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**Article**

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# Two new species of hermit crabs of the genus *Areopaguristes* Rahayu & McLaughlin, 2010 (Crustacea: Anomura: Paguroidea: Diogenidae) from the eastern tropical Pacific

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## Abstract

The genus *Areopaguristes* Rahayu & McLaughlin, 2010 is represented in the eastern Pacific by a single species, *A. mclaughlinae* (Ayón-Parente & Hendrickx, 2006). Based on material recently collected in the Gulf of California, Mexico, and held in museum collections, two new species of this genus are described. *Areopaguristes lemaitrei* **sp. nov.** and *A. waldoschmitti* **sp. nov.** Both have the typical 12 gills of the genus. In addition to its color pattern, *A. lemaitrei* **sp. nov.** is distinguished by the presence of corneous-tipped spines on palm and fingers, a broadly rounded rostrum shorter than lateral projections, and by the shape of the external lobe of the first pleopod. *Areopaguristes waldoschmitti* **sp. nov.** also features a distinctive color pattern, a less spinous armature of chelipeds, antennular peduncles proporcionally longer and antennal acicle shorter, a deep median cleft on the posterior margin of telson, and the distal margin of the inferior lamella of the first male pleopod is unarmed; this last character separates *A. waldoschmtti* **sp. nov.** from all its congeners.

**Key words**: Crustacea, Diogenidae, *Areopaguristes*, new species, eastern Pacific

## Introduction

Among the hermit crabs from the eastern tropical Pacific, the family Diogenidae is the more diverse. To date, a considerable number of studies and reviews of this group are available for the region, but many undescribed species are yet to be described (Ayón-Parente & Hendrickx 2010). Species of the genus *Paguristes* sensu lato occurring in the eastern Pacific have caused considerable taxonomic problems, even among specialists, due to the fact that many species are very similar. In many cases, detailed morphological analysis is required to correctly identify the specimens to genus and species level. When McLaughlin (2002) proposed the genus *Pseudopaguristes*, she stated that in all cases a detailed description of the number and type of gills was needed, particularly in order to elucidate the status of species related to or identified with the genus *Paguristes*.

The genus *Areopaguristes* was recently proposed by Rahayu & McLaughlin (2010) to replace the preoccupied name *Stratiotes* Thomson, 1899. According to the diagnosis proposed by Rahayu (2005), species of *Areopaguristes* are characterized by having 12 pairs of gills. Until now the genus contained 22 species, with only one described from the tropical eastern Pacific, *Areopaguristes mclaughlinae* (Ayón-Parente & Hendrickx, 2006) (McLaughlin *et al*. 2010).

While revising the series of hermit crabs held in the collections of the Laboratorio de Invertebrados Bentónicos, UNAM, in Mazatlán, Mexico, and specimens received on loan from other institutions, we found several specimens of unidentified hermit crabs with morphology similar to the genus *Paguristes*. Following the recomendation of McLaughlin (2002), we examined the gills of these specimens and concluded that they belong to two new species of *Areopaguristes.* These are described herein.

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## Material and methods

Specimens are deposited in the Regional Collection of Invertebrates (EMU), in Mazatlán, Mexico, the Biological Collection of CICIMAR, Instituto Politécnico Nacional (CICIMAR), La Paz, Baja California Sur, Mexico, the crustaceans collection of the Natural History Museum of Los Angeles County, California, USA, the Coleccíon Nacional de Crustáceos (CNCR), Instituto de Biología, UNAM, México DF, Mexico, and the Invertebrate Collection of the University of Arizona (UAZ), Tucson, Arizona, U.S.A. Unless indicated, the specimens were hand collected. Terminology generally follows that of McLaughlin (1974), and McLaughlin (2003) for the use and significance of the term "semichelate". Shield length (SL, in mm) is measured from the midpoint of the rostral lobe to the midpoint of the posterior margin of the shield. The length of the ocular peduncle was obtained by measuring the total length of the ultimate peduncular segment, including the cornea on the lateral face of the peduncle. Other abbreviations used: NS, not sexed; NM, not measured; St., sampling station; ovig., ovigerous.

## Taxonomy

### Paguroidea

### Diogenidae

#### *Areopaguristes* Rahayu & McLaughlin, 2010

#### *Areopaguristes lemaitrei* sp. nov.
(Figs 1–3)

*Paguristes* sp.— Westervelt, 1967: 64, 75.
*Areopaguristes* sp 1.— Ayón-Parente & Hendrickx, 2010: 4.

**Material examined.** *Holotype*: male (SL 3.40 mm), Estero de Urias, Mazatlán, Sinaloa, Mexico (23°11'00''N, 106°21'42''W), 15 Mar 2006, Van Veen dredge, 1 m (EMU-9520). *Paratypes*: 1 male (SL 1.89 mm), 1 female (SL 1.87 mm), and 1 ovig. female (SL, 3.05 mm), Estero de Urias, Mazatlán, Sinaloa (23°11'00''N, 106°21'42''W), 19 May 2006, Van Veen dredge, mud, 1 m (EMU-9521); 1 male (SL 2.90 mm), Punta Central, Bahía Kino, Sonora (28°45'43''N, 111°56'25''W), 9 Mar 2007 (EMU-9252); 1 male (SL 3.97 mm), Bahía Kino, Sonora (28°45'43''N, 111°56'28''W), 9 Mar 2007 (EMU-9249); 2 males (SL 1.67 and 2.10 mm), Las Amacas and El Pinto, Bahía de Topolobampo, Sinaloa (25°32'05''N, 109°05'01''W), 26 Nov 2004, 0–0.5 m (LACM CR 2004-034); 1 male (SL 2.57 mm) and 1 female (SL 2.19 mm), Las Amacas and El Pinto, Bahía de Topolobampo, Sinaloa (25°32'05''N, 109°05'01''W), 26 Nov 2004, 0–0.5 m (CNCR-26661).

**Additional material.** 2 males (SL 2.83 and 3.45 mm) and 4 ovig. females (SL 2.62–3.10 mm), Bahía La Choya, Puerto Peñasco, Sonora 8 Sep 1983 (UAZ-1519); 2 males (SL 3.20 and 3.35 mm), Bahía La Choya, Sonora, (31°20'36''N, 113°38'40''W), 6 Mar 2007, (EMU-9247); 23 specimens in shell (NS, NM), Bahía La Choya, Sonora (31°20'36''N, 113°38'40''W), 6 Mar 2007 (EMU-9248); 11 males (SL 1.45–3.00 mm) and 2 females (SL 2.00 mm), Estero de La Cruz, Bahía Kino, Sonora (28°47'32''N, 111°54'48''W), 7 Mar 2007 (EMU-9251); 5 males (SL 1.50–2.70 mm), Isla Alcatraz, Bahía Kino, Sonora (28°48'43''N, 111°57'42''W), 8 Mar 2007 (EMU-9253); 2 males (SL 1.30 and 2.20 mm), Isla Alcatraz, Bahía Kino, Sonora (28°48'56''N, 111°57'51''W), 8 Mar 2007 (EMU-9254); 1 female (SL 1.08 mm), Bahía de Bacochibampo, Guaymas, Sonora, 2 Sep 2001 (EMU-9522); 12 males (SL 1.47–3.07 mm), 7 females (SL 1.33–2.33 mm), and 7 specimens in shell (NS, NM), Punta Prieta, Bahía de Topolobampo, Sinaloa, 25 Nov 2004, oyster dredge, 0.5–1.0 m (EMU-9523); 2 males (SL 2.20 and 2.46 mm), 2 females (SL 1.76 and 2.17 mm), and 6 specimens in shell (NS, NM), Ensenada El Pabellón, Sinaloa St. 11 (24°29'12''N, 107°31'16''W), 13 Dec 1990, beam trawl, 2.5 m (EMU-9524); 1 female (SL 2.20 mm), Las Ratas, Ensenada El Pabellon, Sinaloa, St. 1A (24°29'56''N, 107°41'19'W), 5 Mar 1991 (EMU-9525); 11 specimens in shell (NS, NM), La Figueroa, Ensenada El Pabellón, Sinaloa (24°28'49''N, 107°44'W), 22 Jun 1991, 0.8–1 m, sand (EMU-9526); 2 males (SL 2.17 and 2.59 mm) and 1 female (SL 2.58 mm), Ensenada El Pabellón, Sinaloa (24°24'12''N, 107°34'15''W), 23 Jun 1991, 2 m, trawl (EMU-9527); 4 males (SL 2.26–3.21 mm), 2

females (SL 1.46 and 1.88 mm), and 2 ovig. females (SL 1.60 and 1.78 mm), Las Ventanas, Ensenada El Pabellón, Sinaloa (24°28’07’’N, 107°37’32’’W), 6 Mar 1991, push net (EMU-9528); 1 male (SL 1.33 mm) and 1 female (SL 1.70 mm), Ensenada El Pabellón, Sinaloa (24°24’12’’N, 107°34’15’’W), 23 Jun 1991, 2 m, trawl (EMU-9529); 1 male (SL 1.51 mm) and 4 specimens in shell (NS, NM), La Palma-Altata, Sinaloa, serie 28, St. 15 (EMU-9530); 3 males (SL 2.14–2.54 mm), Isla Capultita, Ensenada El Pabellón, Sinaloa (24°28’08’’N, 107°42’49’’W), 2 May 1991 (EMU-9531); 2 males (SL 1.43 mm), Las Ratas, Ensenada El Pabellón, Sinaloa, serie 72, St.1 (24°29’56’’N, 107°41’19’’W), 22 Jun 1991, 0.40 m (EMU-9532); 1 male (SL 1.46 mm) and 2 ovig. females (SL 1.04 mm), Bahía de Mazatlán, Sinaloa (23°12’12’’N, 106°25’57’’W), BBMAZ cruise C13 B/E FC1, 8 Jul 1980, (EMU-9533); 1 ovig. female (SL 1.39 mm) and 5 specimens in shell (NS, NM), Puerto Viejo, Bahía de Mazatlán, Sinaloa (23°13’36’’N, 106°27’28’’W), 20 Oct 2006, oyster dredge, 4 m, sand (EMU-9534).

**Description.** Shield (Fig. 1A) as long as broad, dorsal surface with numerous toothed tubercles, spines, spinules, and tufts of long setae; well marked, anterior median concavity. Rostral tooth short, obtusely triangular, weakly produced, shorter than lateral projections; lateral projections obtuse, each armed with small marginal spine, reaching bases of ocular acicles. Margin between rostrum and lateral projections slightly concave or straight. Anterolateral margins sloping; anterolateral angle with 1 submarginal strong spine. Branchiostegites each with row of small to moderately strong spines on anterodorsal distal margin, partially concealed by tufts of long setae; distal margin with long setae.

Ocular peduncles (Fig. 1A) long, cylindrical or slightly compressed in middle; length 0.70 times width of shield; dorsomesial margin with row of short setae. Cornea small, not dilated, diameter about 0.20 peduncular length. Ocular acicles long, subtriangular or subrectangular, mesial margins contiguous, each armed with 2–4 small spines on lateral margin and tufts of long plumose setae, terminating in 2 or 3 spines; inner margin ocasionally with one submarginal small spine at subdistal margins.

Antennular peduncles (Fig. 1A) long, overreaching ocular peduncles by 0.50 length of ultimate segment when fully extended; ultimate and penultimate segments unarmed; basal segment with ventromesiodistal and laterodistal margins each bearing 1 small spine and tufts of setae.

Antennal peduncles long, reaching half of cornea or slightly overreaching ocular peduncles, with supernumerary segmentation. Fifth segment unarmed, with longitudinal row of long setae on dorsolateral margin. Fourth segment with one small spine on dorsodistal margin. Third segment with rounded ventral margin and with 1–3 spines on ventromesial distal angle and long setae. Second segment with dorsolateral distal angle produced, terminating in strong bifid spine; lateral margin with 1 or 2 small spines; dorsomesial distal angle terminating in strong spine; mesial margin with tufts of setae. First segment with 1 small spine on lateral distal margin. Antennal acicles long or moderately long, straight or slightly curved, reaching 0.70 length of ocular peduncles; mesial margin with 4 or 5 spines and tufts of long setae, lateral margin unarmed, terminating in bifid spine. Antennal flagella short, not exceeding length of chelipeds, each article with long and paired setae ventrally.

Mandible with 3-segmented palp. Maxillule (Fig. 2A) with proximal endite subquadrate; distal endite subrectangular, enlarged distally; endopod with one apical seta on weakly produced internal lobe, external lobe well developed, recurved, about 0.80 length of endopod, exterobasal angle with 2 or 3 long setae. Maxilla (Fig. 2B) with endopod moderately long, slightly exceeding scaphognathite in distal extension. First maxilliped (Fig. 2C) with endopod moderately short, not reaching distal end of basal segment of exopod; proximal segment of exopod subtriangular, tapering distally; flagellum short, distally laminar, with long plumose setae; epipod well developed. Second maxilliped (Fig. 2D) with basis-ischium fusion incomplete. Third maxilliped (Fig. 2E) with basis-ischium fusion complete; coxa with one large spine at ventrodistal margin, basis with 3 spines or denticles partially concealed by tufts of long setae; ischium with well developed crista dentata, without accesory tooth; merus with ventral margin unarmed, dorsodistal margin with minute spine; carpus, propodus and dactyl unarmed.

Chelipeds (Fig. 1A, B) short, slightly unequal, left larger than rigth and differing somewhat in armature. Dactyls 1.10–1.20 times longer than palms, each terminating in large corneous-tipped claw overlapped by tip of fixed fingers; dactyls and fixed fingers equal in breadth; dorsal surface with few small spines accompanied by tufts of long setae; dorsomesial margin with row of strong, corneous-tipped spines decreasing in size distally; mesial surface with rows of single, bifid or trifid spine-like tubercles or spines accompanied by tufts of long setae; ventral surface with row of tubercles acompanied by tufts of long setae; cutting edge with calcareous teeth interspaced with corneous denticles. Palms arcuate on dorsomesial margin, latter armed with 4–6 (usually 5), strong, corneous-tipped spines and tufts of long setae; dorsal surface with 3–4 (left) or 4–5 (right) longitudinal rows of corneous-tipped spines, smaller than dorsomesial spines, more densely set in fixed finger surface, accompanied with tufts of

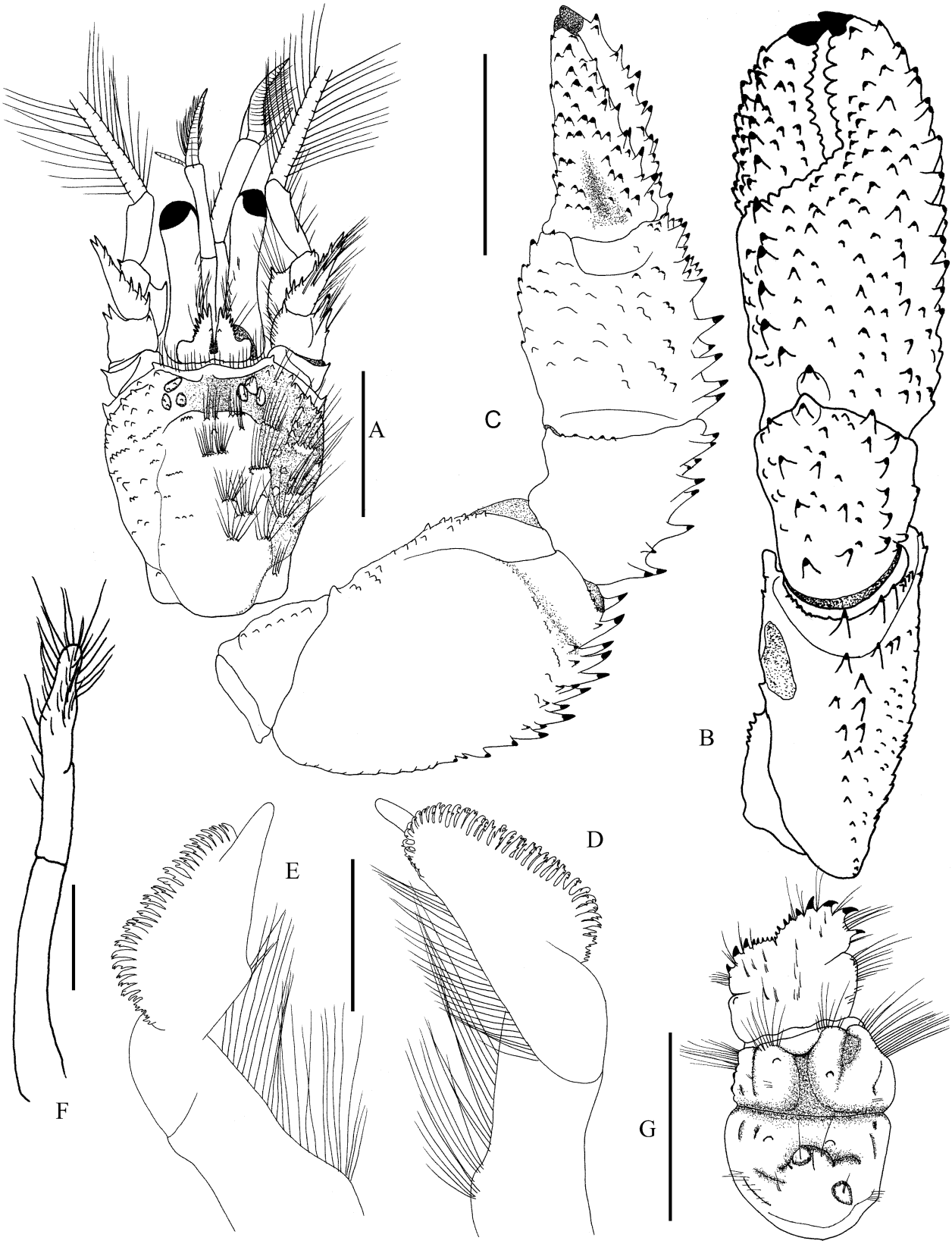


**FIGURE 1**. *Areopaguristes lemaitrei* **sp. nov.** Holotype male (SL 3.40 mm). A, shield and cephalic appendages, dorsal view; B, right cheliped, dorsal view, setae omitted; C, right cheliped, mesial view, setae omitted; D, first pleopod, inner view; E, first pleopod, external view; F, second pleopod; G, telson and sixth abdominal segment, dorsal view. Scale bars: A–C, G 2 mm, D–F 0.5 mm.

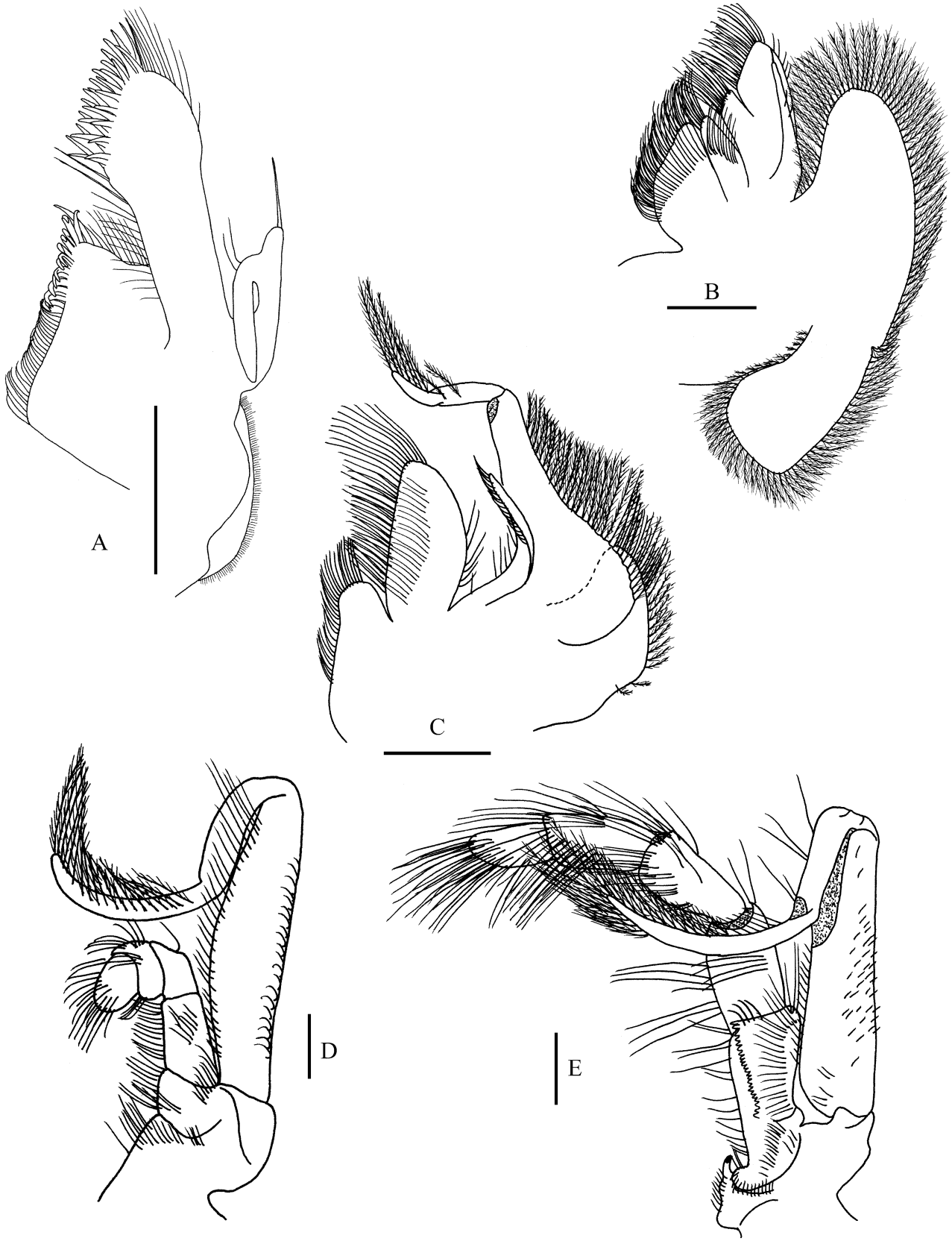


**FIGURE 2**. *Areopaguristes lemaitrei* **sp. nov.** Holotype male (SL 3.40 mm); right mouthparts: A, maxillule, internal view; B, maxilla, internal view; C, first maxilliped, internal view; D, second maxilliped, internal view; E, third maxilliped, internal view. Scale bar: 1 mm.

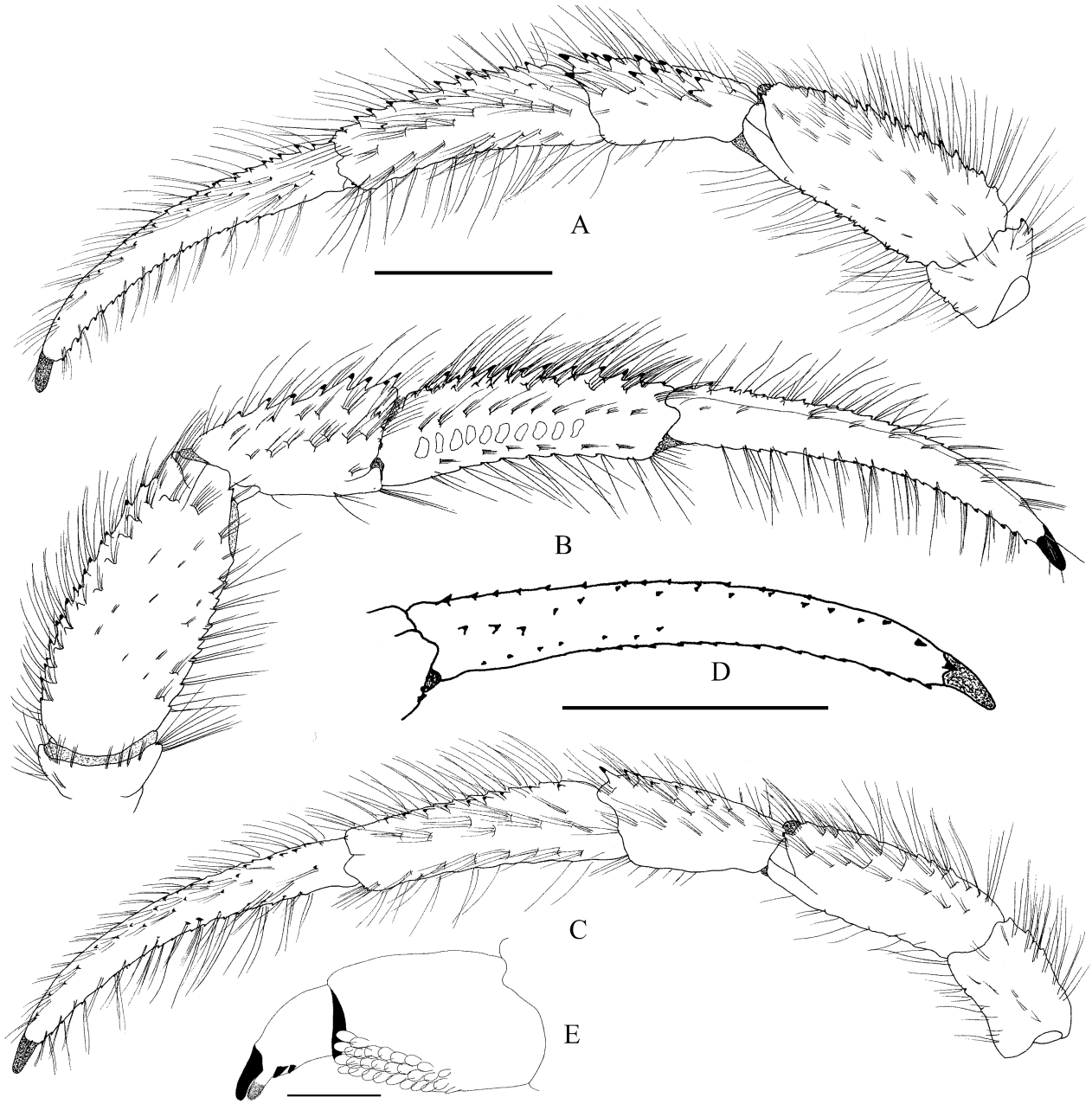


**FIGURE 3**. *Areopaguristes lemaitrei* **sp. nov.** Holotype male (SL 3.40 mm). A, second right pereopod, mesial view; B, second right pereopod, lateral view; C, third right pereopod, mesial view; D, dactyl of second left peropod, mesial view, setae omitted; E, dactyl and propodus of fourth left pereopod, lateral view, setae omitted. Scale bars: A–D 2 mm, E 0.5 mm.

long setae; dorsolateral margin with row of strong, corneous-tipped spines decreasing in size proximally and distally; mesial, lateral and ventral surfaces each with irregular longitudinal row of strong granules or spine-like tubercles; fixed finger ending in corneous-tipped claw, dorsal surface with 2 or 3 irregular longitudinal rows of conical spines accompanied with tufts of long setae; cutting edge with calcareous teeth. Carpi 0.55 to 0.67 length of meri; dorsal surfaces each with few corneous-tipped spines, distal margin with corneous-tipped spines and tufts of long setae, one strong spine near articulation with palm; dorsomesial margins each with 4–6 (usually 5) corneous-tipped conical spines acompanied with tufts of long setae; dorsolateral margins each with 4 corneous-tipped conical spines; mesial and lateral surfaces with tubercles or granules accompanied with tufts of stiff setae. Meri long, 0.80–1.00 times length of palm; dorsal margins each with row of tubercles proximally, becoming corneous-tipped spines distally, the latter extending on lateral surfaces, and tufts of long stiff setae; distal and subdistal margins each with strong, corneous-tipped spines and tufts of long stiff setae; mesial faces smooth, with some tufts of long setae proximally and scattered granules distally; distal margins each with tufts of long stiff setae; ventromesial margins

with teeth or tubercles and tufts of long plumose setae; lateral faces with numerous granules or tubercles, larger anteriorly, and tufts of long plumose setae; ventrolateral margins with tubercles and tufts of long plumose setae; ventral surfaces with scarse tubercles accompanied by tufts of short setae. Ischia with granules or teeth on ventromesial margin and tufts of long plumose setae.

Second and third pereopods (Fig. 3A–D) long, slender and setose on dorsal and ventral margins, exceeding chelipeds by 0.50 length of dactyl. Dactyls long, 1.33 times length of propodi, ending in large corneous claw; dorsal surfaces each with row of corneous-tipped spines proximally, decreasing in size distally (second) or with row of spine-like granules decreasing in size distally (third), accompanied by tufts of long stiff setae; dorsomesial and dorsolateral margins each with irregular row of small, spine-like granules, partially concealed by tufts of long stiff setae (second) or only with tufts of long stiff setae (third); mesial surfaces each with 2 irregular longitudinal rows of small, corneous-tipped spines, largest proximally, accompanied by tufts of long stiff setae; ventromesial margins with tufts of long setae; lateral surfaces each with longitudinal smooth sulcus flanked by tufts of moderately long setae; ventrolateral margins with tufts of long setae; ventral margins each with row of corneous spines increasing in size distally. Propodi moderately long, 1.25–1.30 times length of carpi; dorsal surface with row of large, corneous-tipped spines (second) or with small, spine-like tubercles accompanied by tufts of long stiff setae (third); mesial and lateral surfaces rugose or with irregular longitudinal rows of flattened tubercles bearing tufts of long setae; dorsomesial and dorsolateral margins each with row of small, corneous-tipped spines acompanied by tufts of long stiff setae; ventral surfaces with flattened granules or tubercles bearing tufts of long stiff setae. Carpi short, 0.75–0.90 length of meri; dorsal surfaces each with double irregular row (second) or single row (third) of large or moderately large corneous-tipped spines accompanied by tufts of long stiff setae; mesial surfaces each with 2 irregular longitudinal rows of tufts of moderately long setae; lateral surfaces each with 2 longitudinal rows of tufts of short setae, distal margin with some small spines. Meri long, compressed laterally; dorsal surfaces each with row of small corneous-tipped spines (second) or double row of small, spine-like flattened tubercles (third) concealed by tufts of long plumose setae; mesial surfaces smooth, with few tufts of short stiff setae or bristles; lateral surfaces each with numerous small granules or tubercles accompanied by tufts of long stiff setae; ventral surfaces each with double row of corneous tubercles or teeth (second) or only flattened granules or tubercles (third) concealed by tufts of long plumose setae. Ischia each with row of small granules or spines on ventromesial margin, dorsodistal margins with strong, corneous-tipped spine (second) or row of small granules or spines (third) and tufts of long, stiff plumose setae.

Sternite of third pereopods with bilobate, anterior lobe, each lobe with tufts of long stiff setae.

Fourth pereopods (Fig. 3E) weakly semichelate; dactyl short, setose, with 1 or 2 moderately strong spines posterior to preungual process; preungual process well developed, almost as long as dactyl, covered apically by very short setae; propodi with propodal rasp consisting of 3 or 4 rows of oval corneous scales. Carpus and merus unarmed, with tufts of long setae on dorsal margin. Fifth pereopods chelate; dactyl with 2 or 3 rows of corneous denticles; propodus with well developed rasp.

Male first and second pleopods modified as gonopods. First pleopod (Fig. 1D, E) with row of long setae on mesial margin of basal lobe, superior mesial angle with tufts of long setae, lateral margin of basal lobe naked or with 2 or 3 long setae proximally; inferior lamella with row of long setae on lateral margin, distal margin with row of simple, bifid or trifid, curved corneous spines extending on mesial face; external lobe subtriangular, exceeding inferior lamella in distal extention, naked; inner lobe reduced or vestigial, mesial margin with tuft of short setae proximally. Second pleopod (Fig. 1F) with basal segment usually naked; endopod with few long setae; appendix masculina strongly twisted, lateral and distal margins and ventral face with long setae. Pleopods 3–5 unpaired, exopod well developed, endopod vestigial or absent.

Female with paired gonopores; lacking first pleopods; pleopods 2–4 on left side with both rami well developed; pleopod 5 as in male. Brood pouch represented by row of long setae posterior to pleopod 4.

Sixth pleonal tergite subrectangular (Fig. 1G), well calcified, divided in 3 areas by sulci, anterior area larger; dorsal face with scarce granules or crenulations and tufts of long setae; anterior margin rounded, posterior margin straight; posterolateral margins fringed with long setae, left posteriorly oblique.

Uropods and telson asymmetrical. Telson (Fig. 1G) with posterior lobes subrectangular to subquadrate, left larger than right; separated by small median, shallow cleft; posterior margin of lobes each armed with 7 or 8 strong, corneous-tipped spines, increasing in size towards lateral margins; lateral margin of left lobe usually with 2 strong spines. Anterior lobe unarmed, usually with 1 granule or crenulation distally and tufts of long setae on lateral margins.

**Color.** *In life:* specimens collected in estuaries present the following coloration. Pleon greenish-blue. Carapace purple over white or cream background. Shield and ocular acicles olive. Antennal and antennular segments, and antennal flagella transparent. Ultimate and penultimate antennular segments each with two longitudinal reddish-brown stripes, one on dorsomesial and another on ventromesial margins. First antennal segment and antennal acicle whitish. Antennal flagella with one longitudinal brown stripe on ventral margin. Ocular peduncles light pink. Cornea light brown or honey. Third maxillipeds transparent with merus, carpus, propodus and dactyl each with proximal brown band. Chelipeds and ambulatory legs with orange setae. Chelipeds with movable and fixed fingers white, movable fingers with proximal brown band. Palms and carpi with dorsal and half of lateral surfaces brown, ventral surface white. Meri with dorsal surface olive and proximal half of lateral surface brown, mesial surface with one subdistal blue spot. Ambulatory legs with dactyls cream lateraly, olive dorsally, each with brown band proximally. Propodi olive over whitish background, with proximal brown band. Carpi light olive with dorsal surface dark-green. Meri olive laterally, dorsal surface light brown, mesial surface with one blue spot.

Specimens collected in the intertidal and subtidal zones present the following coloration. General coloration orange, with ocular peduncles pink. Chelipeds with a blue spot on inner side of meri. This color pattern agrees with the description provided by Westervelt (1967) for *Paguristes* sp.

Specimen fixed over a long period of time. Shield whitish or cream; chelipeds, pereopods and remainder of body cream or light orange. A large, uncalcified area can be seen on the inner surface of merus of chelipeds, which appears reddish or purple under light.

**Habitat.** *Areopaguristes lemaitrei* **sp. nov.** is abundant in bays and estuaries throughout its range, on sand and muddy-sand, between 0 and 4 m depth. Specimens examined use several species of gastropod shells, but more frequently *Cerithium maculosum* Kiener, 1841.

**Distribution.** Eastern coast of the Gulf of California, from Bahía La Choya, Puerto Peñasco, Sonora, to Estero de Urias, Mazatlán, Sinaloa, Mexico.

**Etymology.** The species name honors Rafael Lemaitre from Smithsonian Institution National Museum of Natural History, in recognition of his enormous contributions to the study of hermit crabs, and the countless occasions on which he has shared his experience and knowledge of anomurans with us; used as a noun in the genitive case.

**Remarks.** The material reported as *Paguristes* sp. by Westervelt (1967) is from Puerto Peñasco, one of the many localities at which *A. lemaitrei* **sp. nov.** was collected. The color pattern provided by Westervelt (1967) fits well with the color of the material of *A. lemaitrei* **sp. nov.** collected in the intertidal zone on sandy beaches during this study and we believe that both are conspecific. Based on the color pattern, the reference to *Paguristes* sp. by Snyder-Conn (1980: 277, key) might also refer to *A. lemaitrei* **sp. nov.** or to the other new species described herein.

Among the species of *Areopaguristes*, *A. lemaitrei* **sp. nov.** shows major morphological similarities with *A. mclaughlinae* (Ayón-Parente & Hendrickx, 2006), both species having contiguous and multispinous ocular acicles, antennular and antennal peduncles of equal length, and antennal flagella bearing long setae ventrally. The armature of the chelipeds is also very similar, but in *A. lemaitrei* **sp. nov.** the spines on the palm and fingers are corneous-tipped while in *A. mclaughlinae* they are obtuse. *Areopaguristes lemaitrei* **sp. nov.** is also distinguished from *A. mclaughlinae* by the shape of the rostrum, which is broadly rounded and shorter than lateral projections in the former vs. triangular and equal in length to lateral projections in the latter, and by the antennal acicles, unarmed on lateral margin in the former vsarmed with 1 or 2 small spines in the latter. Also, the male first pleopod in *A. lemaitrei* **sp. nov.** features a subtriangular external lobe, rather than a subrectangular lobe in *A. mclaughlinae*. The habitat occupied by these two species also differs. *Areopaguristes lemaitrei* **sp. nov.** occurs at intertidal or shallow depths (0–4 m), while *A. mclaughlinae* is subtidal (5–27 m). The colour pattern of these two species is also different. In *A. mclaughlinae* the shield bears reddish-brown spots on a cream background; ocular peduncles white; chelipeds reddish-brown with dactyl and fixed finger white; ambulatory legs with dactyl and propodus white, each with narrow, reddish-brown band proximally; carpi and meri reddish-brown on dorsal surface, lateral and ventral surfaces white (Ayón-Parente & Madrid-Vera 2009).

*Areopaguristes lemaitrei* **sp. nov.** also shows some superficial resemblances with *Paguristes praedator* Glassell, 1937, including in the shape of the rostrum and the antennal flagellum. In *P. praedator*, the ocular peduncles are proportionally longer and more slender, and the ocular acicles are separated and bear a single spine, while in *A. lemaitrei* **sp. nov.** these are contiguous and multispinous.

***Areopaguristes waldoschmitti* sp. nov.**
(Figs 4–6)

*Paguristes* sp.— Schmitt, 1939:9. Haig *et al*., 1970: 19. — (?) Ramírez-Guillen, 1983: 72, fig. 20.
*Areopaguristes* sp. 2. — Ayón-Parente & Hendrickx, 2010: 4.

**Material examined.** *Holotype*: male (SL 1.34 mm), Punta Arboleda (26º55'36"N, 110º05'06"W), Sonora, CORTES I cruise, St. 16, 05 May 1982, 24 m, trawl (EMU-9535). *Paratypes*: 1 male (SL 1.10 mm), Punta Arboleda (26º56'36"N, 110º05'06"W), CORTES I cruise, St. 16, 05 May 1982, 24 m, trawl (EMU-9536); 1 male (SL 1.30 mm) and 1 ovig. female (SL 1.02 mm), Punta Arboleda (26º56'36"N, 110º05'06"W), CORTES I cruise, St. 16, 05 May 1982, 24 m, trawl (EMU-9537); 1 male (SL 1.30 mm), Punta Arboleda (26º56'36"N, 110º05'06"W), CORTES I cruise, St. 16, 05 May 1982, 24 m, trawl (LACM-1982-2180); 1 male (SL 2.10 mm), off Las Cabras (22º43'8"N, 106º10'43"W), Sinaloa, CEEMEX-C1 cruise, 21 Jun 1990, 30m, trawl (CNCR-26660).

**Additional material.** 3 males (SL 2.45–3.35 mm) and 2 ovig. females (SL 2.25 mm), Boca de López Mateos, Baja California Sur, 23 May 2008 (CICIMAR-2200); 1 male (SL 2.66 mm), Los Praditos, Estero Santo Domingo, Baja California Sur, 3 Apr 2006, 1 m (CICIMAR-2201).

**Description.** Shield (Fig. 4A) 1.00–1.10 times as long as broad; dorsal surface with a few spines or spinules and tufts of long setae anteriorly, particularly laterally; a well marked, anterior median concavity. Rostral tooth broadly obtuse or obsolete, shorter than lateral pojections; lateral projections triangular, obtuse with marginal spine. Margin between rostrum and lateral projections slightly concave or straight. Anterolateral angles each armed with strong or moderately strong spine; posterior margin rounded. Branchiostegites with row of strong or moderately strong spines on dorsal margin, partially concealed by tufts of long setae; distal margin with tufts of long setae.

Ocular peduncles (Fig. 4A) cylindrical, straight, broadest basally, length about 0.77 length of shield; dorsomesial margin with row of tufts of short setae; cornea small, slightly dilated; corneal diameter 0.28 length of ocular peduncles. Ocular acicles subtriangular, broad basally, mesially contiguous, ending in strong single or bifid spine; lateral margins with 3–5 spines.

Antennular peduncles (Fig. 4A) long, when totally extended exceeding in length to ocular peduncles by length of ultimate segment; ultimate and penultimate segments unarmed, with some long setae on dorsal margin; basal segment with a spine at ventromesiodistal and dorsolaterodistal margins.

Antennal peduncles long, equalling in length to ocular peduncles or exceeding these by 0.33 length of ultimate segment. Fifth segment unarmed, with some short setae on dorsal and ventral margins. Fourth segment with small dorsodistal spine. Third segment with prominent ventrodistal spine. Second segment with dorsolateral distal angle produced, usually terminating in bifid spine, lateral margin unarmed; dorsomesial distal angle with small spine, mesial margin with tutfs of short setae. First segment with 1 or 2 small spines at laterodistal angle. Antennal acicle equalling in length to fourth antennal segment, almost straight, mesial margin armed with 3 or 4 spines, terminating in bifid or trifid spine. Antennal flagellum short, about 1.25 times length of shield; ventral margin with double row of very long setae.

Mandible without distinghishing characters. Maxillule (Fig. 5A) with proximal endite subcircular, distal endite subrectangular, enlarged distally; endopod with one apical seta on weakly produced internal lobe, external lobe well developed, recurved, about 0.50 length of endopod. Maxilla (Fig. 5B) with endopod moderately long, slightly exceeding scaphognathite in distal extensión, somewhat inflated basally. First maxilliped (Fig.5C) with endopod elongated, about 0.75 length of basal segment of exopod, strongly twisted; proximal segment of exopod subtriangular, tapering distally; flagellum short, distally laminar, with long plumose marginal setae distally; epipod well developed. Second maxilliped (Fig. 5D) with basis-ischium fusion incomplete. Third maxilliped (Fig. 5E) with basis-ischium fusion incomplete; basis unarmed; ischium with crista dentata well developed, without accesory tooth; merus with ventral margin unarmed, dorsodistal margin with minute spine; carpus, propodus and dactyl unarmed.

Chelipeds (Fig. 4B, C) subequal, left slightly stronger than right; armature similar. Dactyls 1.40–1.50 times length of palms; dorsomesial margin with row of corneous-tipped spines accompanied by tufts of long setae; dorsal surface with longitudinal row of corneous-tipped spines and tufts of setae; mesial surface with irregular transverse rows of single or bifid spine-like tubercles accompanied by tufts of long setae; cutting edge with calcareous teeth interspaced with small corneous spines; large, corneous-tipped claw overlapped by fixed finger. Palms 0.67–0.70

length of carpi; dorsomesial margin with 4 prominent spines accompanied by tufts of long setae, mesial surface with scattered flattened tubercles accompanied by tufts of long setae; dorsal surface flat to slightly convex, with 3 longitudinal rows of corneous-tipped spines, one row extending on entire length of fixed finger; dorsolateral margin with row of corneous-tipped spines increasing in size on fixed finger, lateral surface with longitudinal rows of spine-like tubercles accompanied by tufts of long setae; ventral surface with row of flattened tubercles extending on entire length of fixed finger; cutting edge of fixed finger with calcareous teeth interspaced with small corneous spines; large, corneous-tipped claw. Carpi 0.60 length of meri; dorsomesial margin with 5 (occasionally 6) prominent spines accompanied by tufts of long setae; dorsal surface with some corneous-tipped spines and tufts of long setae; dorsolateral margin with 5 or 6 moderately strong, corneous-tipped spines accompanied by tufts of long setae; mesial and lateral surfaces with scattered flattened tubercles and tufts of long setae. Meri triangular in dorsal view; dorsal margin with flattened tubercles proximally, arranged in short transverse rows of small corneous-tipped spines distally and accompanied by tufts of long plumose setae; subdistal margin with row of spines extending on mesial and lateral surfaces; dorsodistal margin with 4 or 5 moderately strong, corneous-tipped spines and tufts of long setae; mesial surface smooth; lateral surface with numerous small spines or spinules; ventromesial margin with denticles; ventrolateral margin with small corneous-tipped spines. Ischia usually with 1 granule or denticle on ventromesial, margin partially concealed by tufts of long setae.

Second (Fig. 6A, B, D) and third (Fig. 6C) pereopods slender, long, exceeding chelipeds by length of dactyls, second slightly longer than third and somewhat different in armature; left longer than right. Dactyls 1.40-1.66 length of propodi; dorsal surfaces each with 4 or 5 (second) or 4–6 (third) proximal corneous-tipped spines accompanied by tufts of long setae (small specimens), or row of corneous-tipped spines decreasing in size distally (large specimens); mesial surfaces each with 2 or 3 irregular longitudinal rows of tufts of long setae (juveniles), or tufts of setae acompanied by small corneous spines (large specimens); lateral surfaces each with 2 longitudinal rows of tufts of long setae; ventral margins each with row of 5–9 small or minute corneous spines in distal half, partially concealed by tufts of long setae. Propodi 1.30–1.60 length of carpi; dorsal surfaces each with row of moderately strong, corneous-tipped spines (second), or only with low tubercles accompanied by tufts of long setae (third); lateral surfaces each with 2 longitudinal rows of tufts of long setae; mesial surfaces each with 2 or 3 irregular longitudinal rows of tufts of long setae, frequently associated with protuberances or spinules; ventral margins with tufts of long setae. Carpi moderately long, 0.70 (second) to 0.80–0.90 (third) length of meri; dorsal margins each with row of large, corneous-tipped spines (second) or 1 large dorsodistal spine and row of smaller additional spines (third); lateral surfaces each with weak longitudinal sulcus and 2 or 3 rows of tufts of moderately long setae and 1 or more spines, sometimes with median row of small spines (second); ventral surfaces each with tufts of long or moderately long setae. Meri compressed laterally; dorsal margins each with row of small spines (second) or with only 1 small distal spine (third), and tufts of long setae; lateral surfaces each with low tubercles or spinules and tufts of short setae; ventral margins each with row of small spines and tufts of long setae (second) or with only low protuberances and long setae (third); ventrolateral distal angle with 1 small spine (second) or only tufts of long setae (third). Ischia each with 1 moderately strong dorsodistal spine (second) or unarmed (third); ventromesial margin with row of small spinules (second) or with only tufts of long setae (third).

Sternite of third pereopods (Fig. 4D) transversely subrectangular, bilobate, each lobe with tufts of long stiff setae.

Fourth pereopods (Fig. 4F, G) weakly semichelate; dactyl short, 0.85 length of propodus, with 2 or 3 strong spines posterior to preungual process; preungual proccess well developed, slender, covered apically with short setae; propodus with propodal rasp consisting of 3 or 4 rows of corneous scales. Carpus and merus unarmed, with tufts of long setae on dorsal margin. Fifth pereopods chelate. Dactyl with 1 or 2 rows of corneous denticles; propodus with rasp well developed.

Male first pleopod (Fig. 6E, F) with tuft of setae on mesial margin of basal lobe, upper mesial angle with tuft of setae; internal lobe subcircular, with row of long setae on inner margin; lower lamella with row of long setae on lateral margin, distal margin unarmed; external lobe subtriangular. Second pleopod (Fig. 4E) with elongate basal segment, endopod naked or with few setae; appendix masculina with long setae marginally and on inner face. Left pleopods 3–5 with endopod vestigial or rudimentary. Females with paired gonopores; first pleopods absent; pleopods 2–4 with both rami well developed; pleopod 5 as in male. Brood pouch represented by row of long setae posterior to pleopod 4.

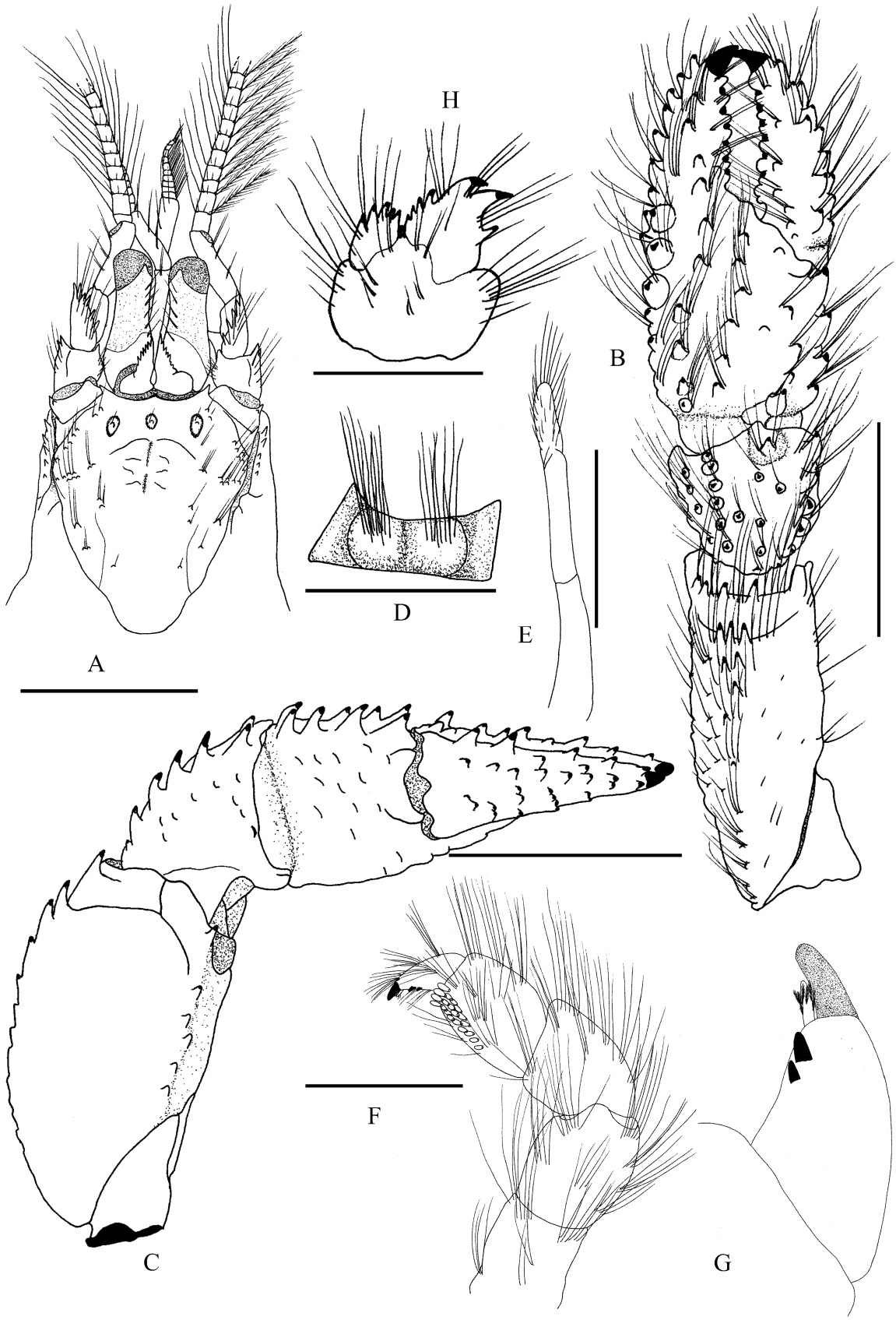


**FIGURE 4**. *Areopaguristes waldoschmitti* **sp. nov.** Holotype male (SL 1.34 mm). A, shield and cephalic appendages, dorsal view; B, left cheliped, dorsal view; C, left cheliped, mesial view, setae omitted; D, sternite of third pereopods; E, second male pleopod; F, left fourth pereopod, lateral view; G, same, dactyl, enlarged, lateral view, setae omitted; H, telson, dorsal view. Scale bars: A-C 1 mm; D–H 0.5 mm.

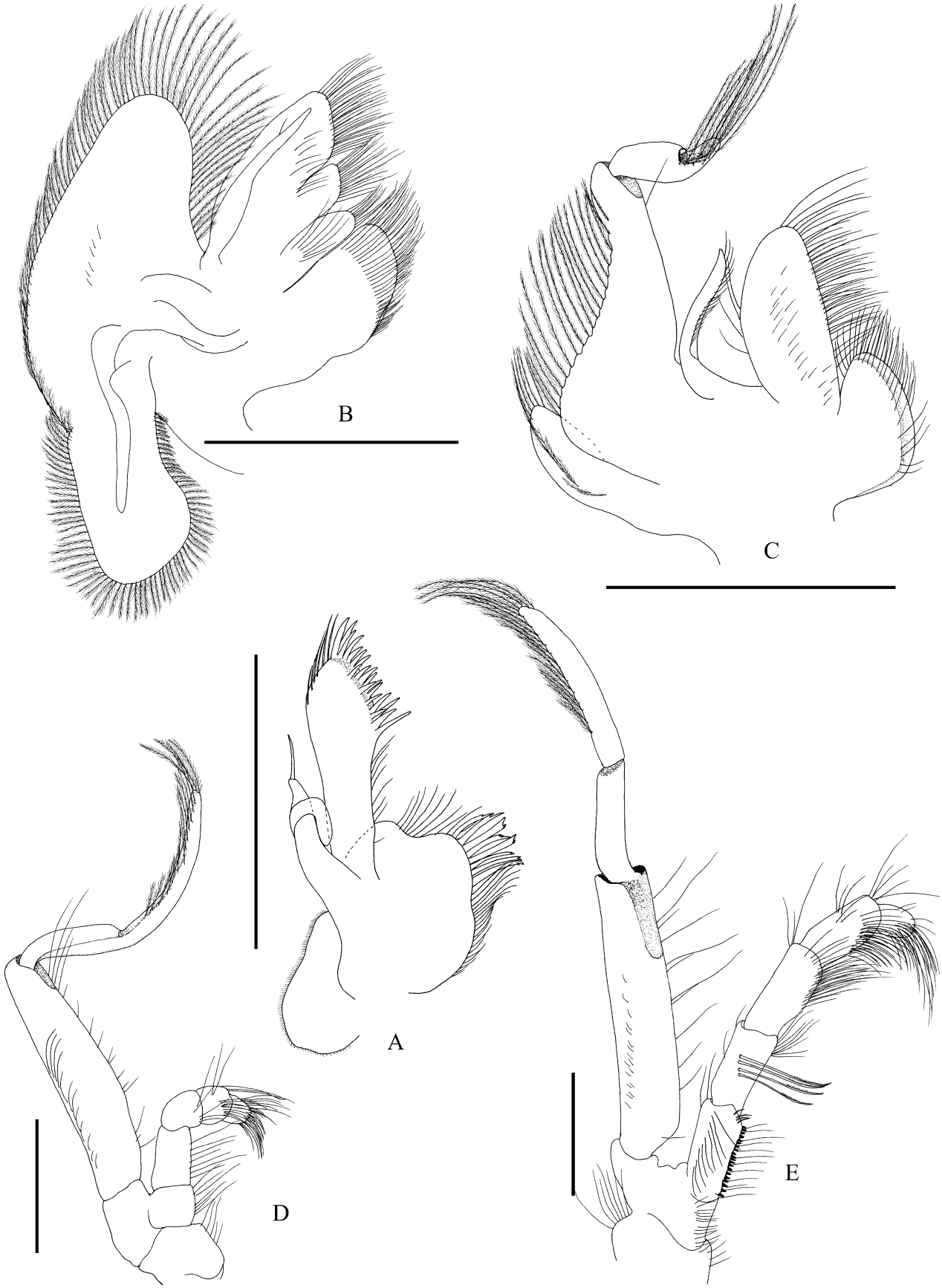


**FIGURE 5**. *Areopaguristes waldoschmitti* **sp. nov.** Holotype male (SL 1.34 mm), left mouthparts: A, maxillule, internal view; B, maxilla, internal view; C, first maxilliped, internal view; D, second maxilliped, internal view; E, third maxilliped, internal view. Scale bar: A–E 0.5 mm.

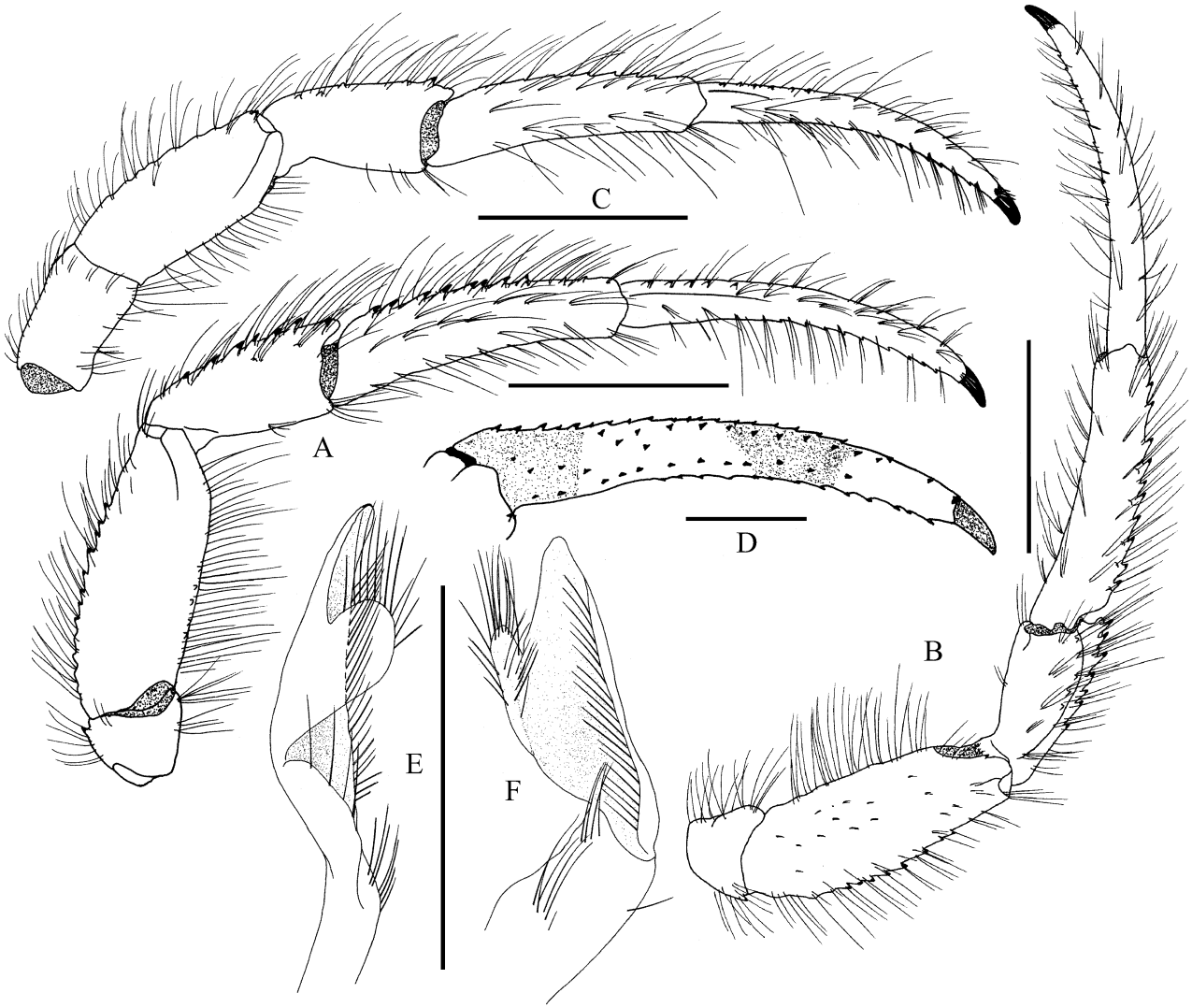


**FIGURE 6**. *Areopaguristes waldoschmitti* **sp. nov.** A-C, E, F, holotype male (SL 1.34 mm); D, male (SL 3.35 mm) (CICIMAR-2200). A, second left pereopod, mesial view; B, second left pereopod, lateral view; C, third left pereopod, mesial view; D, dactyl of second left pereopod, mesial view, setae omitted; E, first pleopod, external view; F, first pleopod, internolateral view. Scale bars: A–D 2 mm, E–F 0.5 mm.

Uropods and telson asymmetrical. Telson (Fig. 4G) with posterior lobes separated by deep, median cleft; left lobe longer than rigth, subeliptic to subrectangular, with posterior margin armed with 3–6 strong spines, 1–4 near median cleft and 2 stronger corneous-tipped spines towards lateral margin, lateral margin usually with 1 strong spine; rigth lobe subquadrate, distal margin usually armed with 5 corneous-tipped spines, lateral margin unarmed or with 1 small spine. Anterior lobes unarmed, with tufts of long setae on lateral margins and a few setae dorsally.

**Color.** *In life.* Carpi of chelipeds red; chelae white with red blotches, which merge to form a transverse band about midway along each finger. Ambulatory legs white; propodus and dactyl each with a proximal and subdistal red ring (adapted of Haig *et al*. 1970).

*In ethanol*. Shield with orange spots on cream background; ocular peduncles light pink; cornea honey. Chelipeds stained of orange on white to cream background, dactyl and fixed finger white, with orange band at midlength. Ambulatory legs cream with one subdistal and one proximal orange bands on dactyl, propodus, carpus and merus.

**Habitat.** Specimens have been collected on sandy substrates, in 1–40 m depth. According to Haig *et al*. (1970), this species is abundant along the west coast of Baja California. Ovigerous females have been collected in May, June and October (Haig *et al*. 1970; Ramírez-Guillén 1983).

**Distribution.** From Boca de las Animas to Bahía Magdalena, west coast of Baja California Sur, and from Punta Arboleda, Sonora, to Las Cabras, Sinaloa, Mexico, Gulf of California (Haig *et al*. 1970; Ramírez-Guillén 1983; this study). The Puerto Peñasco record provided by Ramírez-Guillén (1983) probably corresponds to the material cited by Westervelt (1967; as *Paguristes* sp.) and, as previously noted (see above), this record belongs to *A. lemaitrei* **sp. nov.**

**Etymology.** The species is named to honor Waldo L. Schmitt in recognition to his great contribution to our knowledge on decapod crustaceans, and who first reported this species of hermit crab. It is treated in the genitive case as a combination of "Waldo" and "Schmitt".

**Remarks.** Schmitt (1939) reported on an ovigerous female of *Paguristes* sp. from Bahía Magdalena, Baja California Sur, Mexico. While referring to material from the same locality, Haig *et al*. (1970) considered it to be conspecific with Schmitt specimen (identified as *Paguristes* sp.). Haig *et al.* (1970) provided a color description which fits the color pattern of *A. waldoschmitti* **sp. nov.** In addition to the colour pattern, morphological characters also provided by Haig *et al.* (1970) convince us that the Bahía Magdalena specimens do, indeed, correspond to *A. waldoschmitti* **sp. nov.**

Ramírez-Guillén (1983) collected a series of specimens in Bahía Concepción, on the east coast of the Baja California Peninsula and identified these as *Paguristes* sp. The color description and morphological features he provided fit well with *A. waldoschmitti* **sp. nov.**

*Areopaguristes waldoschmitti* **sp. nov.** has major resemblances with *A. lemaitrei* **sp. nov.** and *A. hummi* (Wass, 1955), a species from the West Atlantic. All three species are characterized by a broadly round or obtuse rostrum, shorter than the lateral projections; ocular acicles contiguous and multidenticulated, and by stout antennal flagella bearing very long setae ventrally. In *A. waldoschmitti* **sp. nov.**, the antenular peduncle is proportionally longer and the antennal acicle is shorter than in *A. hummi*. In *A. waldoschmitti* **sp. nov.** the chelipeds are less spiny but the spines are larger compared with *A. lemaitrei* **sp. nov.** The distal margin of the inferior lamella of the first male pleopod in *A. waldoschmitti* **sp. nov.** is unarmed instead of having the usual row of hook-like spines, a character that separates *A. waldoschmtti* **sp. nov.** from all its congeners. In *A. waldoschmitti* **sp. nov.** , the telson features a deep median cleft on the posterior margin vs a shallow cleft in both *A. mclaughlinae* and *A. lemaitrei* **sp. nov.**

Moran (1984) referred to an undescribed species of *Isocheles* from El Salvador but did not name it. When comparing the figure of this material with the three species of *Areopaguristes* now known from the eastern Pacific, it seems likely to belong to the latter genus. Unfortunely we could not review the El Salvador material.

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