2 m, coll. E. Nishi (SCUBA diving), 30 May.1990; 1 ovig. female (SL 3.1 mm) (CBM-ZC 2265), data as for holotype; 1 male (SL 2.2 mm) (CBM-ZC 2266), Andonohana, Kushimoto, Kii Peninsula, 33°21.8'N, 135°45.1'N, 10 m, coll. K. Nomura (SCUBA diving), 7 Jun.1995; 3 males (SL 1.9-2.5 mm) (CBM-ZC 2275), 1 female (SL 2.2

mm), 1 ovig. female (SL 2.7 mm), Zanpa-misaki, 2-5 m, coll. E. Nishi (SCUBA diving), 5 May, 1995.

Others: 1 male (SL 2.1 mm) (RMNH D 31935), Philippine Islands (from aquarium), 1973, identified as *Paguritta gracilipes* by McLaughlin & Lemaitre (1993).

Description of females.-Shield (Fig. 2A, B) longer than broad (ratio of shield length/breadth 1.13-1.30), dorsal surface almost glabrous, but with few scattered tufts of short setae; anterior margin between rostrum and lateral projections concave, without row of setae; anterolateral margins sloping. Rostrum prominent, triangular, terminating in spinule. Lateral projections obtusely triangular, armed with minute terminal spinule. Posterior carapace (Fig. 2B) membranous except for moderately well calcified posteromedian plate, with sparse row of tufts of setae on branchial region; posteromedian plate separated in two sections by distinct transverse suture and row of setae; cardiac sulci slightly divergent posteriorly, extending nearly to posterodorsal margin; sulci cardiobranchialis strongly convergent and connecting posteriorly with cardiac sulci.

Ocular peduncles (Fig. 2A) shorter than shield (ratio of ocular peduncle length/shield length 0.75-0.92), slightly broadened basally and slightly constricted medially; corneae slightly dilated. Ocular acicles elongate, narrow, terminating in strong spine, with acute or subacute lateral or submarginal spine; separated basally by about half basal width of one acicle.

Antennular peduncles (Fig. 2A) reaching beyond distal margin of cornea; basal segment with unarmed mesial and lateral surfaces.

Antennal peduncle (Fig. 2A, C) reaching or overreaching distal margin of corneae; fifth and fourth segments with few scattered setae; third segment without spine at ventrodistal margin; second segment stout, with dorsolateral distal angle strongly produced, terminating in acute spine and with two or three additional spines on mesiodistal margin, dorsomesial distal angle unarmed. Antennal acicle reaching base of cornea, terminating in small spinule and with long marginal setae. Antennal flagellum (Fig. 2D) long, each article with one or two short setae and pair of long setae bearing minute setules.

Mandible (left) (Fig. 3A) with incisor process bearing two acute teeth at anteromesial corner; palp three-segmented. Maxillule (Fig. 3B) with well-produced, triangular external lobe of endopod, internal lobe with two setae. Maxilla (Fig. 3C) with endopod slightly inflated proximally, reaching anterior margin of scaphognathite. First maxilliped (Fig. 3D) with endopod reaching beyond anterior margin of distal endite. Second maxilliped (Fig. 3E) with basis-ischium fusion incomplete. Third maxilliped (Fig. 3F) with basis-ischium fusion incomplete; ischium (Fig. 3G) with well developed crista dentata, one accessory tooth (rarely two teeth present on either side); merus and carpus unarmed.

Right cheliped (Fig. 4A-C) with chela moderately broad, dorsomesial margin strongly convex. Dactyl approximately as long as palm, terminating in strong calcareous claw; cutting edge with row of small calcareous teeth; dorsal surface with numerous long setae and few small spinules basally; dorsomesial margin with row of acute spines. Palm about as long as carpus; dorsal margins of palm and fixed finger circumscribed by row of prominent, relatively stout or slender curved spines, five or six on dorsomesial margin strongest; dorsal surface nearly flattened, armed with scattered small spines or spinules sometimes appearing as irregular rows, also with numerous scattered long setae; fixed finger with dorsal surface bearing small spines basally, cutting edge with row of small calcareous teeth and terminating

in calcareous claw; mesial, lateral and ventral surfaces of palm all glabrous, lateral surface hardly visible from dorsal view, ventral surfaces of dactyl and fixed finger with scattered tufts of moderately short setae. Carpus subequal to merus in length; dorsomesial distal angle unarmed; dorsolateral margin armed with row of three spines and moderately strong dorsodistal spine; dorsal surface with scattered long setae distally; mesial, lateral and ventral surfaces glabrous, with long setae ventrodistally. Merus and ischium unarmed but with few long setae dorsodistally or ventrally.

Left cheliped (Fig. 4D-F) with dactyl slightly shorter than palm, cutting edge with row of small corneous teeth and terminating in small corneous claw; dorsal surface unarmed, but with scattered long setae; dorsomesial margin with row of small spines and long setae. Palm distinctly shorter than carpus; propodal-carpal articulation rotated clockwise 15-30° from perpendicular; dorsomesial margin sloping, with few small spines, dorsal surface with numerous scattered setae but without spines, dorsolateral margin with row of strong spines slightly curved upward and decreasing in size on fixed finger; cutting edge of fixed finger with row of small calcareous teeth and terminal calcareous claw; ventral surfaces of fixed finger and dactyl with scattered tufts of long or short setae. Carpus subequal to length of merus; dorsodistal margin armed dorsally with three strong spines and mesially with one small spine, unarmed laterally; dorsal surface with one moderately strong spine and numerous long setae. Merus with few small tubercles ventrally. Merus and ischium almost glabrous, with few setae dorsally and numerous setae ventrally.

Second pereopods (Fig. 4G) longer than third (Fig. 4I); dactyls of both (Fig. 4H, I) 0.6 times as long as propodi, terminating in strong corneous claws, dorsal surfaces and mesial and lateral faces all with long setae, ventral margins each with three or four (rarely five) long corneous spines. Propodi distinctly longer than carpi, dorsal and ventral surfaces with scattered long setae, ventrodistal angles each with single corneous spine; carpi and meri unarmed, but with scattered long setae dorsally and shorter setae ventrally. Ischia of second and third pereopods generally similar in shape; coxae of third pereopods (Fig. 2E) each with large gonopore.

Fourth pereopods (Fig. 3H) relatively stout, subchelate; dactyl stout, strongly curved, with row of corneous spines on ventral margin; propodal rasp composed of single row of corneous scales; distal three segments with numerous setae on dorsal surfaces. Fifth pereopods chelate.

Sternite of third pereopods (Fig. 2E) with anterior lobe subrectangular, anterior margin armed with four to six rather acute spines. Sternite of fifth pereopods (Fig. 2F) divided into two distinct lobes, each with prominent anteriorly directed acute spine.

Abdomen nearly straight, with biramous pleopods on left side of second to fourth somites. Uropods (Fig. 2G, H) with moderately short propods bearing cluster of 6-8 small tubercles; exopods elongate, 3.5 times as long as wide; endopod reaching beyond exopodal bases. Telson (Fig. 2G) with posterior lobes and anterior lobes separated by prominent transverse suture; terminal margins of posterior lobes each with 7 to 9 moderately strong calcareous spines interspersed with 1 or 2 smaller spines.

Description of males.-Right cheliped (Fig. 5A, G) with chela more or less elongate. Dactyl approximately as long as palm. Palm distinctly longer than carpus; dorsal margins of palm circumscribed by row of moderately strong, curved spines, spines on weakly convex

to nearly straight dorsomesial margin curved inward; dorsal surface varying from almost flat to convex, with few spinules; lateral surface partially visible from dorsal view.

Ambulatory pereopods (Fig. 5C, D) relatively longer and more slender than in females. Gonopores on coxae of third pereopods (Fig. 5E) relatively smaller than those in females.

Gonopores on coxae of fifth pereopods (Fig. 5F) obscured posteriorly by row of setae; vas deferens protruded.

Abdomen without paired or unpaired pleopods.

Coloration in life (Fig. 1).-Shield cream-yellow with four brown stripes (two submedian and two along lateral margins). Ocular peduncles with four brown stripes on cream background; corneae deep brown; acicles cream. Antennular and antennal peduncle cream in general, second segment of antennal peduncle pale brown; antennal flagellum generally brown dorsally with transparent area in proximal one-fourth. Posterior carapace with two brown stripes continuing from two submedian stripes on shield; pterygostomian region grayish. Abdomen dorsally with four brown stripes on cream background. Maxillipeds grayish green or grayish blue. Chelipeds similarly colored, entirely cream-yellow with dark brown stripes; dorsal surface of palm with three stripes, lateral and mesial faces with one stripe; carpus with five stripes in total, each continuing with stripe on palm. Ambulatory legs cream.

Biological notes.-*Paguritta vittata* usually lives in calcareous tubes of *Spirobranchus corniculatus* Grube (Polychaeta: Serpulidae), and rarely in tubes of other species of serpulid polychaetes or shells of *Dendropoma* sp. (Gastropoda: Vermetidae), which were usually associated with the living massive or plate-like coral, *Porites* spp.

The eggs of *P. vittata* are quite large, globular in shape, measuring 0.79-0.93 mm in diameter. The number was relatively few for pagurids, 48 in one ovigerous specimen (CBM-ZC 2275, SL 2.7 mm). This observation suggests that this species may have an abbreviated larval development.

Distribution.-Southern Japan northward to Kii Peninsula, Ryukyu Archipelago, Philippines and Vietnam; subtidal to 10 m.

Etymology.-The name is from the Latin *vittatus* (=with stripes), referring to the characteristic striped color pattern on the chelipeds and the body.

DISCUSSION

Paguritta vittata appears closest to *P. harmsi*, the two showing characters such as five or fewer than five ventral spines on the ambulatory dactyls, and dorsal surface of the left palm with few spinules. Our observation confirms McLaughlin & Lemaitre's (1993) indication that *Paguritta gracilipes* is readily distinguished from all other members of *Paguritta* in having more numerous ventral spines on the ambulatory dactyls, i.e., six to eight versus five or less than five.

McLaughlin & Lemaitre (1993) indicated that living color was the most diagnostic



Fig. 1. *Paguritta vittata*, new species. Top, paratype male from Kushimoto, SL 2.2 mm, CBM-ZC 2266 (photo courtesy of K. Nomura), inhabiting a tube in the coral *Porites* sp.; Bottom, female just outside tube housing, from Zanpa-misaki, Okinawa-jima Island, specimen not preserved (photo taken by E. Nishi).

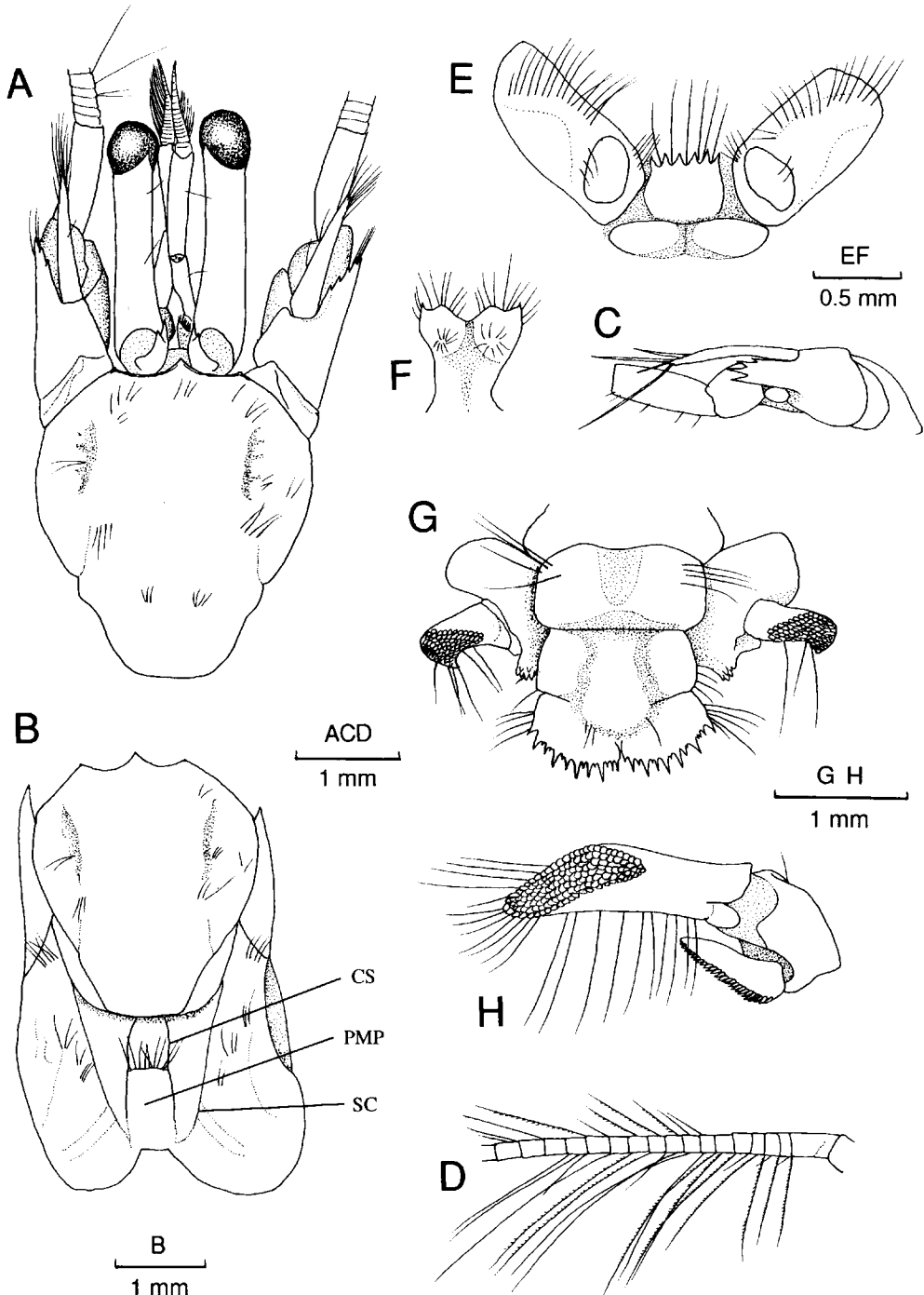


Fig. 2. *Paguritta vittata*, new species. Holotype female, SL 2.8 mm, CBM-ZC 2168. A, shield and cephalic appendages, dorsal; B, carapace, dorsal; C, left antennal peduncle, lateral; D, proximal part of antennal flagellum, dorsolateral; E, coxae and sternal lobes of third pereopods, ventral; F, sternal plate of fifth pereopods, ventral; G, telson, posterior section of sixth abdominal tergite and basal part of uropods, dorsal; H, left uropod, lateral. Abbreviations are as follows: CS=cardiac sulcus; PMP=posteromedian plate; SCB=sulcus cardiobranchialis.

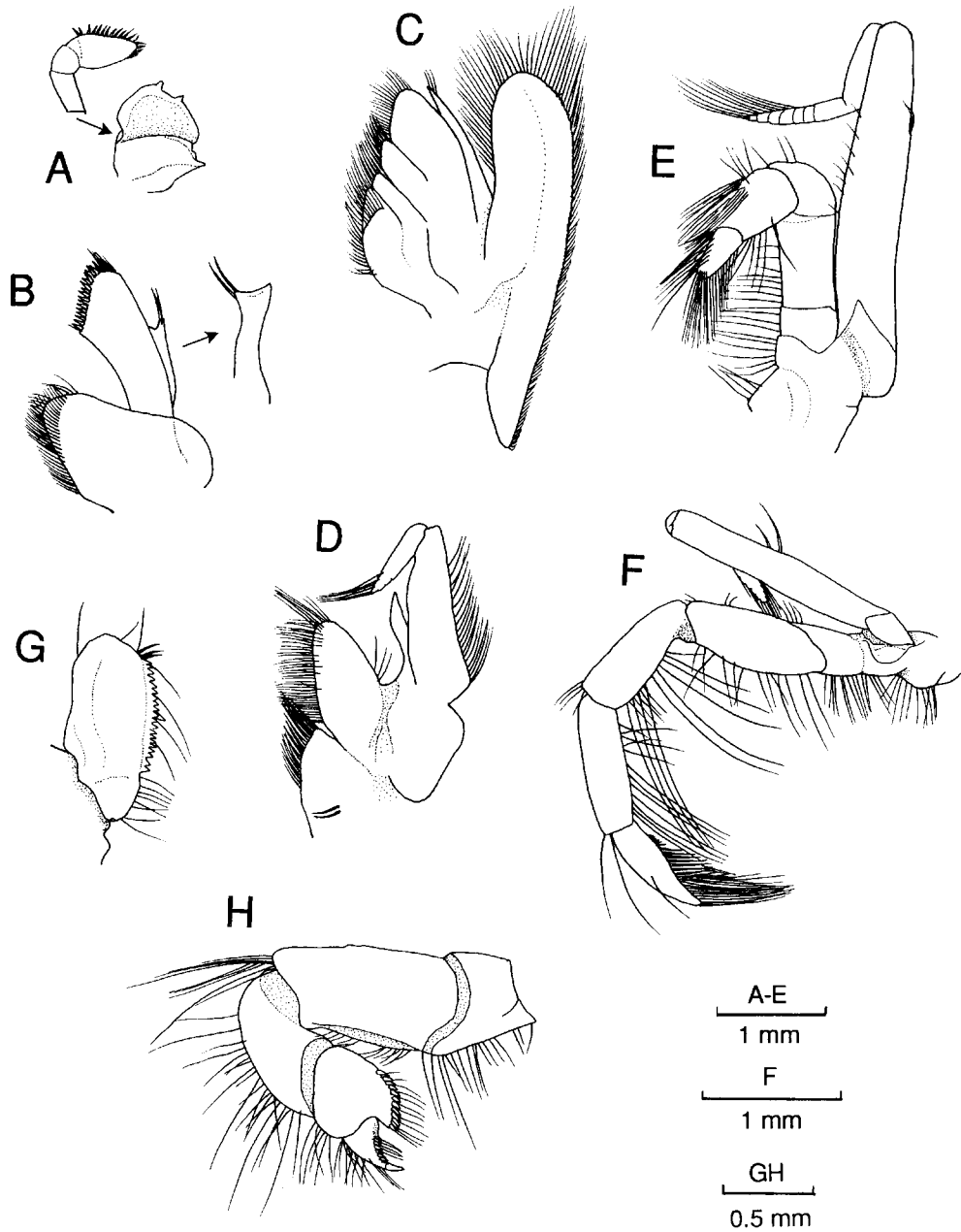


Fig. 3. *Paguritta vittata*, new species. Holotype female, SL 2.8 mm, CBM-ZC 2168. Left mouthparts and fourth pereopod. A, mandible, internal; B, maxillule, external; inset, endopod, lateral; C, maxilla, external; D, first maxilliped, external; E, second maxilliped, external; F, third maxilliped, lateral; G, same, ischium, internal; H, fourth pereopod, lateral.

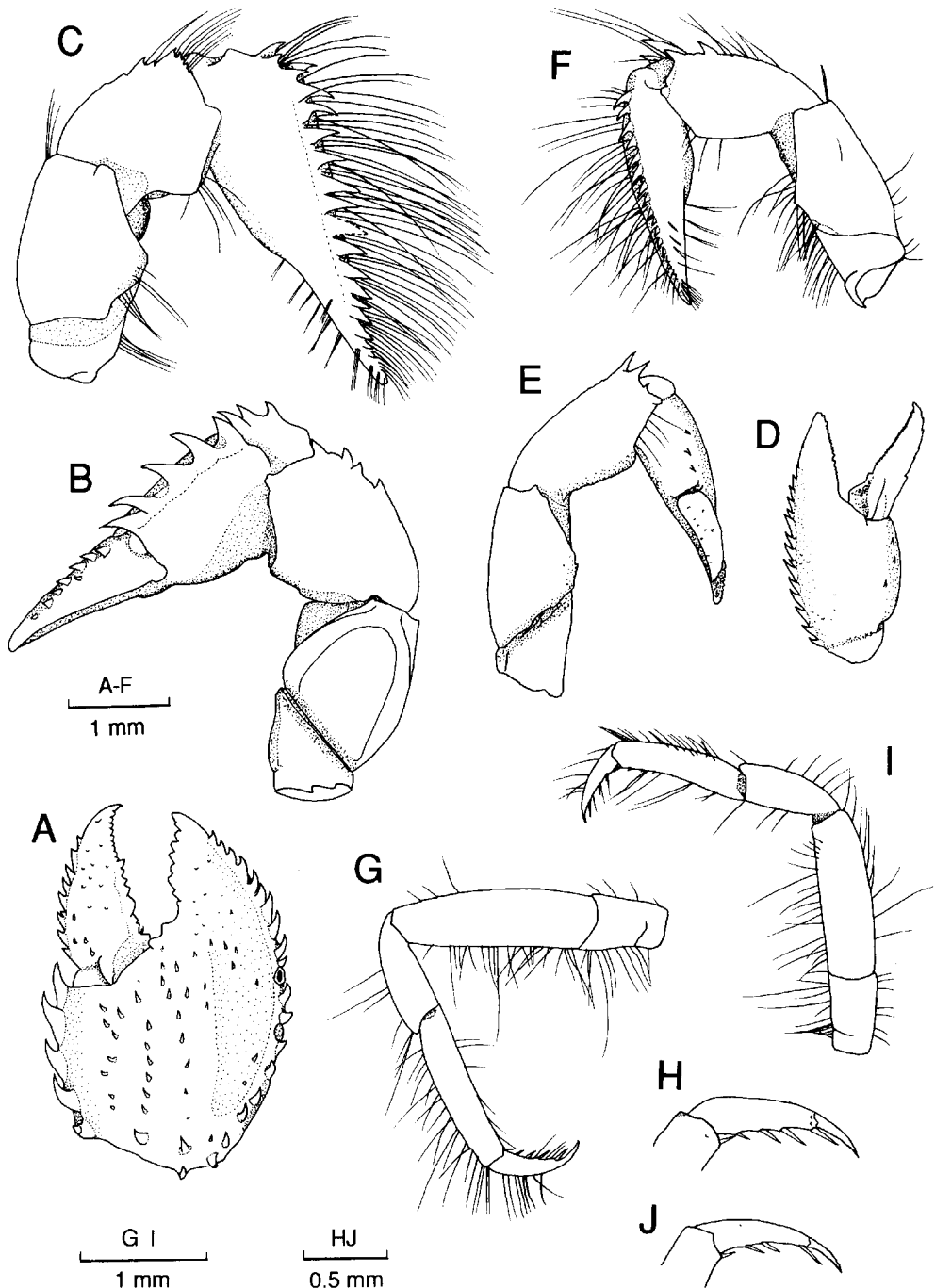


Fig. 4. *Paguritta vittata*, new species. Holotype female, SL 2.8 mm, CBM-ZC 2168. A, right chela, dorsal, setae omitted; B, right cheliped, mesial, setae omitted; C, same, lateral; D, left chela, dorsal, setae omitted; E, left cheliped, mesial, setae omitted; F, same, lateral; G, left second pereopod, lateral; H, dactyl of same, mesial, setae omitted; I, left third pereopod, lateral; J, dactyl of same, setae omitted.

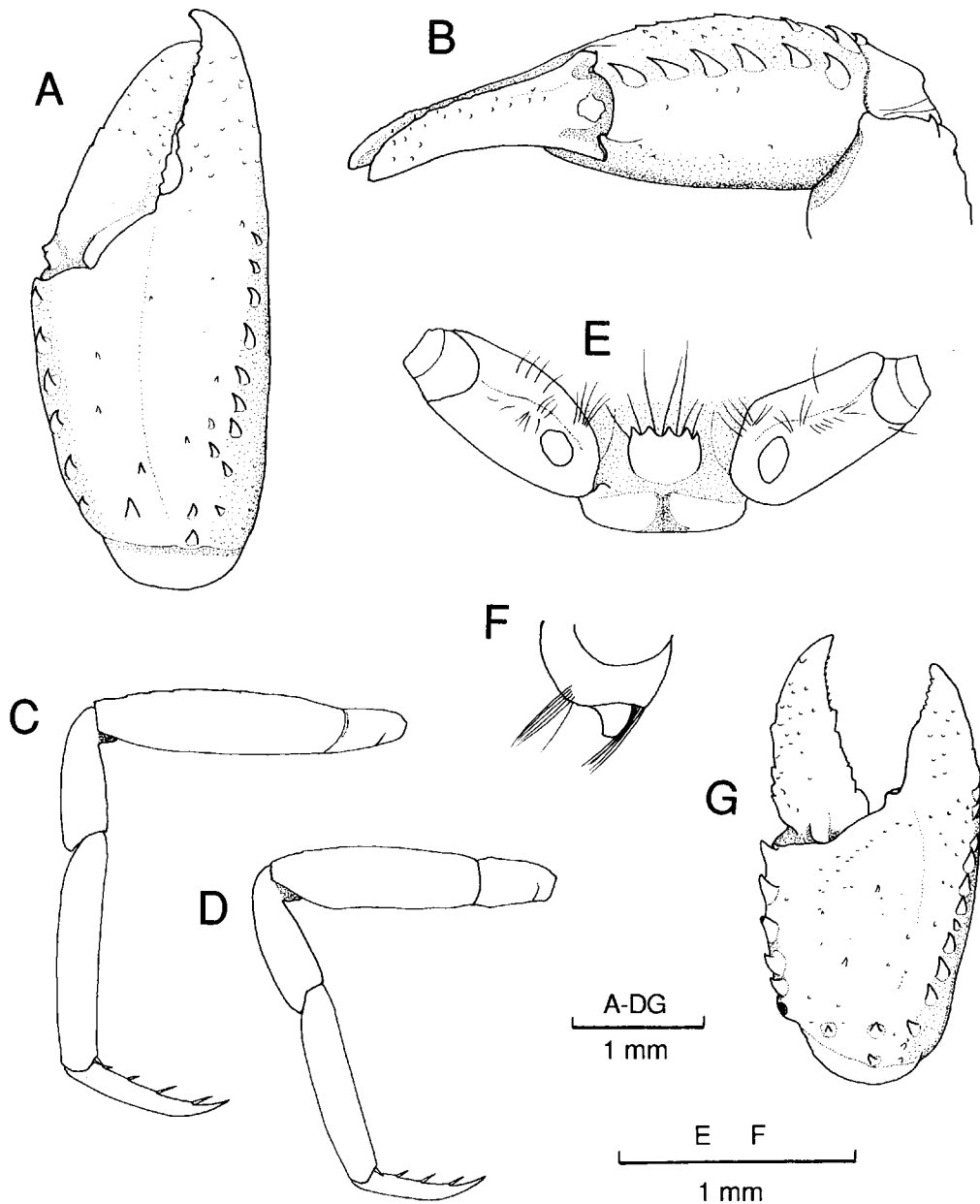


Fig. 5. *Paguritta vittata*, new species. A-F, paratype male from Kushimoto, SL 2.2 mm, CBM-ZC 2266; G, paratype male from Zanpa-misaki, Okinawa-jima, SL 2.5 mm, CBM-ZC 2275. A, right chela, dorsal, setae omitted; B, same, mesial, setae omitted; C, left second pereopod, lateral, setae omitted; D, left third pereopod, setae omitted; E, coxae and sternal lobes of third pereopods, ventral; F, coxae of left fifth pereopod, lateral; G, right chela, dorsal, setae omitted.

character in the recognition of the species of *Paguritta*. In *P. vittata*, the palms of the chelipeds have three dark brown stripes on the yellow cream dorsal surfaces. *P. harmsi* has a reticulated or mosaic color pattern of brown and cream on the chelae (McLaughlin & Lemaitre, 1993). In the absence of color, *P. vittata* can be distinguished from *P. harmsi* by its relatively longer shield, greater number of longer spines on each terminal margin of the telson (six to nine longer spines interspersed by spinules versus three to five longer spines interspersed by spinules), and the presence of a cluster of six to eight tubercles, instead of less than six, on the posterior face of the uropodal protopod. The shape of the anterior lobe of the sternite of the third pereopods also distinguishes the new species from *P. harmsi*. In *P. vittata*, the anterior lobe is subrectangular in shape, whereas in *P. harmsi* it is relatively broad and rather ovate in shape.

The striped color pattern of the chelipeds of the new species, can not be applied to *P. gracilipes*. As already noted, the newly obtained topotypic specimens from Ogasawara Islands show that *P. gracilipes* has a mottled color pattern of brown, light purple and yellow cream on the chelae, uniformly pale brown ocular peduncles, and uniformly cream abdomen.

The six available males of *P. vittata* have not only the typical paired gonopores on the coxae of the fifth pereopods, but also paired female-type gonopores on the coxa of the third pereopods. There is no indication of rhizocephalan infestation, and consequently, the presence of the female-type gonopores in the males is considered to be normal condition for *P. vittata*. In other hermit crabs, a similar apparent hermaphroditism is known in *Dardanus deformis* (Diogenidae) and the congeneric *Paguritta kroppi* (see McLaughlin & Lemaitre, 1993). This condition also appears to be a possible diagnostic character of *P. vittata*. It is unknown at present whether this is an indication of sex reversal.

McLaughlin & Lemaitre (1993) examined two syntypes of *P. gracilipes* and one supplemental specimen from Philippine Archipelago identified as *P. harmsi* by Schumacher (1977) and Lewinsohn (1978), and they concluded that the specimens belonged to *P. gracilipes*. We examined the Philippine specimen (RMNH D 31935) and have found that all ambulatory pereopods were missing in the specimen and that the color has faded to straw entirely. Our examination showed that in the absence of the ambulatory pereopods *P. vittata* may be distinguished from *P. gracilipes* by the possession of female gonopores on the third pereopods in the males, which are absent in *P. gracilipes*. The presence of the female gonopores in the Philippine male specimen and the striped color pattern described or figured by Schumacher (1977) and Lewinsohn (1978), evidentially place this specimen in *P. vittata*. The absence of the ambulatory pereopods in the Philippine specimen might have led McLaughlin & Lemaitre (1993) to confuse *P. gracilipes* with the present new species.

Based on his described color patterns, we believe that Serène's (1957) specimens of *Orthopaguropsis harmsi* also should be referred to the new species. Miyake (1978) reported *Paguritta harmsi* from Amami-Oshima Island, but McLaughlin & Lemaitre (1993) noted that his diagnosis unquestionably pertained to species other than *P. harmsi* s. str. It is likely that Miyake (1978) was actually reporting the present new species, but it is difficult at present to determine without reexamination of his specimens. Miyake's figure (1982: pl. 41-2), shown as *P. harmsi*, most certainly depicts two species of *Paguritta*. There is little doubt that the striped specimen on the left, collected from Sesoko-jima Island, Okinawa, is *P. vittata*. The individuals shown by color photographs as *P. harmsi* (Takeda, 1986; Kamezaki et al., 1988; Imafuku, 1992) are all *P. vittata*. Takeda (1994) and Asakura (1995) also showed color photographs of *Paguritta* with striped chelipeds as *P. gracilipes*. Their identifications,

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