

## Two new *Mastigodiptomus* (Copepoda, Diaptomidae) from southeastern Mexico, with a key for the identification of the known species of the genus

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Two new species of the freshwater planktonic copepod genus *Mastigodiptomus*—*M. maya* and *M. reidae*—are described from material collected in southeastern Mexico. This neotropical genus is known to be distributed mainly in the southern part of the United States, Mexico and Central America, and now embraces eight species. Of these, six occur in Mexico. Both new species seem to be closely related to *M. texensis* and *M. albuquerquensis*. It is probable that this group of Mexican species represents a northwards radiation from the Proto-Antilles–Central America region into the continent, eventually reaching North America. A key for the identification of the known species of the genus is provided.

KEYWORDS: Copepoda, freshwater, neotropical.

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### Introduction

*Mastigodiptomus* Light, 1939 is probably the commonest diaptomid genus in Mexico and Central America. Of the six known species of the genus (Dussart and Defaye, 1983; Bowman, 1986), four have been hitherto recorded from Mexico (Wilson in Wilson and Yeatman, 1959; Reid, 1990; Suárez-Morales *et al.*, 1996; Suárez-Morales and Reid, 1998). These are: *Mastigodiptomus montezumae* (Brehm, 1955), widely distributed in central Mexico (Dos Santos *et al.*, 1996), but not recorded in the southeast lowlands; *M. nesus* (Bowman, 1986), found only in southeastern Mexico; *M. albuquerquensis* (Herrick, 1895), the most widely distributed diaptomid copepod in Mexico (Suárez-Morales and Reid, 1998), which is recorded even in the southeastern lowlands, and *M. texensis* (M.S. Wilson, 1953), known only from Tamaulipas and the Yucatan Peninsula. The two species not recorded in Mexico are *M. amatitlanensis* (Wilson, 1941), and *M. purpureus* (Marsh, 1907) which are known from Guatemala and Cuba, respectively (Marsh, 1907; Dussart and Defaye, 1983).

The state of Campeche, on the western coast of the Yucatan Peninsula, is one of the least surveyed areas for freshwater Copepoda in Mexico (Suárez-Morales and Reid, 1998). In early October 1998 samples collected by us at different localities in

the southern part of the Yucatan Peninsula, yielded an abundance of calanoid copepods which proved to be two previously undescribed species of the genus *Mastigodiptomus*.

### Method

Males and females of both new species were collected during surveys of several connected ephemeral ponds at Chicaná, an archaeological locality in the Yucatan Peninsula. This site lies on the southern border of the Biosphere Reserve of Calakmul, one of the largest tropical natural reserves in Latin America. Samples were collected by nets with a mesh size of 0.06 mm. The material was fixed in a 4% formalin solution and preserved in 70% ethanol. Specimens were dissected in glycerin and drawn with the aid of a camera lucida. They were then mounted in glycerin and sealed with DEPEX medium.

### Results

*Mastigodiptomus maya* n. sp.  
(figures 1–22)

#### *Material examined*

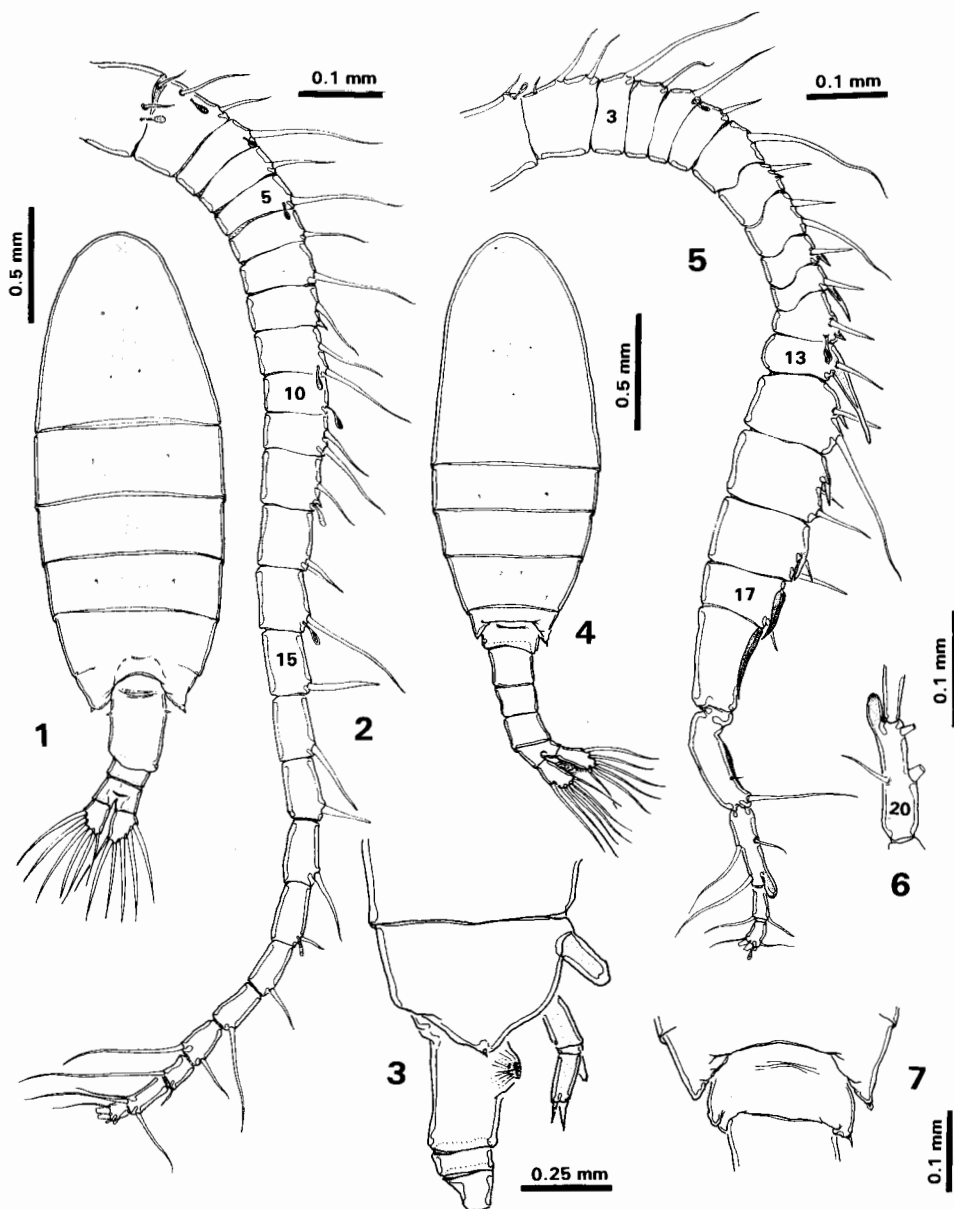
**HOLOTYPE:** adult male, collected 3 October 1998 from a small pond in Chicaná, Campeche, Mexico, deposited at The Natural History Museum, London, registered under number 1998.2716. **ALLOTYPE:** adult female, collected 3 October 1998, in same locality, deposited at The Natural History Museum, London, registered under number 1998.2717.

**PARATYPES:** one adult male, and one adult female from the same locality, deposited at the Muséum National d'Histoire Naturelle, Paris, catalogue numbers MNHN-Cp1686 and MNHN-Cp1687, respectively. One adult male, and one adult female from the same locality, deposited at the National Museum of Natural History, Smithsonian Institution, Washington DC, catalogue numbers USNM-261486 and 261487, respectively. One adult female, one male, same locality, deposited at El Colegio de la Frontera Sur (ECO-CH-Z00411). Original samples and additional specimens are deposited at El Colegio de la Frontera Sur, Unidad Chetumal, Quintana Roo, Mexico.

*Type locality.* An ephemeral pond (surface area < 1 ha) located in the archaeological site of Chicaná (18°30'50"N, 89°28'54"W), State of Campeche, within the Biosphere Reserve of Calakmul, Mexico.

#### *Description*

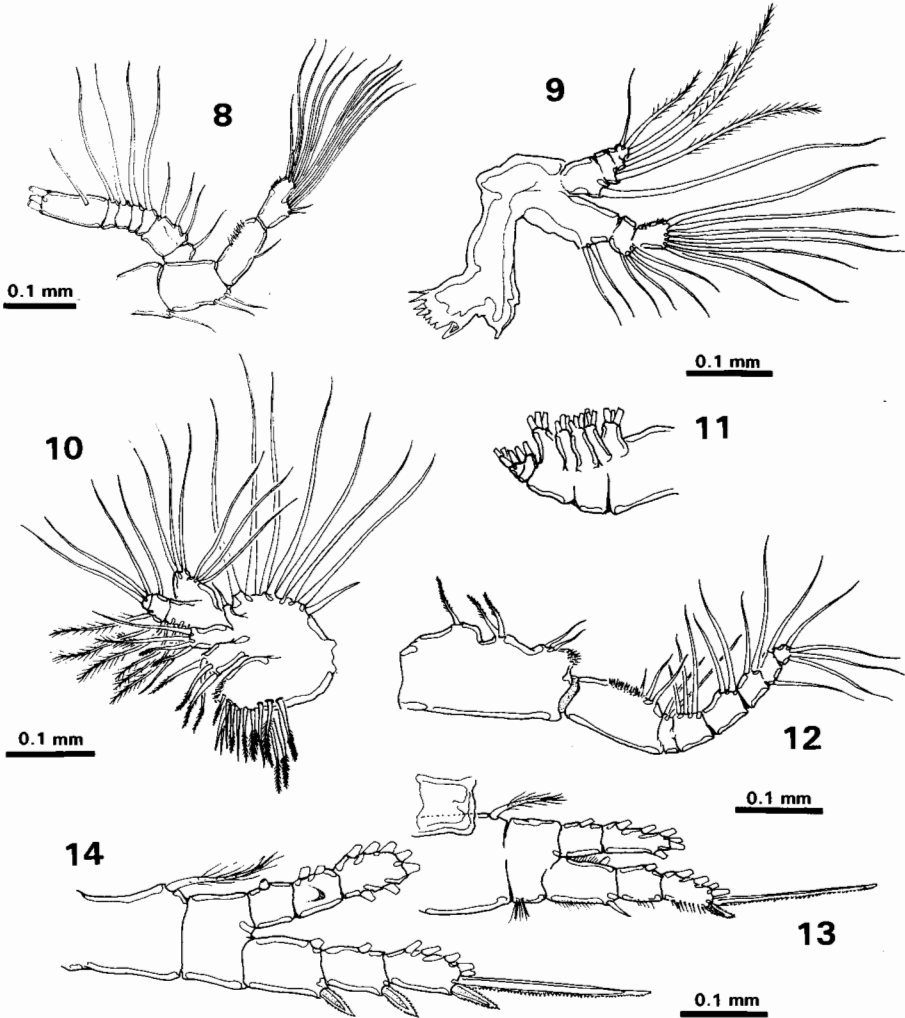
*Female* (figure 1). Mean length excluding furcal rami:  $2.38 \pm 0.09$  mm, range = 2.30–2.47 mm. Body robust, prosome slightly narrower anteriorly, symmetrical. Rostral points strong, distally acute (figure 21). Thoracic wings slightly asymmetrical, left shorter than right. Right wing with one posteriorly directed process ending in a relatively large spine-like process. Left wing with a small spine on posterior margin. Urosome of three somites, relative lengths: 66.6:11.6:21.7 = 100. Genital double-somite slightly asymmetrical, with a small spine on anterior third of each lateral margin (figure 1). Genital double-somite expanded ventrally, with rounded protuberance on genital opening (figure 3). Anal somite about twice as long as preanal somite. Caudal rami about as long as wide, slightly asymmetrical, both



FIGS 1-7. *Mastigodiptomus maya* n. sp. Female: (1) habitus, dorsal; (2) antennule; (3) urosomites, lateral. Male: (4) habitus, dorsal; (5) right antennule; (6) antepenultimate segment of right antennule; (7) posterior corners of last thoracic somite, dorsal.

margins lightly setose (not shown in figure 1). Caudal rami with three terminal, one dorsal, and two lateral setae, all setae biserially plumose, and more than 2.5 times as long as caudal rami (figure 1).

Antennules (figure 2) short, 25-segmented, reaching proximal third of genital double somite. Setae on segments 3, 5, 7 and 14 long. Armature per segments as follows (Arabic numerals=segment, Arabic numerals in parentheses=number of setae, ae=aesthetasc, sp=spine): 1(1+ae), 2(3+ae), 3(1+ae), 4(1), 5(1+ae),

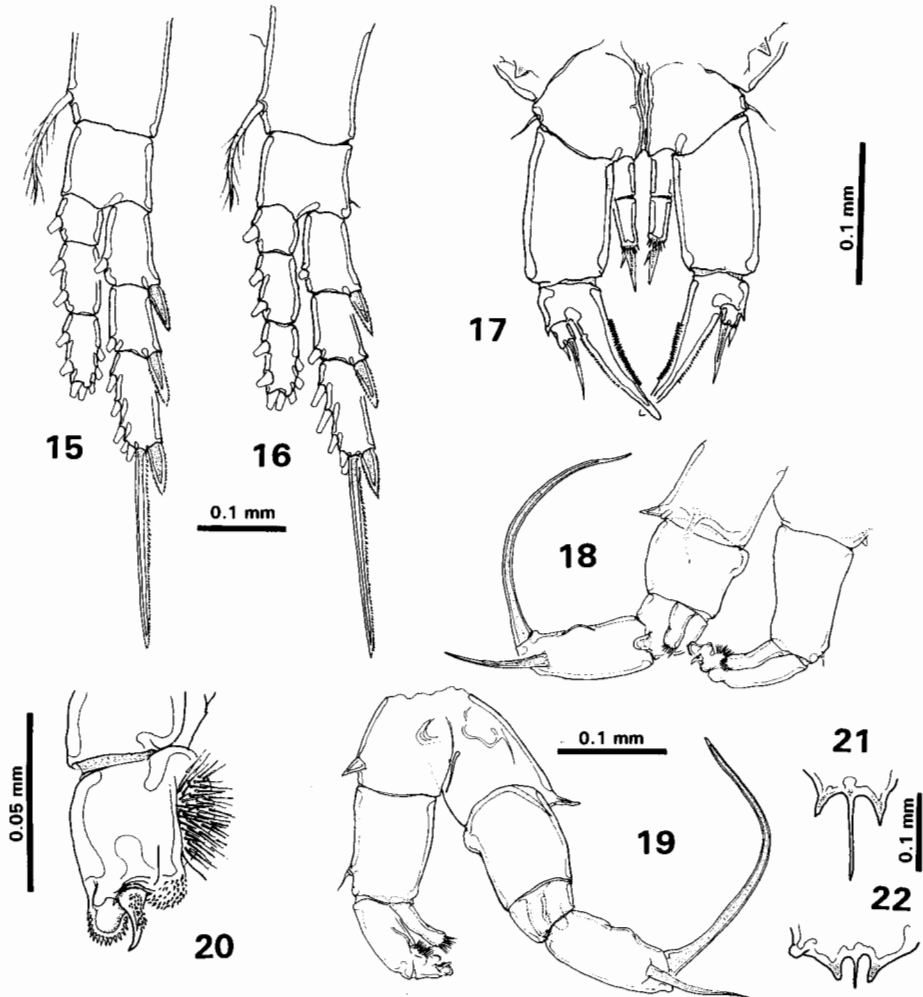


FIGS 8–14. *Mastigodiptomus maya* n. sp. Female: (8) antenna; (9) mandible; (10) maxillule; (11) maxilla; (12) maxilliped; (13) first leg; (14) second leg.

6(1), 7(1), 8(1+sp), 9(2+ae), 10(ae), 11(2), 12(1+ae+sp), 13(1), 14(1+ae), 15(1), 16(1), 17(1), 18(1), 19(1+ae), 20(1), 21(1), 22(2), 23(2), 24(3), 25(4+ae).

Antenna (figure 8) with exopod longer than endopod. Coxa with one seta. Basis with two short setae on outer distal margin. Endopod reduced, of two segments. First segment with one outer seta and a cluster of setules on inner margin. Distal portion of terminal segment with two lobes, outer with one short posterior and six anterior setae; internal with two short and six long setae. Exopod seven-segmented, with one seta on first segment, three on second, and one seta on segments 3–6. Distal segment with one short seta on proximal third of inner margin, and three long terminal setae subequal in length.

Mandible (figure 9) with six teeth on gnathobase, at least three are bi-pointed; ventral outermost tooth longer and wider. Distal end of inner margin with short, slender spine-like projection. Basis with two setae; endopod two-segmented, proximal



FIGS 15-22. *Mastigodiptomus maya* n. sp. Female: (15) third leg; (16) fourth leg; (17) fifth legs. Male: (18) fifth legs, anterior; (19) fifth legs, posterior; (20) distal segment of left fifth leg exopod. Female: (21) rostrum, ventral. Male: (22) rostrum, ventral.

segment with four setae; distal segment longer, with seven setae. Exopod four-segmented, with normal 1,1,1,3 setation pattern.

Maxillule (figure 10) with praecoxal arthrite bearing 13 spiniform setae. Coxal epipodite with eight setae, inner wider than the rest, coxal endite with five setae. Basis with one wide and short internal lobe bearing a short, single seta. Proximal and distal basal endites each with four setae. Endopod reduced, two-segmented, distalmost segment with two apical and one subapical setae. Exopod with six setae.

Maxilla (figure 11) indistinctly segmented, with two praecoxal and two coxal lobes, and a well developed basal lobe. Setation pattern of five lobes: 4, 3 (first and second praecoxal endites), 2, 3 (first and second coxal endites), 3 (basal endite); endopod well developed, three-segmented, with setation pattern: 1,1,3.

Maxilliped (figure 12) well developed. Coxa fused with praecoxa, with anterior protuberance projecting over next segment, and row of short spinules surrounding

process. Coxa with three distinct lobes, proximalmost with one seta, second and third each with two. Basis with row of short spinules on middle portion of inner margin, and group of three setae on inner margin distal third. Endopod six-segmented. First segment partially fused to basis, bearing two subequal setae. Second segment with three subequal setae, third, fourth, and fifth each with two setae; terminal segment with four subequal setae.

First leg (figure 13) with three-segmented exopod, and two-segmented endopod, coxa with plumose seta on internal margin, reaching proximal margin of first endopod segment. Basis with a cluster of long, thin setae on outer margin. Second, third and fourth legs (figures 14–16) with three-segmented exopods and endopods. Armature formula for swimming legs:

	coxa	basis	exopod	endopod
leg 1	0-1	0-0	I-1;0-1;I,3,2	0-1;1,2,3
leg 2	0-1	0-0	I-1;I-1;I,3,3	0-1;0-2;2,2,3
leg 3	0-1	0-0	I-1;I-1;I,3,3	0-1;0-2;2,2,3
leg 4	0-1	0-1	I-1;I-1;I,3,3	0-1;0-2;2,2,3

Leg 5 (figure 17). Coxa with small spiniform lateral process. Basis with inner margin straight, with short, slender lateral seta barely reaching one-quarter length of first exopod segment. Endopod two-segmented, 5.3 times long as wide, its distal end reaching level of second third of inner margin of first exopod segment; armed with one long terminal spine and one short, subterminal seta. Spine 1.6 times as long as seta. Distal margin of endopodal tip rounded, covered by short, stout setae. First exopod segment nearly as long as second, with smooth, straight lateral margins. Claw of second segment with blunt tip, inner and outer margins armed with row of small teeth on mid margin, those on inner margin are longer and more closely set. Third exopod segment reduced, barely distinct from second, represented by short, strong, spiniform process near usual spine of second segment.

*Male* (figure 4). Length excluding furcal rami:  $2.18 \pm 0.04$ , range = 2.1–2.22 mm. Body relatively slender, with typical diaptomid shape. Rostrum as in figure 22. Pediger 4 wider than succeeding somite; pediger 5 tapering posteriorly, asymmetrical, with reduced lateral wings, less developed than in female. Right wing (figure 7) pointing outwards, posterior end reaching almost to distal third of first urosomite, with terminal mamilliform spine. Left wing reduced, with small naked lobe, pointing posteriorly. Urosome symmetrical, five-segmented. First urosomite with posterior spine on right margin, with rounded process on left margin. Relative lengths of urosomites: 15.4:26.3:20.3:21.4:16.6 = 100. Caudal rami as for female. Only inner margin setose.

Antennules (figure 5) slightly longer than in female, last segment surpassing posterior margin of caudal rami. Right antennule geniculated between segments 18 and 19, with one seta on segments 3–7; large setae on segments 3, 7 and 14. Aesthetascs on segments 1, 5 and 12. Segment 8 with one short spine and one seta; 9 with one long and one short setae; 10 and 11 each with one stout spine, that on former short, barely reaching proximal third of next segment, that on latter reaching beyond middle of segment 12; segment 12 with one seta and a short spine; 13 with one seta and one large stout spine, its base almost as wide as bearing segment, spine reaching beyond middle of segment 14. Segment 14 with one spine, a short seta plus one long seta reaching middle of segment 16; segment 15 with one spine and two setae; 16 with broad-based spiniform process pointing distally on outer margin, with

one spine borne near its base, and long seta on distal margin; 17 with one seta, and spine-like process closely adjacent to inner margin of segment; 18 and 19 with spiniform processes on inner margin. Segment 20 (figure 20) with short, wide knob-like process on distal inner margin, almost reaching halfway along next segment (figure 5), and bearing three setae, two inserted in middle and one distally. Segment 21 with one seta. Terminal segment relatively short, with three apical large setae plus two subapical. Setation of left antennule, mouthparts and swimming legs as for female.

Left leg 5 (figures 18, 19) short, barely reaching middle portion of inner margin of right first exopod segment. Coxa with large, basally wide spiniform anterior process on outer margin. With a strong cuticular, heavily chitinized process near inner anterior margin. Basis with short, subterminal lateral outer seta, not reaching distal end of bearing segment. First exopod segment longer and wider than second. Second with large basal, inner pad covered with long fine setules, plus two distal pad-like processes, one terminal, digitiform, with terminal row of low tooth-like spines arranged in a semicircular pattern, the other a rounded pad with tiny spines over its surface; between these, a spine-like projection with curved end, covered with spinules along its longitudinal axis. Endopod one-segmented, reaching beyond two-thirds of second exopod segment, tip covered with stiff setules.

Right leg 5 (figure 19). Coxa with usual spinous process on distal portion of external margin, with two cuticular processes on anterior surface. Basis about three times as long as first exopod segment with faint cuticular ridge on anterior surface, and an additional rounded protuberance on proximal portion of inner margin. Outer margin of first exopod segment straight and smooth, inner margin without lateral process; segment with tongue-like chitinous process on distal margin, projecting into succeeding segment. Second exopod segment more than three times as long as first, with a low rounded protuberance on inner margin. Lateral spine slender, slightly curved, almost as long as bearing segment, with a row of low spinules along mid portion of inner margin, extending beyond distal third of segment. Terminal claw relatively slender, curved, tapering gradually from enlarged base, about 1.7 times longer than exopod segments 1 and 2 combined, without teeth on inner margin, but with very fine irregularities mainly along its middle portion. Right endopod reduced to a single lobe, short, one-segmented, barely reaching proximal margin of first exopod segment, without suture on posterior surface, with a row of setules on tip.

*Colour.* Some individuals show an intense blue coloration; in others the cephalothorax has a light violet tone and the rest of the body is blue. Most specimens become discoloured after ethanol preservation.

*Etymology.* The species is named '*maya*' by apposition and refers to its occurrence at one of the main archaeological sites of the ancient Mayan culture in Campeche.

#### *Remarks*

*Mastigodiptomus maya* is distinguished by its large size and by differences between the spiniform processes on segments 13 and 14 of the right male antennule. These spines are commonly subequal in length in the genus. Another distinguishing character is the spiniform sensilla of the basipodite of leg 5 of the female, which is very short, not spatulate as is typical in most species of *Mastigodiptomus*. However, these differences are not sufficient to justify the erection of a new genus.

The new species can be distinguished from its congeners by a combination of

distinctive characters: the right posterior corner of the female double-genital somite is slightly produced posteriorly, the female leg 5 endopodite is short, the basipodite of the male right leg lacks the hyaline process which is present in all the other species of *Mastigodiptomus*. The spine on the male right antennule segment 13 is very large, and that of segment 14 is much reduced, whereas both tend to be subequal in other species of the genus. A similar condition is present in *M. purpureus* (see Wilson, in Wilson and Yeatman, 1959), but in this species the spine on segment 13 is shorter. Another distinctive feature is the rounded shape of the protrusion on the antepenultimate segment of the same antennule. This process is acute or fang-shaped in most of the other species of the genus. A striking feature of this species is its large size (2.4 mm). Most other species of *Mastigodiptomus* range from 1–1.7 mm. The only exception is *M. purpureus* (2.5 mm).

*Mastigodiptomus reidae* n. sp.  
(figures 23–39)

*Material examined*

HOLOTYPE: adult male, collected 3 October 1998, from a small pond in Chicaná, Campeche, Mexico, deposited at The Natural History Museum, London, registered under number 1998.2718. ALLOTYPE: adult female, collected 3 October 1998, in the same locality, deposited at The Natural History Museum, London, registered under number 1998.2719.

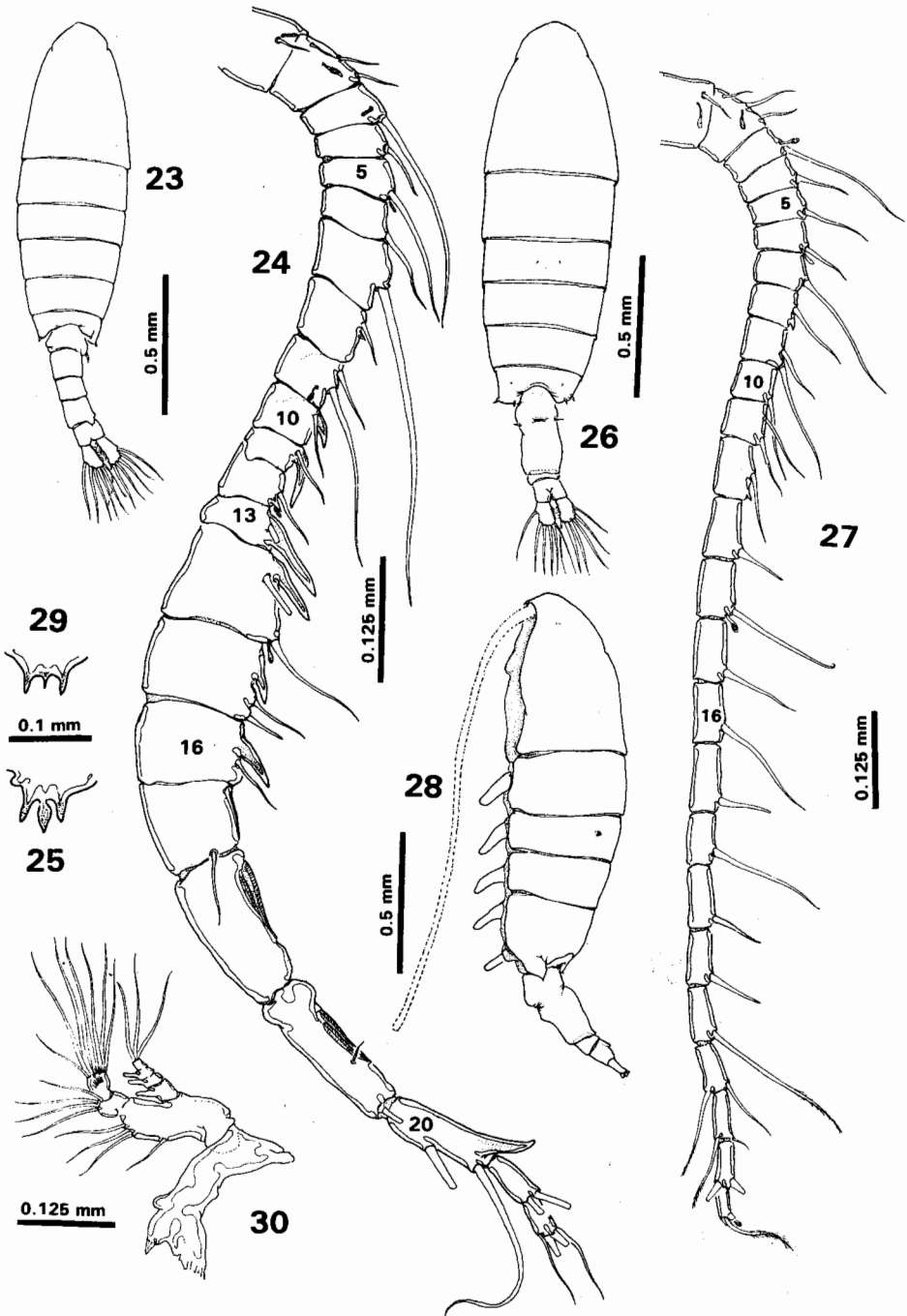
PARATYPES: one adult female, and one adult male, same locality, deposited at the Muséum National d' Histoire Naturelle, Paris, catalogue numbers MNHN-Cp1689 and MNHN-Cp1688. One adult female, and one adult male, same locality, deposited at the National Museum of Natural History, Smithsonian Institution, Washington DC, catalogue numbers USNM-261488 and 261489, respectively. One adult female, and one adult male from same locality, deposited at El Colegio de la Frontera Sur under number ECO-CH-Z00410. Original samples are deposited at El Colegio de la Frontera Sur, Unidad Chetumal, Quintana Roo, Mexico.

*Type locality.* A pond (surface < 1 ha) located in the archaeological site of Chicaná (18°30'50"N, 89°28'54"W) in the State of Campeche, within the Biosphere Reserve of Calakmul, Mexico.

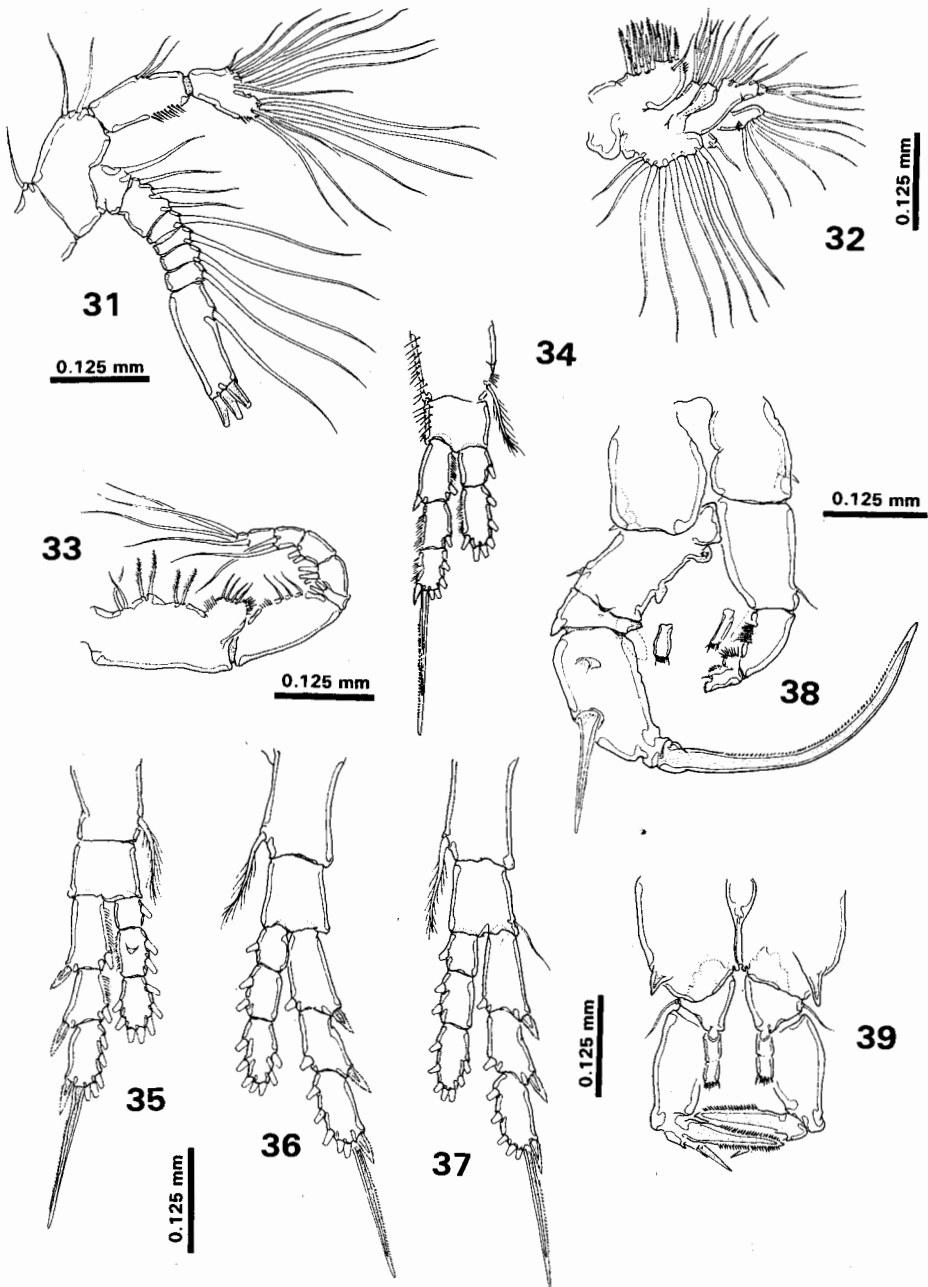
*Description*

*Female* (figure 26). Mean length excluding furcal rami  $1.54 \pm 0.05$  mm, range 1.47–1.60. Body slender, prosome slightly narrower anteriorly, symmetrical. Rostrum as in figure 29. Thoracic wings weakly developed, asymmetrical, right shorter than left. Right wing with two spine-like processes, both posteriorly directed. Left wing with a nearly transversal posterior margin, ending in a single spine, directed outwards; another spine on inner end of wing, directed posteriorly. Urosome with three somites, relative lengths: 72.9:8.35:18.7 = 100. Genital double-somite slightly asymmetrical, with one slender spine on anterior third of both lateral margins, right spine inserted in a slightly more proximal position than left (figure 26). Genital double-somite ventrally expanded, with low protuberances around genital opening (figure 28). Anal somite more than twice as long as previous somite. Caudal rami about as long as wide, inner margin setose. Caudal rami with three terminal,





FIGS 23-30. *Mastigodiptomus reidae* n. sp. Male: (23) habitus, dorsal; (24) right antennule; (25) rostrum, ventral. Female: (26) habitus, dorsal; (27) antennule; (28) habitus, lateral; (29) rostrum, ventral; (30) mandible.



FIGS 31–39. *Mastigodiptomus reidae* n. sp. Female: (31) antenna; (32) maxillule; (33) maxilliped; (34) first leg; (35) second leg; (36) third leg; (37) fourth leg. Male: (38) fifth legs. Female: (39) fifth legs.

one dorsal, and two lateral setae, all setae biserially plumose, more than 2.5 times as long as caudal rami.

Antennules (figure 27) relatively short, 25-segmented, barely reaching posterior margin of genital double somite (figure 28). Seta on segments 3, 7 and 9 very long.

Armature per segments as follows: 1(1+ae), 2(3+ae), 3(1+ae), 4(1), 5(1), 6(1+ae), 7(1), 8(1+sp), 9(2), 10(1), 11(2), 12(1+sp), 13(1), 14(1+ae), 15(1), 16(1), 17(1), 18(1), 19(1), 20(1), 21(1), 22(2), 23(2), 24(2), 25(4+ae).

Antenna (figure 31) as in *M. maya*, but outer lobe of distal portion of terminal endopod with one short posterior and six anterior setae, and with subterminal cluster of four or five small hair-like spinules; internal with two short and seven long setae.

Mandible (figure 30) with six teeth on gnathobase, at least one is bi-pointed; ventral outermost tooth longer and wider. Distal end of inner margin with short setulated spine-like projection. Basis with four setae; endopod two-segmented, proximal segment with four setae; distal segment longer, with seven setae. Exopod four-segmented, with normal 1,1,1,3 setation pattern.

Maxillule (figure 32) with praecoxal arthrite bearing 14 spiniform setae. Coxal epipodite with nine setae, coxal endite with five setae. Basis with one wide and long internal lobe bearing two setae, second endite with two setae, basal exite reduced, represented by a small lobe bearing a single seta. Endopod reduced, three-segmented, articulating with the basis, proximalmost segment with four setae, second with one seta, distalmost with three apical setae. Exopod with six setae, with a row of small spines on proximal third. Maxilla as in *M. maya* but endopod four-segmented, setation pattern 1,1,1,3.

Maxilliped (figure 33) well developed. Coxa with several distinct lobes, proximalmost with two setae, second and third with two, distalmost with anterior protuberance projecting over next segment, with row of short spinules surrounding process, and four short setae. Basis with row of slender spinules on middle portion of inner margin, group of three setae on middle portion of inner margin. Endopod six-segmented, first segment partially fused to basis, bearing two subequal setae. Second endopodal segment with three subequal setae, third and fourth with two setae, fifth with one seta; terminal segment with three subequal setae.

First leg (figure 34) with three-segmented exopod, and two-segmented endopod, coxa with stout setules on outer margin, plumose seta on internal margin, reaching proximal end of first endopod. Second endopod segment of leg 2 with Schmeil's organ mammiliform. Second, third and fourth legs (figures 35–37) with three-segmented exopods and endopods. Armature formula for swimming legs:

	<b>coxa</b>	<b>basis</b>	<b>exopod</b>	<b>endopod</b>
<b>leg 1</b>	0-1	0-0	I-1;0-1;I,3,2	0-1;1,2,3
<b>leg 2</b>	0-1	0-0	I-1;I-1;I,3,3	0-1;0-2;3,2,2
<b>leg 3</b>	0-1	0-0	I-1;I-1;I,3,3	0-1;0-2;3,2,2
<b>leg 4</b>	0-1	0-1	I-1;I-1;I,3,3	0-1;0-2;3,2,2

Leg 5 (figure 39): coxa with strong spiniform lateral process. Basis with inner margin straight, naked, with short, slender lateral seta reaching proximal third of first exopod segment. Posterior margin of basis with rounded process projecting over endopod. Endopod two-segmented, intersegmental division faint. Endopod long, four times long as wide, its distal end reaching level of second third of inner margin of first exopod segment; armed with one long terminal spine and a group of short, subterminal stout setae. First exopod segment nearly as long as second, with smooth, straight lateral margins. Claw of second segment with blunt tip, inner and outer margins armed with row of teeth along both margins. Third exopod segment reduced, barely distinct from second, represented by short, strong, spiniform process near usual spine of second segment.

*Male* (figure 23). Mean length (mm)  $1.56 \pm 0.09$ , range 1.45–1.62.

Body slender, with typical diaptomid shape. Rostrum as in figure 25. Pediger 4 wider than succeeding somite; pediger 5 tapering posteriorly, asymmetrical, with reduced lateral 'wings'. Right wing with two spine-like processes, pointing posteriorly. Left wing reduced, with small lobe ending in a small spine, pointing posteriorly. Urosome asymmetrical, five-segmented. First urosomite with relatively long posterior spine on right margin, with rounded protuberance on left margin. Relative lengths of urosomites being: 20.4:18.7:20.3:22.8:18.6=100. Preanal somite with a rounded process on left side of posterior margin, projecting over the anal somite. Caudal rami as for female. Inner and outer margins of caudal rami naked.

Antennules slightly shorter than in female, last antennular segment barely reaching posterior margin of preanal somite. Right antennule (figure 24) geniculated between segments 17 and 18, with one seta on segments 3–7; setae on segments 3, 5, 7 and 9 large. Aesthetascs on segments 1–3, 5, 9, 12 and 14. Segment 8 with one short spine and one seta; 9 with one long and one short setae; 10 and 11 each with one stout spine, that on former short, barely reaching distal third of bearing segment, that on latter reaching slightly beyond middle of segment 12; segment 12 with one seta and a short, broad spine; 13 with one seta and one large, strong spine, its base almost as wide as bearing segment, spine reaching proximal third of segment 14. Segment 14 with large spine, slightly smaller than that of previous segment, with a short seta at its base plus one long seta at distal end reaching segment 16; segment 15 with one spine and two setae; 16 with broad-based spine process pointing distally, with one seta borne near its base. Segment 17 with spiniform process inserted on proximal portion; 18 and 19 with typical spine-like processes closely adjacent to inner margin of segment, segment 19 also with one short seta on middle portion and one on distal margin. Segment 20 with long, wide-based fang-like process on distal inner margin, almost reaching halfway along next segment, segment bearing two setae, one inserted in middle of outer margin, the other distally. Segment 21 with two distal setae. Terminal segment relatively short, with two large apical setae plus two subapical. Setation of left antennule, mouthparts and swimming legs as for female.

Left leg 5 (figure 38) reaching middle portion of inner margin of right second exopod segment. Coxa with large, basally wide spiniform anterior process on outer margin. Basis with short, subterminal lateral outer seta, barely reaching distal end of bearing segment. First exopod segment longer and wider than second, with low pad on middle portion, covered with stout setules. Second exopod segment with two pad-like processes, one a basal rounded structure covered by short, stout setules, the other rounded, covered with low tooth-like spines arranged in a semicircular pattern; on top of these, a spine-like projection with curved end, with a distal comb-like structure. Endopod short, one-segmented, barely reaching second third of first exopodal segment, tip covered with a crown of stout setules.

Right leg 5 (figure 38): coxa with large spinous process on distal portion of external margin, inner margin smooth. Basis about 2.5–3 times as long as first exopod segment, with semicircular cuticular ridge on distal margin of anterior surface, with strong subrectangular protuberance on proximal third of inner margin, plus two hyaline processes, one rounded, with heavily chitinized central core on proximal third, and the other subquadrate, on the middle portion. Outer margin with short socketed seta on middle portion. First exopod segment short, with outer margin straight, slender, with subtriangular distal protuberance; inner margin with

low subtriangular lateral process. Second exopodal segment more than three times as long as first, with a chitinous semicircular process on anterior surface in proximal third. Lateral spine straight, with small spinules along inner margin, almost as long as bearing segment, borne slightly beyond distal third of segment. Terminal claw relatively slender, curved, tapering gradually from enlarged base, about 2.5 times longer than the second exopod segment, with row of low teeth along most inner margin. Right endopod reduced to a single lobe, short, one-segmented, barely reaching distal margin of first exopod segment, without suture on posterior surface, with a crown of stout setules on tip.

*Colour.* Light blue in live and recently preserved specimens.

*Etymology.* Named after Dr Janet W. Reid, National Museum of Natural History at Washington, DC, in recognition of her abundant and relevant contributions to the knowledge of the Neotropical freshwater copepod fauna, and of her continuous interest in helping and guiding Latin American copepodologists.

#### *Remarks*

The distinguishing characters of *M. reidae* include a strong spine on segment 16 of the right male antennule (absent in *M. montezumae*, *M. purpureus* and relatively underdeveloped in *M. albuquerquensis*, *M. amatitlanensis*, *M. nesus*, *M. texensis*, and *M. maya*). The new species has two well-defined internal hyaline processes on the inner margin of the basipod: other species have only one. The proximalmost process is clearly rounded, but it is subquadrate in *M. nesus* and *M. albuquerquensis*, oval in *M. purpureus* and *M. maya*, acute, triangular in *M. texensis*, and absent in *M. montezumae* and in *M. amatitlanensis*. In *M. reidae*, the second is subquadrate and located on the distal third of the segment. No other known species of this genus bears a second process. Another character is the chitinous process on the posterior surface of the second exopod segment of the right fifth leg. Other appendages are similar to those of *M. montezumae* (Dos Santos *et al.*, 1996).

The occurrence of a dorsal keel on the female fourth pediger in *Mastigodiptomus* has been recognized as variable, not present in all individuals (Bowman, 1986; Suárez-Morales *et al.*, 1999). Therefore, in some species of the genus, the presence/absence of this character has no taxonomic value. In *M. reidae* this process is absent, but that does not eliminate the possibility that some individuals have a dorsal keel.

#### **Discussion**

*Mastigodiptomus* is a neotropical genus dwelling in a wide variety of environments, from the highlands of Mexico (over 2000 m above sea level), to the lowlands (Dos Santos *et al.*, 1996; Suárez-Morales and Reid, 1998). Only *M. albuquerquensis* and *M. texensis* seem to occur in the north, and reach the southern part of the United States (Wilson, 1953; Wilson in Wilson and Yeatman, 1959; Dussart and Defaye, 1983; Bowman, 1986).

Bowman (1986) suggested that the widely distributed *M. albuquerquensis*, or a continental ancestor, was the original form which dispersed phoretically to Cuba and the Cayman Islands and gave origin to *M. nesus*. This might explain part of the known distribution of the genus. However, this is probably more related to regional geological processes. An ancestor of the genus probably originated in the Proto-Antilles–Central America complex, linked with the continental mass during the Eocene–Pliocene (see Rosen, 1975; Pielou, 1979; Bănărescu, 1995). It radiated northwards into the continent, with relicts in the insular Caribbean

(*M. albuquerquensis*, *M. purpureus*, *M. nesus*) and the Cayman Islands (*M. nesus*). This kind of radiation is opposite to that suggested for other American diaptomid genera, such as *Leptodiaptomus*, which is clearly a temperate North American derivate which radiated to the south (Elías-Gutiérrez *et al.*, 1999) and has a restricted distribution southwards, with its range limit in Central America.

The two new species were found at the southernmost locality for *Mastigodiaptomus* in Mexico (see Suárez-Morales *et al.*, 1996). The southernmost American record is of *M. amatitlanensis* from Guatemala (Suárez-Morales *et al.*, 1996). The new species represent the seventh and eight described species of the genus, and increase to six the number of *Mastigodiaptomus* recorded in Mexico (Suárez-Morales and Reid, 1998).

Diaptomid copepods tend to show restricted distributional ranges and endemism is relatively high (Dussart and Defaye, 1995). Only further work can reveal whether, like other Mexican diaptomids (Suárez-Morales and Reid, 1998), the new species are endemics.

It is not unusual that two species of *Mastigodiaptomus* coexist (Dos Santos *et al.*, 1996), but this could be the first report of three *Mastigodiaptomus* species coexisting in a relatively small system. These three species probably have sharp differences in their trophic ecology, as suggested by their different size ranges.

#### Key to species of *Mastigodiaptomus*

##### *Males*

- 1a Spine on segment 16 strongly developed. Second basipod of right fifth leg with a proximal subrectangular projection and two small bulb-like processes along inner margin . . . . . *M. reidae*
- 1b Spine on segment 16 absent or reduced, processes on second basipod not as described above . . . . . 2
- 2a Large (over 2.2 mm, excluding furcal rami) . . . . . 3
- 2b Small or medium-sized (less than 2.0 mm length, excluding furcal rami) . . . . . 4
- 3a First exopod of right fifth leg with a transverse ridge; antepenultimate segment of right antennule with fang-like process . . . . . *M. purpureus*
- 3b First exopod of right fifth leg with tongue-like projection. antepenultimate segment of right antennule with rounded, knob-like process . . . . . *M. maya*
- 4a Second exopod of right fifth leg with lateral spine long, at least 75% of length of its segment . . . . . 5
- 4b Second exopod of right fifth leg with lateral spine short: less than half the length of segment . . . . . 7
- 5a Second basipod of right fifth leg with posterior butterfly-like sclerotization on inner margin . . . . . *M. albuquerquensis*
- 5b Same structure without such sclerotization . . . . . 6
- 6a Left fifth leg exopod with distal process smooth, right endopod not reaching distal margin of first endopodal segment . . . . . *M. nesus*
- 6b Left fifth leg exopod with distalmost process denticulate, right endopod reaching the distal margin of first endopodal segment . . . . . *M. texensis*
- 7a Second exopod of right fifth leg with a semicircular transverse lamella on proximal posterior surface and a fine longitudinal 'y' shaped longitudinal ridge. Lateral spine inserted on second third of segment . . . . . *M. montezumae*

- 7b Second exopod of right fifth leg without a lamella or ridges on proximal posterior surface. Lateral spine subterminal . . . . . *M. amatitlanensis*

### Females

- 1a Genital double somite asymmetrical, with lateral protuberances outwards, on one or both sides . . . . . 2  
 1b Genital double somite symmetrical, with both margins nearly straight . . . . . 6  
 2a Fifth leg with one-segmented endopodites . . . . . 3  
 2b Fifth leg with two-segmented endopodites . . . . . 4  
 3a Second urosomite with posterodistal protrusion . . . . . *M. amatitlanensis*  
 3b Second urosomite with straight posterior margins . . . . . *M. montezumae*  
 4a Antennules long, reaching beyond furcal setae . . . . . *M. nesus*  
 4b Antennules short, reaching at most midlength of caudal rami . . . . . 5  
 5a Genital double somite elongated, 2.25 times longer than wide, lateral spines weakly developed . . . . . *M. reidae*  
 5b Genital double somite almost square, nearly as wide as long, lateral spines strong . . . . . *M. albuquerqueensis*  
 6a Large, more than 2.2 mm long excluding furcae . . . . . 7  
 6b Small or medium-sized, never reaching 2.0 mm . . . . . *M. texensis*  
 7a Sensilla on first basipod of fifth leg small and short, length/width ratio less than 1.2 . . . . . *M. maya*  
 7b Sensilla on first basipod of fifth leg, large and long, length/width ratio over 2.0 . . . . . *M. purpureus*

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