A NEW SPECIES OF FRESHWATER PRAWN, *MACROBRACHIUM TOTONACUM* (DECAPODA, PALAEMONIDAE), WITH ABBREVIATED DEVELOPMENT FROM MEXICO

BY

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ABSTRACT

A new species of the genus *Macrobrachium* from northern Oaxaca, Mexico, with abbreviated larval development, is described. *Macrobrachium totonacum* new species, is similar to *M. tuxtlaense* and *M. vicconi* in exhibiting abbreviated larval development, but differs from these in the length of the first pereiopod and relative proportions of the articles of the second pereiopod. *Macrobrachium totonacum* occurs in the San Antonio River, which originates in the Cueva del Nacimiento del Río San Antonio where the troglobyte *M. villalobosi* is found. However, both species differ in pigmentation, the number of rostral spines, proportions of the scaphocerite, relative proportions of the carpus and propodus of the first pereiopod, and the carpus, merus, and propodus of the second pereiopod.

RESUMEN

Se describe una nueva especie del género *Macrobrachium* con desarrollo abreviado del norte de Oaxaca, México. *Macrobrachium totonacum* nueva especie, es similar a *M. tuxtlaense* y *M. vicconi* por exhibir desarrollo larval abreviado, pero difiere de ellas en el largo del primer pereiópodo y las proporciones de los segmentos del segundo pereiópodo. *Macrobrachium totonacum* se distribuye en el Río San Antonio, que se origina en la Cueva del Nacimiento del Río San Antonio en donde se encuentra el troglobio *M. villalobosi*, sin embargo ambas especies difieren en la pigmentación, número de espinas rostrales, proporciones del escafocerito, proporciones relativas del carpo y propodio del primer pereiópodo y en el carpo, mero y propodio del segundo pereiópodo.

INTRODUCTION

Fifteen species of *Macrobrachium* have been recorded in Mexico (Román et al., 2000). Along the slopes of the Pacific coast and the Gulf of Mexico 11 species

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occur with extended larval development, while four other species, two stygobites (*M. villalobosi* Hobbs, 1973, and *M. acherontium* Holthuis, 1977) and two epigean ones (*M. tuxtlaense* Villalobos & Alvarez, 1999, and *M. vicconi* Román, Ortega & Mejía, 2000) are strictly freshwater forms and exhibit abbreviated larval development.

Until very recently, abbreviated larval development in *Macrobrachium* of the American Continent was only known from South American species (Pereira & García, 1995). With the description of two new species with abbreviated development from southern Mexico and the species described herein, a new pattern is emerging that suggests the existence of many more *Macrobrachium* species restricted to freshwater on this continent.

In this paper, a new species with abbreviated larval development is described from the San Antonio River in northern Oaxaca, a tributary of the Papaloapan River (fig. 1). The relationships of the new species with other epigean species with abbreviated larval development are discussed. The type-specimens are deposited in the National Crustacean Collection (CNCR) of the Instituto de Biología, Universidad Nacional Autónoma de México, Mexico City, and in the Colección de Crustáceos de Referencia, Universidad Autónoma Metropolitana — Xochimilco, Mexico City.

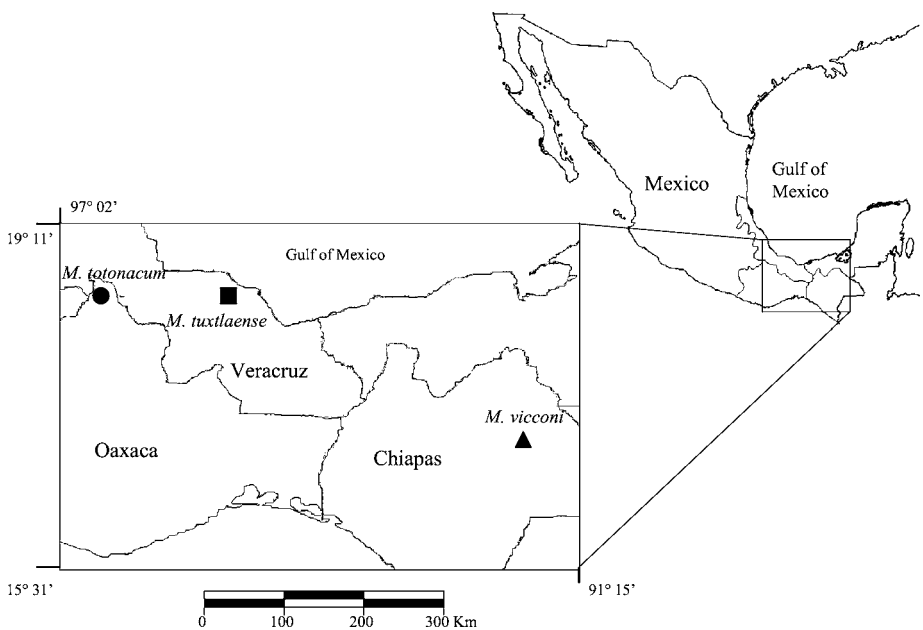

Fig. 1. Distribution of the epigean species of *Macrobrachium* with abbreviated development in Mexico.

SYSTEMATICS

Macrobrachium totonacum new species (figs. 2-3)

Holotype. — ♂, 26 June 1999; coll. L. M. Mejía; spring of the San Antonio River, Oaxaca, Mexico (18°28′8″N 96°38′6″W), 90 m altitude; CNCR 19915.

Allotype. — ♀, 26 July 2001; same collector and locality as holotype; CNCR 19916.

Paratypes. — Three ♂♂, 7 ♀♀; 9 April 1999; colls. J. Cruz-Hernández, M. Signoret, and L. M. Mejía; CNCR 19917. Three ♂♂, 7 ♀♀; 26 June 1999; colls. M. López-Mejía, M. Hernández-Guzmán, J. A. Viccon-Pale, and L. M. Mejía; CNCR 19918. One ♂, 11 ♀♀; 6 January 2000; colls. M. López-Mejía, M. Signoret, R. G. Hartnoll, J. Cruz-Hernández, and L. M. Mejía (CCR-UAM-232). All paratypes collected in the type locality.

Description. — Small sized prawn, maximum total length 35.5 mm. Rostrum large, straight, tip slightly surpassing distal border of scaphocerite; dorsal margin bearing 10 teeth, two in postorbital position, three teeth on ventral margin (fig. 2A).

Carapace smooth, maximum length 10 mm, with antennal spine smaller than hepatic spine. Branchiostegal groove shallow.

Abdomen smooth, pleura of first three somites broadly rounded (fig. 2A). Posteroventral margin of fourth and fifth pleura forming 90° angle, bearing setae on ventral border. Sixth somite 1.6 times as long as fifth. Telson 1.3 times longer than sixth somite, shorter than uropodal rami; bearing two pairs of dorsal spines, first pair in proximal fifth, second pair in middle section of telson; posterior margin broadly triangular bearing two pairs of lateral spines, inner pair 2.7 times longer than external one, with plumose setae between inner spines.

Eyes normally developed, cornea pigmented, not reduced.

Antennules with acute stylocerite reaching proximal third of first peduncular segment (fig. 2B). First antennular segment with acute distolateral spine and concave depression to fit eye. Second antennular segment cylindrical, with sinuous distal margin and lateral row of long setae.

Antennae with basicerite bearing large spine on internal margin. Scaphocerite 3.61 times as long as wide, distolateral spine short, widely separated from distal margin of main blade (fig. 2D).

Mandibles with 3-segmented palp, first segment the shortest, second and third segments of equal length; incisor process with 3 conical teeth, molar process with 2 wide, rounded teeth on mesial border (fig. 3A).

Maxillules with bilobed palp, distal lobe slender, devoid of setae, proximal lobe blunt with single, thick seta; anterior lacinia approximately oval, with three long setae on mesial margin, distal margin with seven thick spines and a row of fine setae, lateral margin straight, devoid of setae; posterior lacinia tapering distally, curved inwards, distal half covered with setae (fig. 3B).

Maxillae with scaphognathite bordered with plumose setae, anterior lobe narrower and longer than posterior one; palp devoid of setae, tapering distally, strongly

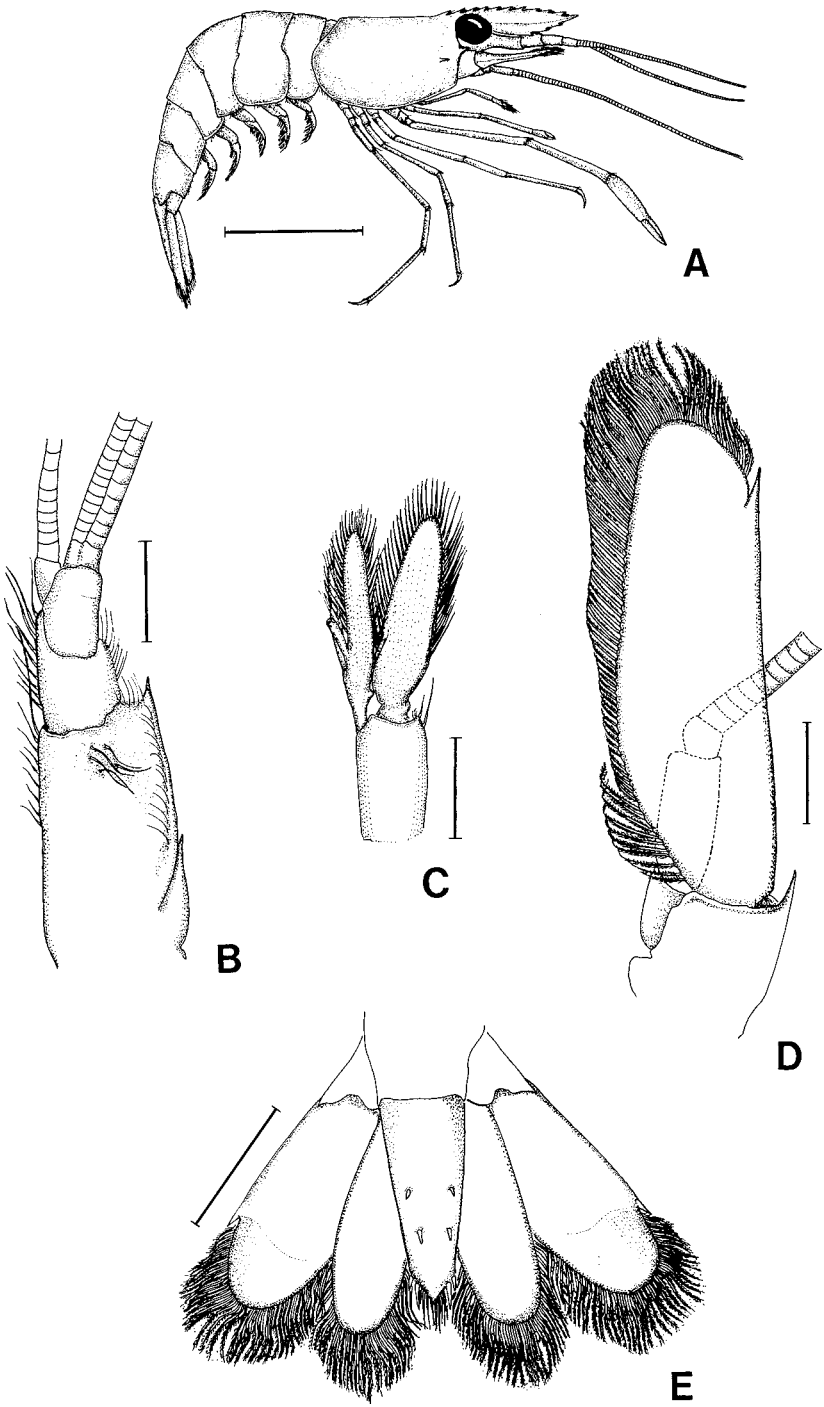

Fig. 2. *Macrobrachium totonacum* new species, male holotype CNCR 19915. A, lateral view; B, distal portion of antennular peduncle; C, second pleopod with appendix masculina; D, distal portion of antennal peduncle; E, telson and uropods. Scale bars represent: A, 5 mm; B-D, 1 mm; E, 2 mm.

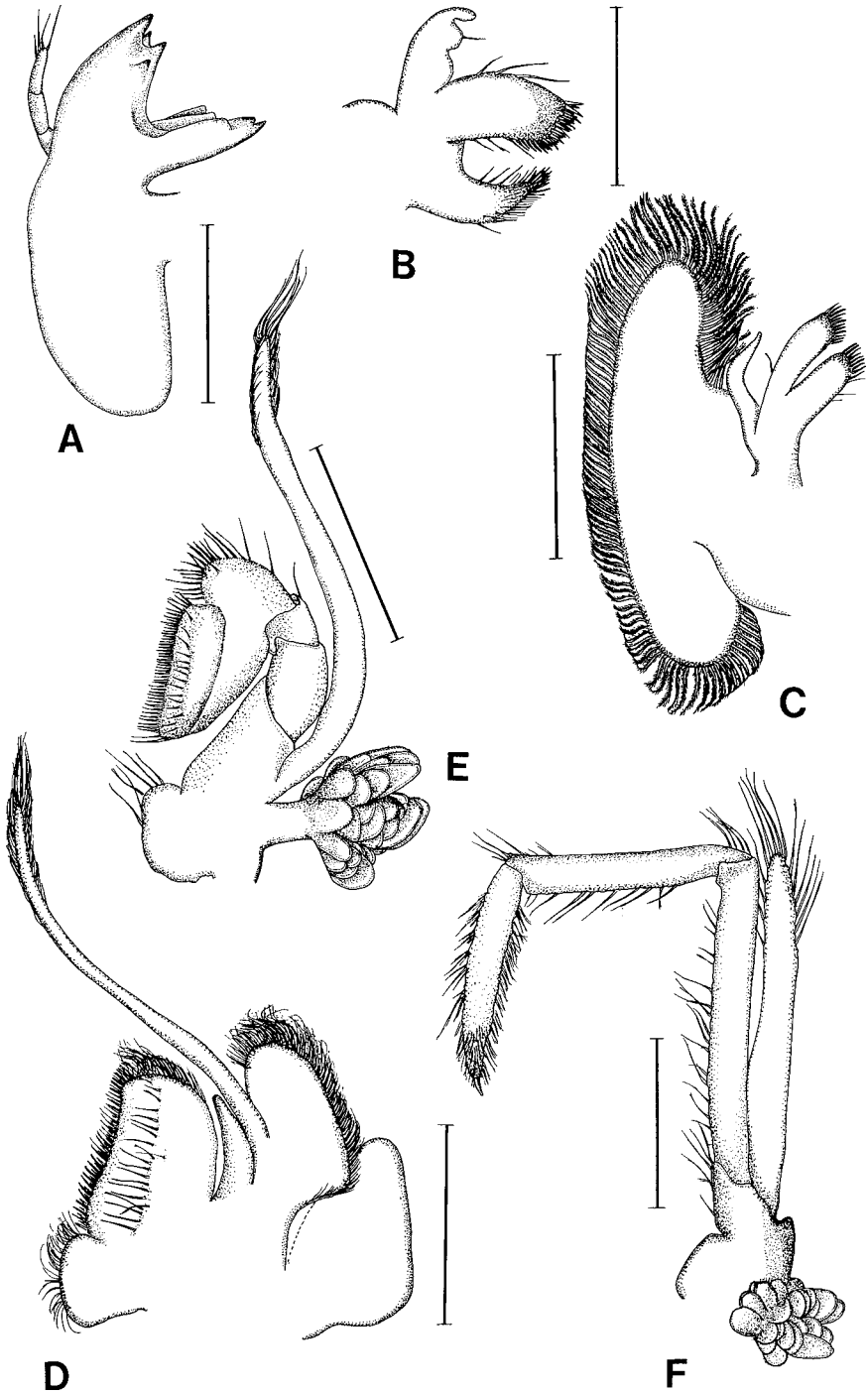

Fig. 3. *Macrobrachium totonacum* new species, male holotype CNCR 19915. A, right mandible; B, right maxillule; C, right maxilla; D, first maxilliped; E, second maxilliped; F, third maxilliped. Scale bars represent 1 mm.

curved inwards; endite bilobed, divided by incision along distal third, both lobes slender, with terminal tufts of setae (fig. 3C).

First maxilliped with bilobed endite, bearing marginal and submarginal setae along margin, and row of setae on surface of distal lobe. Exopod slender, 5 times as long as palp, distal third bearing long setae; palp simple, devoid of setae, shorter than endite; caridean lobe large, fused to base of exopod, bearing long, plumose setae all along margin; epipodite trapezoidal (fig. 3D).

Second maxilliped subpediform, podobranch present, well developed; endopodite 4-segmented, distal 2 segments oriented mesially, gnathal border with marginal setae and spines and submarginal setae; exopodite slender, more than twice as long as endopodite, tip bearing long, plumose setae (fig. 3E).

Third maxilliped pediform, slender, reaching basal portion of antennal flagellum; arthrobranch present, well developed; coxa with rounded lateral projection (fig. 3F). Endopodite 3-segmented, with scattered setae, becoming denser distally; first segment slender, 1.3 times as long as second segment; second segment 1.2 times as long as third, distal margin rounded. Exopodite slender, flat, as long as first segment of endopodite, bearing long setae distally.

First pereiopods slender, smooth, with tufts of setae on articulation of dactylus and fixed finger. Tips of fingers surpassing distal margin of scaphocerite; palm slightly compressed, as long as dactyl; carpus 3.2 times palm length, 1.28 times merus length.

Second pair of pereiopods slightly unequal in size, right pereiopod larger, without spines. Palm semicylindrical, 3.5 times as long as wide, with rows of scattered setae, 1.6 times dactylus length; carpus 1.5 times palm length, 1.2 times as long as merus; ischium 0.9 times merus length. Fingers not gaping, cutting margins covered with rows of tufts of setae, fixed finger with three teeth, dactylus with four small teeth.

Propodus and dactylus of third pereiopod sparsely pilose. Two rows of four and eight movable spines, respectively, on inner border of propodus, distal pair of spines on articulation with dactylus. Propodus 3.2 times length of dactylus, 2.4 times carpus length.

Fourth pereiopods, sparsely pilose; propodus 3.5 times dactylus length, 1.9 times as long as carpus; with two rows of 9 and 8 movable spines on inner border of propodus, 1 pair of spines on propodus-dactylus articulation.

Fifth pair of pereiopods the longest. Propodus and carpus pilose; two longitudinal rows of 10 and 8 movable spines, 1 pair of spines on propodus-dactylus articulation; propodus 4.5 times dactylus length, 2 times carpus length.

Appendix masculina 1.8 times length of appendix interna, inner margin with 11 pairs of spines (fig. 2C).

Remarks. — The water quality parameters of the San Antonio River measured at the time of collection were: temperature 23°C, pH 7.6, and dissolved oxygen concentration from 5.56 to 6.43 mg/l. The deepest part of the river in this area is 1.8 m, with a maximum width of 10 m. The freshwater crab *Avotrichodactylus oaxensis* (Rodríguez, 1992) occurs together with *M. totonacum.* Both prawn and crab are more abundant among the roots of the riparian vegetation.

Live *M. totonacum* are transparent with small tufts of brown setae on the dorsal surface of the carapace and scattered, red punctations. The second pair of pereiopods has transversal yellow bands on the merus, carpus, and the articulation of the fingers of the chelae.

The females carried between 9 and 28 eggs, 1.8 to 2.3 mm in diameter (average 2 mm); recently oviposited eggs are dark brown or black, progressively becoming light green to transparent. According to criteria of Jalihal et al. (1993), *M. totonacum* exhibits a partially abbreviated larval development. First stage juveniles measure on an average 5.3 mm in total length and 2.25 mm in carapace length, and take 5 to 7 days to moult to the second stage. At hatching, they exhibit a long and slender rostrum, with the sharp tip oriented downwards and devoid of teeth; the eyes are sessile, the first and second pereiopods chelate, with well developed pleopods.

DISCUSSION

Geographically, *Macrobrachium totonacum* is very close to *M. villalobosi*, occurring in the same river. *Macrobrachium villalobosi* a stygobiont, with an unpigmented body, enlarged appendages, and reduced and unpigmented eyes. It is found inside the Cave Nacimiento del Río San Antonio, where a permanent spring gives origin to the river of the same name. At 100 m from the entrance of the cave along the San Antonio River *M. totonacum* is found. Although morphologically very different, the distribution of both species poses the questions of who invaded the freshwater habitat first and if they are genetically related at all.

The differences between the new species described herein and the other two Mexican species of *Macrobrachium* with abbreviated larval development, *M. tuxtlaense* and *M. vicconi*, are in the ornamentation of the rostrum, the proportions of some articles of the first and second pereiopods, the length of the first pereiopod in relation to the second one, and the proportion between the length of the appendix masculina and the length of the appendix interna, as well as the disposition and number of setae on the appendix masculina (table I).

Geographically, the three species are very distant from each other. *Macrobrachium tuxtlaense* occurs in small tributaries of Lake Catemaco, 175 km to the

TABLE I

Comparison between species of *Macrobrachium* with abbreviated larval development from Mexico

	M. villalobosi Hobbs	*M. acherontium* Holthuis	*M. tuxtlaense* Villalobos & Alvarez	*M. vicconi* Román, Ortega & Mejía	*M. totonacum* sp. nov.
Rostrum	9-11 dorsal teeth 2 ventral teeth reaching beyond distal margin of scaphocerite	8-11 dorsal teeth 3 ventral teeth reaching distal margin of scaphocerite	9-11 dorsal teeth 2 ventral teeth reaching distal margin of scaphocerite	9 dorsal teeth 3 ventral teeth reaching distal margin of scaphocerite	10 dorsal teeth 3 ventral teeth reaching distal margin of scaphocerite
Scaphocerite	3 times as long as wide	2.7 times as long as wide	2.8 times as long as wide	2.7 times as long as wide	3.6 times as long as wide
Telson	1.4 times the length of sixth abdominal somite	1.2 times the length of sixth abdominal somite	1.2 times the length of sixth abdominal somite	1.4 times the length of sixth abdominal somite	1.3 times the length of sixth abdominal somite
Eyes	Absent	Globular	Well developed	Well developed	Well developed
First pereiopods	Reaching proximal third of carpus of second pereiopods, carpus 2 times the length of chelae	Reaching distal third of carpus of second pereiopods, carpus less than 2 times the length of chelae	Reaching distal margin of carpus of second pereiopods, carpus 1.5 times the length of chelae	Reaching distal border of merus of second pereiopods, carpus 1.7 times the length of chelae	Reaching proximal third of carpus of second pereiopods, carpus 1.6 times the length of chelae
Second pereiopods	Smooth with scattered setae; ischium 0.7 merus length, 0.5 carpus and chela length; 0.5 times total length	Smooth with scattered setae; ischium 0.9 merus length, 0.7 carpus length, 0.6 carpus length, 0.5 times total length	Covered with granules and small spines; ischium as long as merus and carpus, 0.5 chela length; 0.6 times total length	Covered with abundant small spines; ischium 1.6 merus and carpus length, 2.4 chela length; as long as total length	Smooth, without spines, with scattered setae, ischium 0.9 merus length, 0.7 carpus length; 0.6 chela length; 0.6 times total length
Appendix masculina	1.8 times the length of appendix interna, with 14 pairs of spines	2 times the length of appendix interna, with 21 pairs of spines	2.5 times the length of appendix interna, with 9 pairs of spines	2 times the length of appendix interna, with 16 pairs of spines	1.8 times the length of appendix interna, with 11 pairs of spines

east, and *M. vicconi* in the Perlas stream in the Lacantún River drainage, 510 km to the southeast (fig. 1). Regarding body size, *M. totonacum* is the smallest species with abbreviated development yet described for Mexico, with a maximum total length of 35.5 mm (mean 27.49 ± 3.83 mm). The egg size of *M. totonacum* is comparable to that of *M. iheringi* (Ortmann, 1897), *M. jelskii* (Miers, 1877), *M. quelchi* (De Man, 1900), and *M. nattereri* (Heller, 1862) (cf. Pereira & García, 1995). The larval development of the new species is similar to that of *M. tuxtlaense* (cf. Alvarez et al., 2002) and *M. nattereri* (cf. Magalhaes, 1989).

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