

**Revisiting *Paguritta gracilipes* (Crustacea: Decapoda:
Anomura: Paguridae), with Description of
its Coloration in Life**

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The coral-inhabiting hermit crab *Paguritta gracilipes* Melin, 1939 has been represented only by the two syntypes and three more recent specimens, all from the Ogasawara Islands. An additional specimen obtained from Hachijo Island in the Izu Islands now allows us to describe more precisely the coloration in life, which is an important diagnostic feature for identifying the species of the genus. The study of one of the two syntypes and other available specimens has revealed morphological inaccuracies in published accounts and made possible the description of the left cheliped for the first time. This species is rediagnosed and illustrated in detail.

Key Words: Crustacea, Decapoda, Anomura, *Paguritta gracilipes*, re-description, coloration in life, Japan.

The coral-inhabiting hermit crab genus *Paguritta* Melin, 1939 was reviewed recently by McLaughlin and Lemaitre (1993). They redescribed the type species of the genus, *P. gracilipes* Melin, 1939, based on the two syntypes from the Ogasawara Islands and a supplemental specimen from the Philippines. Komai and Nishi (1996) found that the Philippine specimen referred to *P. gracilipes* by McLaughlin and Lemaitre (1993) represented an undescribed species, and described it as *P. vittata* Komai and Nishi, 1996. The Japanese authors also referred three topotypic specimens from the Ogasawara Islands to *P. gracilipes*, noting the coloration of the recently preserved material.

Recently, an additional specimen of this rare species collected from Hachijo Island in the Izu Islands has been made available for examination. This specimen now enables us to describe the coloration in life, an important diagnostic feature for identifying the species of *Paguritta*. Reexamination of the male syntype has disclosed that the redescription of this species by McLaughlin and Lemaitre (1993) contained a misinterpretation of the dorsal surface armature of the palm of the right cheliped; furthermore, the morphology of the left cheliped has been unknown, and it is here described in detail. *Paguritta gracilipes* is herein rediagnosed.

Specimens examined in this study are deposited in the following institutions:

Coastal Branch of the Natural History Museum and Institute, Chiba (CMNH); Natural History Museum and Institute, Chiba (CBM); Swedish Museum of Natural History (SMNH). One measurement, shield length (sl), provides an indication of the size of the specimens examined. General terminology used in the description follows McLaughlin (1974), with exception of the posterior carapace (see Lemaitre 1995), fourth pereopod (see McLaughlin 1997), and gill structure (see McLaughlin and de Saint Laurent 1998). The drawings were made with the aid of a drawing tube mounted on Leica MZ-8 stereomicroscope.

Taxonomy

Paguritta gracilipes Melin, 1939

(Figs 1–5)

Paguritta gracilipes Melin, 1939: 51, figs 30, 31; Forest 1951: 185; Gordan 1956: 324; McLaughlin and Lemaitre 1993: 5 (in part), figs 1, 2; Asakura 1995: 367 (in part), not pl. 97, fig. 14; Komai and Nishi 1996: 462.

Paguritta harmsi: Miyake 1982: 121 (in part), pl. 41, fig. 2 (right); 1991: 121 (in part), pl. 41, fig. 2 (right); 1999: 121 (in part), pl. 41, fig. 2 (right). [Not *Paguritta harmsi* (Gordon, 1935). See "Remarks"]

Paguritta morgani: McLaughlin and Lemaitre 1993: 15 (in part). [See "Remarks"]

Paguritta sp. 1: Minemizu 2000: 158, unnumbered fig.

Not *Paguritta gracilipes*: Takeda 1994: 198, fig. 1; Asakura 1995, pl. 97, fig. 14; Takeda and Kawashima 1997: 178, unnumbered fig.; Debelius 1999: 236; Masuda 1999: 57, unnumbered fig.; Yoshino 1999: 27, unnumbered fig.; Kobayashi 2000: 186, unnumbered fig. [= *Paguritta vittata* Komai and Nishi, 1996. See "Remarks"]

Not *Paguritta gracilipes*: Gosliner *et al.* 1996: 225. [See "Remarks"]

Material examined. Takinoura, Ani-jima Island, Bonin (=Ogasawara) Islands, 28.VII.1914, coll. S. Bock, syntype male (sl 2.5 mm) (SMNH Type no. 2293); Tsurihama Beach, Chichi-jima Island, Ogasawara Islands, 1.5–3 m, 27.VI.1995, SCUBA diving, coll. E. Nishi, 1 male (sl 2.7 mm), 2 females (sl 3.5, 3.8 mm) (CBM-ZC 2276); Yaene Harbor, Hachijo Island, Izu Islands, 5 m, 26.XI.1999, SCUBA diving, coll. S. Kato and J. Okuno, 1 female (sl 3.9 mm) (CMNH-ZC 00255).

Redescription. Eleven pairs of biserial phyllobranchiae.

Shield (Fig. 2A) 1.1–1.2 times longer than broad; dorsal surface with few tufts of setae anteriorly and laterally; anterior margin between rostrum and lateral projection weakly concave; anterolateral margins sloping. Rostrum broadly triangular, terminating in spinule, overreaching lateral projections. Lateral projections obtusely triangular, each armed with minute submarginal spinule. Posterior carapace (Fig. 2B) membranous except for moderately well calcified posteromedian plate, with tufts of long setae on branchial region; posteromedian plate separated in two sections by transverse suture, posterior section with pair of tufts of setae on anterior margin; *sulci cardiobranchialis* obsolete.

Ocular peduncles (Fig. 2A) about 0.8 times as long as shield, slightly broadened basally, with tufts of long setae dorsomesially; corneas not dilated. Ocular acicles elongate, narrow, terminating in rounded process, with strong submarginal spine.



Fig. 1. *Paguritta gracilipes* Melin, 1939. Top, female from Hachijo Island (sl 3.9 mm, CMNH-ZC 00255) in life, inhabiting empty tube of unidentified serpulid polychaete made on massive coral *Porites* sp. (photographed by M. Sumi); bottom, same, entire animal, dorsal (photographed by J. Okuno).

Antennular peduncles (Fig. 2A) reaching or slightly overreaching distal margins of corneas when fully extended; basal segment without spinule on statocyst lobe and ventromesial distal angle.

Antennal peduncles (Fig. 2A) nearly reaching distal margins of corneas; fifth and fourth segments with few tufts of setae; third segment without spine on ven-

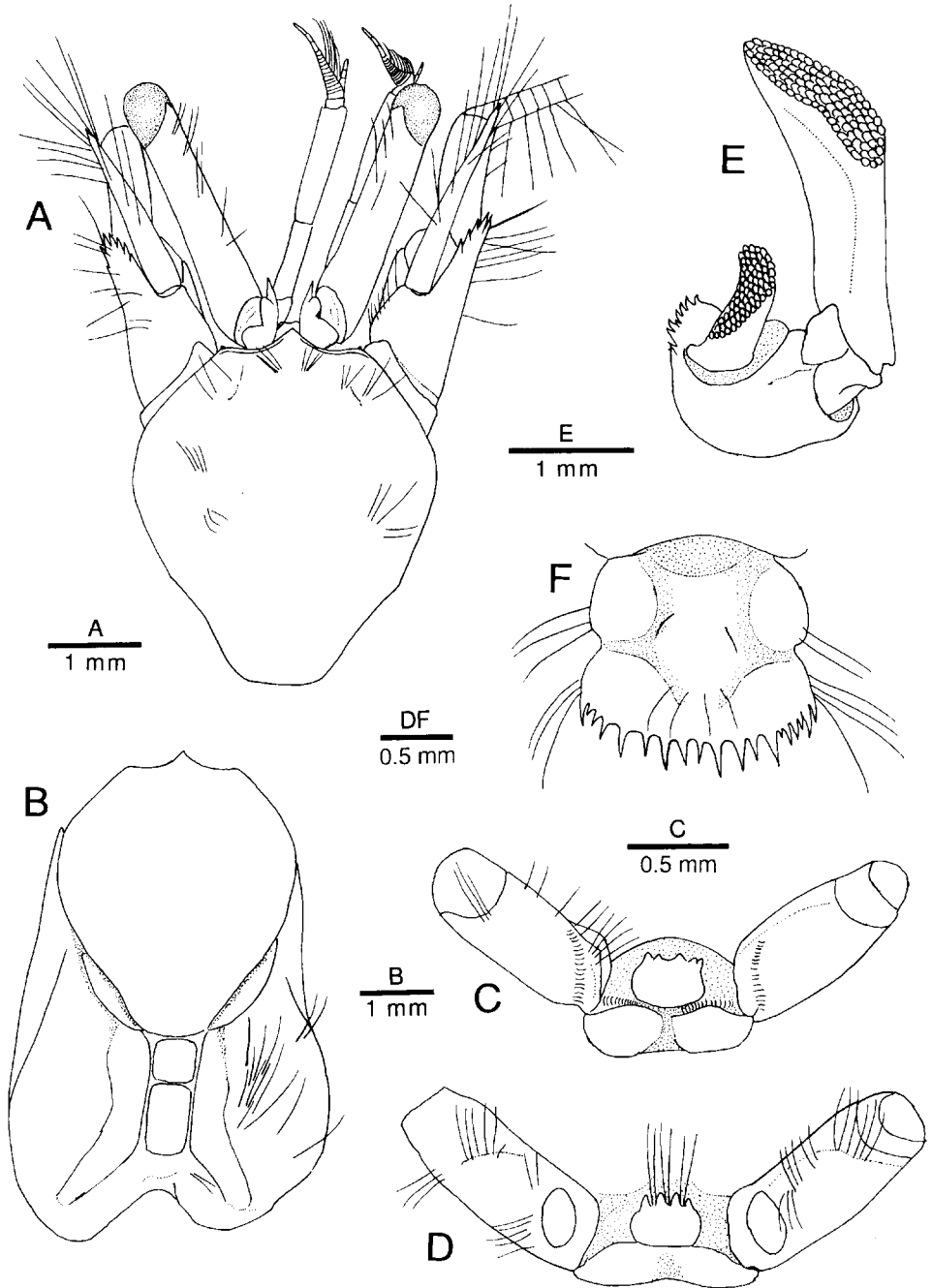


Fig. 2. *Paguritta gracilipes* Melin, 1939. A, B, D–F, female (sl 3.8 mm, CBM-ZC 2276) from Tsurihama Beach, Chichi-jima Island, Ogasawara Islands; C, syntype male (sl 2.5 mm, SMNH Type No. 2293) from Takinoura, Ani-jima Island, Ogasawara Islands. A, shield and cephalic appendages, dorsal; B, carapace, dorsal, setae partially omitted; C, D, coxae of third pereopods and sixth thoracic sternite, ventral; E, left uropod, lateral, setae omitted; F, telson, dorsal.

trodistal margin; second segment stout, with dorsolateral distal angle strongly produced, terminating in simple or bifid spine and with 3 or 4 additional spinules on mesiodistal margin, dorsomesial distal angle without spine; first segment without spine on lateral face; supernumerary segment large, rounded. Antennal acicle nearly reaching distal margin of cornea, terminating in small spine, with row of tufts of long setae on dorsal surface. Antennal flagellum (Fig. 1, bottom) long, each article with 1 or 2 short setae and pair of long setae bearing minute setules.

Mouthparts similar to those of *Paguritta vittata* (see Komai and Nishi 1996).

Right cheliped (Fig. 3) with chela 1.7–1.8 times longer than broad, dorsomesial margin weakly convex. Dactylus approximately as long as palm, terminating in rather slender, curved, calcareous claw; cutting edge with row of small calcareous teeth, these diminishing in size distally; dorsal surface slightly convex, with numerous tufts of long setae and/or short spiniform setae; dorsomesial margin with row of small, corneous-tipped spines, becoming smaller distally; mesial face unarmed, but with numerous tufts of setae; ventral surface strongly convex, with 2 rows of tufts of short setae. Palm about as long as carpus; dorsal margin (including fixed finger) circumscribed by row of prominent, rather slender, curved spines, 7–9 on dorsomesial margin strongest; dorsal surface nearly flattened, with few minute spinules and scattered spiniform setae and tufts of long setae; fixed finger broad-based, its cutting edge with row of small calcareous teeth in distal half, terminating in slender, curved, calcareous claw; lateral, mesial and ventral surfaces of palm all glabrous, only with few tufts of short setae; ventral surface of fixed finger with 2 rows of tufts of setae. Carpus almost as long as merus; dorsal surface convex, with row of low protuberances accompanied by small corneous spine and tufts of long setae on midline, dorsodistal margin with row of spines, mesial 2 of which strongest; lateral and mesial faces glabrous, with few very short setae; mesiodistal angle without spine. Merus nearly as long as deep, with row of sparse tufts of setae on dorsal surface; dorsodistal margin unarmed; lateral and mesial faces with few tufts of setae; ventral surface convex, unarmed, with few tufts of short setae. Ischium with ventromesial margin not delimited; ventral surface with tufts of setae. Coxa unarmed, with long setae.

Left cheliped (Fig. 4A–C) with chela about 2.3 times longer than wide. Dactylus almost as long as palm, its cutting edge with row of small corneous teeth, terminating in small, curved corneous claw; dorsal surface slightly convex, without spine, but with numerous tufts of long setae, dorsomesial margin not delimited; mesial face with 2 rows of tufts of short setae; ventral surface with 2 rows of tufts of short setae mesially. Palm distinctly shorter than carpus; propodal-carpal articulation rotated clockwise 15°–30° from perpendicular; dorsomesial margin not distinctly delimited, but with 3 or 4 small spines; dorsal surface nearly flattened, with numerous scattered tufts of setae and/or short spiniform setae but without spines or spinules, dorsolateral margin with row of strong spines, slightly curved and decreasing in size on fixed finger; fixed finger broad-based, its cutting edge with row of small, acute or subacute calcareous teeth, terminating in small calcareous claw; lateral, mesial, and ventral surfaces with few tufts of short setae, ventral surface of fixed finger with 2 or 3 rows of tufts of short setae mesially. Carpus subequal to merus in length; dorsal surface with row of few tufts of long setae on midline, dorsodistal margin with 3 or 4 strong spines and additional few small spines laterally; lateral face glabrous, with few very short setae; mesial face with row of tufts of

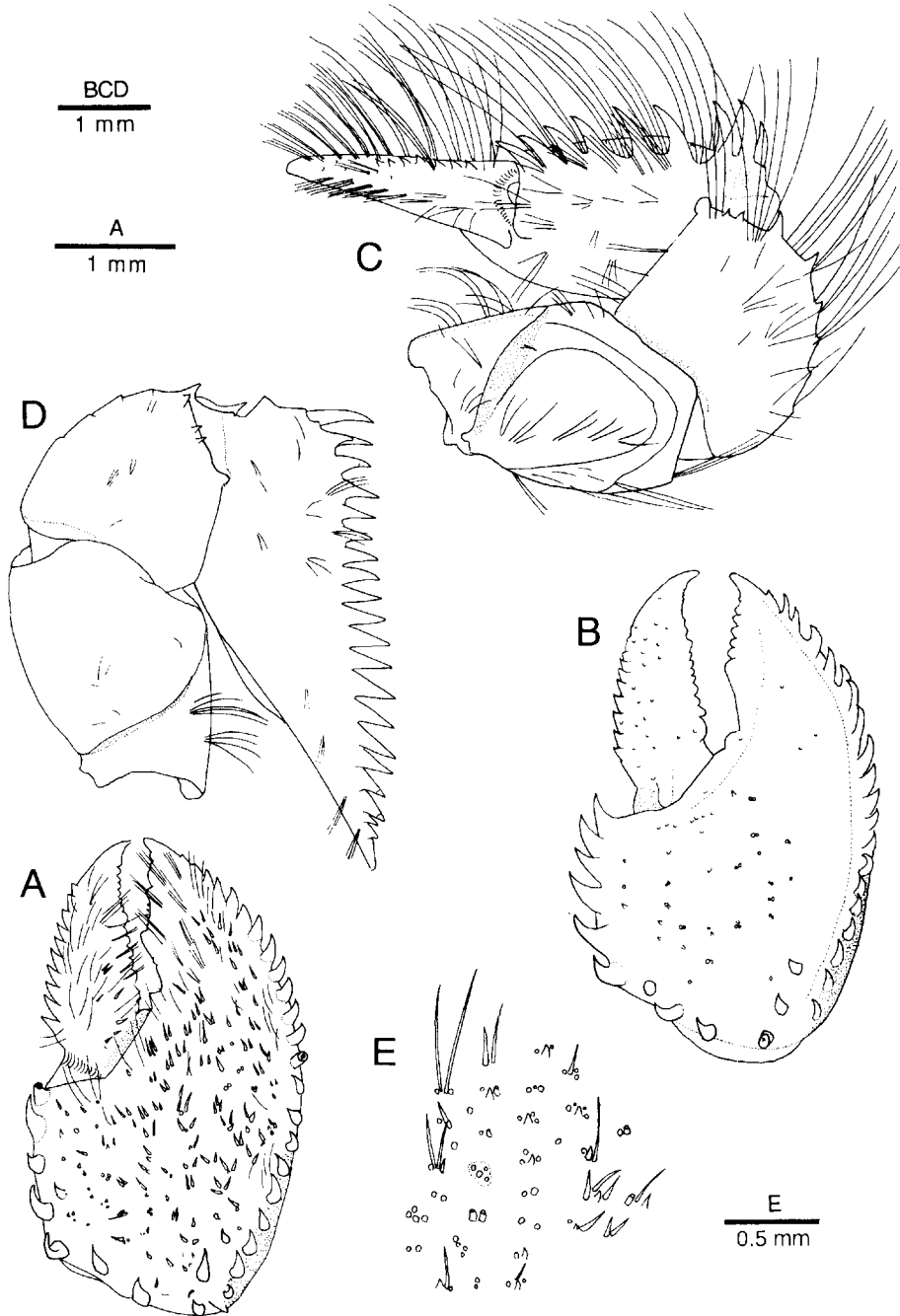


Fig. 3. *Paguritta gracilipes* Melin, 1939, right cheliped. A, syntype male (sl 2.5 mm, SMNH Type no. 2293) from Takinoura, Ani-jima Island, Ogasawara Islands. B–E, female (sl 3.8 mm, CBM-ZC 2276) from Tsurihama Beach, Chichi-jima Island, Ogasawara Islands. A, chela, dorsal, setae on margins omitted; B, same, dorsal, setae omitted; C, entire right cheliped, mesial; D, same, lateral, setae omitted; E, part of dorsal surface of palm, showing spiniform setae and spinules, several setae missing, but represented by pit-like sockets.

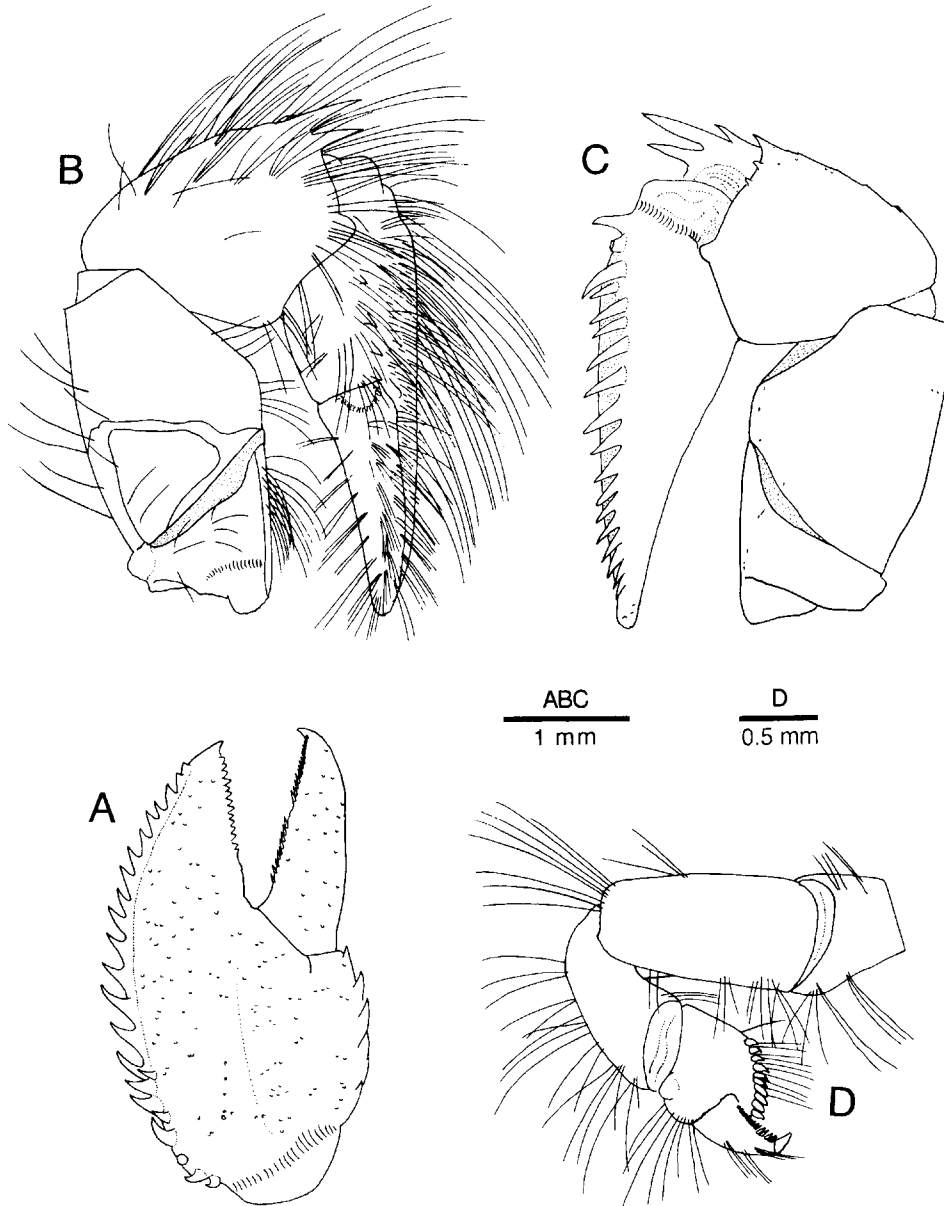


Fig. 4. *Paguritta gracilipes* Melin, 1939, female (sl 3.8 mm, CBM-ZC 2276) from Tsurihama Beach, Chichi-jima Island, Ogasawara Islands. A, left chela, dorsal, setae omitted; B, entire left cheliped, mesial; C, same, lateral, setae omitted; D, left fourth pereopods, lateral.

long setae dorsally; ventral surface with few short setae. Merus with moderately long setae on all surfaces. Ischium with tufts of setae on all surfaces; ventromesial margin not delimited. Coxa unarmed, with long setae.

Second and third pereopods (Fig. 5A, C) similar between right to left. Dactyli

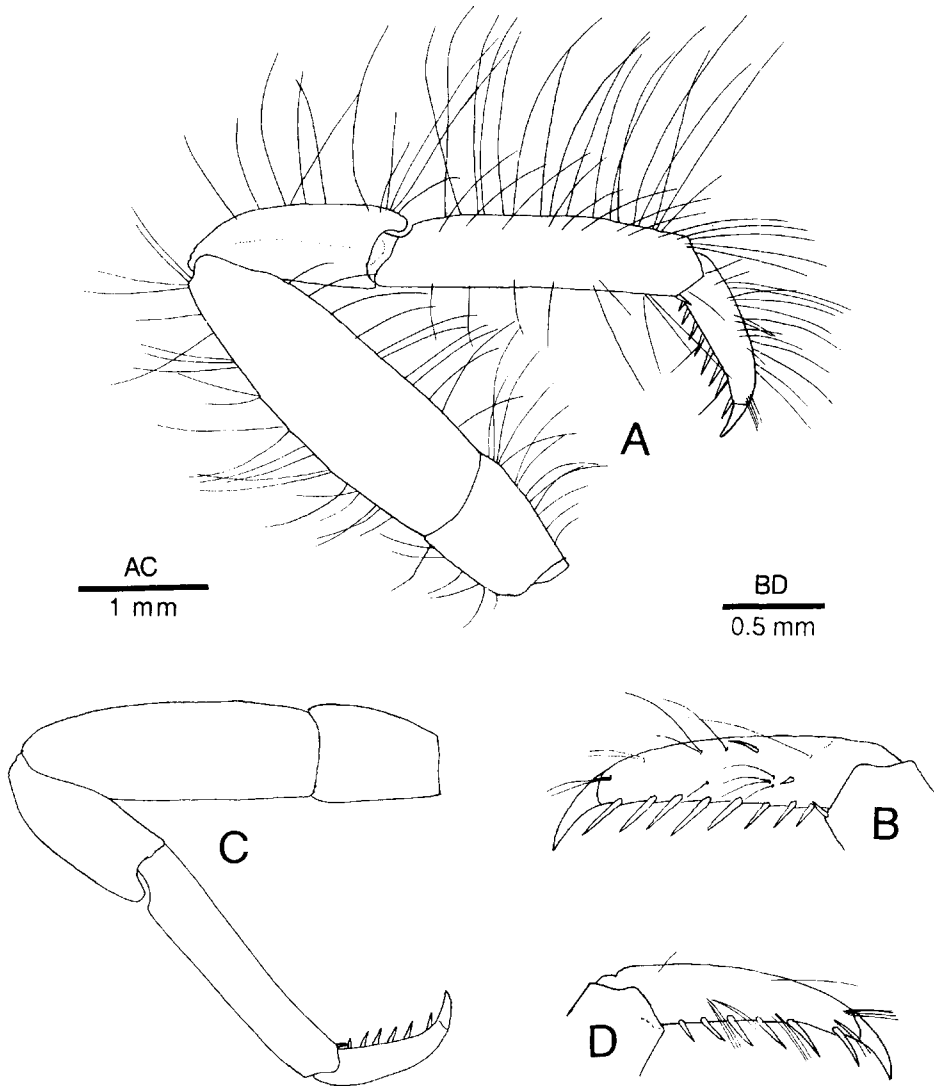


Fig. 5. *Paguritta gracilipes* Melin, 1939, ambulatory pereopods of female (sl 3.8 mm, CBM-ZC 2276) from Tsurihama Beach, Chichi-jima Island, Ogasawara Islands. A, right second pereopod, lateral; B, same, dactylus, mesial, setae partially omitted; C, left third pereopod, lateral, setae omitted; D, same, dactylus, setae partially omitted.

(Fig. 5B, D) about 0.6 times as long as propodi, terminating in strong corneous claws, dorsal surfaces each with tufts of long setae; lateral and mesial faces each with few tufts of setae; ventral margins each with 5-9 (second) or 5-8 (third) long corneous spines. Propodi distinctly longer than carpi, dorsal surfaces with numerous tufts of long setae; lateral and mesial faces with few short setae; ventral surfaces each with tufts of setae and 1 or 2 small corneous spines on ventrodistal margin. Carpi unarmed on dorsal surfaces, but with tufts of long setae; lateral and

mesial faces with few short setae; ventral surfaces with few tufts of setae. Meri strongly compressed laterally; dorsal and ventral surfaces with tufts of long setae, lateral and mesial faces with few tufts of very short setae. Ischia with tufts of setae on dorsal and ventral surfaces. Coxae with long setae; males not exhibiting female gonopores; females with large, paired gonopores.

Fourth pereopods (Fig. 4D) stout, semichelate. Dactyli stout, terminating in strongly curved corneous claw; ventral margin with row of small corneous teeth. Propodi deep, with strongly convex ventral margin; propodal rasp composed of single row of corneous scales.

Fifth pereopods chelate. Males with large, paired gonopores, each partially obscured by tuft of setae; no distinct sexual tubes, but vas deferens slightly protruded.

Anterior lobe of sixth thoracic sternite (Fig. 2C, D) subovate, anterior margin with 4 or 5 blunt spines or tubercles. Eighth thoracic sternite divided in 2 lobes, each with prominent, anteriorly directed spine at anterolateral corner.

Abdomen flexed (Fig. 1, bottom), not coiled; male without pleopods; female with biramous pleopods, each with well developed exopod and endopod on left side of second to fourth somites. Uropods (Fig. 2E) subequal, with moderately short propods bearing cluster of spinules; exopods elongate.

Telson (Fig. 2F) with distinct transverse indentation; posteromedian cleft narrow; terminal margins of posterior lobes each with 8–11 calcareous spines of various size.

Coloration in life (Fig 1). Shield reddish brown, gastric region paler than other parts, with small white spots; 2 broken submedian stripes of white extending from somewhat posterior of anterior margin of shield to about 0.75 length of shield. Posterior carapace reddish brown generally, with irregular pattern of large, white blotches just lateral to accessory portion; branchial region with tinge of dark gray dorsally; anterior part of branchiostegite dark brown. Ocular peduncles generally dark purple, with 4 longitudinal stripes of light yellow dorsally and ventrally; corneas deep brown. Antennular and antennal peduncles brown; antennal flagella brownish, transparent. Maxillipeds dark brown generally, with brilliant blue stripe on each exopod; third maxilliped with small spots of blue or white on endopod. Right chela generally brown; dactylus with white blotch and tinge of purple proximally on dorsal surface, becoming orangish distally; dorsal surface of palm of right cheliped light yellowish brown in center, with blotches of dark brown laterally and mesially; fixed finger with large, white blotch laterally and 2 white spots mesially, becoming orangish distally; carpus uniformly brown; merus with white spots of various size on lateral and mesial faces. General color of left cheliped similar to that of right cheliped; dactylus white in proximal half, distal half orange-brown with obscure light yellow spot; dorsal surface of palm just posterior to base of dactyl purple; dorsal surface of fixed finger proximally brown with tinge of purple, with blotch of light yellow. Ambulatory pereopods generally brown; propodi, carpi, and meri each with white band distally. Abdomen generally brown with scattered white spots of various size; tergites of third to fifth somites each with narrow median and broad lateral white stripes.

Habitat. Found to inhabit empty serpulid tubes growing on colonies of massive live corals, *Porites* spp.

Distribution. So far known only from the following Japanese localities: Oga-

sawara Islands (type locality); Hachijo Island, Izu Islands; Kushimoto, Kii Peninsula, Honshu. Occurring in subtidal to shallow waters on coral reefs, at maximum depth of 10 m.

Remarks. The available material indicates that the palm of the right cheliped is generally similar in both males and females in *P. gracilipes*. Sexual dimorphism in the shape of the right cheliped palm has been documented so far only in *P. vittata* (see Komai and Nishi 1996) among the species of *Paguritta*.

The three specimens from the Ogasawara Islands (CBM-ZC 2276) agree with the redescription of *Paguritta gracilipes* by McLaughlin and Lemaitre (1993) particularly in having relatively numerous ventral spines on the ambulatory dactyli (six to eight, rather than five or fewer than five in the other species). However, initial comparison of these topotypic specimens with the redescription of the syntypes of *Paguritta gracilipes* given by McLaughlin and Lemaitre (1993) suggested that our specimens differed from the syntypes in the absence of irregular rows of small, apparently calcareous spines on the dorsal surface of the right palm. In order to ascertain whether this apparent difference is of specific significance or intraspecific variation, we reexamined the male syntype of *Paguritta gracilipes* (SMNH Type No. 2293). Our examination has shown that McLaughlin and Lemaitre (1993) misinterpreted the armature of the dorsal surface of the palm of the right cheliped. The small, acutely pointed structures on that surface, which were called "small spines" by McLaughlin and Lemaitre (1993), cannot in fact be referred to as "spines" but as "spiniform setae", because these structures are not calcified, but, conversely, are flexible.

The specimen from Hachijo Island (CMNH-ZC 00255) has five ventral dactylar spines on the left second pereopod and both third pereopods and six spines on the right second pereopod. Nevertheless, it agrees very well with the syntype and topotypic specimens from the Ogasawara Islands in other respects and the general color pattern of the chelae described by Komai and Nishi (1996), and we do not hesitate to assign the specimen from Hachijo Island to *P. gracilipes*. Hence, the number of the ventral spines of the ambulatory dactyli is not always reliable for distinguishing *P. gracilipes* from *P. harmsi* (Gordon, 1935) and *P. vittata* Komai and Nishi, 1996, since the latter two species usually have four, or rarely five or six, ventral spines on the ambulatory dactyli (McLaughlin and Lemaitre 1993; Komai and Nishi 1996). Nevertheless, this character is still useful to distinguish *P. gracilipes* from *P. corallicola* Lewinsohn, 1978, *P. morgani* McLaughlin and Lemaitre, 1993, *P. kroppi* McLaughlin and Lemaitre, 1993, and *P. scottae* McLaughlin and Lemaitre, 1993, since in the latter four species there are only two to four ventral spines on the ambulatory dactyli. Since variation has been observed, it is advisable to check the number of dactylar ventral spines on each pereopod.

We have found that *P. gracilipes* is characterized by the absence of small calcareous spines on the dorsal surface of the right palm. In other species of *Paguritta*, there are small but prominent calcareous spines arranged in irregular rows on the dorsal surface of the right palm (McLaughlin and Lemaitre 1993; Komai and Nishi 1996). The absence of small but prominent calcareous spines on the dorsal surface of the left palm is useful in distinguishing *P. gracilipes* from *P. corallicola* and *P. morgani*. Further, *P. kroppi* and *P. scottae* differs from *P. gracilipes* in the presence of one or two calcareous spines on the dorsolateral margin of the carpus of the left cheliped proximal to the dorsodistal marginal spine.

ences, Yokohama National University) for providing us with the specimens from the Ogasawara Islands and Mrs. Karin Sindemark (Swedish Museum of Natural History) for the loan of the syntype of *Paguritta gracilipes*. Grateful thanks are also extended to Ms. Miho Sumi (Ohta-ku, Tokyo) for allowing us to publish the color photograph of the live specimen and Mr. Shoichi Kato (Hachijo Island) for his kind help in collecting the specimen. The manuscript was improved by comments from Dr. Patsy A. McLaughlin, Dr. Masayuki Osawa, and an anonymous reviewer.

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