

A new genus and new species of the family Paguridae (Crustacea: Decapoda: Anomura), from Hachijo-jima Island, Japan, with a list of hermit crab species found in the same collection sites

Masayuki Osawa and Junji Okuno

(MO) Department of Zoology, National Science Museum, Tokyo, 3-23-1, Hyakunincho, Shinjuku-ku, Tokyo 169-0073, Japan, email: osawam@kahaku.go.jp;

(JO) Coastal Branch of Natural History Museum and Institute, Chiba, 123, Yoshio, Katsuura, Chiba 299-5242, Japan, email: okuno@chiba-muse.or.jp

Abstract.—A new genus and new species of pagurid hermit crab, *Hachijopagurus rubrimaculatus*, is described and illustrated on the basis of three specimens from Hachijo-jima Island in the Izu Islands, Japan. The new genus *Hachijopagurus* appears close to *Pygmaeopagurus* McLaughlin, 1986, but differs from the latter in having the eighth thoracic sternite with a pair of ventrally flattened lobes in male and female, and a rod-like sexual tube on the coxa of the right fifth pereopod in male. The distinct concavity at the dorsomesial distal angle of the palm of the right cheliped can be regarded as unique for *H. rubrimaculatus* since such the structure has not been described for any known pagurid species. A list of the hermit crab species found in the collection sites of the present new species is provided.

Kato & Okuno (2001) introduced the richness of the shallow-water decapod crustacean fauna around Hachijo-jima Island of the Izu Islands, Japan, in their local guidebook “Shrimps and crabs of Hachijo Island”, with many underwater photographs. Their book contains a photograph of an unusual hermit crab, “Paguridae sp.”, taken at the depth of 40 m. The photographed specimen could be collected, and was found to have a characteristic right cheliped with a distinct concavity at the dorsomesial distal angle of the palm. In addition to this specimen, two hermit crabs proved to be conspecific with Kato & Okuno’s (2001) “Paguridae sp.” from Hachijo-jima Island were made available for close taxonomic study. The examination of the three specimens revealed that they represent an undescribed species that can not be assigned to any known pagurid genera. Thus, we herein describe and illustrate these specimens as a new genus and new species.

General terminology used in the descrip-

tion follows that of McLaughlin (1974:9), with the exception of the posterior carapace (see Lemaitre 1995:2), fourth pereopod (see McLaughlin 1997:435), and gill structure (see McLaughlin & de Saint Laurent 1998:161). The submedian grooves on the shield are termed “paragastric grooves” (see Komaï & Osawa 2001:1291). Forest et al. (2000:24) is followed in the interpretation of the ocular peduncle, which is provided basally with a small calcified plate referred to as the “ocular acicle”. The sternites of the third maxillipeds and third and fifth pereopods are each shown as “third”, “sixth”, and “eight” thoracic sternites. Shield length (sl), as measured from the tip of the rostrum to the midpoint of the posterior margin of the shield, indicates specimen size. The lengths of the segments of the chelipeds were measured along the dorsomesial margin except for the chelae, which were measured along each the dorsal midline from the proximal margin of the palm to the level of the distal tip of the

fixed finger. The widths of the chelae were measured at the dorsoproximal points of the fingers. The lengths of the segments of the ambulatory legs were measured along the dorsal margins, but for the propodus, excluding the proximal oblique margin and distal projection. The heights of the propodi and meri of the ambulatory legs were measured along the lateral transverse midline. The drawings were made with the aid of a drawing tube mounted on a Leica MZ8 stereomicroscope. The type material of the new species is deposited in the Coastal Branch of Natural History Museum and Institute, Chiba (CMNH, with code of ZC), and National Science Museum, Tokyo (NSMT, with code of Cr).

A list of hermit crabs found in the collection sites of the present new species is given in "Appendix", with the specimen and collection data. The specimens are deposited in CMNH.

Hachijopagurus, new genus

Diagnosis.—Eleven pairs of biserial, phyllobranchiate gills. Shield with moderately well developed, broadly triangular rostrum. Ocular acicles subtriangular, not elongate. Antennal peduncles with supernumerary segmentation. Maxillule with endopod bearing subtriangular external lobe. Third maxilliped with ischium bearing developed crista dentata and accessory tooth. Chelipeds markedly unequal, right much stronger. Fourth pereopod semichelate, propodal rasp composed of single row of corneous scales, dactyl lacking preungual process. Sixth thoracic sternite with semicircular anterior lobe. Eighth thoracic sternite with pair of ventrally flattened lobes. Male with coxae of fifth pereopods slightly asymmetrical, right larger; each with sexual tube rod-like, distally curved, longer than coxal length measured on ventral surface; 3 unpaired, unequally biramous left pleopods on third to fifth abdominal somites. Female with unpaired left gonopore; no paired pleopods; 4 unpaired, unequally biramous left

pleopods on second to fifth abdominal somites. Abdomen well developed, dextrally coiled. Uropods markedly asymmetrical. Telson with midlateral transverse indentations on lateral margins; posterior lobes with terminal margins separated by shallow median cleft.

Type species.—*Hachijopagurus rubrimaculatus*, new species, by present designation.

Etymology.—The genus name is a combination of "*Hachijo*", meaning the locality where the type species was collected, and "*pagouros*," meaning crab in Greek. Gender is masculine.

Remarks.—*Hachijopagurus* shares with certain species belonging to the genera *Alainopagurus* Lemaitre & McLaughlin, 1995, *Decaphyllus* de Saint Laurent, 1968, *Iridopagurus* de Saint Laurent-Dechancé, 1966, *Nematopaguroides* Forest & de Saint Laurent, 1968, *Nematopagurus* A. Milne-Edwards & Bouvier, 1892, and *Solitariopagurus* Türkay, 1986, a pair of sexual tubes being longer than the coxa of the fifth pereopod in male measured on the ventral surface. Among these genera, *Hachijopagurus* resembles *Nematopaguroides* or *Nematopagurus* in that the right sexual tube is slender and distally filamentous, but differs from the latter two genera in having markedly unequal chelipeds in both male and female, and unpaired left gonopore in female. Species of *Nematopaguroides* and *Nematopagurus* have subequal or somewhat unequal chelipeds, and paired gonopores in female (see McLaughlin 1997, 2003; Wang & McLaughlin 2000).

Hachijopagurus rather appears close to *Pygmaeopagurus* McLaughlin, 1986 currently recognized as monotypic (type species: *P. hadrochirus* McLaughlin, 1986 from Hawaii), in sharing a set of characters as follows: eleven pairs of biserial gills; shield with a moderately well developed, broadly triangular rostrum; crista dentata of the third maxilliped with an accessory tooth; semichelate fourth pereopods with a single row of corneous scales in the pro-

podal rasp; male with a rod-like sexual tube on the coxa of the left fifth pereopod and three unpaired left biramous pleopods; and female with unpaired left gonopore, no pair of pleopods modified as goponods on the first abdominal somite, and four unpaired left biramous pleopods. However, the shape of the eighth thoracic sternite in both male and female and the coxa of the right fifth pereopod in male immediately distinguish the two genera. The eighth thoracic sternite consists of a pair of ventrally flattened lobes in *Hachijopagurus*, whereas it is produced as two closely-set lobes in *Pygmaeopagurus*. The coxa of the right fifth pereopod has a rod-like sexual tube in *Hachijopagurus*, but lacks a sexual tube and gonopore in *Pygmaeopagurus*.

Hachijopagurus is also allied to *Anapagurides* de Saint Laurent-Dechancé, 1966, but the structure of sexual tubes in male is different in the two genera. *Hachijopagurus* has a rod-like sexual tube on each the right and left coxae of the fifth pereopods, but *Anapagurides* possesses a pair of short or very short sexual tubes or only a right tube (see Komai 1999:25). On the coxa of the left fifth pereopod, *Anapagurides facetus* (Melin, 1939) from the Ogasawara Islands of Japan has a slightly protruded vas deferens (see McLaughlin & Sandberg 1995:583); while *A. reesei* (McLaughlin, 1986) from Hawaii possesses frequently a vestige of sexual tube (see McLaughlin 1986:801, as *Nanopagurus* McLaughlin, 1986), and *A. aequalis* Komai, 1999 from off Torishima Island of Japan has a very short sexual tube (see Komai, 1999:24).

The monotypic *Trichopagurus* de Saint Laurent, 1968 (type species: *Catapagurides? trichophthalmus* Forest, 1954 from Tahiti) is somewhat similar to *Hachijopagurus*, but has quadriserial gills with lamellae weakly divided distally, and a rudimentary left sexual tube in male (see de Saint Laurent 1970:210, figs. 11, 16). *Hachijopagurus* has biserial gills, and a rod-like left sexual tube.

Hachijopagurus rubrimaculatus

new species

Figs. 1–3

Paguridae sp.: Kato & Okuno 2001:83, unnumbered fig.

Type material.—Holotype: male (sl 1.6 mm), Nazumado, Hachijo-jima Island, Izu Islands, 45 m, 25 Nov 2000, SCUBA dive, coll. S. Kato, CMNH-ZC 470. Paratypes: 1 female (sl 1.4 mm), Nazumado, Hachijo-jima Island, Izu Islands, 40 m, 17 Dec 2000, SCUBA dive, coll. S. Kato, NSMT-Cr 14556 [specimen of “Paguridae sp.” photographed by Kato & Okuno (2001)]. 1 female (sl 1.3 mm), Kyokucho-hama, Hachijo-jima Island, Izu Islands, 40 m, 9 Jul 2002, SCUBA dive, coll. J. Okuno & K. Tanaka, CMNH-ZC 930.

Description.—Eleven pairs of biserial phyllobranchiate gills; 2 moderately well to well developed arthrobranchs on each third maxilliped to fourth pereopod; single moderately well developed pleurobranch on seventh thoracic somite.

Shield (Fig. 1A) slightly longer than broad or slightly broader than long, not strongly calcified; anterior margin between rostrum and lateral projections concave; anterolateral margins sloping; posterior margin roundly truncate; dorsal surface weakly convex in general but concave laterally along conspicuous paragastric grooves, with short setae behind rostrum and lateral projections. Rostrum moderately well developed, broadly triangular, terminating in small spine directed ventrally at slight angle, overreaching lateral projections, dorsal surface with weak, short median ridge. Lateral projections broadly subtriangular, each with small submarginal spine. Accessory portions along cervical groove (not illustrated) narrow, generally membranous but slightly calcified along cervical groove. Posterior carapace membranous, with few tufts of short setae; posteromedian plate very weakly calcified, with pair of tufts of short setae in posterior half; cardiac sulci weakly marked, subparallel in anterior half

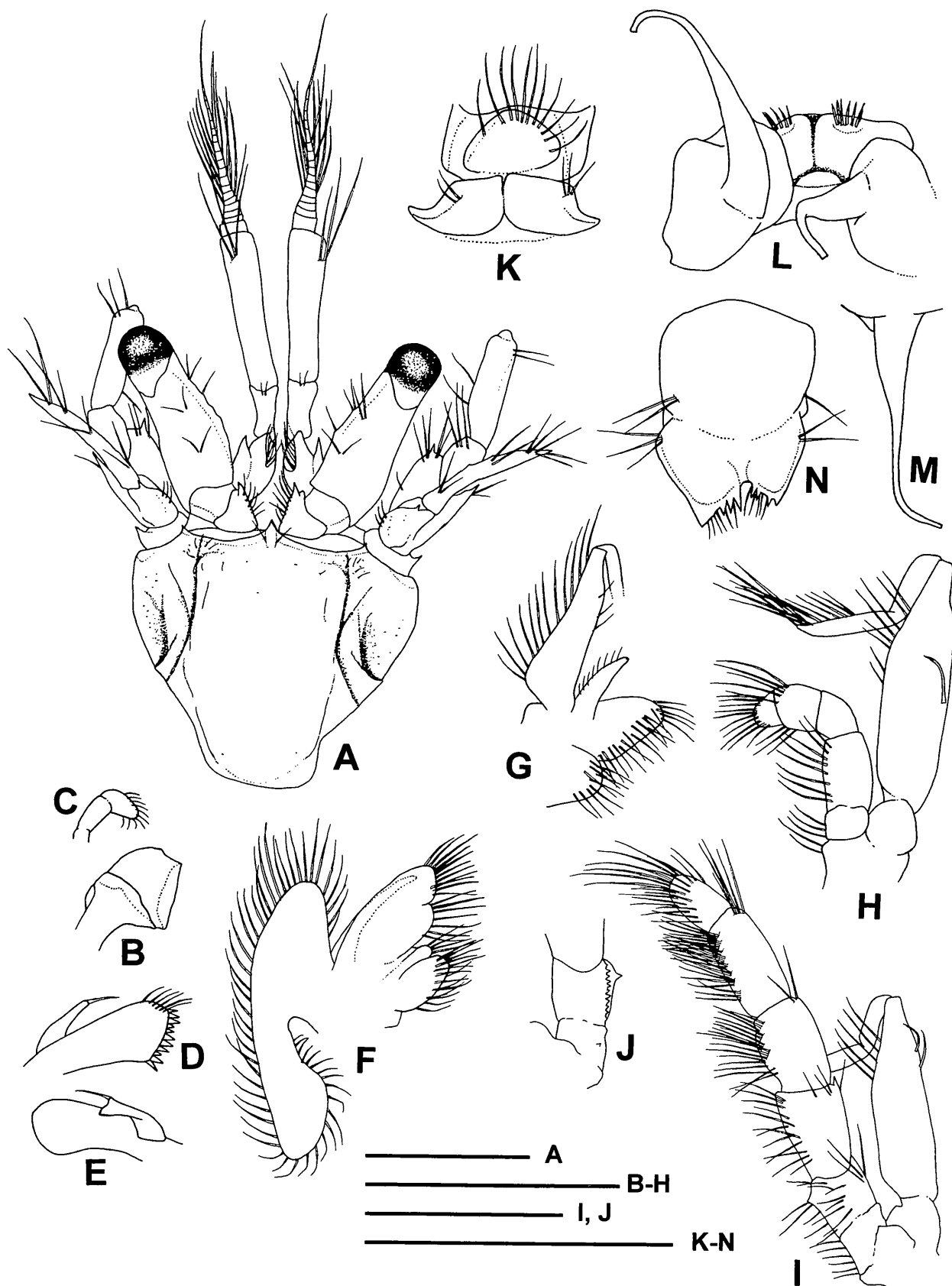


Fig. 1. *Hachijopagurus rubrimaculatus*, new genus and new species. Holotype male (sl 1.6 mm) from Hachijo-jima Island, Izu Islands, Japan, CMNH-ZC 470. A, shield and cephalic appendages, dorsal; B, left mandible, internal; C, same, palp, internal; D, right maxillule (coxal endite missing), external; E, same, lateral; F, right maxilla, external; G, right first maxilliped (flagellum of exopod missing), external; H, left second maxilliped, external; I, left third maxilliped, lateral; J, same, ischium and basis, dorsal (internal); K, sixth thoracic sternite, ventral; L, eighth thoracic sternite, ventral; M, left sexual tube, lateral; N, telson, dorsal. Scales equal 1.0 mm.

but divergent in posterior half, extending to posterior margin; sulci cardiobranchialis extending posteriorly along posterior margin of branchiostegite. Branchiostegites membranous; anterior margins broadly rounded, unarmed, fringed with short setae.

Ocular peduncles (Fig. 1A) stout, subcylindrical, 0.7 times as long as shield; dorsal surface with 2 rows of sparse tufts of short setae mesially; basal portion inflated; median portion concave laterally but slightly convex mesially; corneas occupying 0.3 length of peduncle, not dilated, semispheric, pigmented. Ocular acicles well developed, subtriangular, each with distinct marginal spine terminally, separated basally by half basal width of 1 acicle; dorsal surface convex; mesial margin with short and moderately long setae.

Antennular peduncles (Fig. 1A), when fully extended, exceeding ocular peduncles by 0.9 length of ultimate segment. Ultimate segment elongate, 1.8 times longer than penultimate segment, somewhat deeper distally, with 3 long setae near dorsodistal margin. Penultimate segment with few short setae on dorsodistal margin. Basal segment elongate; statocyst lobe produced laterally, with spine on lateral margin; ventrodistal margin with minute spine and short setae. Upper flagellum elongate, slightly longer than ultimate peduncular segment; lower flagellum reaching midlength of upper flagellum.

Antennal peduncles (Fig. 1A), when fully extended, exceeding distal margins of corneas by approximately half length of fifth segments. Fifth and fourth segments with few scattered, moderately long setae. Third segment with few moderately long setae and small spine at ventromesial distal angle. Second segment with dorsolateral distal angle strongly produced, reaching midlength of fourth segment, terminating in small spine; dorsomesial distal angle with small spine; mesial margin with few short setae. First segment with small spine on ventrolateral margin distally; ventrodistal margin unarmed. Antennal acicles slender,

arcuate, reaching midlength of fifth peduncular segment and overreaching bases of corneas, each terminating in small spine; mesial margin with tufts of moderately long setae. Antennal flagella (missing in holotype) approximately 3.0 times longer than shield, with 4 short setae distally on every article.

Mandible (Fig. 1B, C) with incisor process without distinct teeth on mesial margin. Maxillule (Fig. 1D, E) with external lobe of endopod subtriangular, not recurved; internal lobe with apical bristle. Maxilla (Fig. 1F) with endopod overreaching anterior margin of scaphognathite. First maxilliped (Fig. 1G) with endopod less than half length of exopod, exopod inflated proximally. Second maxilliped (Fig. 1H) with basis-ischium fusion incomplete. Third maxilliped (Fig. 1I, J) with carpus unarmed on dorsodistal margin; merus bearing small distolateral spine; ischium with crista dentata composed of row of small corneous teeth, accessory tooth small but distinct; basis-ischium fusion incomplete; basis with few small denticles on mesial margin.

Chelipeds (Figs. 2A–F, 3A–D) considerably unequal, right much stronger than left. Right cheliped of male holotype (Fig. 2A–D) massive, dactyl articulating obliquely with palm, propodal-carpal articulation not twisted. Chela with general outline subovate in dorsal view, 1.6 times longer than wide; dactyl and fixed finger weakly curved ventrally, each terminating in small corneous claw. Dactyl slightly longer than fixed finger, 0.9 length of palm; cutting edge with rounded calcareous teeth on proximal 0.8 and small corneous teeth on distal 0.2; dorsal surface convex, with closely-set, small rounded tubercles and several short setae; dorsomesial margin delimited by subacute ridge of rounded tubercles; mesial surface with irregular rows of small rounded tubercles along dorsal and ventral margins; ventromesial margin delimited by subacute ridge of rounded tubercles, with several short setae; ventral surface with small rounded tubercles and double row of tufts

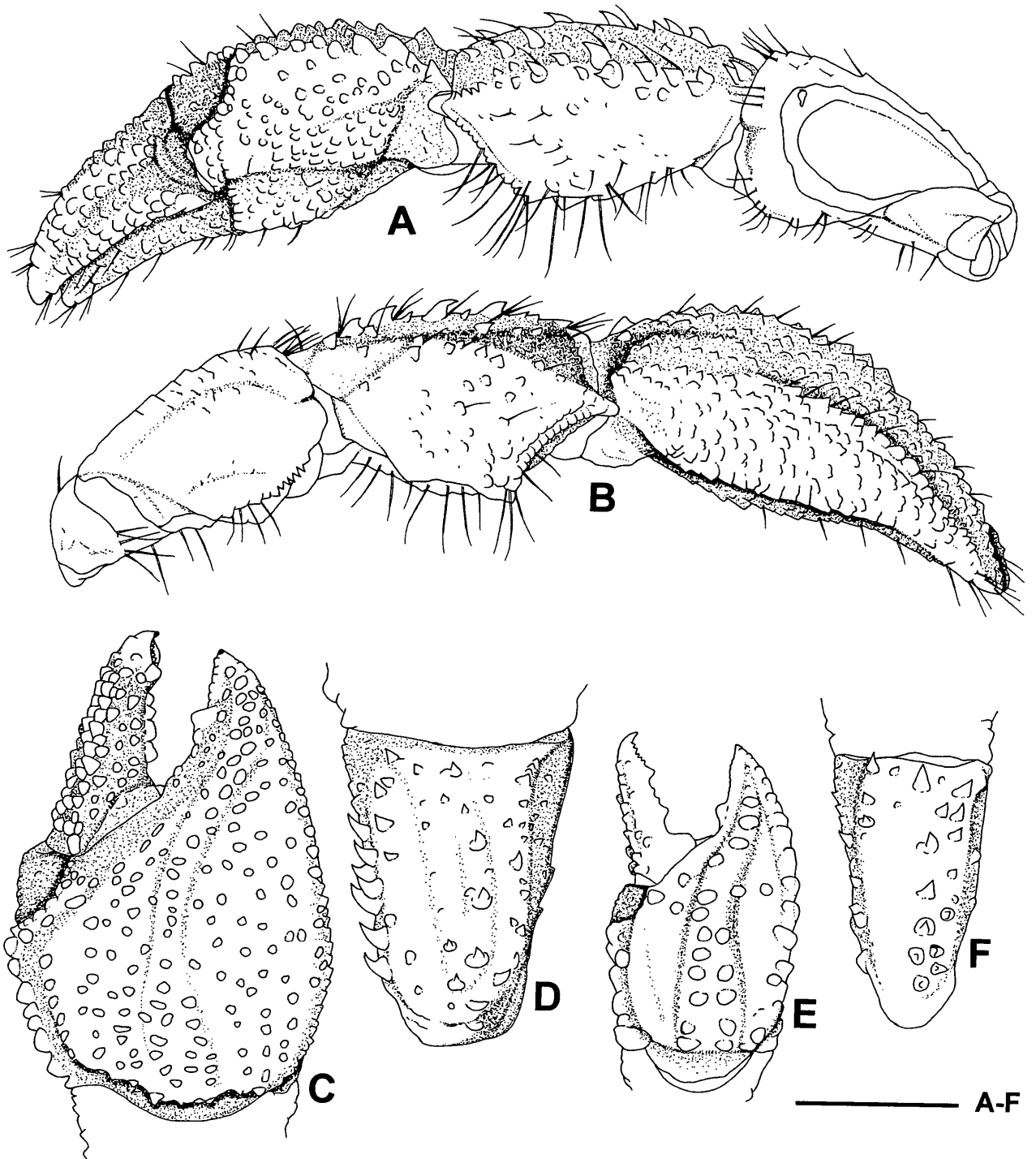


Fig. 2. *Hachijopagurus rubrimaculatus*, new genus and new species. A–D, holotype male (sl 1.6 mm) from Hachijo-jima Island, Izu Islands, Japan, CMNH-ZC 470; E, F, paratype female (sl 1.4 mm), same locality as holotype, NSMT-Cr 14556. Right cheliped. A, entire cheliped, mesial; B, same, lateral; C, E, chela, dorsal, setae omitted; D, F, carpus, dorsal, setae omitted. Scale equals 1.0 mm.

of short setae along cutting region. Palm slightly shorter than carpus; dorsomesial margin subacute, distinctly delimited by row of moderately large tubercles, bearing few short setae, dorsomesial distal angle with prominent concavity; dorsal surface of palm and fixed finger convex, with numerous small rounded tubercles each occasion-

ally accompanied by tuft of few short setae, palm with weakly elevated longitudinal row of tubercles on midline and extending onto fixed finger along cutting edge; dorsolateral margin convex, delimited by subacute ridge of rounded tubercles and low protuberances, with several short setae; mesial surface with numerous, small tubercles; lateral sur-

face with numerous, small low protuberances; ventromesial and ventrolateral margins each delimited by subacute ridge of low protuberances; ventral surface with numerous, small low protuberances and tubercles, and several short setae, larger protuberances present on longitudinal midline of palm, several tufts of setae present along cutting region; cutting edge of fixed finger with low, rounded calcareous teeth on proximal 0.6 (distalmost tooth well developed) and small rounded calcareous teeth each with minute corneous tip on distal 0.4. Carpus broad, becoming broader distally in dorsal view, 1.2 times longer than merus; dorsomesial margin depressed, with irregular row of curved spines accompanied by few short setae, distal part with small tubercles, distal angle produced bluntly; dorsodistal margin unarmed; dorsal surface with short row of curved spines distally on mesial half, row of curved spines adjacent to dorsolateral margin, and scattered smaller spines and tubercles, each spine occasionally accompanied by few short setae; dorsolateral margin weakly delimited, with irregularly arranged small spines and tubercles, distal angle produced bluntly; mesial face with few scattered short setae, distal margin with tuberculate ridge; ventromesial margin protuberant, with tufts of moderately long setae; lateral face with small low protuberances, distal margin with tuberculate ridge; ventrolateral margin smooth, distal part produced, subtriangular ventrally, bearing moderately long setae; ventral surface slightly concave, with scattered, moderately long setae, distal margin without spines or tubercles. Merus subtriangular in dorsal view; dorsal surface roundly ridged along midline, with row of short transverse ridge; dorsodistal margin unarmed but with row of short setae; mesial face with few short setae; lateral face with few small flattened tubercles; ventromesial margin unarmed but with short setae; ventrolateral margin with row of small spines on subdistal part and short setae; ventral surface with few very short setae. Ischium unarmed on

dorsal surface; surfaces with scattered short setae. Coxa unarmed but with long setae on ventromesial margin. On carpus and merus, setae on ventromesial and ventrolateral margins and ventral face plumose; setae on other faces and on chela and coxa apparently simple.

Right cheliped of each female paratype (Fig. 2E, F) smaller than that of male holotype; chela narrower and less tuberculate on dorsal surface than that of male holotype, 1.7–1.8 times longer than wide; dactyl 0.9–1.0 length of palm; palm 0.7 length of carpus, with more strongly elevated, longitudinal median row of larger tubercles irregularly arranged in single or double, and more strongly elevated dorsomesial and dorsolateral margins than those of male holotype.

Left cheliped (Fig. 3A–D) moderately slender, reaching (female paratypes) or not reaching (male holotype) to proximal margin of dactyl of right cheliped; dactyl articulating obliquely with palm; propodal-carpal articulation not twisted. Chela elongate, 3.2–3.4 times longer than wide; dactyl and fixed finger slightly curved ventrally, each terminating in small corneous claw. Dactyl slightly longer than fixed finger, 1.2 length of palm; cutting edge with row of sharply pointed, small corneous teeth on distal 0.7; dorsal surface weakly convex, with few very short ridges each bearing short setae along cutting region; dorsomesial margin delimited by small low protuberances and short transverse ridges each bearing tuft of few short and moderately long setae, proximal part subacute; mesial surface with few very short ridges bearing short and moderately long setae; ventromesial margin rounded; ventral surface with row of tufts of few short and moderately long setae along cutting region. Palm 0.5–0.6 times as long as carpus; dorsomesial margin delimited, with row of irregularly arranged small tubercles and several moderately long setae, proximal tubercles spinulose; dorsal surface convex, with elevated row of spines and spinulose tubercles on midline of palm and

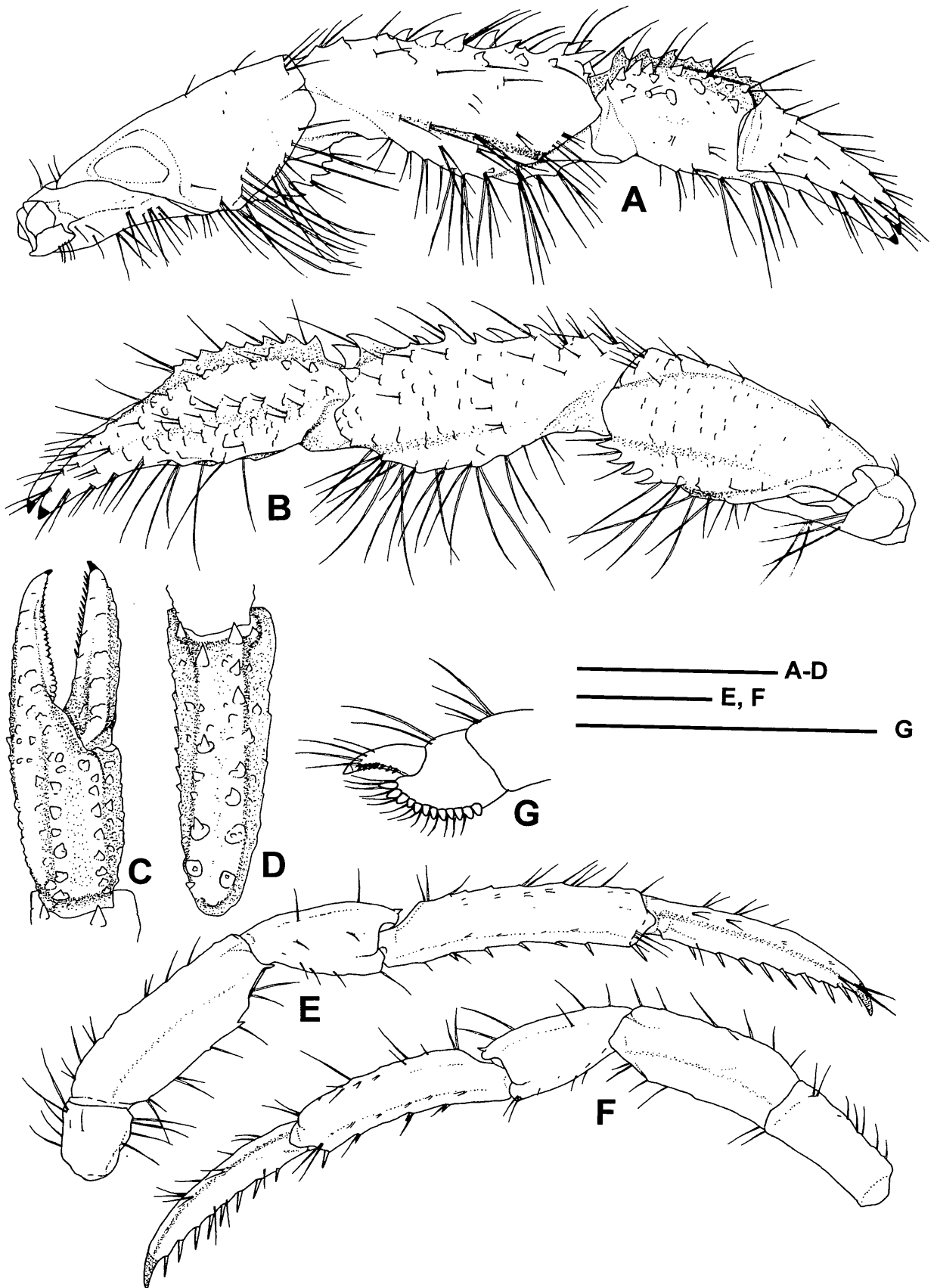


Fig. 3. *Hachijopagurus rubrimaculatus*, new genus and new species. Holotype male (sl 1.6 mm) from Hachijo-jima Island, Izu Islands, Japan, CMNH-ZC 470. A, left cheliped, mesial; B, same, lateral; C, same, chela, dorsal, setae omitted; D, carpus of same, dorsal, setae omitted; E, right second pereopod, lateral; F, left third pereopod, lateral; G, left fourth pereopod, dactyl and propodus, lateral. Scales equal 1.0 mm.

extending onto fixed finger along cutting region, tubercles on fixed finger reduced, lateral part of fixed finger with irregularly arranged small protuberances and tubercles, spines and tubercles accompanied by few short or moderately long setae; dorsolateral margin not delimited; mesial face with small flattened tubercles and short oblique ridges dorsally; lateral face with small low protuberances, short oblique ridges, and several short and moderately long setae; ventral surface roundly crested on longitudinal midline, with several short transverse ridges bearing long and short setae on palm and longitudinal double row of irregularly arranged tufts of short and moderately long setae on fixed finger; cutting edge of fixed finger with row of small calcareous teeth interspersed with very short corneous teeth. Carpus 1.1–1.2 times longer than merus; dorsomesial and dorsolateral margins each with row of strong spines and several moderately long setae, spine at each distal angle largest; dorsodistal margin unarmed; dorsal surface with few small tubercles; mesial face with row of small spinulose protuberances and moderately long setae adjacent to dorsomesial margin; lateral face with short or very short transverse ridges sometimes bearing short setae; ventromesial margin with few tufts of long setae; ventrolateral margin with small tubercles, protuberances, and tufts of long setae; ventral surface slightly concave, with tufts of long and moderately long setae. Merus subtriangular in dorsal view; dorsal surface roundly ridged along midline, with few short transverse ridges bearing short setae; dorsodistal margin unarmed but with row of moderately long setae; mesial face nearly naked; ventromesial margin unarmed but with transverse tufts of long setae; lateral surface with short and very short transverse ridges; ventrolateral margin with strong spines distally, and long and short setae; ventral surface with several long setae. Ischium unarmed on dorsal surface; ventral surface with moderately long setae. Coxa unarmed but with long setae on ventromesial margin.

On carpus and merus, setae on ventromesial and ventrolateral margins and ventral face plumose; setae on other faces and on chela and coxa apparently simple.

Second and third pereopods (Fig. 3E, F) generally similar from left to right but different in length, right subequal to or slightly longer than left; right second pereopod slightly overreaching tip of right cheliped. Dactyls 1.2 times as long as propodi in second, 1.2 times as long in third, moderately slender, weakly curved ventrally in lateral view, straight in dorsal view, each terminating in corneous claw; lateral and mesial surfaces unarmed but each with shallow sulcus along midline and tufts of sparse short setae along dorsal margin; ventral margins each with 6–8 (second) or 6–9 (third) slender corneous spines and few short setae. Propodi 1.3 times longer than carpi and 3.8 times longer than high in second, 1.2–1.4 times longer than carpi and 3.5 times longer than high in third; lateral and mesial surfaces with few tufts of very short setae along each dorsal and ventral margin; dorsal faces weakly protuberant on right but apparently smooth on left, each with row of sparse, moderately long setae; ventral faces each with row of 4–6 small corneous spines and few short setae, spine at distal angle largest. Carpi 0.7 length of meri in second, 0.8–0.9 length in third, each with spinule near dorsodistal angle; lateral and mesial surfaces with few short setae; dorsal and ventral faces with sparse setae, setae on dorsal face longer. Meri 2.9 times longer than high in second, 2.4–2.7 times longer in third; lateral surfaces apparently naked; ventral margins each with few small protuberances, and small spine at each distal angle and distal third on second, but unarmed on third; dorsal and ventral surfaces each with row of sparse short and moderately long setae; mesial faces naked. Ischia with short and moderately long setae on dorsal and ventral surfaces. Coxae unarmed, with few tufts of short and moderately long setae; female with gonopore only on left side.

Fourth pereopods (Fig. 3G) subequal in size, semichelate, with scattered tufts of moderately long, simple and plumose setae marginally. Dactyl moderately curved, with row of tiny corneous teeth on lateral face ventrally, no preungual process at base of terminal claw. Propodus with strongly convex ventral margin; propodal rasp composed of single row of small ovate and lanceolate, corneous scales on distal 0.8 of ventral margin. Carpus unarmed on dorsal surface.

Fifth pereopods chelate; size of coxae (Fig. 1L) slightly asymmetrical with right larger in male, but equal in female. Male with right coxa with membranous, rod-like sexual tube approximately 2.2 coxal length measured on ventral surface, directed anteriorly; distal part recurved posteriorly, naked; left coxa (Fig. 1M) with membranous, rod-like sexual tube directed ventromesially, slightly shorter and slenderer than right; distal part recurved posteriorly, naked.

Third thoracic sternite unarmed on anterior margin. Sixth thoracic sternite (Fig. 1K) with semicircular anterior lobe slightly skewed to left and bearing moderately long setae on anterior margin. Eighth thoracic sternite (Fig. 1L) with pair of ventrally flattened lobes separated by shallow median depression, each with tuft of short bristles (male holotype) or moderately long setae (female paratypes) anteriorly.

Male with 3 left pleopods subequal in size; each endopod 0.3 length of exopod. Female (posterior half of abdomen missing in paratype, CMNH-ZC 930) with 4 left pleopods; pleopods on second to fourth somites well developed, pleopods on fourth somite slightly smaller than precedences; pleopod on fifth somite much smaller; anterior 2 pleopods each with endopod half length of exopod, posterior 2 pleopods each with endopod 0.3 length of exopod.

Telson (Fig. 1N) with distinct, midlateral transverse indentations on lateral margins indicating division of anterior and posterior lobes; posterior lobes slightly asymmetrical, separated by shallow median cleft; terminal

margins oblique, each with 3 small spines and short setae (male holotype) or apparently lacking spines but bearing short stiff setae (female paratypes), lateral angles acute; lateral margins convex, each with weakly delimited ridge.

Color in flesh specimens.—Shield pale pink or reddish. Ocular peduncles and acicles, antennular and antennal peduncles, third maxillipeds, left cheliped, and second to fourth pereopods greenish or pale yellow with scattered small red speckles. Antennal flagella semitransparent with interspaced few red articles. Right cheliped pale pink or reddish with yellow and orange tints.

Habitat.—Small gastropod shells, *Gyrineum pusillum* (Broderip) or *Gyrineum* species, family Ranellidae.

Distribution.—So far known only from Hachijo-jima Island in the Izu Islands, Japan; 40–45 m.

Etymology.—The specific name is a combination of the Latin, “*ruber*”, meaning red, and “*maculatus*”, meaning spotted, in reference to the scattered red speckles on most parts of the body.

Remarks.—The specimen of “Paguridae sp.” depicted in a color photograph by Kato & Okuno (2001:83) is a female paratype of this new species (NSMT-Cr 14556).

Hachijopagurus rubrimaculatus shows intraspecific variations in the structure of the right cheliped. The chela and carpus of the male holotype are broader than those of two smaller female paratypes. The palm of the male is much more tuberculate, has a less elevated longitudinal row of smaller tubercles on the dorsal surface, and less elevated dorsomesial and dorsolateral margins than those of the females.

As noted in the remarks for the genus, *Hachijopagurus* resembles *Pygmaeopagurus*. Both *H. rubrimaculatus* and *P. hadrochirus* have relatively large right chelipeds, but the size is different in comparison to the total body mass. The cheliped is mentioned to be at least twice the mass in *P. hadrochirus* (see McLaughlin 1986:790), whereas it is approximately as same as or

less than the mass in *H. rubrimaculatus*. *Hachijopagurus rubrimaculatus* also seems to differ from *P. hadrochirus* in having a prominent concavity at the dorsomesial distal angle of the palm of the right cheliped. *Pygmaeopagurus hadrochirus* may have a similar structure in the mentioned part from dorsal view (see McLaughlin, 1986:792, fig. 2b). However, the dorsomesial margin of the right palm is described as having two or three broad, thin, plate-like projections, and the mesial surface apparently has a sulcus along the dorsomesial margin, judging from McLaughlin (1986:792, fig. 2c). The distinct concavity at the dorsomesial distal angle of the palm of the right cheliped can be regarded as unique for *H. rubrimaculatus* since such the structure has not been described for any known pagurid species. The shape of the corneas of the ocular peduncles is also different between *H. rubrimaculatus* and *P. hadrochirus*. It is semispheric in *H. rubrimaculatus*, but cone-like and bluntly pointed in *P. hadrochirus*.

Available field observations with SCUBA equipment in Hachijo-jima Island revealed that *Hachijopagurus rubrimaculatus* occurred among or under stones on shelly sand bottom at depths of around 40 m. In the collection sites of this species, the following hermit crab species were also found: *Calcinus anani* Poupin & McLaughlin, 1998; *Dardanus lagopodes* (Forskål, 1775); *Pagurus lophochela* Komai, 1999; *Pylopaguropsis furusei* Asakura, 2000; *Pylopaguropsis speciosa* McLaughlin & Haig, 1989; and *Pylopaguropsis zebra* (Henderson, 1893) (see Appendix). Individuals of *Hachijopagurus rubrimaculatus* are much smaller in size than those of other species found except for *Pagurus lophochela*. The small size of the specimens of this new species makes it rather difficult to find them in the field.

Acknowledgments

We thank Mr. Shoichi Kato of the "Regulus Diving", a well-known service shop

for local SCUBA divers in Hachijo-jima Island, for first finding this unusual hermit crab in the field, and kindly providing us with the specimens for study. Mr. Kotaro Tanaka of the "Diving Club Con:color" in Hachijo-jima Island also assisted the second author in collecting additional material. Mr. Masahiro Aizawa of the Coastal Branch of Natural History Museum and Institute, Chiba, kindly identified the gastropod shells carried by the hermit crabs for us. We are grateful to Dr. Patsy A. McLaughlin of the Shannon Point Marine Center, Western Washington University, Dr. Rafael Lemaitre of the National Museum of Natural History, Smithsonian Institution, and Dr. Akira Asakura of the Natural History Museum and Institute, Chiba, for their valuable comments and suggestions to improve the manuscript. This study was supported in part by a research fellowship for young scientists from the Japan Society for the Promotion of Science, to the first author.

Literature Cited

- Asakura, A. 2000. A review of Japanese species of *Pylopaguropsis* Alcock, 1905 (Decapoda: Anomura: Paguridae).—Crustacean Research 29: 70–108.
- Forest, J. 1954. Crustacés Décapodes Marcheurs des Iles de Tachiti et des Tuamotu. I. Paguridea (suite).—Bulletin du Muséum national d'Histoire naturelle, Paris, 2^e série, 26:71–79.
- , & M. Saint Laurent. de. 1968. Résultats scientifiques des campagnes de la "Calypso". Part VIII. Campagne de la Calypso au large des côtes Atlantiques de l'Amérique du Sud (1961–1962). 6. Crustacés Décapodes: Pagurides.—Annales de l'Institut océanographique de Monaco, n. s. 45:47–172.
- , ———, P. A. McLaughlin, & R. Lemaitre. 2000. The marine fauna of New Zealand: Paguridea (Decapoda: Anomura) exclusive of the Lithodidae.—National Institute of Water and Atmospheric Research Biodiversity Memoir 114:1–250.
- Forskål, P. 1775. Descriptiones animalium avium, piscium, amphibiorum, insectorum, vermium; quae in itinere orientali observavit: 1–19. i–xxxii. 1–164.
- Henderson, J. R. 1893. A contribution to Indian carcinology.—Transactions of the Linnean Society of London, Zoology (2)5:325–458.

- Kato, S., & J. Okuno. 2001. Shrimps and crabs of Hachijo Island. TBS-BRITANNICA Co., Ltd., Tokyo, 160 pp. (in Japanese).
- Komai, T. 1999. Hermit crabs of the families Diogenidae and Paguridae (Crustacea: Decapoda: Anomura) collected during Shin'yo-maru cruise to the Ogasawara Islands and Torishima Island, oceanic Islands in Japan.—Natural History Research, Chiba, Special Issue 6:1–66.
- , & M. Osawa. 2001. A new distinctive species of pagurid hermit crab (Crustacea: Decapoda: Anomura) from Japan.—Zoological Science 18: 1291–1301.
- Lemaitre, R. 1995. A review of the hermit crabs of the genus *Xylopagurus* A. Milne Edwards, 1880 (Crustacea: Decapoda: Paguridae), including descriptions of two new species.—Smithsonian Contributions to Zoology 570:i–iii, 1–27.
- , & P. A. McLaughlin. 1995. *Alainopagurus crosnieri* n. gen., n. sp. (Decapoda: Anomura: Paguridae) from the western Pacific.—Bulletin Muséum national d'Histoire naturelle, Paris 4^e série, section A, 17:273–282.
- McLaughlin, P. A. 1974. The hermit crabs (Crustacea, Decapoda, Paguridea) of northwestern North America.—Zoologische Verhandlungen 130:1–396.
- . 1986. Three new genera and species of hermit crabs (Crustacea, Anomura, Paguridae) from Hawaii.—Journal of Crustacean Biology 6: 789–803.
- . 1997. Crustacea Decapoda: Hermit crabs of the family Paguridae from the KARUBAR cruise in Indonesia in A. Crosnier, and P. Bouchet, eds., Résultats des Campagnes MUSORSTOM, 16.—Mémoires du Muséum national d'Histoire naturelle, Paris 172:433–572.
- . 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.
- , & J. Haig. 1989. On the status of *Pylopaguropsis zebra* (Henderson), *P. magnimanus* (Henderson), and *Galapagurus teevanus* Boone, with descriptions of seven new species of *Pylopaguropsis* (Crustacea: Anomura: Paguridae).—Micronesica 22:123–171.
- , & M. Saint Laurent. de. 1998. A new genus for four species of hermit crabs formerly assigned to the genus *Pagurus* Fabricius (Decapoda: Anomura: Paguridae).—Proceedings of the Biological Society of Washington 111:158–187.
- , & L. Sandberg. 1995. Redescriptions of Gustaf Melin's "*Eupagurus (Pagurillus)*" *exiguus*, "*Eupagurus (Catapagurus)*" *vallatus*, and "*Eupagurus (Spiropagurus)*" *facetus* (Decapoda: Anomura: Paguridae) based on the type material.—Journal of Crustacean Biology 15:569–587.
- Melin, G. 1939. Paguriden und Galatheiden von Prof. Dr. Sixten Bocks Expedition nach den Bonin-Inseln 1914.—Kungliga Svenska Vetenskapsakademiens Handlingar, series 3 18:1–119.
- Milne-Edwards, A., & E.-L. Bouvier. 1892. Observations préliminaires sur les paguriens recueillis par les expéditions du *Travailleur* et du *Talisman*.—Annales des Sciences Naturelles, Zoologie et Paléontologie, série 7, 13:185–226.
- Poupin, J., & P. A. McLaughlin. 1998. Additional records of *Calcinus* species (Decapoda: Anomura: Diogenidae) from French Polynesia with description of three new species and a key to Indo-west Pacific species of the genus.—Crustacean Research 27:9–27.
- Saint Laurent, M. de. 1968. Révision des genres *Catapaguroides* et *Cestopagurus* et description de quatre genres nouveaux. I. *Catapaguroides* A. Milne Edwards et Bouvier et *Decaphyllus* nov. gen. (Crustacés Décapodes Paguridae).—Bulletin du Muséum national d'Histoire naturelle, Paris, 2^e série, 39 [1967]:923–954.
- . 1970. Révision des genres *Catapaguroides* et *Cestopagurus* et description de quatre genres nouveaux. V. *Trichopagurus* de Saint Laurent (Crustacés Décapodes Paguridae). VI. Conclusion.—Bulletin du Muséum national d'Histoire naturelle, Paris, 2^e série, 42:210–222.
- Saint Laurent-Dehancé, M. de. 1966. Remarques sur la classification de la famille des Paguridae et sur la position systématique d'*Iridopagurus* de Saint Laurent. Diagnose d'*Anapagurides* gen. nov.—Bulletin du Muséum national d'Histoire naturelle, Paris, 2^e série, 38:257–265.
- Türkay, M. 1986. Crustacea Decapoda Reptantia der Tiefsee des Roten Meeres.—Senckenbergiana Maritima 18:123–185.
- Wang, Y.-L., & P. A. McLaughlin. 2000. First report of *Nematopaguroides* (Crustacea: Decapoda: Paguridae) in the Indo-Pacific, and the description of a new species.—Proceedings of the Biological Society of Washington 113:956–963.

Appendix

List of hermit crab species found in the collection sites of *Hachijopagurus rubrimaculatus*, new species, at Hachijo-jima Island, Izu Islands, Japan

Family Diogenidae

Calcinus anani Poupin & McLaughlin, 1998. 1 male (sl 3.8 mm), Nazumado, 40 m, 30 Nov 2000, SCUBA dive, coll. S. Kato, CMNH-ZC 516. 1 female (sl 4.2 mm), Nazumado, 45 m, 4 Dec 2000, SCUBA dive, coll. S. Kato, CMNH-ZC 517.

Dardanus lagopodes (Forskål, 1775). 1 male (sl 9.6

mm), Nazumado, 40 m, 1 Dec 2000, SCUBA dive, coll. S. Kato, CMNH-ZC 933. 1 male (sl 10.0 mm), Kyokuchō-hama, 40 m, 9 Jul 2002, SCUBA dive, coll. J. Okuno & K. Tanaka, CMNH-ZC 936. 1 juvenile (sl 1.8 mm), same data as CMNH-ZC 936, CMNH-ZC 937.

Family Paguridae

Pagurus lophochela Komai, 1999. 1 male (sl 2.2 mm), Nazumado, 45 m, 4 Dec 2000, SCUBA dive, coll. S. Kato, CMNH-ZC 595. 1 male (sl 1.6 mm), same data as CMNH-ZC 595, CMNH-ZC 596. 1 ovigerous female (sl 1.5 mm), Kyokuchō-hama, 40 m, 9 Jul 2002, SCUBA dive, coll. J. Okuno & K. Tanaka, CMNH-ZC 934. 1 male (sl 1.2 mm), same data as CMNH-ZC 934, CMNH-ZC 935. 1 female (sl 1.6 mm), same data as CMNH-ZC 934, CMNH-ZC 938,

Pylopaguropsis furusei Asakura, 2000. 1 female (sl 3.4 mm), Nazumado, 40 m, 24 Nov 2000, SCUBA dive, coll. S. Kato, CMNH-ZC 874. 1 female (sl 2.5 mm), same data as CMNH-ZC 874, CMNH-ZC 875. 1 female (sl 2.2 mm), Nazumado, 45 m, 4 Dec 2000, SCUBA dive, coll. S. Kato, CMNH-ZC 876. 1 male (sl 2.7 mm), same data as CMNH-ZC 876, CMNH-ZC 877.

Pylopaguropsis speciosa McLaughlin & Haig, 1989. 1 male (sl 3.7 mm), Nazumado, 40 m, 30 Nov 2000, SCUBA dive, coll. S. Kato, CMNH-ZC 522. 1 male (sl 1.9 mm), same data as CMNH-ZC 522, CMNH-ZC 873.

Pylopaguropsis zebra (Henderson, 1893). 1 male (sl 2.4 mm), Nazumado, 40 m, 30 Nov 2000, SCUBA dive, coll. S. Kato, CMNH-ZC 523. 1 male (sl 2.5 mm), same data as CMNH-ZC 523, CMNH-ZC 525.