# A new species of crayfish of the genus *Procambarus* (Crustacea: Decapoda: Cambaridae) from Veracruz, Mexico

Yolanda Rojas, Fernando Alvarez, and José Luis Villalobos

Colección Nacional de Crustáceos, Instituto de Biología, Universidad Nacional Autónoma de México, Apartado Postal 70-153, México 04510 D.F., México

Abstract.—Procambarus (Austrocambarus) citlaltepetl, new species, is described from Ciudad Mendoza, Veracruz, Mexico. The new species can be placed in the mexicanus Group, and is most similar to P. (A.) mexicanus, from which it can be distinguished by the absence of branchiostegal spines, gonopod with blade-like mesial process curved over the apex and thicker lateral portion, and annulus ventralis with complete preannular plate. SEM micrographs of the male and female genitalia of the new species, as well of those of P. (A.) mexicanus, are provided to facilitate comparisons, and to clarify the identity of the latter.

Confusion concerning the identity of the crayfish Procambarus (Austrocambarus) mexicanus (Erichson, 1846) has existed for more than a century, primarily because of the incomplete original description lacking figures, loss of the holotype, and the high degree of morphological variation found among the many populations assigned to this taxon (Villalobos 1954). Several efforts have been made to clarify the status of P. (A.) mexicanus. Villalobos (1954) described four new species, one subspecies, and redescribed six species of Procambarus, including P. (A.) mexicanus, most from central and southern Veracruz, and proposed the "mexicanus" Group for eight of these species. Hobbs (1987) synonymized Cambarus aztecus Saussure, 1857 with P. (A.) mexicanus, which he redescribed, listing 23 collection sites; he also described P. (A.) olmecorum Hobbs, 1987 an placed it in the "mexicanus" Group.

In spite of these efforts, the distribution range of P. (A.) mexicanus as reviewed by Hobbs (1987), still included a vast area in the states of Veracruz, Puebla, and Oaxaca (Fig. 1), and included a wide array of morphological forms. Presumably, the northern

limit of the distribution range is in the environs of Jalapa, Veracruz; the southern limit occurs in Tuxtepec, Oaxaca; to the west it occurs along the slope of the Mexican central plateau; and to the east it reaches the Sierra de Los Tuxtlas, Veracruz (Fig. 1).

After a detailed examination of specimens from Rincón de la Doncella, Ciudad Mendoza, it became clear that they represented a new species, different but morphologically similar to P. (A.) mexicanus. In this study we describe this new species, Procambarus (Austrocambarus) citlaltepetl, and in order to clearly separate the new species from P. (A.) mexicanus, we provide scanning electron microscope (SEM) micrographs of the gonpod, annulus ventralis, and epistome of both species. The SEM micrographs of P. (A.) mexicanus were taken from specimens from the type locality in order to help in the recognition of other new forms which may exist within this Group.

All specimens used are deposited in the Colección Nacional de Crustáceos, Instituto de Biología, Universidad Nacional Autónoma de México (CNCR). Other abbreviaVOLUME 112, NUMBER 2



Fig. 1. Localities where *Procambarus* (Austrocambarus) mexicanus has been collected in the states of Puebla, Oaxaca, and Veracruz.

tions used are: coll, collector; RL, rostrum length; TCL, total carapace length; USNM, National Museum of Natural History, Smithsonian Institution, Washington, D.C.

### Procambarus (Austrocambarus) citlaltepetl, new species Figs. 2A-C, 3A-C, 4

Diagnosis.-Body pigmented, eyes normally developed. Rostrum devoid of marginal spines. Acumen length ranging from 0.07% to 0.14% of RL ( $\bar{X} = 0.10\%$ ). Carapace with or without small cervical tubercle. Areola ranging from 7.1 to 16.8 ( $\bar{X}$  = 10.9) times as long as wide, 30.8% to 39.5% ( $\bar{X} = 34.9\%$ ) of TCL, with 1–3 punctations across narrowest part. Suborbital angle weak, infraorbital spine absent. Branchiostegal spine absent. Postorbital ridges well marked, slightly sinuous in dorsal view, converging anteriorly, ending in spine anteriorly. Antennal scale varying from 1.61 to 1.96 ( $\bar{X} = 1.79$ ) times as long as wide; maximum width at midlength. Chelipeds subequal, shorter than TCL, partially covered with squamous tubercles; chela moderately elongated, not pubescent, fingers shorter than palm, palm about twice as long as broad; movable finger with squamous tubercles along dorsal margin, opposable margin devoid of tubercles distally, finely serrate; fixed finger punctate, devoid of tubercles except for inferior margin, opposable margin finely serrate distally with 5 tubercles proximally. First pair of pereiopods shorter than total length of body, covered with small squamous tubercles from distal half of merus to proximal half of fingers. Ischium of third pereiopod armed with single, acute hook, reaching beyond articulation with basipodite. First pair of pleopods of male form I symmetrical, devoid of subterminal setae, reaching coxae of third pair of pereiopods; shoulder on cephalic surface slightly concave, forming rounded angle with cephalic border (Figs. 2A, 3A); mesial process blade-like, becoming narrower distally, laterodistally oriented (Fig.

2B), curved over apex in cephalic view (Fig. 2C); cephalic process absent; central projection triangular, cephalodistally oriented. Female with hinged annulus ventralis; preannular plate strong, complete, oriented perpendicular to longitudinal axis of body; annulus oval-shaped, divided by deep and narrow mesial groove, seminal receptacle opening on caudal portion as sinuous groove; postannular sclerite strong, ovalshaped, wider than annulus, cephalic margin subacute, caudal margin almost straight (Fig. 3B). Sternal plates adjacent to fifth pair of pereiopods wide, rounded, extending mesially, reaching postannular sclerite. Coxae of fourth and fifth pair of pereiopods separated.

Measurements of types.—See Table 1.

Holotypic male, form I.-Body pigmented. Cephalothorax subcylindrical, becoming thicker in branchial region, 0.91 times length of abdomen. Areola 15.6 times as long as wide, 34.9% of TCL (Fig. 4A). Dorsal surface of carapace densely punctate along branchial and cardiac regions. Lateral surfaces finely granulate along hepatic and branchial regions. Rostrum devoid of marginal spines; dorsal surface slightly concave, densely punctate posteriorly. Rostrum with lateral margins convergent, anterior width 2.1 mm, posterior width 3.6 mm, ending anteriorly in acute angle; subrostral ridges not evident in dorsal view, oriented ventrally. Acumen length 0.11% of RL, reaching anterior portion of third article of anntenular peduncle. Postorbital ridge moderately strong, ending anteriorly in triangular spine oriented laterally. Suborbital angle weak, infraorbital spine absent. Branchiostegal spine absent. Cervical groove with blunt tubercle in hepatic region (Fig. 4B).

Abdomen narrower than carapace. Somites with tergal region finely punctate, pleural region densely punctate. Dorsal surface of telson covered with short setae, cephalic section with 3 spines in posterolateral angles, caudal section with posterior margin rounded. Epistome triangular, ante-

#### VOLUME 112, NUMBER 2



Fig. 2. Lateral (A, D), caudal (B, E), and cephalic views (C, F) of left gonopod. A-C, *Procambarus (Austrocambarus) citlaltepetl*, new species, holotype (CNCR 17317); D-F, *Procambarus (Austrocambarus) mexicanus (CNCR 2339)*.

rior vertex triangular, posterior angles rounded, ventral surface slightly concave; cephalic lobe elongated, oval-shaped; main body with well defined fovea, anteriorly

with second, larger depression (Fig. 3C). Antennal scale 1.72 times as long as wide, maximum width at midlength, lateral margin terminating in spine (Fig. 4C). Antennal

#### PROCEEDINGS OF THE BIOLOGICAL SOCIETY OF WASHINGTON



Fig. 3. Mesial view of left gonopod (A, D), annulus ventralis (B, E), and epistome (C, F). A-C, *Procambarus* (*Austrocambarus*) citlaltepetl, new species holotype (CNCR 17317); D-F, *Procambarus* (*Austrocambarus*) mexicanus (CNCR 2339).

peduncle with basis ending in short distolateral spine, ischium with lateral blunt tubercle. Third maxilliped reaching distal portion of third segment of antennal peduncle; midventral surface of ischium covered with fine, simple, plumose setae, laterally with tufts of short setae.

Chelipeds shorter than TCL, tuberculate



Fig. 4. *Procambarus (Austrocambarus) citlaltepetl*, new species (all figures of holotype (CNCR 17317), except F of female allotype (CNCR 17318)): A, carapace, dorsal view; B, carapace, lateral view; C, antennal scale; D, distal podomeres of cheliped; E, basal podomeres of left second, third, and fourth pereiopods; F, distal podomeres of cheliped. Scale bars represent 1 mm.

from distal half of merus to midlength of fingers. Right chela moderately elongated, 2.9 times as long as broad, not pubescent, fingers slightly shorter than palm; uniformly covered with squamous tubercles except on fingers. Palm about 1.8 times long as broad. Movable finger with squamous tubercles along dorsal margin, lateral surfaces punctate, covered with regularly spaced tufts of setae, opposable margin finely serrate, devoid of tubercles distally, with 4-5small tubercles proximally. Surface of fixed

	Holotypic male, form I	Allotypic female	Morphotypic male, form II
Total length	52.6	67.5	61.8
Carapace			
Total length	25.2	32.7	30.5
Postorbital length	20.6	26.4	24.5
Width	12.6	16.0	14.4
Areola			
Length	8.8	12.2	10.5
Width	0.7	1.0	0.7
Rostrum			
Length	6.8	7.8	7.8
Anterior width	2.1	2.5	2.4
Posterior width	3.6	5.0	4.7
Acumen length	0.7	1.0	1.0
Cheliped			
Length of mesial margin			
of palm	9.2	6.6	8.7
Width of palm	6.2	6.2	6.5
Length of lateral margin	16.7	16.3	18.6
Length of dactyl	8.7	8.7	10.5
Abdomen			
Width	10.8	14.3	10.4
Length	27.5	34.9	31.9

Table 1.—Measurements (mm) of type specimens of Procambarus (Austrocambarus) citlaltepetl, new species.

finger punctate, devoid of tubercles except for difuse row along inferior margin; lateral surfaces covered with regularly spaced tufts of setae; opposable margin finely serrate with 5 well defined tubercles proximally (Fig. 4D).

Carpus short, approximately conical in shape, dorsal and lateral surfaces covered with subsquamous tubercles, lateral surface with shallow longitudinal groove, inferior surface with small, scattered subsquamous tubercles. Distal third of merus with minute tubercles along mesial and lateral surfaces; inferior border with 2 rows of blunt tubercles, inner row with small tubercles increasing in size distally, outer row with larger tubercles ending distally in large spiny tubercle.

Ischium of third pair of pereiopods with simple acute hook, overreaching basioischial articulation (Fig. 4E).

First pleopods as described in Diagnosis. Proximal lobes of uropods with short, acute spines. Endopodite with distomedial spine located premarginally, and well developed distolateral spine. Exopodite with 3 spines on distolateral angle, external and internal ones fixed, medial one largest, articulated.

Allotypic female.—Similar to holotype, differing in following characters: acumen length 0.12% of RL; areola 12.2 times as long as wide, 37.3% of TCL; chelae more robust, 2.7 times as long as broad, fingers longer than palm, palm about 1.5 times as long as broad (Fig. 4F); sternal thoracic plate tapering anteriorly, wide between third pair of pereiopods, becoming ridgelike by third maxillipeds. Annulus ventralis as described in Diagnosis.

Paratypic male, form II.—Differing from holotype in following characters: cardiac and gastric regions of carapace less densely punctate, acumen length 0.12% of RL, areola 15 times as long as wide; rostrum with scattered punctations, rostral borders converging anteriorly; ischium of third pair of pereiopods with small blunt projection, not reaching basioischial articulation.

Apical structures of first pair of pleopods poorly developed, non corneous; mesial process strong and rounded apically, anterior margin of central projection rounded, central projection divided into cephalic and caudal portions by groove.

*Type locality.*—Rincón de la Doncella Park (altitude 1400 m), Ciudad Mendoza, Municipio de Camerino Z. Mendoza, Veracruz (18°48'N, 97°10'W). Rincón de la Doncella is a spring fed lake that carries water all year.

*Disposition of types.*—Holotypic male form I CNCR 17317, allotypic female CNCR 17318, and morphotypic male form II CNCR 17319. Paratypic males form I (8) CNCR 2326.

*Material examined.*—All from Rincón de la Doncella Park, Ciudad Mendoza, 1400 m of altitude, Veracruz, México: 23  $\delta$  form I, 17  $\delta$  form II, 25  $\Im$  (CNCR 500), 18 May 1956, coll. A. Villalobos; 3  $\delta$  form I, II  $\delta$ form II, 21  $\Im$  (CNCR 508), 1  $\delta$  form I (CNCR 17317), 1  $\Im$  (CNCR 17318), 1  $\delta$ form II (CNCR 17319), 28 Aug 1948, coll. A. Villalobos; 2  $\delta$  form I, 2  $\delta$  form II, 11  $\Im$ , 20 juv. (CNCR 17021), 1 Nov 1995, colls. J. L. Villalobos, F. Alvarez, R. Robles, J. Calderón.

*Etymology.*—The specific epithet *citlal-tepetl* is taken from "Citlaltepetl", in nahuatl "mountain of the star", or "Pico de Orizaba", the highest mountain in Mexico, from which the springs feeding Rincón de la Doncella originate. The name is treated as a noun in apposition.

Remarks.—Procambarus (Austrocambarus) citlaltepetl, new species, is morphologically similar to P. (A.) mexicanus. The new species can be separated from P. (A.) mexicanus through the following characters: branchiostegal spine absent; gonopod with mesial process blade-like, curved over lateral portion of apex; in cephalic view, lateral portion of gonopod thicker than mesial portion; preannular plate of annulus ventralis straight, undivided, perpendicular to longitudinal axis of body; annulus ventralis more rounded, mesial groove narrower and deeper, seminal receptacle opening shorter, postannular sclerite of annulus ventralis oval-shaped; and epistome with well defined fovea and an anterior excavation, anterior lobe triangular, cephalic lobe elongated.

The new species is also similar to *P*. (*A*.) *veracruzanus* Villalobos, 1954, *P*. (*A*.) *ruth-veni* (Pearse, 1911), and *P*. (*A*.) *zapoapensis* Villalobos, 1954, in the general shape of the gonopod and annulus ventralis. However, marked differences exist in the carapace and chelipeds among these species.

Procambarus (Austrocambarus) mexicanus, as defined by Hobbs (1987), still represents a variety of closely related forms distributed over a distance of more than 185 km from Jalapa, Veracruz to Tuxtepec, Oaxaca, from the rim of the central plateau at an altitude of 1440 m to areas in the coastal plains near the Gulf of Mexico. A detailed study of the populations assigned to this species will probably result in the discovery of additional new species. Rojas (1998) described the high degree of morphological variation found among these populations.

#### Acknowledgments

We wish to thank Sara Fuentes for taking the SEM micrographs, Rolando Mendoza for producing the drawings, and Citlali Pérez and Carmen Loyola for preparing the final prints of the SEM micrographs.

#### Literature Cited

- Erichson, W. F. 1846. Uebersicht der Arten der Gattung Astacus.—Archiv für Naturgesichichte, Berlin 12(1):83–106.
- Hobbs, H. H., Jr. 1987. On the identity of Astacus (Cambarus) mexicanus Erichson (1846) (Decapoda: Cambaridae) with the description of Procambarus olmecorum, new species, from Veracruz, Mexico.–Proceedings of the Biological Society of Washington 100:198–215.
- Pearse, A. S. 1911. Report on the Crustacea collected by the University of Michigan-Walker Expedition in the state of Veracruz, Mexico.—13<sup>th</sup> An-

nual Report of the Michigan Academy of Sciences 13:108–113.

Rojas, Y. 1998. Revisión taxonómica de ocho especies del género *Procambarus* (Crustacea: Decapoda: Cambaridae) del centro de Veracruz, México. Tésis Professional, Facultad de Ciencias, Universidad Nacional Autónoma de México, 158 p.

Saussure, H. de. 1857. Diagnoses de quelques crusta-

cés nouveaux de l'Amérique tropicale.—Revue et Magasin de Zoologie Pure et Appliquée, series 2, 9:501–505.

Villalobos, A. 1954. Estudios de los cambarinos mexicanos. XII, parte 1. Revisión de las especies afines a *Procambarus mexicanus* (Erichson), con descripción de nuevas formas.—Anales del Instituto de Biología, Universidad Nacional Autónoma de México 25(1–2):299–379.



Rojas, Y, Alvarez, Fernando, and Villalobos Hiriart, Jose

# Luis

٦

. 1999. "A new species of crayfish of the genus Procambarus (Crustacea: Decapoda: Cambaridae) from Veracruz, Mexico." *Proceedings of the Biological Society of Washington* 112, 396–404.

View This Item Online: <a href="https://www.biodiversitylibrary.org/item/107571">https://www.biodiversitylibrary.org/partpdf/45166</a> Permalink: <a href="https://www.biodiversitylibrary.org/partpdf/45166">https://www.biodiversitylibrary.org/partpdf/45166</a>

Holding Institution Smithsonian Libraries

**Sponsored by** Biodiversity Heritage Library

## **Copyright & Reuse**

Copyright Status: In copyright. Digitized with the permission of the rights holder. Rights Holder: Biological Society of Washington License: <u>http://creativecommons.org/licenses/by-nc-sa/3.0/</u> Rights: <u>https://biodiversitylibrary.org/permissions</u>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at



Rojas, Y, Alvarez, Fernando, and Villalobos Hiriart, Jose

# Luis

٦

. 1999. "A new species of crayfish of the genus Procambarus (Crustacea: Decapoda: Cambaridae) from Veracruz, Mexico." *Proceedings of the Biological Society of Washington* 112, 396–404.

View This Item Online: <a href="https://www.biodiversitylibrary.org/item/107571">https://www.biodiversitylibrary.org/partpdf/45166</a> Permalink: <a href="https://www.biodiversitylibrary.org/partpdf/45166">https://www.biodiversitylibrary.org/partpdf/45166</a>

Holding Institution Smithsonian Libraries

**Sponsored by** Biodiversity Heritage Library

## **Copyright & Reuse**

Copyright Status: In copyright. Digitized with the permission of the rights holder. Rights Holder: Biological Society of Washington License: <u>http://creativecommons.org/licenses/by-nc-sa/3.0/</u> Rights: <u>https://biodiversitylibrary.org/permissions</u>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at



Rojas, Y, Alvarez, Fernando, and Villalobos Hiriart, Jose

# Luis

٦

. 1999. "A new species of crayfish of the genus Procambarus (Crustacea: Decapoda: Cambaridae) from Veracruz, Mexico." *Proceedings of the Biological Society of Washington* 112, 396–404.

View This Item Online: <a href="https://www.biodiversitylibrary.org/item/107571">https://www.biodiversitylibrary.org/partpdf/45166</a> Permalink: <a href="https://www.biodiversitylibrary.org/partpdf/45166">https://www.biodiversitylibrary.org/partpdf/45166</a>

## **Holding Institution**

Smithsonian Libraries and Archives

**Sponsored by** Biodiversity Heritage Library

## **Copyright & Reuse**

Copyright Status: In copyright. Digitized with the permission of the rights holder. Rights Holder: Biological Society of Washington License: <u>http://creativecommons.org/licenses/by-nc-sa/3.0/</u> Rights: <u>https://biodiversitylibrary.org/permissions</u>

This document was created from content at the **Biodiversity Heritage Library**, the world's largest open access digital library for biodiversity literature and archives. Visit BHL at

https://www.biodiversitylibrary.org.