

# Clarifications of the identities of *Paguristes balanophilus* Alcock, 1905 and *P. calvus* Alcock, 1905 (Crustacea, Decapoda, Anomura, Paguroidea, Diogenidae), and the description of another broadly distributed new species

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## ABSTRACT

*Paguristes balanophilus* Alcock, 1905, a species mistakenly included in the Japanese paguroid fauna, is redescribed and illustrated from material discovered amongst the collections of the Muséum national d'Histoire naturelle, Paris, and the Natural History Museum, London. A lectotype is designated and the species distribution is restricted to Arabian and Andaman Seas. A supplemental and detailed description, with illustrations, for a poorly known species, *Paguristes calvus* Alcock, 1905, is provided. The distribution of this species is expanded to include not only the northern Bay of Bengal and the Red Sea, but also the Andaman Sea. The general appearance of these two species is similar in having unequal chelipeds with one row of spine on the mesial face of the dactyl, and unarmed telson; however, *Paguristes balanophilus* is easily distinguished from *P. calvus* by the covering of closely-spaced tuberculate spines studded with bi- or trifid, acute spinules, circumscribed by tufts of short setae on the dorsal surface of chelipeds. Additionally, a new species of the genus *Paguristes* s.s., *P. simplex* n. sp., with a disjunct distribution is described from Madagascar and northern Western Australia. This new species has subequal chelipeds with one row of spine on the mesial face of its dactyl and unarmed telson but can be distinguished from other known species of the genus *Paguristes* s.s., by having small, subovate, non scalloped marginally female brood pouch and strongly asymmetrical lobes of the telson.

## KEY WORDS

Crustacea,  
Decapoda,  
Anomura,  
Paguroidea,  
Diogenidae,  
*Paguristes*,  
*P. balanophilus*,  
*P. calvus*,  
new species.

## RÉSUMÉ

*Précisions sur l'identité de Paguristes balanophilus Alcock, 1905 et P. calvus Alcock, 1905 (Crustacea, Decapoda, Anomura, Paguroidea, Diogenidae) et description d'une nouvelle espèce à large distribution.*

*Paguristes balanophilus* Alcock, 1905, une espèce incluse par erreur dans la faune japonaise des Paguroidea, est redécrite et illustrée à partir de matériel des collections du Muséum national d'Histoire naturelle, Paris, et du Natural History Museum, Londres. Un lectotype est désigné et la distribution de l'espèce est limitée aux mers d'Arabie et d'Andaman. Une description supplémentaire et détaillée est proposée, ainsi que des illustrations, pour l'espèce peu connue *Paguristes calvus* Alcock, 1905. La distribution de cette espèce est étendue, elle n'inclut pas seulement le nord de la baie du Bengale et la mer Rouge, mais aussi la mer d'Andaman. L'aspect général de ces deux espèces est similaire par la présence de chélicères inégaux avec une rangée d'épines sur la face mésiale du dactyle et un telson lisse; toutefois *Paguristes balanophilus* se distingue facilement de *P. calvus* par la couverture d'épines tuberculées, serrées, parsemées de spinules aiguës bi- ou trifides, délimitée par des touffes de courtes soies sur la surface dorsale des chélicères. Par ailleurs, une nouvelle espèce du genre *Paguristes* s.s., *P. simplex* n. sp., avec une distribution disjointe, est décrite de Madagascar et du nord-ouest de l'Australie. Cette nouvelle espèce a des chélicères subégaux avec une rangée d'épines sur la face mésiale du dactyle et un telson lisse, mais peut être distinguée des autres espèces connues du genre *Paguristes* s.s. par la possession de petites poches incubatrices femelles subovales, non festonnées sur la marge, et par les lobes du telson fortement asymétriques.

## MOTS CLÉS

Crustacea,  
Decapoda,  
Anomura,  
Paguroidea,  
Diogenidae,  
*Paguristes*,  
*P. balanophilus*,  
*P. calvus*,  
espèce nouvelle.

## INTRODUCTION

McLaughlin & Provenzano (1975) informally subdivided the genus *Paguristes* Dana, 1851 s.l. (cf. Rahayu 2005) into two groups (A and B) based on whether the terminal margins of the telson were provided with spines or spinules (A) or were unarmed (B). Although that subdivision was only partially adopted by Miyake (1978b) in his review of Japanese species of *Paguristes* s.l., it was utilized by Komai (1999, 2001), for the western Pacific species that he reviewed. However, when Rahayu (2005) divided *Paguristes* s.l. into three distinct genera, she found that McLaughlin & Provenzano's (1975) subdivisions applied only to taxa retained in *Paguristes* s.s. Species transferred either to *Stratiotes* Thomson, 1899 or *Pseudopaguristes* McLaughlin, 2002 all had armed telsonal margins. Not only did telsonal armature furnish an essential key character used by both of

the present authors for initial generic subdivisions in their individual reviews of Indonesian and Australian species of *Paguristes*, respectively (Rahayu 2006; McLaughlin in press), it has provided the unifying "thread" for the recently published clarifications of poorly defined taxa and the descriptions of new species (McLaughlin & Rahayu 2005), as it does in the present investigation.

Among the holdings of the Muséum national d'Histoire naturelle, Paris (MNHN), the authors found one lot of specimens, a gift from the Indian Museum, Calcutta (IM), that contained two specimens labeled *Paguristes balanophilus* Alcock, 1905, and one labeled *P. calvus* Alcock, 1905. Although the specimens, all from *Investigator* station 239 in the Andaman Sea, were not thought to represent type materials, it was a major discovery nonetheless because the Indian Museum's current policy not to loan material had made the accurate interpretations of

several of Alcock's (1905) species extremely difficult. However, critical examination of the two specimens of *P. balanophilus* revealed certain differences that might or might not have been attributable to intraspecific variation. With just the two specimens, the situation was not possible to evaluate. The authors already were aware that the collections of The Natural History Museum, London (NHM) included a pair of specimens from the John Murray Expedition attributed by Thompson (1943) to *P. balanophilus* that agreed with Alcock's (1905) original description (McLaughlin & Rahayu 2005). Was it possible that London had shared in a specimen exchange program with the Indian Museum as Paris apparently had? A query to the NHM produced positive results and the loan of apparent syntypes of *P. balanophilus*. The Indian Museum catalog numbers (IM 2644-63/10) accompanying the specimens indicated that the gift lot from *Investigator* station 239 consisted of 20 specimens although only 16 of those numbers were actually published by Alcock (1905: 34) as syntypes. The Natural History Museum catalog numbers (NHM 1903.4.6.181-191) implied that this same lot consisted of 11 specimens; however, the bottle actually contained 10 specimens without pleons, a vial of detached appendages and 18 shells, of which 10 still contained hermit crabs. Because the NHM and MNHN specimens both came from station 239, it seemed reasonable to assume that the specimens deposited in both museums were at least part of one of the four syntypic lots upon which *P. balanophilus* had been described. However, it appeared that only the 10 specimens removed from their shells and possibly one or two of the 10 shelled specimens in the NHM collection might have been examined, or at least cataloged, by Alcock (1905) and it was from that material that the lectotype was selected. The 10 shells still containing hermit crabs were cracked and the specimens removed. Nine proved to be *P. balanophilus*, whereas one, as in the Paris sample, agreed well with Alcock's (1905: 35, pl. 1, fig. 4) description and illustration of *P. calvus*. As the two specimens of *P. calvus* did not come from the syntypic series of that species we were only able to provide a detailed description supplemental to that provided by Alcock. However, we have also reviewed the specimen identified by Balss (1915) as

*P. calvus* from the Red Sea housed in the collections of the Naturhistorisches Museum in Wien, Vienna (NHMW 7492).

In addition to clarifications of the characters defining *P. balanophilus* and *P. calvus*, another new species is now added to the current list of 19 Indo-Pacific taxa assigned to McLaughlin & Provenzano's (1975) group B. This species, first found in the collections of the Western Australian Museum (WAM) by the second author, was subsequently also recognized by the first author in the MNHN collections from Madagascar. The holotype and Madagascar paratypes are deposited in the collections of the MNHN. The Australian paratypes are deposited in the collections of the WAM.

## MATERIALS AND METHODS

Materials for this study have come from the collections of the Muséum national d'Histoire naturelle, Paris; Naturhistorisches Museum in Wien, Vienna; The Natural History Museum, London; and the Western Australian Museum, Perth, and have been returned to those institutions. Terminology for the descriptions and measurement protocol follow those of McLaughlin & Rahayu (2005). Animal size is indicated by shield length included in parentheses and measured from the tip of the rostrum to the midpoint of posterior margin of the shield. Station data for Royal Indian Marine Survey *Investigator* is from the *List of Stations 1884-1913* (Anonymous 1914). The abbreviations stn, ovig., and coll. refer to station, ovigerous, and collector, respectively.

## SYSTEMATICS

Family DIOGENIDAE Ortmann, 1892  
Genus *Paguristes* Dana, 1851 *s.s.*

*Paguristes* Dana, 1851: 269; 1852a: 122; 1852b: 437. — A. Milne-Edwards & Bouvier 1893: 32. — Alcock 1905: 30 (in part). — Forest 1954: 170 (in part). — Forest & de Saint Laurent 1968: 67 (in part). — Zariquiey Alvarez 1968: 235. — McLaughlin 1974: 17. — Miyake 1978b: 25. — Forest & McLaughlin 2000: 58 (in part). — Rahayu 2006: 350.

*Pagurites* – Lörenthey & Beurlen 1929: 71 (misspelling).

TYPE SPECIES. — By subsequent designation by Stimpson (1858), *Paguristes hirtus* Dana, 1851, shown by Haig (1956) to be a junior subjective synonym of *Pagurus weddellii* H. Milne Edwards, 1848.

OTHER SPECIES INCLUDED. — *Paguristes balanophilus* Alcock, 1905; *P. calvus* Alcock, 1905; and *P. simplex* n. sp.

DISTRIBUTION. — Indian Ocean, Gulf of Oman, and northern Australia; 73-804 m.

*Paguristes balanophilus* Alcock, 1905  
(Figs 1-3)

*Paguristes balanophilus* Alcock, 1905: 33, pl. 3, fig. 1. — Balss 1924: 769. — Thompson 1943: 414. — Gordan 1956: 321 (list). — Tikader *et al.* 1986: 163 (list). — Morgan & Forest 1991: 686.

*Paguristes calvus* – Alcock 1905: 35 (in part), not pl. 1, fig. 4 (see Remarks).

Not *Paguristes balanophilus* – Miyake 1961: 11 (list); 1975: 294, pl. 112, figs 8, 11; 1978a: 29 (list); 1978b: 40, fig. 14, pl. 2, fig. 7; 1982: 97, pl. 33, fig. 1; 1991: 97, pl. 33, fig. 1; 1998: 97, pl. 33, fig. 1. — Miyake *et al.* 1962: 125 (list). — Matsuzawa 1977: pl. 79, fig. 2. — Miyake & Imafuku 1980: 4 (see Remarks).

TYPE MATERIAL. — **Andaman Sea.** *Investigator*, stn 239, 11°49.5'N, 92°55.0'E, 102 m, 14.IV.1898, ♂ lectotype (herein selected) 7.6 mm (NHM 1903.4.6.181-191); 4 ♂♂ paralectotypes 3.8-10.4 mm; 5 paralectotypes ♀♀ 5.0-7.1 mm; 1 paralectotype ovig. ♀ 7.4 mm (NHM 1903.4.6.181-191).

OTHER MATERIAL EXAMINED. — **Gulf of Oman.** John Murray Expedition, stn 72, 25°38.3'N, 56°26.6'E, 73 m, 26.XI.1933, 2 ♂♂ 6.0 and 8.8 mm (NHM 1952.6.17.28-29).

**Andaman Sea.** *Investigator*, stn 239, 1 ♀ 6.0 mm; 1 ovig. ♀ 6.5 mm (MNHN Pg 1533); 4 ♂♂ 3.6-6.5 mm; 5 ♀♀ 6.4-7.4 mm (NHM 1903.4.6.181-191).

TYPE LOCALITY. — Andaman Sea, *Investigator*, stn 239, 11°49.5'N, 92°55.0'E, 102 m.

DISTRIBUTION. — Arabian and Andaman Seas.

DESCRIPTION

Thirteen pairs of quadriserial gills; branchiostegites each with few spinules on distal margin. Shield

(Fig. 1A) longer than broad; dorsal surface with several tubercles laterally. Rostrum slender, elongate, reaching midlength of ocular acicles and considerably overreaching lateral projections, terminating acutely. Lateral projections triangular, each with terminal spinule.

Ocular peduncles subequal, left very slightly longer than right, approximately 0.8 length of shield, each with row of sparse tufts of setae on dorsal surface medially; corneal diameter 0.2 of peduncular length. Ocular acicles subtriangular, terminating in 2-4 small spines; separated by half of basal width of one acicle.

Antennular peduncles, when fully extended, reaching from proximal margin to midlength of cornea of left ocular peduncle; basal segment with small spine on lateral face of statocyst lobe.

Antennal peduncles reaching 0.6 length of ocular peduncles; fifth segment with few scattered setae; fourth segment with small dorsodistal spine and few setae; third segment with sparse setae laterally, ventrodorsal margin terminating in acute spine; second segment with dorsolateral distal angle produced, terminating in small bifid or simple spine, dorsomesial distal angle with small spine, lateral and mesial margins with setae; first segment unarmed. Antennal acicle reaching to distal 0.2 or nearly to distal margin of fifth peduncular segment, terminating in prominent bifid spine; three to five spines on dorsal surface mesially, two or three spines on lateral margin, and scattered setae not concealing armature. Antennal flagellum 1.2-2.0 length of shield; articles each with one or two short setae proximally, slightly more numerous distally.

Chelipeds unequal, somewhat dissimilar; left larger. Left cheliped (Fig. 2A, B) with dactyl approximately 2 length of palm; dorsomesial margin often not distinctly delimited, distally flattened dorsal surface covered by large, sometimes bifid, closely-spaced, corneous-tipped acute spines or somewhat blunt tubercles, each accompanied by short setae; mesial face (Fig. 2D) with row, sometimes somewhat irregular, of small corneous-tipped spines medially, continued to tip, second row ventrally reaching 0.6 length of dactyl, each spine or tubercle usually accompanied by tuft of sparse, short setae; cutting edge with row of small calcareous teeth on proximal

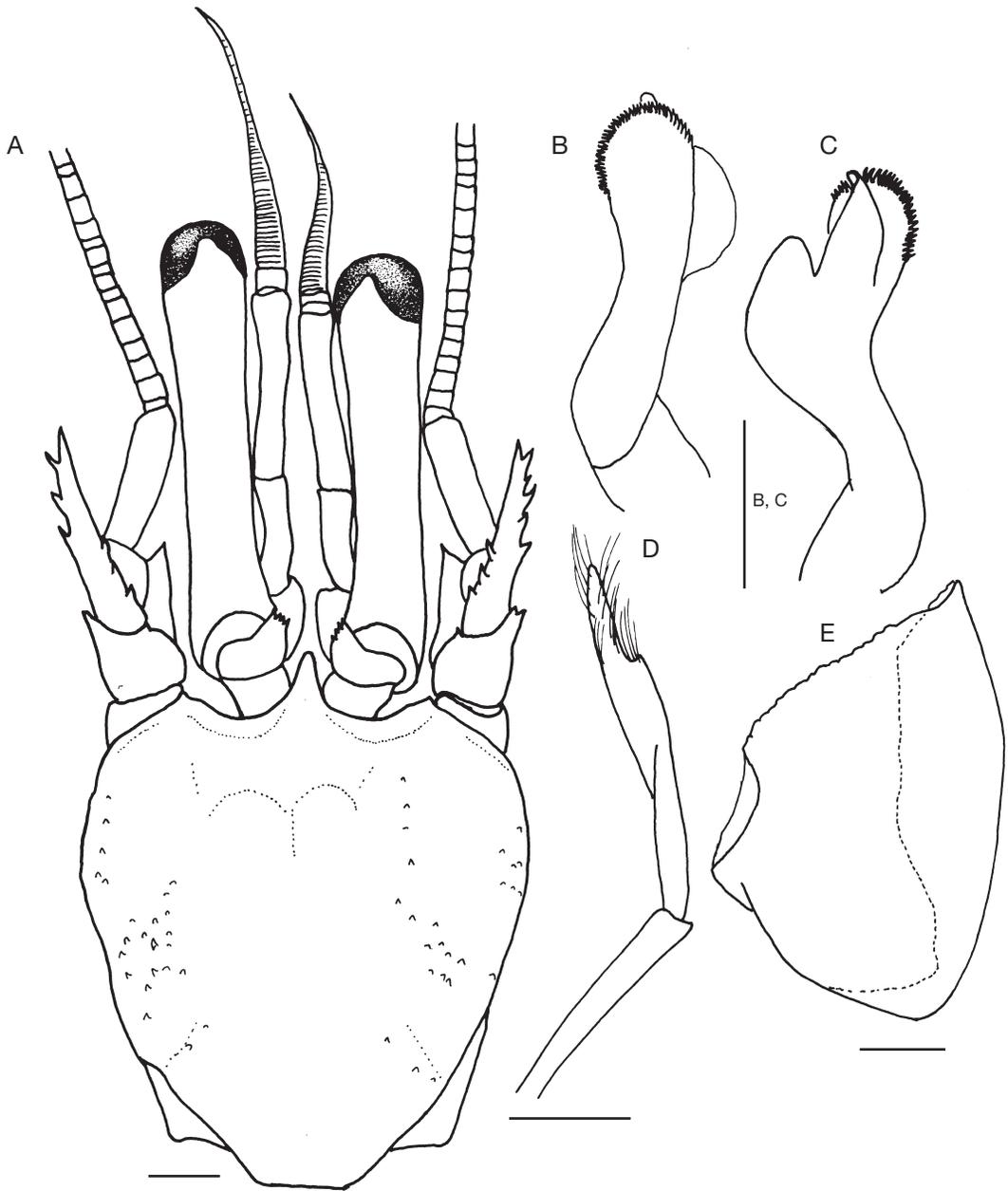


FIG. 1. — *Paguristes balanophilus* Alcock, 1905: **A-D**, ♂ 6.5 mm; **A**, shield and cephalic appendages; **B**, male first pleopod, dorsal view, setae omitted; **C**, male first pleopod, mesial view, setae omitted; **D**, male second pleopod, dorsal view, setae partially omitted; **E**, ♀ 6.5 mm, brood pouch. Scale bars: 1 mm.

0.3, corneous teeth on remainder, terminating in small corneous claw; no hiatus between dactyl and fixed finger. Palm usually with row of moderate to

large spines on dorsomesial margin, convex dorsal surface with covering of closely-spaced, tuberculate spines or tubercles, each armed with bi- or trifold,

acute or blunt, spinule, circumscribed by tuft of short, stiff setae (Fig. 2C), armature continued onto fixed finger and presenting scale-like appearance; dorsolateral margin not delimited, but rows of moderate to large, often corneous-tipped spines, becoming more prominent and acute distally on fixed finger, each spine accompanied by tuft of moderately long setae; mesial face with scattered tubercles; lateral face of palm and fixed finger with scattered spinulose tubercles, ventral surface with row of large spines, decreasing in size on fixed finger and sparse tufts of setae. Carpus with row of moderately prominent spines on dorsomesial margin, each spine accompanied by tuft of sparse setae, distal margin with row of small spines, extending onto lateral face; dorsolateral margin not delimited, dorsal and lateral surfaces with numerous acute or subacute spines accompanied by tufts of setae; mesial face with scattered spinulose tubercles. Merus with row of large spines on distal margin extending onto lateral and mesial faces, dorsal surface with one or two subdistal short, transverse rows of spines also extending onto lateral and mesial faces, remainder of dorsal margin with row of spines decreasing in size and becoming obsolete proximally; mesial face smooth, ventromesial margin with two irregular rows of small, spinulose tubercles or tuberculate spines and sparse tufts of setae; lateral face spinulose ventrally, ventrolateral margin with row of tuberculate spines and tufts of long setae, ventral surface with scattered tubercles and tufts of setae. Ischium with row of small tubercles on ventromesial margin.

Right cheliped (Fig. 2E) with dactyl approximately twice length of palm; dorsomesial margin with row of moderately small, corneous-tipped spines, decreasing in size distally; dorsal surface with numerous, quite small tubercles; cutting edge with row of very small calcareous teeth in proximal 0.2-0.3, corneous teeth distally, terminating in small corneous claw; mesial face (Fig. 2F) with row of small corneous-tipped spines near dorsal margin, few tubercles and shallow longitudinal sulcus below midline, each spine and tubercle accompanied by tuft of stiff moderately long setae. Palm with moderate to prominent, corneous-tipped spines on dorsomesial margin, dorsolateral margin not delimited, dorsal surface of palm and fixed finger

with covering of closely-spaced tubercles or tuberculate spines, each often with bi- or trifid spinule and accompanied by tuft of short setae, giving overall surface scale-like impression; mesial face of palm with subdistal row of low tubercles and scattered small to large tubercles; ventral surface with row of spines, corneous-tipped proximally, simple and smaller distally; lateral surface of palm and fixed finger with scattered spinulose, sometimes corneous-tipped spines, larger spine near ventral margin; cutting edge of fixed finger with row of small calcareous teeth, terminating in small corneous claw; no hiatus between dactyl and fixed finger. Carpus with row of usually prominent, corneous-tipped spines on dorsomesial margin, dorsodistal margin with row of spinules, extending onto lateral face; dorsolateral margin not delimited, dorsal surface and lateral face each with numerous small, tuberculate, sometimes corneous-tipped, spines; shallow longitudinal sulcus in midline; mesial face with few tuberculate spines; each spine accompanied by tuft of short setae. Merus with row of spines on distal margin extending onto lateral and mesial faces, dorsal surface with short, transverse, subdistal row of spines also extending onto lateral face, remainder of dorsal surface with row of spines decreasing in size and becoming obsolete proximally; ventromesial margin with row of tuberculate spines and sparse setae; lateral surface spinulose, ventrolateral margin with row of small spines and sparse short setae. Ischium with row of tubercles and tufts of setae on ventromesial margin.

Second and third pereopods (Fig 3) differing somewhat in armature, right slightly larger. Dactyls approximately 1.6 longer than propodi; dorsal margins each with row of spinules, sometimes corneous-tipped (second), and long setae (second and third); ventral margins each with 16-29 corneous spines and sparse stiff setae; lateral faces of second pereopods with sparse tufts of long setae, third with sparse tufts of short to moderate setae; mesial face of left second pereopod flattened, with longitudinal sulcus and scattered small corneous spines, row of small corneous spines near ventral margin, mesial face of right with scattered tufts of setae and longitudinal sulcus; mesial face of left third pereopod also with row of spinules near ven-

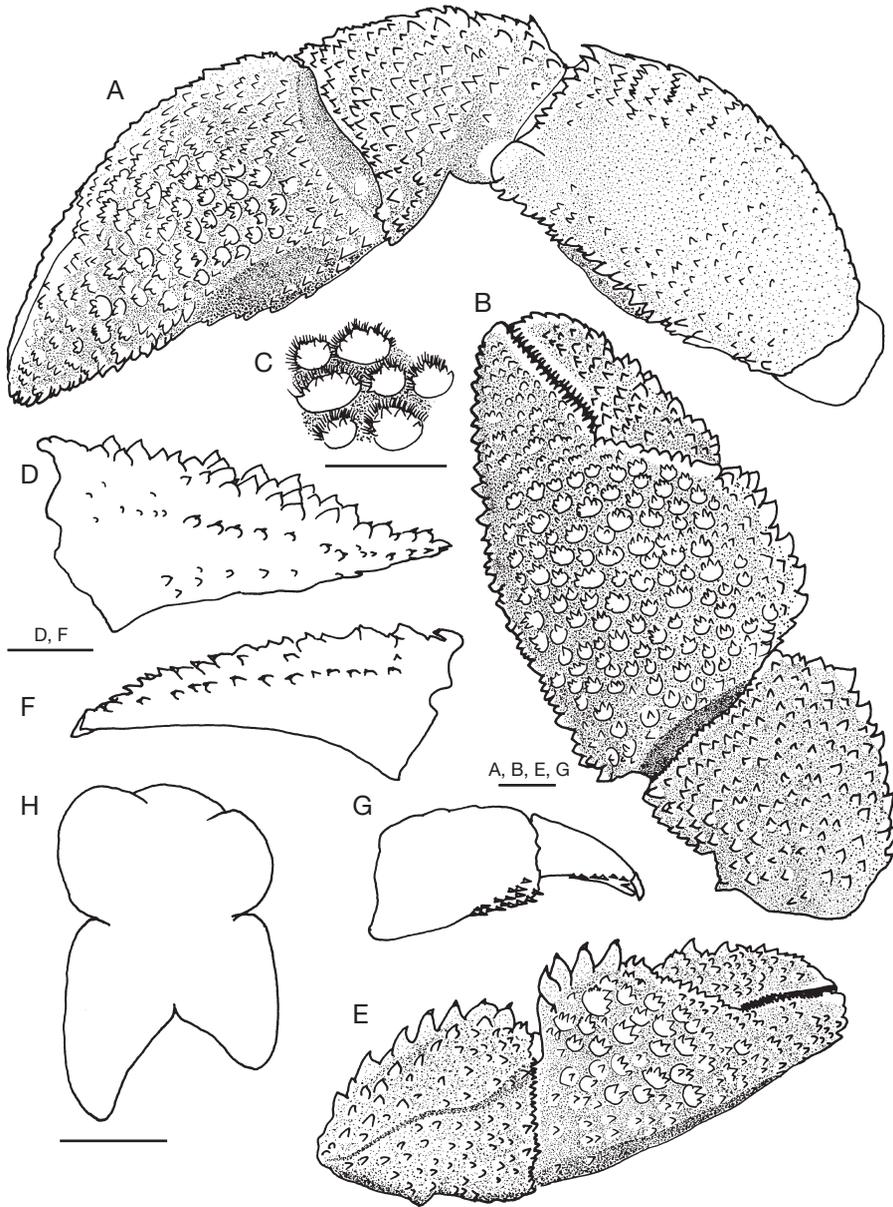


FIG. 2. — *Paguristes balanophilus* Alcock, 1905, ♂ 6.5 mm: **A**, left cheliped, lateral view, setae omitted; **B**, left cheliped, dorsal view, setae omitted; **C**, spines of cheliped; **D**, mesial face of dactyl of left cheliped, setae omitted; **E**, right cheliped, dorsolateral view, setae omitted; **F**, mesial face of dactyl of right cheliped, setae omitted; **G**, left fourth pereopod, lateral view, setae omitted; **H**, telson. Scale bars: 1 mm.

tral margin proximally, remainder of surface with scattered small spinules and small corneous spines, shallow longitudinal sulcus proximally, mesial face

of right third broader but with similar armament. Propodi of second pereopods each with irregular row of moderately large, corneous-tipped spines on

dorsal surface and tufts of long setae, third pereopods each with dorsal row of low protuberances, few additionally small spines and tufts of setae; ventral margins of second pereopods each with row of spinules and tufts of setae, third only with tufts of setae; lateral faces of second pereopods each with transverse rows of long setae near dorsal margin, shallow and narrow longitudinal sulcus accompanied by tufts of sparse short setae medially, and row of small tubercles near ventral margin; lateral faces of third similar but lacking row of small tubercles near each ventral margin; mesial faces of second pereopods each with transverse rows of tubercles and spines ventrally, several tubercles dorsally, each accompanied by tuft of setae denser on left; third pereopods each with row of spines (left) or spinules (right) near dorsal margin and irregular rows of small spines near ventral margin (left), fewer spines (right). Carpi each with shallow longitudinal sulcus and tufts of setae on lateral face; dorsal margins each with irregular double rows of spines and tufts of long setae more prominent on second. Meri of second pereopods each with ventral rows of small spines and tuft of long setae, dorsal margins each with low protuberances and long setae; third unarmed. Ischia unarmed but with long setae on ventral margins. Fourth pereopods (Fig. 2G) each with small preungual at base of claw; no dorsodistal spine on carpus.

Male first gonopods (Fig. 1B, C) each with single row of small hook-like corneous spines on distal margin of inferior lamella; external lobe slightly longer than inferior lamella, internal lobe short, with marginal setae. Second pleopods (Fig. 1D) with basal segment naked, distal segment with tuft of setae distally on endopod, appendix masculina with row of long marginal setae. Female first pleopods each with numerous moderately long setae on distal half of basal segment; distal segment with long marginal setae. Brood pouch (Fig. 1E) large, subquadrate, marginally scalloped and fringed with long, plumose setae. Eggs numerous, diameter 0.7–0.9 mm.

Telson (Fig. 2H) with moderately deep lateral incisions; median cleft small, shallow; posterior lobes markedly asymmetrical, terminal and lateral margins unarmed, each with row of long setae.

#### VARIATION

In the smaller specimens (male 3.6 mm, females 5.0 to 6.2 mm) of the series examined, the tubercles on the dactyls and palms of the chelipeds are simple rather than bi- or trifold; the dorsomesial margins of the dactyls of the left chelipeds are delimited by larger corneous-tipped spines. In larger specimens, particularly the males from the Gulf of Oman, the dorsomesial margins of the dactyls and the palms are armed with more flattened tubercles. Additionally, the mesial faces of the propodi of the left second pereopods in larger specimens are armed with irregular rows of spines or tubercles accompanied by tuft of moderately dense setae. The dissimilarity in the armature of the dorsomesial margins of the chelas and carpi of the left and right chelipeds is more prominently apparent in the smaller specimens.

#### AFFINITIES

*Paguristes balanophilus* was reported by Alcock (1905) to be closely allied with *P.?* *ciliatus* Heller, 1865, *P. calvus*, and *P. emerita* (Linnaeus, 1767) (as the junior synonym, *P. oculatus* (Fabricius, 1775)); with *Paguristes* sp. from the Red Sea by Lewinsohn (1969); with *P. runyanae* Haig & Ball, 1988, by Haig & Ball (1988); with *P. kimberleyensis* Morgan & Forest, 1991 and *P. longirostris* Dana, 1852, by Morgan & Forest (1991); and with *P. alcocki* McLaughlin & Rahayu, 2005, and *P. lewinsobni* McLaughlin & Rahayu, 2005, by the latter authors. As pointed out by McLaughlin & Rahayu (2005), *P. emerita* and Heller's (1865) *P. ciliatus* are immediately set apart by the spination of their respective telsons. In addition to the spination of the telson also reported for *P. longirostris* by McLaughlin (2002), the subequal chelipeds of both *P. longirostris* and *P. runyanae* will promptly differentiate these two species from the remainder. McLaughlin & Rahayu (2005) determined that Alcock's (1905) *P.?* *ciliatus* was conspecific with *P. alcocki* and Lewinsohn's (1969) *Paguristes* sp. was described as *P. lewinsobni*. *Paguristes balanophilus*, *P. alcocki*, and *P. lewinsobni* all appear to have a characteristic patch of colour on the distomesial and distolateral surfaces of each cheliped that is also present in *P. longirostris*, but absent in *P. runyanae* and *P. kimberleyensis*. *Paguristes alcocki* is most

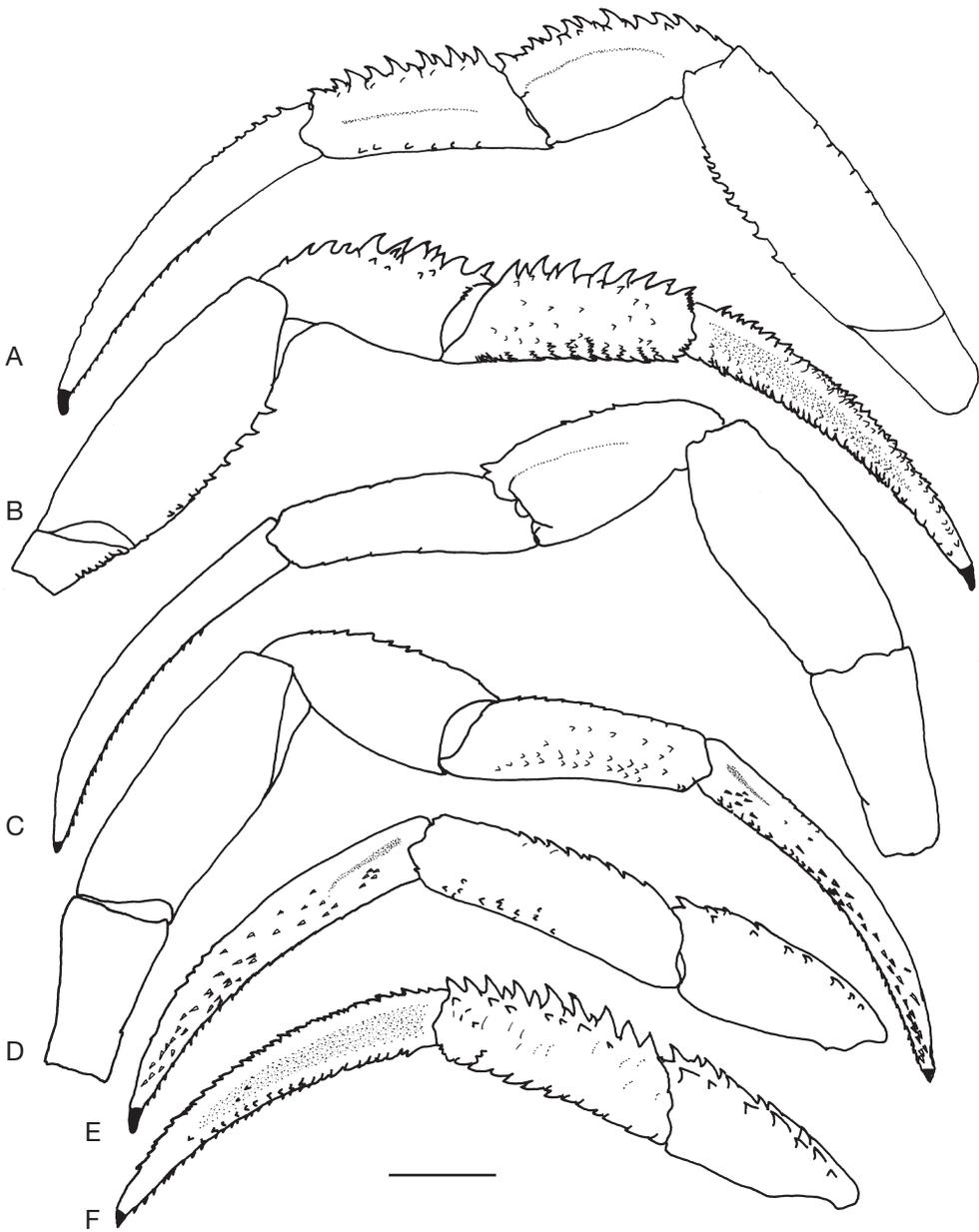


FIG. 3. — *Paguristes balanophilus* Alcock, 1905, ♂ 6.5 mm: **A, B**, left second pereopod; **C, D**, left third pereopod; **E**, right third pereopod; **F**, right second pereopod; **A, C**, lateral view; **B, D-F**, mesial view. Setae omitted. Scale bar: 2 mm.

easily distinguished from both *P. balanophilus* and *P. lewinoehni* by the armature of the mesial faces of the dactyls of the chelipeds. In both latter

species those surfaces have one or two principal rows of often corneous-tipped spines, whereas in *P. alcocki* the mesial faces of the dactyls are armed

with several irregular rows of small simple or corneous-tipped spinules. Additionally, the ocular acicles of *P. alcocki* each terminate acutely or with a single spine, while those of *P. lewinoehni* and *P. balanophilus* terminate as a bi- to multifid spinose processes. *Paguristes balanophilus* and *P. lewinoehni* clearly are the most closely allied of any of the aforementioned species, and until colours in life are known, small specimens, because of their more acute armature, will probably be separated with difficulty. The mesial faces of the dactyls of the chelipeds (Fig. 2D, F), although somewhat variable, are provided with fewer spines and/or tubercles in *P. balanophilus* and the cutting edges of the dactyls each are provided with small calcareous teeth over only approximately 0.3 of the length. The chelas of *P. balanophilus* are dissimilar in size and shape, the left being much larger and subtriangular whereas the right is subrectangular. The armature of the dorsal surfaces of both chelipeds of *P. balanophilus* generally consists of coverings of closely-spaced tubercles or tuberculate spines, each usually muricated or studded with bi- or trifold spinules and accompanied by or circumscribed by short setae; this armature differs primarily in the size and prominence of the spines on the dorsomesial margins of the chelas and carpi. With increased animal size, these tubercles often become more flattened and squamiform. The ventral surfaces of the chelas each have a row of large spines. In contrast, the mesial faces of the dactyls of *P. lewinoehni* differ from left to right, with the right much more weakly armed; the calcareous teeth of both dactyls extend 0.6-0.8 of the entire lengths of the cutting edges. The chelas of *P. lewinoehni*, although distinctly differing in size, are both generally subtriangular when viewed dorsally; the dorsal surfaces each have a much less dense covering of individual corneous-tipped spines, those of the right chela typically somewhat larger; the spines on the dorsomesial margins of the chela and carpus of the right cheliped are appreciably larger than those of the left. The ventral surfaces of the chelas both lack a row of large spines. Although both species have the terminal telsonal margins unarmed, a distinct median cleft separates the two lobes in *P. balanophilus*, whereas the cleft is obsolete or entirely absent in *P. lewinoehni*.

#### REMARKS

According to Alcock (1905), a total of 19 specimens of *P. balanophilus* (IM 2644-59/10, 4239/10, 4248/10, 4310/10) were recorded from four *Investigator* stations in the Andaman Sea and off Bombay, whereas the five specimens of *P. calvus* (IM 4701-5/10) came from one station in the northern Bay of Bengal. It was apparently the practice of the Indian Museum at that time that only depths and catalog numbers were provided for the collection localities, while station numbers were mentioned separately in the Biological Collections list (see Anonymous 1914). The Andamans' depth of 55 fathoms (102 m) corresponds with the data provided for station 239 in the list of stations of the *Investigator* from 1884 to 1913 (Anonymous 1914). As previously indicated, it was this station number that accompanied the specimens given as gifts of *P. balanophilus* to the NHM and the MNHN. The NHM catalog number indicated 11 specimens; however, 20 specimens were present, but only 10 specimens had been removed from their shells. Our reexamination included all of the specimens, of which 19 were *P. balanophilus*, but one proved to be *P. calvus*. The label accompanying the three specimens presented to the Paris museum now includes only *Investigator* station 239, the notation of the gift, the MNHN catalog number, and the identifications of two specimens as *P. balanophilus* and one as *P. calvus*. Presumably, this subsequent identification was made by a member of the MNHN staff after 1903 and most probably was done by Bouvier.

In his original description, Alcock (1905: 33) said simply that the left cheliped of *P. balanophilus* was somewhat larger; however his illustration (*ibid.*: pl. 3, fig. 1) depicted a significantly larger left cheliped. Miyake and coauthors (Miyake 1961, 1975, 1978a, b, 1982; Miyake *et al.* 1961; Miyake & Imafuku 1980) in several publications noted *P. balanophilus* as a member of the Japanese hermit crab fauna, but only in his monograph of the Anomura of Sagami Bay (Miyake 1978b) did he provide a diagnosis of the species he had identified as *P. balanophilus*. His 1975, 1978 and 1982 (reprinted in 1991 and 1998) publications also provided colour illustrations. Matsuzawa (1977) similarly presented a photo of a species identified as *P. balanophilus*. It is not

obvious from any of these reproductions whether the chelipeds are subequal or unequal; however in his diagnosis, Miyake (1978b: 40) clearly stated that the chelipeds of his species were subequal. As indicated in the redescription of *P. balanophilus*, the left cheliped is routinely appreciably larger than the right. Although we have not had the opportunity to locate any of Miyake's material, we must conclude that the Japanese species heretofore reported as *P. balanophilus* is not Alcock's (1905) taxon. Miyake (1978b: 41) described his species as being easily distinguished from other members of the genus by its particular colour pattern that included a dark red large circular patch in a violet field on both the inner and outer surfaces of the meri of the chelipeds. Unfortunately, there are several species that exhibit similar patches of colour, some with the colour restricted to the meri of the chelipeds, others with similar patches on the meri of the ambulatory legs as well. McLaughlin (2002) commented that the colour pattern of a species she identified from the Andaman Sea off Thailand as *P. longirostris* agreed better with the coloration described by Miyake (1978b) for *P. balanophilus* than it did with the colour of *P. longirostris* reported by Thomas (1989). However, in contrast to Miyake's (1978b) unarmed telson, McLaughlin (2002) described the telsons of the Thai specimens as being armed with a few spines. At present, the true identity of Miyake and colleagues species is not known, but Dr T. Komai (pers. comm.) suspects it may prove to be *P. gonagrus* (H. Milne Edwards, 1836).

*Paguristes calvus* Alcock, 1905

(Figs 4; 5)

*Paguristes calvus* Alcock, 1905: 35, pl. 1, fig. 4. — Bals 1915: 9; 1929: 25. — Ramadan 1936: 4 (list). — Gordan 1956: 321 (list). — Lewinsohn 1969: 13. — Turkey 1986: 132.

TYPE MATERIAL. — **Northern Bay of Bengal.** *Investigator*, stn not listed, 120 m, 5 syntypes (IM 4701-5/10) not seen.

OTHER MATERIAL EXAMINED. — **Andaman Sea.** *Investigator*, stn 239, 11°49.5'N, 92°55.0'E, 102 m, 14. IV.1898, 1 ♀ 5.6 mm (NHM 1903.4.6.181-191); 1 ♀ c. 6.0 mm, shield damaged (MNHN Pg 1533).

**Red Sea.** *Pola* Expedition, stn 179, 26°34'N, 34°14'E, 490 m, 28.II.1898, 1 ♀ 5.7 mm (NHMW 7492).

TYPE LOCALITY. — Northern Bay of Bengal; 120 m.

DISTRIBUTION. — Northern Bay of Bengal; Andaman and Red seas.

DESCRIPTION

Thirteen pairs of quadriserial gills; branchiostegites each with few spinules on distal margin and dorsal margin distally. Shield (Fig. 4A) longer than broad; dorsal surface with few tubercles laterally. Rostrum slender, elongate, reaching distal 0.3 of ocular acicles and considerably overreaching lateral projections, terminating acutely. Lateral projections triangular, each with tiny terminal spinule.

Ocular peduncles shorter than shield length, each with row of sparse tufts of setae on dorsal surface; corneal diameter 0.3 of peduncular length. Ocular acicles subtriangular, terminating acutely or in simple spine; separated by considerably more than basal width of one acicle.

Antennular peduncles, when fully extended, slightly longer than ocular peduncles; basal segment with small spine on lateral face of statocyst lobe.

Antennal peduncles reaching bases of corneas; fifth segment with few scattered setae; fourth segment with small dorsodistal spine and few setae; third segment with sparse setae laterally, ventrodistal margin with one or two acute spines; second segment with dorsolateral distal angle produced, terminating in simple or small to moderately large bifid spine, dorsomesial distal angle with small spine, lateral and mesial margins with setae; first segment unarmed. Antennal acicle reaching distal 0.2 to nearly distal margin of fifth peduncular segment, terminating in prominent bifid spine; two spines on lateral margin, four or five spines on mesial margin, with scattered setae not concealing armature. Antennal flagellum considerably longer than shield; articles each with one or two short setae proximally, slightly more numerous setae distally.

Chelipeds unequal, dissimilar; left larger. Left cheliped (Fig. 4B) with dactyl approximately 1.7 length of palm; dorsomesial margin delimited by row of large corneous-tipped spines, dorsal surface with irregular row of moderately small corneous-tipped spines and

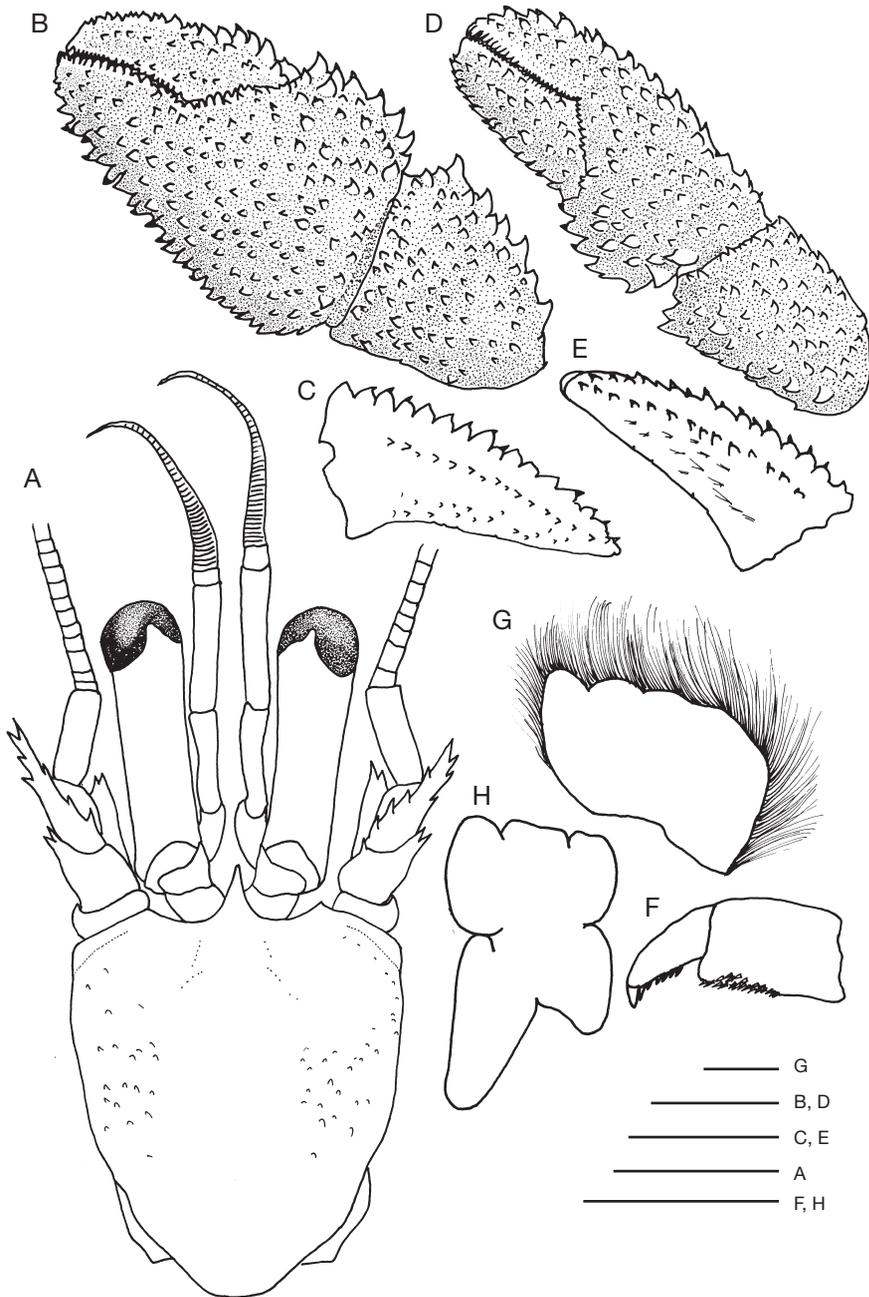


FIG. 4. — *Paguristes calvus* Alcock, 1905, ♀ 5.6 mm: **A**, shield and cephalic appendages, setae omitted; **B**, left cheliped, dorsal view, setae omitted; **C**, mesial face of dactyl of left cheliped, setae omitted; **D**, right cheliped, dorsal view, setae omitted; **E**, mesial face of dactyl of right cheliped, setae partially omitted; **F**, left fourth pereopod, lateral view, setae omitted; **G**, brood pouch, setae partially omitted; **H**, telson. Scale bars: 1 mm.

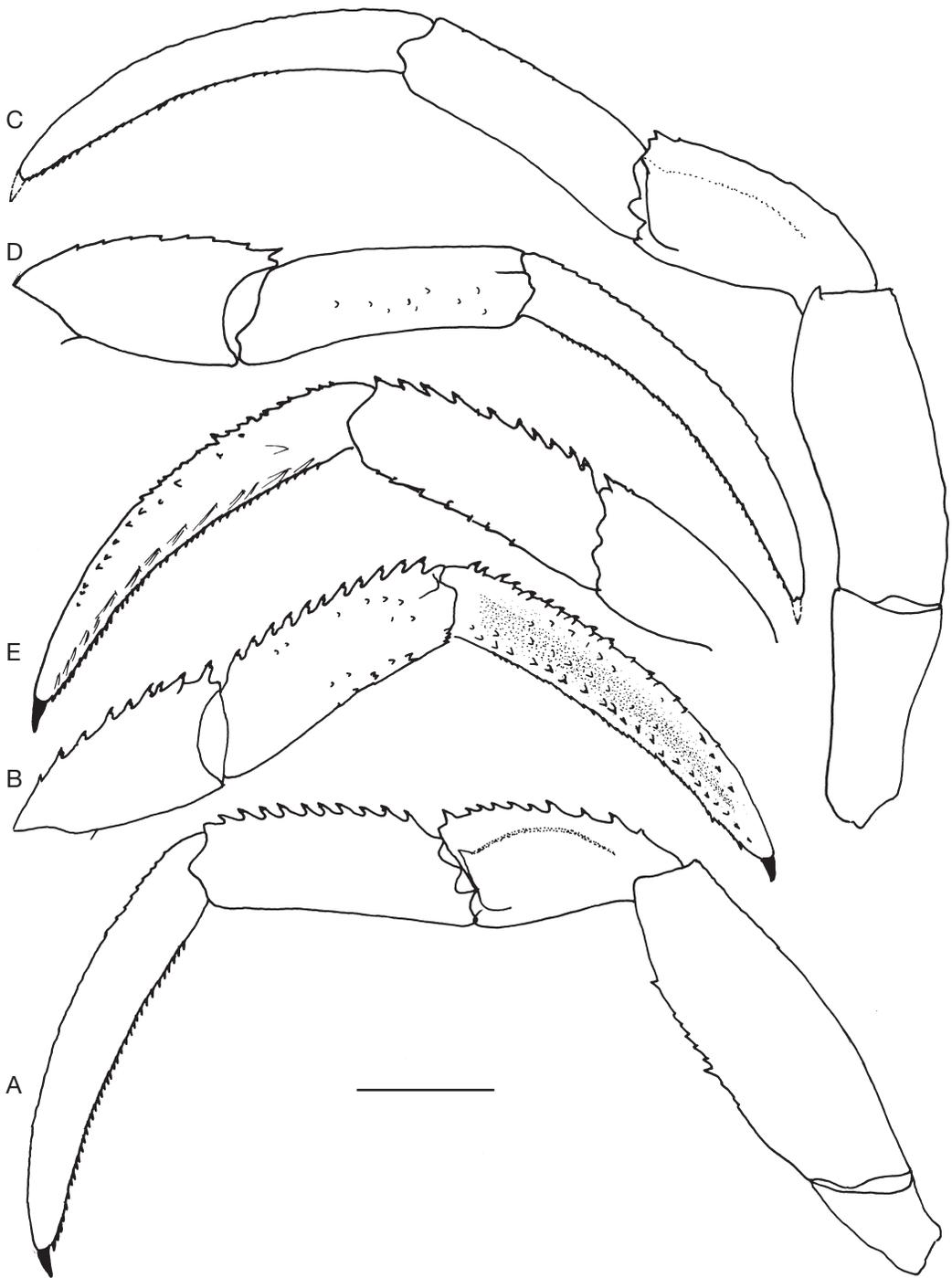


FIG. 5. — *Paguristes calvus* Alcock, 1905 ♀, 5.6 mm: **A, B**, left second pereopod, setae omitted; **C, D**, left third pereopod, setae omitted; **E**, right second pereopod, setae partially omitted; **A, C**, lateral view; **B, D, E**, mesial view. Scale bar: 1 mm.

row of tubercles laterad of midline, near cutting edge, few setae on dorsal surface; mesial face (Fig. 4C) with row of small corneous-tipped spines medially, several tubercles and small corneous-tipped spines below midline accompanied by sparse setae; cutting edge with row of small calcareous teeth, terminating in small corneous claw; without hiatus between dactyl and fixed finger. Palm with row of moderate to large spines on dorsomesial margin, convex dorsal surface with covering of prominent corneous-tipped spines and sparse tufts of setae, dorsolateral margin weakly delimited by row of large and small corneous-tipped spines, becoming more prominent and acute distally on fixed finger; mesial face with scattered small tubercles; lateral face of palm and fixed finger with scattered spinulose tubercles, ventral surface with row of large spines, decreasing in size on fixed finger and sparse tufts of setae. Carpus with row of moderately prominent spines on dorsomesial margin accompanied by tufts of sparse setae, distal margin with row of small spines extending onto lateral face; dorsolateral margin not delimited, dorsal and lateral surfaces with numerous spines, each spine with tuft of sparse setae; mesial face with subdistal row of small spinulose tubercles and two rows of tubercles dorsally. Merus with row of large spines on distal margin extending onto lateral and mesial faces, dorsal surface with subdistal short, transverse row of spines also extending onto lateral and mesial faces, remainder of dorsal margin with row of spines decreasing in size proximally and becoming obsolete; mesial face spinulose, ventromesial margin with row of small, spinulose tubercles or tuberculate spines and sparse tufts of setae; lateral face spinulose near ventral margin, ventrolateral margin with row of small, tuberculate spines and tufts of long setae. Ischium with row of small tubercles on ventromesial margin.

Right cheliped (Fig. 4D) with dactyl approximately 1.6 length of palm; dorsomesial margin with row of moderately small, corneous-tipped spines, decreasing in size distally, each spine accompanied by tuft of sparse setae; dorsal surface with numerous quite small tubercles; cutting edge with row of very small calcareous teeth in proximal 0.2, corneous teeth distally, terminating in small corneous claw; mesial face (Fig. 4E) with row of small corneous-tipped spines dorsally, second irregular row and few tubercles

ventrally. Palm with prominent, corneous-tipped spines on dorsomesial margin, dorsolateral margin not delimited, dorsal surface of palm and fixed finger with irregular rows of moderately large, sometimes corneous-tipped spines, each accompanied by sparse short setae; cutting edge of fixed finger with row of small calcareous teeth, terminating in small corneous claw; mesial face of palm with subdistal row of low tubercles and scattered smaller and larger tubercles; ventral surface with row of spines, corneous-tipped proximally, smaller spines distally; lateral surface of palm and fixed finger with scattered, sometimes corneous-tipped, spines, largest near ventral margin. Carpus with row of prominent corneous-tipped spines on dorsomesial margin, dorsodistal margin with row of spinules, extending onto lateral face; dorsolateral margin not delimited, dorsal and lateral surfaces each with numerous small, tuberculate, sometimes corneous-tipped spines; mesial face with few tuberculate spines. Merus with row of spines on distal margin extending onto lateral and mesial faces, dorsal surface with short, transverse row of subdistal spines also extending onto lateral face, remainder of dorsal surface with row of spines decreasing in size proximally and becoming obsolete; ventromesial margin with row of tuberculate spines and sparse setae; lateral surface spinulose, ventrolateral margin with row of small spines and sparse short setae. Ischium with row of tubercles and tufts of setae on ventromesial margin.

Second and third pereopods (Fig. 5) differing somewhat in armature. Dactyls about twice length of propodi; dorsal margins each with row of spinules, sometimes corneous-tipped (second), and long setae (second and third); ventral margins each with 29-40 corneous spines; lateral faces each with sparse tufts of setae and weak longitudinal sulcus proximally; mesial face of second left pereopod slightly flattened, with row of small corneous spines near ventral margin and scattered small corneous spines, right with row of stiff setae near ventral margin, sparse corneous spines near dorsal margin, and weak longitudinal sulcus proximally; mesial faces of third pereopods each with shallow longitudinal sulcus proximally, row of setae near ventral margin and row of tufts of sparse setae medially. Propodi of second pereopods each with irregular row of moderately small spines

and tufts of long setae on dorsal surface; ventral margins each with row of spinules and tufts of setae, mesial faces with numerous scattered tubercles (left) or sparse tubercles and corneous-tipped spinules (right). Propodi of third pereopods each with dorsal row of low protuberances and tufts of setae on dorsal surface; ventral margins with tufts of setae and mesial faces each with few tiny tubercles. Carpi each with shallow longitudinal sulcus on lateral face; second pereopods each with dorsal row of prominent spines and tufts of long setae, third with prominent dorsodistal spine and small spines or protuberances and tufts of setae on remainder of dorsal surface. Meri of second pereopods each with ventral rows of small spines and tuft of long setae, third unarmed. Ischia of second with few spinules on ventral margin, third unarmed. Fourth pereopods (Fig. 4F) each with small preungual at base of claw; no dorsodistal spine on carpus.

Female first pleopods each with numerous moderately long setae on distal half of basal segment; distal segment with long marginal setae. Brood pouch (Fig. 4G) large, subtriangular, margin slightly scalloped, fringed with long, plumose setae.

Telson (Fig. 4H) with moderately deep lateral incisions; median cleft small, shallow; posterior lobes markedly asymmetrical, terminal and lateral margins unarmed, each with row of long setae.

#### AFFINITIES

As noted by Alcock (1905), *P. calvus* is morphologically quite similar to *P. balanophilus*. Alcock distinguished *P. calvus* by its shorter, stouter ocular peduncles, longer antennal flagella and less setation. However, as demonstrated by McLaughlin (2004), ocular peduncular length and stoutness are frequently growth-related variables. Antennal flagellar length and setal densities are subject to appreciable intraspecific variation. With the few specimens of *P. calvus* that have ever been reported, it is not possible to assess variation in this species. However, there are characters that clearly are not subject to as much variation that can be used to differentiate between the two taxa. The number of spines on ventral margins of dactyls of the second and third pereopods tends to be greater in *P. calvus*, 29-40 rather than the 16-29 seen in *P. balanophilus*. The

three specimens of *P. calvus* that we have been able to examine all have simple ocular acicles, although the left acicle of the Red Sea specimen is damaged. The acicles of *P. balanophilus* are bi- to multifid. The mesial faces of dactyl and propodus of the left second pereopod of *P. calvus*, while slightly flattened, are not as distinctively so as is seen in *P. balanophilus*; the surfaces lack the longitudinal sulci; and the number and arrangement of spines are different. Although in smaller specimens of *P. balanophilus* the spines and tubercles on the dorsal surfaces of the chelipeds have not yet taken on squamiform appearances, the encircling short setae that accompany them are present. These arcs of setae are not seen in *P. calvus* where only 1-3 longer setae may occasionally accompany individual spines.

#### REMARKS

For the identification of *P. calvus* from the *Valdivia* Expedition, Turkey (1986) compared his four males and one female with the female identified by Balss (1915). Although Turkey (1986) gave no information on the morphology of his specimens, he did confirm the species' occurrence in the Red Sea and called attention to new depth record for the taxon. Balss' (1915) specimen had been collected at a depth of 490 m; the *Valdivia* specimens came from depths between 748 and 804 m. Alcock's (1905) specimens were from the much shallower depth of 120 m.

#### *Paguristes simplex* n. sp. (Figs 6; 7)

TYPE MATERIAL. — **Madagascar.** *Vauban*, stn CH 14, 12°43.3'S, 48°15.7'E, 245-255 m, 15.IV.1971, coll. A. Crosnier, ♂ holotype 6 mm (MNHN); same data as holotype, 3 ♂♂ paratypes 5.8-6.0 mm (MNHN). **Western Australia.** 114 nautical miles north of Point Headland, 18°25'S, 118°22'E, 201 m, 2.IV.1982, 5 ♂♂ paratypes 4.6-7.4 mm, 5 ♀♀ paratypes 2.9-4.7 mm, 2 ovig. ♀♀ paratypes 4.1, 5.3 mm (WAM C16715).

ETYMOLOGY. — From the Latin *simplex* meaning one and referring to the single row of primary tubercles or spines on the mesial face of the dactyl of each cheliped.

TYPE LOCALITY. — Madagascar, *Vauban*, stn CH 14, 12°43.3'S, 48°15.7'E, 245-255 m.

DISTRIBUTION. — Madagascar; northern Western Australia.

#### DESCRIPTION

Gills deeply quadriserial; branchiostegites each with short row of very small to tiny spinules on dorsal margin distally, anterior margins each with 1 or 2 spinules or very small spines. Shield (Fig. 6A) slightly longer than broad; anterolateral margins sloping; anterior margin between rostrum and lateral projections concave; posterior margin roundly truncate; dorsal surface with very few spinules marginally and very sparse setae. Lateral projections triangular, subacute, with or without terminal spinule. Rostrum triangular, reaching beyond bases of ocular acicles, unarmed or with terminal spinule and with marginal short setae.

Ocular peduncles unequal, left longest, 0.6-0.9 length of shield; dorsal surfaces each with sparse row of moderately long setae; corneal diameter 0.1-0.3 peduncular length. Ocular acicles acutely triangular, each with small terminal spine; separated basally by approximately basal width of one acicle.

Antennular peduncles, when fully extended, not quite reaching left distal corneal margin to exceeding margin by 0.3 length of ultimate segment. Ultimate and penultimate segments with few moderately short setae. Basal segment with acute spine on dorsolateral margin of statocyst lobe and 1 spine at ventromesial distal angle.

Antennal peduncles reaching distal 0.2-0.3 of left ocular peduncle; fifth segment unarmed; fourth segment with small dorsodistal spine; third segment with prominent ventrodistal spine; second segment with dorsolateral distal angle produced, terminating in simple or bifid spine; dorsomesial distal angle with small to moderately large spine; first segment with small spine on ventrodistal margin. Antennal acicle reaching 0.5-0.6 of left ocular peduncle; with bifid terminal spine; mesial margin with 3-5 spines, lateral margin with 2 spines in distal half. Antennal flagellum shorter than carapace; each article with 1-4 long and 1 or 2 short setae.

Third maxilliped with 1 small spine on ventrodistal margin of ischium; dorsodistal margin of merus unarmed, ventral margin with 3-5 spines.

Chelipeds subequal; left (Fig. 7A, B) or right slightly larger; armature generally similar; dactyl and fixed finger without hiatus. Dactyl slightly longer than palm; dorsomesial margin with row of moderately large spines, decreasing in size distally and accompanied by sparse tufts of moderately long setae, adjacent dorsal surface with row of tuberculate spines and sparse tufts of setae; mesial face (Fig. 7C) with 1 row of moderately large tuberculate spines or spinulose tubercles dorsally, occasionally row of widely-spaced protuberances or tubercles ventrally; cutting edge with row of small calcareous teeth in proximal 0.4-0.6, row of corneous teeth distally; terminating in small corneous claw, sometimes slightly overlapped by fixed finger. Palm approximately equal to length of carpus; dorsomesial margin with row of 4 or 5 prominent spines and tufts of setae, dorsolateral margin not delimited; weakly convex dorsal surface with several irregular rows of somewhat smaller tuberculate spines and sparse tufts of long setae, few rows extending nearly entire length of fixed finger; mesial face with scattered small tubercles or spinules, occasionally 1 or 2 irregular rows of 3-5 tubercles; ventral surface with few tubercles and sparse tufts of long setae, tubercles most prominent on fixed finger; cutting edge of fixed finger with row of small calcareous teeth; terminating in small corneous claw. Carpus 0.5-0.6 length of merus; dorsomesial margin with row of 5 or 6 prominent, often corneous-tipped spines, dorsal surface with numerous spines, largest forming irregular median row, and sparse tufts of long setae, dorsolateral margin only weakly delimited by 1 or 2 irregular rows of spines; lateral face with irregular rows of small spines; mesial face with few tubercles or protuberances. Merus with few spines, sometimes corneous-tipped, on distal margin; dorsal margin with row of transverse, spinose or spinulose ridges accompanied by tufts of long setae; ventromesial margin with row of small spines and long setae; ventrolateral margin with few small spines in distal 0.3-0.5. Ischium with row of minute tubercles on ventromesial margin.

Second (Fig. 7D, F) and third pereopods (Fig. 7E) with dactyls 1.4-1.9 length of propodi; dorsal margins each with row of tufts of moderately long, stiff setae, few very small spines proximally on second

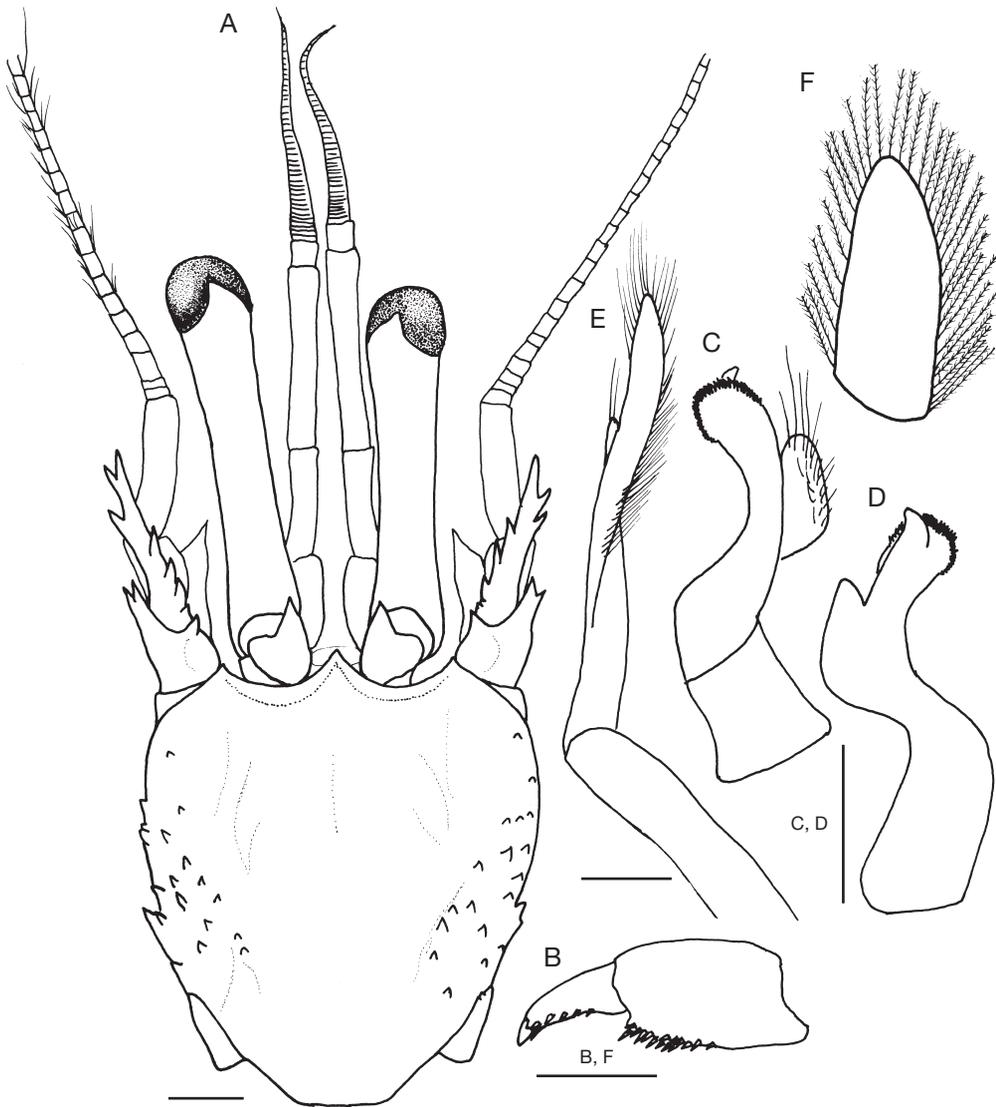


FIG. 6. — *Paguristes simplex* n. sp.: **A-E**, holotype, ♂ 6 mm; **F**, paratype, ♀ 4.3 mm; **A**, shield and cephalic appendages, setae partially omitted; **B**, left fourth pereopod, setae omitted; **C**, male first pleopod, dorsal view, setae partially omitted; **D**, male first pleopod, mesial view, setae omitted; **E**, male second pleopod, dorsal view, setae partially omitted; **F**, brood pouch. Scale bars: 1 mm.

pereopods; lateral faces each with weak longitudinal sulcus, at least proximally, and few to row of sparse tufts of short setae dorsally or medially; mesial faces each with weak longitudinal sulcus and irregular, transverse rows of short setae, few to irregular row of tiny spinules ventrally in larger specimens; ventral margins each with row of 15-18 corneous spines.

Propodi 1.1-1.4 length of carpi; dorsal margins each with row of few spines accompanied by tufts of moderately long setae on second pereopods, third with row of very small spinules or only tufts of moderately long setae, sometimes arising from low protuberances; mesial faces with few fine, moderately long setae; angular lateral surfaces each

with dorsal row of low protuberances or spinules and sparse tufts of setae, row of sparse setae medially; ventral surfaces each with row of low, sometimes spinulose protuberances and sparse tufts of setae. Carpi 0.6-0.8 length of meri; dorsal margins each with irregular row of moderately large spines (second) or dorsodistal spine and sometimes row of very small spines (third); lateral faces each with weak longitudinal sulcus and frequently small spine dorsally; ventral surfaces with few tufts of short setae. Meri each with dorsal row of low protuberances and tufts of moderately short setae; ventral margins of second pereopods each with row of small spines in distal half and tufts of moderately short setae, third unarmed but with sparse tufts of setae. Ischia unarmed but with sparse setae. Fourth pereopods (Fig. 6B) each with small preungual process at base of claw.

Male first pleopods (Fig. 6C, D) each with row of moderately short setae on lateral margin of inferior lamella, row of large, slender hooked spines on distal margin, continued down inner margin and decreasing in size; external lobe reaching distal margin of inferior lamella; internal lobe short, with long marginal setae extending onto inner face. Second pleopods (Fig. 6E) with basal segment naked, distal segment with tuft of setae distally on endopod, appendix masculina with row of long marginal setae. Female gonopores paired; paired first pleopods well developed, 2-segmented. Brood pouch (Fig. 6F) subovate, with marginal plumose setae. Tergites of left pleonal somites 2-4 each with thickened margin and row of long, dense, plumose setae. Telson (Fig. 6G) with deep lateral incisions separating anterior and posterior lobes; asymmetrical posterior lobes separated by very shallow, slit-like median cleft; left lobe usually appreciably elongate, both lobes subtriangular with rounded apices, terminal and lateral margins each with row of long setae.

#### *Colour (in preservative)*

Most colour lost; however, ocular peduncles retain a solid tint of colour.

#### HABITAT

Not reported.

#### VARIATION

Variation that appears to be growth related may be seen in the strength of the armature of the ambulatory legs. The smallest female has fewer spines developed on the dorsal margins of the dactyls of the second pereopods; only a row of very low protuberances is present on the dorsolateral surface of each propodus, and a row of spines is present only on the carpus of each second pereopod. In the males, all of which are larger, and the largest and ovigerous female, the spines on the dorsal margins of the dactyls of the second pereopods are more numerous and better developed; the propodi each have a row of spines or spinules rather than low protuberances on each dorsolateral face; and the carpi of the third pereopods each has a row of spinules on the dorsal surface in addition to the large dorsodistal spine. The brood pouch of the largest female is appreciably broader than that of the smallest, but whether this is related to animal size or an egg bearing condition is not known.

#### AFFINITIES

*Paguristes simplex* n. sp. appears morphologically most closely allied to *P. pusillus* Henderson, 1896 and *P. jalur* Morgan, 1992, sharing with those species the single row of spines or tubercles on the mesial face of each dactyl of the chelipeds and the tendency for the dactyls of the second pereopods, at least, to develop sulci on the mesial and/or lateral faces. The differences between *P. simplex* n. sp. and *P. pusillus* lie in the shape of the telson and the female brood pouch. The posterior lobes of the telson of *P. pusillus* only slightly asymmetrical and separated by V-shaped median cleft while in *P. simplex* n. sp. the posterior lobes are strongly asymmetrical and separated by shallow median cleft. Although the shape of brood pouch can be variable as shown by McLaughlin (2004) for *P. puniceus* Henderson, 1896, the females of *P. simplex* n. sp. have quite consistence shape of the brood pouch which is subovate with marginal plumose setae, while *P. pusillus* has large, fan-shaped brood pouch (McLaughlin & Rahayu 2005).

Morgan (1992) related *P. jalur* to *P. runyanae* Haig & Ball, 1988, and the characters shared by *P. simplex* n. sp. and *P. jalur* are similarly shared by

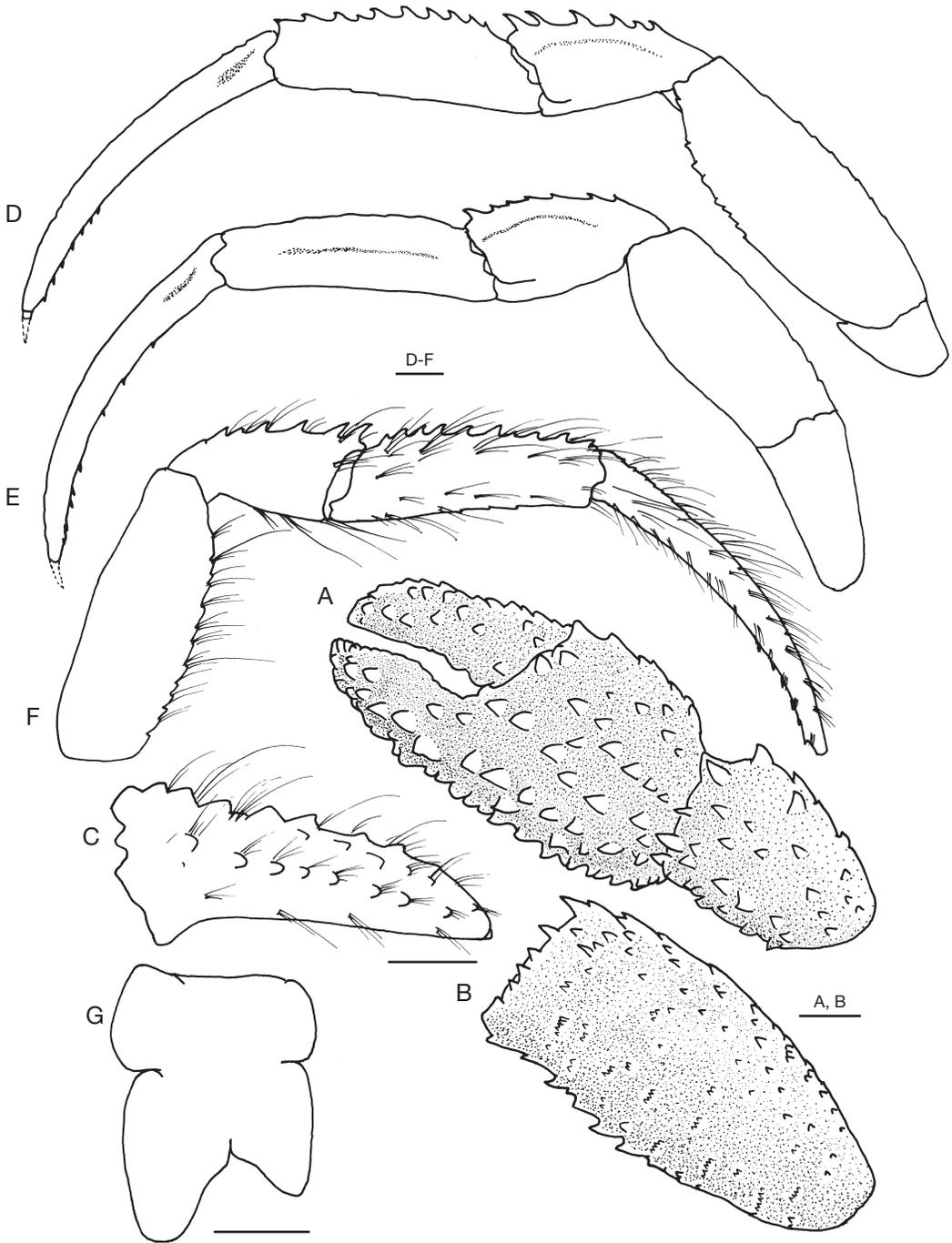


FIG. 7. — *Paguristes simplex* n. sp., holotype, ♂ 6 mm: **A**, left cheliped, dorsal view; **B**, merus of left cheliped, lateral view; **C**, dactyl of left cheliped, mesial view, setae partially omitted; **D**, left second pereopod, lateral view; **E**, left third pereopod, lateral view; **F**, left second pereopod, mesial view, setae partially omitted; **G**, telson. Scale bars: 1 mm.

*P. runyanae*. Of those cited by Morgan (1992) to differentiate between the latter two species, most were shown by McLaughlin (2004) to be growth related. However, for specimens of approximately comparable shield lengths, the ocular peduncles of Haig & Ball's (1988) taxon are considerably longer and slenderer than those of either *P. jalur* or *P. simplex* n. sp. Haig & Ball (1988) did not describe the gill lamellae of *P. runyanae*, but those of *P. jalur* are only distally quadriserial, whereas the lamellae of *P. simplex* n. sp. are deeply quadriserial. Neither Morgan (1992) nor Haig & Ball (1988) specified the number of spines on the ventral margins of the dactyls of the ambulatory legs, but in the illustrated specimens of both species the number did not exceed 12. The smallest specimen of *P. simplex* n. sp. in the type series is smaller than either the specimen of *P. jalur* illustrated by Morgan (1992: fig. 2C, D) or of *P. runyanae* by Haig & Ball (1988: figs 6F, 7A). Nevertheless, the number of spines on the ventral margins of the dactyls of *P. simplex* n. sp. is 17, with the range among the type series being 15 to 18.

Superficially, *P. simplex* n. sp. is also very similar to *P. palythophilus* Ortmann, 1892. These two taxa can be distinguished by the presence, in the latter species, of three to five rows of spines or tubercles on the mesial faces of the dactyls of the chelipeds and the relatively smooth mesial faces of the palms that are usually armed with only two or three large tubercles dorsally. Additionally, in *P. palythophilus* the cutting edge of the dactyl is armed with two or three large calcareous teeth proximally, and rostrum is usually longer.

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