NEW RECORD OF RHODOCHIRUS HIRTIMANUS (FAXON, 1893) (DECAPODA, ANOMURA, PAGURIDAE) IN THE GULF OF CALIFORNIA AND REDESCRIPTION OF THE SPECIES

BY

MANUEL AYÓN PARENTE1,3) and MICHEL E. HENDRICKX2,4)

1) Postgraduate Program, Laboratorio de Invertebrados Bentónicos, Unidad Académica Mazatlán, Instituto de Ciencias del Mar y Limnología UNAM, P.O. Box 811, Mazatlán, Sinaloa 82000, Mexico
2) Laboratorio de Invertebrados Bentónicos, Unidad Académica Mazatlán, Instituto de Ciencias del Mar y Limnología, Universidad Nacional Autónoma de México, P.O. Box 811, Mazatlán, Sinaloa 82000, Mexico

ABSTRACT

Specimens of the pagurid crab, Rhodochirus hirtimanus (Faxon, 1893) were collected in the central Gulf of California and represent a significant extension of its known range to the north. The species is redescribed and illustrated, including buccal appendages that had been only briefly described previously; a detailed description of setation is also provided.

INTRODUCTION

The genus Rhodochirus McLaughlin, 1981 is endemic to America and is represented by only two species: R. rosaceus (A. Milne-Edwards & Bouvier, 1893) in the western Atlantic, from south of Cape Lookout, North Carolina to Key West, Florida, Grenada, Surinam, and Brazil (A. Milne-Edwards & Bouvier, 1893; Williams, 1965; Forest & De Saint Laurent, 1968; McLaughlin, 1981b),

3) To be cited as: AYÓN PARENTE, M.
4) e-mail: michel@ola.icmyl.unam.mx

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and *R. hirtimanus* (Faxon, 1893) in the eastern Pacific, from the southern end of the Gulf of California, Mexico to northern Peru, Cocos Island, Costa Rica, and the Galapagos Islands (McLaughlin, 1981b; Hendrickx & Harvey, 1999). The East Pacific species, *R. hirtimanus*, was briefly described by Faxon (1893; as *Pylopagurus hirtimanus*), who later illustrated one specimen, presumably of the syntype series (Faxon, 1895, pl. 13 figs. 1-1e). Until 1981 it was cited only twice in the literature; first by Alcock (1905) in a catalogue, and later by Walton (1954; without illustrations) in his review of the genus *Pylopagurus* in the Pacific. McLaughlin (1981a, b), while reviewing the group of species traditionally assigned to *Pylopagurus* A. Milne-Edwards & Bouvier, 1893 and *Tomopagurus* A. Milne-Edwards & Bouvier, 1893, described the genus *Rhodochirus* in which she included *P. hirtimanus*. She selected a lectotype and provided an extended diagnosis, photographs of right and left chelae, and an illustration of the dorsal part of the cephalothorax. Since, the species has only been cited in checklists. Sampling records correspond to the type locality (“Albatross” station 3367, off Cocos Island, Costa Rica), the additional material examined by McLaughlin (1981b) from inner Gorda Bank (collected by the “Velero III”), and the type material of *Pagurus pollexcavus* Glassell, 1937 (off Gorda Point and from Arena Bank, collected by the yacht “Zaca”; described without illustrations), now considered a junior synonym of *P. hirtimanus* (see McLaughlin, 1981b). Del Solar (1972) reported this species for Mancora Bank and Walton (1954) from the Galapagos Islands. On the basis of this existing literature, it therefore appears that, although important morphologic characters for *R. hirtimanus* have been described (but not always illustrated) in the past, many (e.g., buccal appendages, setation, pereiopods, branchial formula) have either not been described at all, or were not adequately described, considering criteria used in modern taxonomy (see McLaughlin, 2002).

Benthic samples obtained in the Gulf of California, Mexico, from 1982 to 1987 provide large series of hermit crabs. Many specimens have been identified and are currently available in a regional crustacean reference collection (see Hendrickx, 1994), while others are now being reviewed. Among the unidentified material were two samples of *R. hirtimanus*, which are reported here and represent new records in the central Gulf of California. On the basis of this new material, the species is redescribed, including morphology of parts never illustrated previously.

**MATERIAL AND METHODS**

All specimens reported herein were obtained from bottom trawl samples (commercial shrimp trawls) collected on board the R/V “El Puma” of the Universidad Nacional Autónoma de México (UNAM). Drawings were made with a Wild Heerbrugg microscope equipped with a camera lucida. The specimens are deposited
in the reference collection of the Benthic Invertebrates Laboratory (UNAM) in Mazatlán, Sinaloa, Mexico. McLaughlin (1974, 2003) is followed for general terminology. The abbreviations used are: SL, shield length; CW, carapace width; St, sampling station; EMU, Estación Mazatlán, UNAM reference collection.

DESCRIPTION OF THE SPECIES

**Rhodochirus hirtimanus** (Faxon, 1893)

(figs. 1, 2)


*Pagurus pollexcavus* Glassell, 1937: 261 (type locality: Gorda Bank, off Gorda Point, Baja California, Mexico, 23°02′N 109°27.5′W).


Material examined. — CORTES I, St. 21 (28°08′05″N 112°42′06″W), 6 May 1982, 2♂♂ (SL 3.3 and 5.0 mm; CW 3.3 and 4.8 mm ), 102-110 m, otter trawl (EMU-6541). GUAYTEC II, St. 3 (27°38′00″N 110°44′00″W), 1 July 1987, 1♀ (SL 4.3 mm; CW 4.1 mm), 79-85 m, otter trawl (EMU-6542).

Description. — Eleven pairs of phyllobranch gills (paired arthrobranchs on arthrodial membranes of maxilliped 3, chela, and pereiopods 2-4; single pleurobranch on somite XIII). Shield about as broad as long; anterolateral margins terraced; anterior margin between rostrum and lateral projections concave; posterior margin truncate; dorsal surface with few tufts of setae; anterolateral angles bluntly produced. Rostrum produced beyond lateral projections, obtusely triangular and tipped with an acute spine. Lateral projections obtusely triangular, with a small, acute marginal spine (fig. 1A).

Ocular peduncles about 8/11 length of shield; dorsal surface with a row of tufts of long setae; corneas slightly dilated. Ocular acicles subtriangular, mesial and lateral margins slightly expanded and fringed with tufts of long setae, terminating subacutely, with well developed submarginal spine; dorsal surface slightly concave; separated basally by about the basal width of acicle.

Antennular peduncles moderately long, exceeding ocular peduncles by about ½ length of ultimate segment. Ultimate and penultimate segments unarmed; basal segment with well developed spine on outer distal edge.

Antennal peduncles exceeding ocular peduncles by 1/3 of their length. Fifth and fourth segments unarmed, with a few tufts of setae. Third segment with long setae on inner edge and with a small spine on inner distal edge. Second segment with
Fig. 1. *Rodochirus hirtimanus* (Faxon, 1893), male (EMU-6541). A, shield and cephalic appendages; B, right cheliped, dorsal view; C, left cheliped, dorsal view; D, second left pereiopod, inner view; E, third left pereiopod, inner view; F, third sternite, ventral view; G, female first pleopod; H, telson.

Scale bars 3 mm (A-C), 2 mm (D, E), 0.25 mm (G), and 1 mm (F, H).
dorsolateral distal angle produced, terminating in a single spine; mesial margin inflated, with 4-5 spinules; lateral margin straight, fringed with long setae; dorsal surface with scattered tufts of short setae. First segment with a small spine on lateral edge distally; ventrodistal angle with a small spine. Antennal acicle reaching about 0.71 of the total length of the ultimate antennal segment, slightly arcuate, ending in a well-developed spine, and with tufts of long setae along mesial margin. Flagellum of antenna long and slender; each article usually with 1 to 4 short, fine setae.

Mandible without distinctive characters.

Maxillule with internal lobe of endopod moderately developed, with 1 stiff bristle terminally; external lobe produced, not recurved (fig. 2A). Maxilla with endopod equal to or slightly exceeding length of scaphognathite (fig. 2B). First maxilliped with endopod exceeding distal endite, with 1 stiff bristle terminally (fig. 2C). Second maxilliped without distinctive characters (fig. 2D). Third maxilliped basischial fusion complete; basis with two small spines; ischium with crista dentata well developed, accessory tooth present; merus with dorsodistal spine, ventral margin unarmed (fig. 2E). Sternite of third maxilliped without spinules on sides of midline.

Chelipeds unequal, right larger than left. Right cheliped with dactyl approximately 7/8 length of palm. Cutting edge of dactyl with strong calcareous teeth proximally, a short row of minute corneous spines distally, ending in a small corneous claw, tip overlapped by fixed finger; medial dorsal surface concave with small smooth granules in shape of rosettes; dorsolateral margin with a longitudinal row of granules, the posterior stronger, forming corneous-conical spines with tufts of long setae; lateral surface with tufts of short, fine setae; dorsomesial margin with row of strong, corneous-tipped spines and with tufts of long, fine setae at its base; mesial and ventral surfaces with scattered tufts of long setae. Palm moderately long, about 3/5 length of carpus; dorsal face with several irregular, longitudinal rows of strong, corneous-tipped spines, one of which runs along distal end of palm and extends onto fixed finger as a single row, with tufts of long setae; dorsomesial margin with 7 strong, corneous-tipped spines and tufts of long setae; dorsolateral margin with row of very strong, corneous-tipped spines, decreasing in size proximally and distally, and with tufts of long setae; lateral face with small, flattened tubercles; ventral face with tufts of long setae. Fixed finger with dorsal surface concave, covered with rosette-shaped granules; dorsomesial margin with row of strong, corneous-tipped spines; mesial surface with tufts of short setae; cutting edge with strong calcareous teeth (fig. 1B). Carpus exceeding length of merus, about as wide as long; dorsal surface with small, flattened granules and corneous-tipped spines with tufts of long setae; dorsomesial margin with a row of 5 strong, corneous-tipped spines and with tufts of long setae; distal margin with some small
Fig. 2. *Rodochirus hirtimanus* (Faxon, 1893), male (EMU-6541). Mouthparts: A, maxillule; B, maxilla; C, 1st maxilliped; D, 2nd maxilliped; E, 3rd maxilliped. Scale bars: 0.5 mm (A), and 1 mm (B-E).
conical spines, one large spine near dorsomesial margin and tufts of long setae; mesial face smooth with some tufts of long setae; ventral face with small, smooth granules and tufts of long setae; lateroventral angle with 2 corneous-tipped, conical spines; dorsolateral margin unarmed. Merus short, subtriangular; dorsal surface somewhat rugose transversally near distal margin; middle distal margin with 1-2 small, slender, acute spines and tufts of long setae; lateral face finely rugose; ventrolateral margin with row of 4 small, slender, corneous-tipped spines; ventromesial margin with row of small granules or tubercles; ventral surface with small granules and setae. Ischium with ventromesial margin with row of small granules or spines and tufts of long setae; distal margin with tufts of long, fine setae.

Left cheliped moderately long, reaching to base of dactyl of right cheliped (fig. 1C). Dactyl long, approximately 1.2 times length of palm; tip overlapped by fixed finger; cutting edge with row of small corneous teeth, ending in a small corneous claw; dorsal surface with a longitudinal row of small pointed granules along finger, with tufts of long setae; dorsomesial margin with longitudinal row of small, corneous-tipped spines, increasing in size proximally, with tufts of long setae; mesial and ventral surfaces with tufts of long setae, lateral surface with tufts of long setae. Palm about 2/3 length of carpus; dorsal surface concave with smooth, rosette-shaped granules extending onto fixed finger; irregular longitudinal rows of small spines on mesial surface, one row extending onto fixed finger as stronger spines; dorsal surface with tufts of long setae; dorsomesial margin with row of strong, corneous-tipped spines, decreasing in size on fixed finger, and with tufts of long setae; lateral face with row of small tubercles or spine-tipped tubercles distally, with tufts of short setae; ventral surface with tufts of long setae. Cutting edge of fixed finger with small, calcareous teeth alternating with longer corneous teeth, ending in a corneous tip; dorsal surface concave, covered with rosette-shaped granules; dorsomesial edge with rows of strong, corneous-tipped tubercles; dorsolateral margin with row of very strong spines with basal, rosette-shaped granules, decreasing in size distally, with tufts of long setae. Carpus and merus subequal in length; dorsal surface unarmed; dorsomesial margin with row of small tubercles and long setae; distal margin with 3 spines; dorsolateral margin with a row of strong spines and tufts of long setae; lateral face with row of small flattened tubercles gradually changing to small spines distally; mesial surface with rows of small, flattened tubercles and some small spines, and with long setae; anteromesial angle with a subdistal small spine; ventral surface with small, mostly flattened tubercles and long setae. Merus with dorsal edge rugose near distal end, the latter unarm ed but with long, stiff setae; lateral surface finely rugose or nearly smooth; ventrolateral margin with row of strong spines increasing in size distally, and with tufts of long setae; mesial face nearly smooth; ventromesial margin with
spines proximally. Ischium with row of minute denticles on ventromesial margin; ventrodistal margin with long setae.

Second pereiopod overreaching right cheliped (fig. 1D). Dactyl approximately 1/5 longer than propodus, slightly curved in lateral view, slightly twisted in dorsal view, ending in a long, slender corneous claw; dorsal surface with a row of tufts of stiff setae or bristles; lateral face with tufts of long setae; mesial face with tufts of setae and spines; inner surface with one irregular row of spines, each spine with setae at its basis; ventral margin with a longitudinal sulcus and a row of small, corneous spines increasing in size distally. Propodus exceeding carpus in length; dorsal surface with a row of tufts of long, stiff setae; mesial and lateral faces with tufts of setae; ventral surface with tufts of setae and 2 small spines, one at 1/3 of the propodus length, the other distal. Carpus approximately 2/3 the length of merus; dorsal surface with a row of tufts of setae and 1-2 small distal spines; inner face slightly concave and naked; outer surface convex and with a few tufts of long setae; mesial and ventral surfaces non-setose; lateral face with tufts of setae. Merus laterally compressed; dorsal margin with faint, transverse rugae and tufts of setae; mesial face with some tufts of short setae; lateral face smooth, non-setose; ventral margin with a row of setae and small granules or spines distally. Ischium with dorsal and ventral margins with tufts of long, slender setae. Coxa unarmed, ventromesial margin setose.

Third pereiopod about equal in length to second (fig. 1E). Dactyl long, approximately 0.45 times longer than propodus, slightly twisted in dorsal view, ending in a long, slender corneous claw; dorsal surface with tufts of long setae; mesial face with spinules and tufts of setae; lateral face with tufts of long setae; ventral margin with row of small corneous spinules increasing in size distally, with tufts of long setae. Propodus exceeding carpus in length; dorsal surface with tufts of setae; mesial and lateral surfaces with tufts of long setae; ventral margin with 2 small spinules, one at 1/3 of the propodus length, the other distal; outer face with tufts of long setae; inner face non-setose. Carpus approximately equal in length to merus, with 1 distal spine on dorsal margin; inner and ventral surfaces non-setose; ventrodistal margin with tufts of long setae mesially. Merus laterally compressed; ventral and dorsal margins with tufts of long setae; dorsodistal end with long setae; lateral and mesial margins non-setose. Dorsal and ventral margins of ischium with tufts of long setae.

Fourth pereiopods subchelate, with preungual process at base of dactyl claw; propodal rasp with a single row of corneous scales.

Fifth pereiopods chelate.

Sternite of third pereiopods sub-semicircular; anterior margin with long and capsulate setae (fig. 1F).
Male with unpaired, biramous pleopods, endopod reduced. Female with paired 1st pleopods modified as gonopods and unpaired, biramous pleopods on somites 2-5 (fig. 1G); pleopods 2-4 with both rami well developed, 5th with reduced endopod.

Posterior lobules of telson asymmetrical and subtriangular, left longer than right; lobules separated by deep median cleft, terminal margin slightly concave, each armed with 3-4 strong, acute spines and often with a few up to several smaller spines; lateral margins and anterior lobules unarmed (fig. 1H).

Previously known distribution. — Arena Bank (23°33′N 109°28′05″W) and Pulmo Cape (23°28′N 109°24′W), Baja California Sur, Gulf of California, Mexico; Mancora Bank (10°26′S 81°02′W), Peru; Cocos Island and Galapagos Islands (Faxon, 1893; Glassell, 1937; Walton, 1954; Del Solar, 1972; Hendrickx & Harvey, 1999).

Comments. — The present records represent an extension of the northernmost known distribution limit of approximately 550 km. According to McLaughlin (1981b), *Rhodochirus hirtimanus* is found in deep water, from 128 to 183 m; the material reported by Del Solar (1972) for Peru was collected in 135 m, on gravel and coarse sand. The specimens of *Pagurus pollexcavus* were caught on sandy bottom, at 76-90 m and 120-144 m (Glassell, 1937). The material examined herein was collected between 79 and 85 m and at 102-110 m; the specimens collected deepest were retrieved from medium sand, in an epibenthic oxygen concentration of 3.0 ml O₂/l.

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NOTE ADDED IN PROOF

Prof. Dr. L. B. Holthuis of the National Museum of Natural History, Leiden (in litt.) has verified the years of publication of the two generic names, Pylopagurus A. Milne-Edwards & Bouvier, 1893 and Tomopagurus A. Milne-Edwards & Bouvier, 1893 in the original publication as well as in The Zoological Record on the year 1893. He found that both names indeed date from that same year. This means the mention in Neave (Nomenclator Zoologicus) of Tomopagurus having been published in 1895, is erroneous.

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