



<http://dx.doi.org/10.11646/zootaxa.3669.3.4>

<http://zoobank.org/urn:lsid:zoobank.org:pub:7901C3A1-771E-42C5-921C-5CD493AE748C>

## Two new species of *Melanoplus* Stål, 1873 (Orthoptera: Acrididae: Melanoplinae) from northeastern Mexico

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### Abstract

Two new species of the genus *Melanoplus* Stål 1873 are described. *M. trachodes* n. sp., and *M. parvus* n. sp., both of which are endemic to the cool-temperate mountains of the Eastern Sierra Madre (ESM) in northeastern Mexico. Their habitat represents a transition zone between the ESM and the semiarid High Plateau Biogeographic provinces. This transition zone is characterized by an elevation range from 1,900 to 3,400 m and unique ecological conditions, which give rise to a considerable number of endemisms.

**Key words:** Mexico, biodiversity, endemisms, *Melanoplus trachodes* n. sp., *M. parvus* n. sp.

### Resumen

Se describen dos nuevas especies del género *Melanoplus* Stål 1873. *M. trachodes* n. sp., y *M. parvus* n. sp., ambos taxa son endémicos a las montañas frías templadas de la Sierra Madre Oriental (SMO) en el noreste de México. Su hábitat representa una zona de transición entre dos Provincias Biogeográficas, SMO y Altiplano árido mexicano. Esta zona de transición presenta un rango elevacional de 1,900 a 3,400 metros y condiciones ecológicas únicas, que dan lugar a un número considerable de endemismos.

**Palabras clave:** México, biodiversidad, endemismos, *Melanoplus trachodes* n. sp., *M. parvus* n. sp.

### Introduction

Among the acridid grasshoppers, the Melanoplinae is one of the largest subfamilies with more than 900 species distributed throughout Eurasia and America (Chintauan-Marquier *et al.* 2010). The genus *Melanoplus* Stål, 1873 is comprised of more species than any of the other American melanoplinae with Eades *et al.* (OSF-2013) listing *ca.* 284 valid species. This genus is particularly diverse in México and Central America with numerous endemisms. At least 41 taxa are known from Mexico, with a good number of species described recently (Fontana & Buzzetti 2007, Buzzetti *et al.* 2010, Fontana *et al.* 2011). In recent expeditions to study the Orthoptera of northeastern Mexico, a few specimens of *Melanoplus* that could not be assigned to any of the known taxa were collected. We describe here two new species of *Melanoplus* from northeastern Mexico. These new taxa are associated with the *M. reflexus* group (Fontana & Buzzetti 2007) in one case, and, possibly, with the *M. puer* group (Scudder 1897, Blatchley 1920, Hubbell 1932, Capinera *et al.* 2001) in the other.

### Materials and methods

Specimens were collected using a sweep net or by hand. The following resources were used in trying to identify the specimens: Scudder (1897), Blatchley (1920), Little (1931), Hubbell (1932), Hebard (1937), Gurney & Brooks

(1959), Helfer (1972), Capinera *et al.* (2001), Kirk & Bomar (2005), Eades *et al.* (2013). We also checked the specimens against the Melanoplinae at the University of Michigan-Museum of Zoology (UMMZ) and the Instituto de Biología-Universidad Nacional Autónoma de México (IB-UNAM).

Measurements and laboratory images were taken with a Motic Stereomicroscope, Model 43-FBGG-C, 3.0 mp. Dorsal view measurements: body length (measured from the vertex to the apex of the hind femora aligned to the body) and pronotum length. Lateral view: hind femora and tegmina length. All measurements were taken at 10x. Males' cerci and supra-anal plate drawings were made using a Motic stereomicroscope model K-400L equipped with a drawing device SP10.0102K; drawings were made at 50x, and then reduced 50%. Internal genitalia dissection was performed by relaxing specimens in warm water for 15-20 min. After relaxation the male was positioned on a pinning surface and, using insect pins, with the tip bent at a right angle, the phallus was slipped back. The phallic complex was placed, for *ca.* 10 minutes, in a 10% KOH solution to clear and remove the membranes and muscles. After this time the membranes and muscles were completely removed with insect pins with the tip bent, and the epiphallus was separated from the phallic complex. The mass was then washed with cold water. Phallic structures were then mounted on cardboards and photographs made. This procedure is described by Hubbell (1932) and Cohn & Cantrall (1974).

Descriptions and diagnostic characters were based primarily on males, since females of *Melanoplus* spp. are difficult to differentiate. The easiest way to assign females to a correct species was by associating them to males collected at the same time and locality during field trips, or collecting them during mating.

**Habitat.** Photographs of habitats were made and samples of grasses and host plants collected during field trips; dichotomous keys were used for determination following Rzedowski (2006). Coordinates and altitude measurements were taken using a Garmin-GPS 48-12 channel.

**Depositories:** University of Michigan Museum of Zoology (UMMZ): ♂ holotype and ♀ allotype.

Instituto de Biología-Universidad Nacional Autónoma de México (IB-UNAM): 1 ♂ and 1 ♀ paratypes.

L. Barrientos-Lozano collection-Instituto Tecnológico de Cd. Victoria, Tamaulipas, Mexico. (L. Barrientos-Lozano-ITCV): all other ♂ and ♀ paratypes.

## Results

### Genus *Melanoplus* Stål, 1873

**Diagnosis.** Members of the genus *Melanoplus* possess a prosternal spine or “spur” ventrally, immediately in front of, or between the front legs; this prosternal spine may be variable in size, but always prominent. Because of this characteristic they are commonly known as “spur throated grasshoppers”. The body is moderately stout and feebly compressed. Head is not larger in proportion than the pronotum, not prominent, but little longer than the prozona. Pronotum not enlarged in front to receive the head. Tegmina, when fully developed, narrow, rarely rather broad, but very distinctly tapering in distal half. Cerci of male exceedingly variable, but very rarely styliiform; subgenital plate never very narrow, often very broad, its apical margin usually elevated (Scudder 1897, Blatchley 1920, Kirk & Bomar 2003). Seventeen species of the genus *Melanoplus* have been recorded to occur in northeastern Mexico, including two new species here described. A key to separate these species is presented below, followed by the description of the two new species.

### Key to known species of *Melanoplus* spp., from northeastern Mexico, based on males

1. Tegmina nearly as long as, or longer than the abdomen . . . . . 2
- .- Tegmina short, sometimes longer than pronotum . . . . . 13
2. Hind tibiae usually wholly or in great part reddish-orange or red . . . . . 3
- .- Hind tibiae usually bluish-green, glaucous, greenish or yellowish . . . . . 7
3. Medium in size (20–25 mm), hind tibiae wholly red intense, cerci lamelliform with distal portion convex . . . . . 4
- .- Size large (30–35 mm), hind tibiae reddish-orange, cerci are large, spatulate or distally bilobate . . . . . 5
4. Subgenital plate subconical and the apex always markedly notched. Cerci lamelliform, basally broad, subrectangulate, expanding slightly upward and rounded at the apex. Fig. 1 a, b. . . . . *M. mexicanus*.

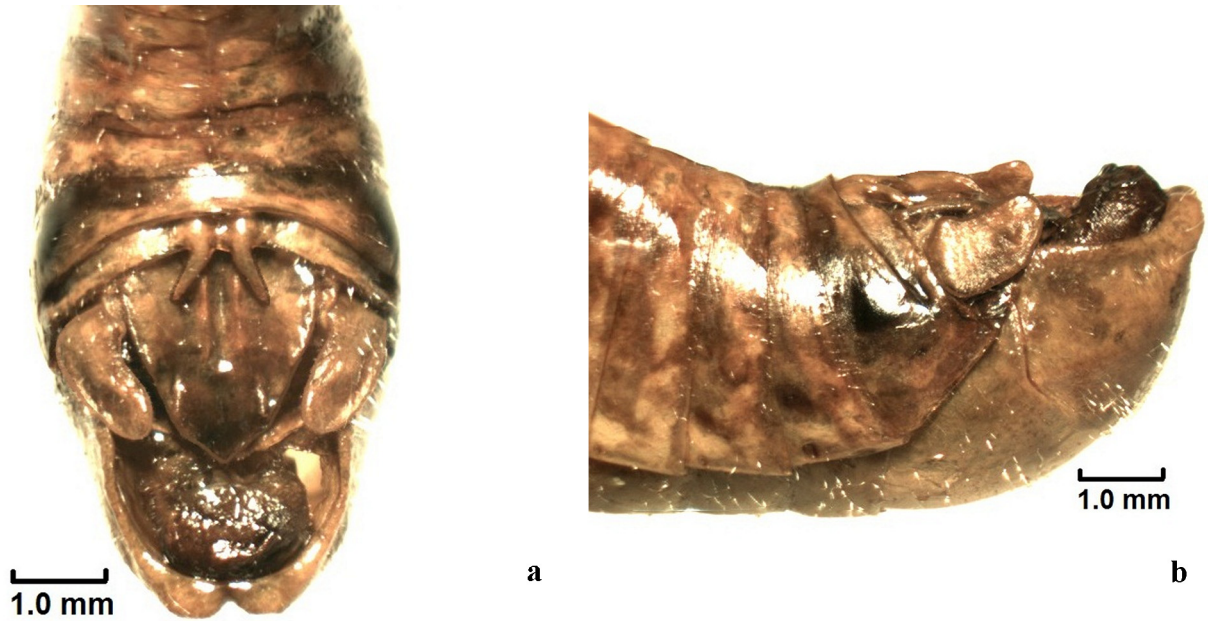


FIGURE 1. *Melanoplus mexicanus*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

- Subgenital plate small, slightly broader basally than at apex, gently compressed and elevated apically, apical margin well rounded, entire. Cerci slightly constricted near the mid-point, grooved at the tip, and curved inward. Furculae short, triangular, widely separated and extensions gently diverging. Fig. 2 a, b. .... *M. gladstoni*.



FIGURE 2. *Melanoplus gladstoni*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

- 5. Two yellow-pale stripes extending from the back of the eyes, across the lateral lobes of the pronotum, to the tips of the fore wings. The stripes converge to form a V at the tip of the wings. Cerci short and boot-shaped (Fig. 3 a, b); compared to *M. sumichrasti sumichrasti* (Fig. 4 a, b) and *M. differentialis nigricans* (Fig. 5 a, b) the cerci are overall shorter and distally the apex is broader. Furculae very short, triangular and widely spaced. .... *M. bivittatus*.
- Without two yellow-pale stripes extending from the back of the eyes, across the lateral lobes of the pronotum and wings. Furculae not as above. .... 6

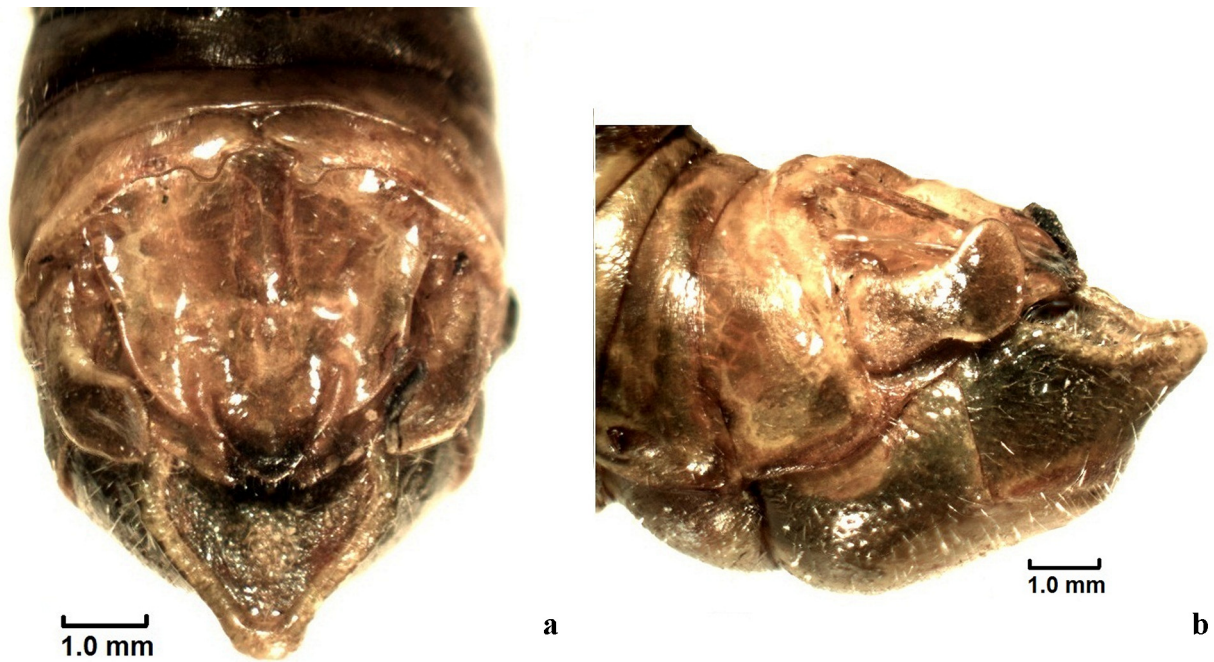


FIGURE 3. *Melanoplus bivittatus*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

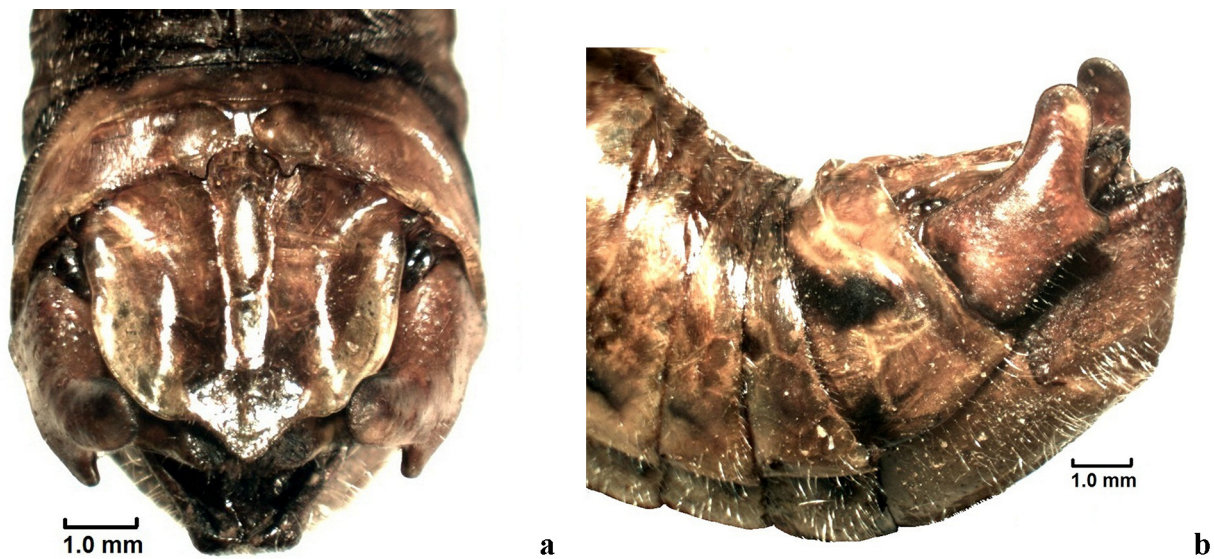


FIGURE 4. *Melanoplus sumichrasti sumichrasti*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

6. Postocular band well marked extending on to prozona. Hind femora medial area black, bearing a horizontal intense-yellow band on lower portion. Hind tibiae below the middle red, above the middle black with a yellow ring. The inner face and lower sulcus of hind femora black, with the exception of a coral-red portion along the middle of the basal half. The cerci boot-shaped (Fig. 4 a, b); compared to *M. differentialis nigricans* (Fig. 5 a, b) the apex of cerci is distally more produced. Furculae made up of short triangular projections. . . . . *M. sumichrasti sumichrasti*.  
 .- The postocular band fading. Hind femora with a cream band on lower portion and bearing black herringbone markings on the outer face; the latter feature is evident even in the black members of this species. The cerci large and boot shaped (Fig. 5 a, b); compared to *M. bivittatus* and *M. sumichrasti sumichrasti* the cerci are intermediate in size. The furculae barely visible. . . . .  
 . . . . . *M. differentialis nigricans*.  
 7. Small in size (15–25 mm). Furculae represented by small digitiform projections or sub-conical . . . . . 8  
 .- Medium size (25–30 mm). Furculae basally robust and very elongated (about midlength of the supra-anal late . . . . . 12  
 8. Furculae digitiform, narrow, more or less elongated (about half the length of the supra-anal plate or less), distally with a pointed apex. Cerci spatulate or lamelliform . . . . . 9  
 .- Furculae short, subconical, distally with a rounded apex. Cerci not as above . . . . . 11

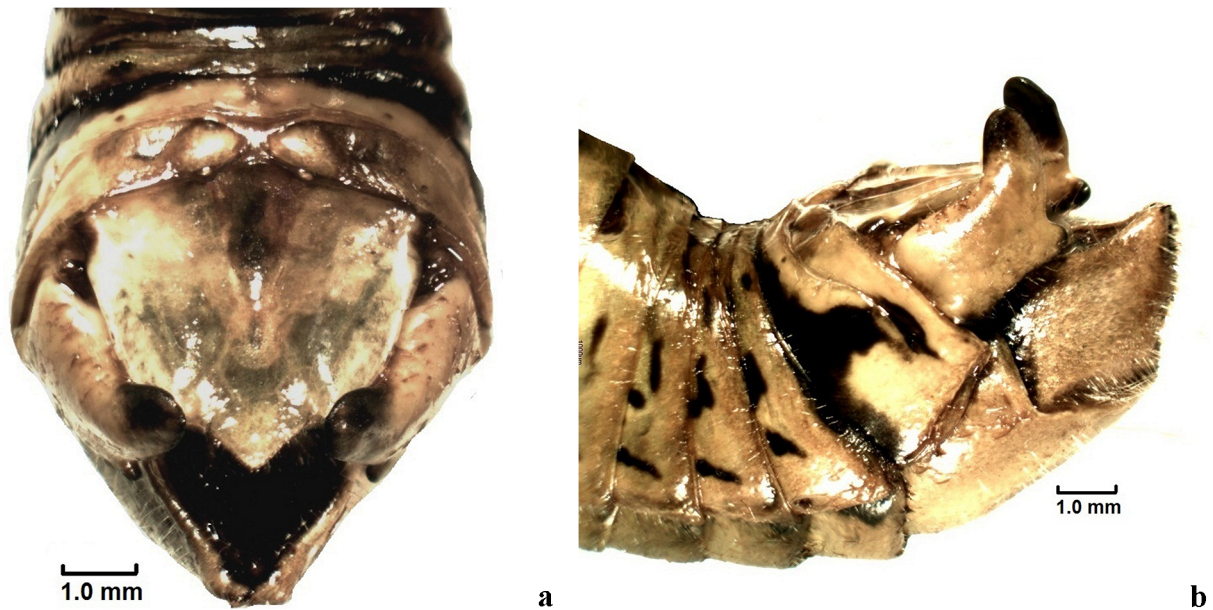


FIGURE 5. *Melanoplus differentialis nigricans*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

9. The tip of the subgenital plate expanded; when view from above it is clearly notched in the middle. Furculae slender, v-shaped (about one-fourth of the supra-anal plate). Cerci compact, extending slightly upward and rounded at the tip. Fig. 6 a, b. . . . .  
 .- . . . . *M. sanguinipes sanguinipes*.  
 .- The tip of the subgenital plate rounded, tubercle absent. . . . . 10

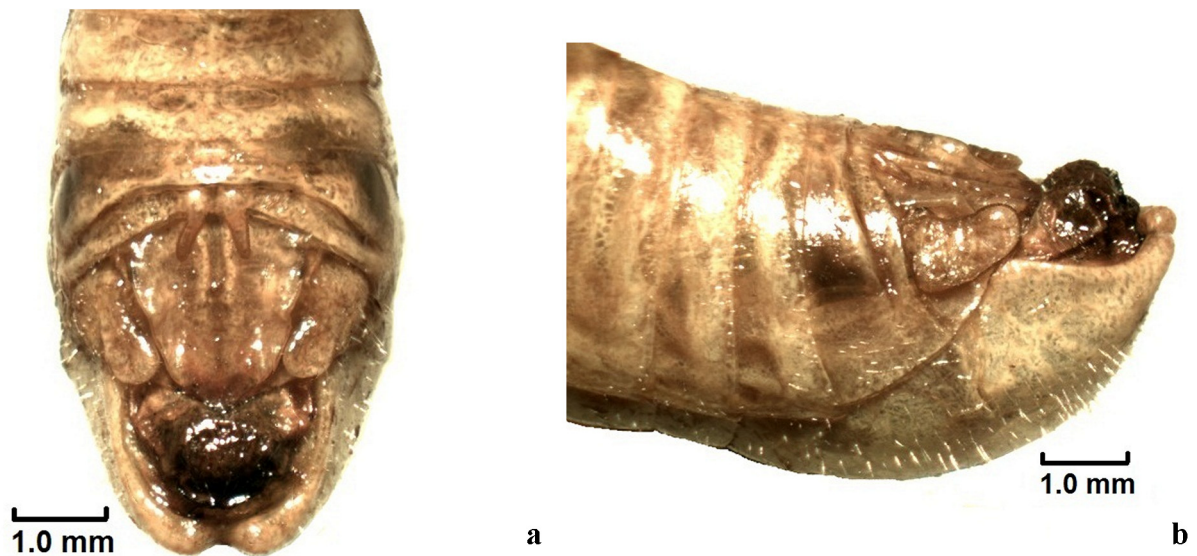


FIGURE 6. *Melanoplus sanguinipes sanguinipes*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

10. Cerci basally broad, strongly narrowed in the basal half, and then only slightly narrow toward the tip; the tip truncated diagonally and longer along the upper edge. Furculae narrow and pointed extending about half the length of the supra-anal plate. Fig. 7 a, b. . . . . *M. femurrubrum*.  
 .- Cerci flat and taper to a sharp point; the upper edge concave, and the lower edge convex. Furculae about one-third the length of the supra-anal plate, with the extensions narrow and pointed. Fig. 8 a, b. . . . . *M. regalis*.  
 11. Tubercle of subgenital plate subapical, subconical, with pointed tip. Cerci short but little longer than its basal width, wide and very stout at base, tapering rapidly, the distal half subequal, tapering to a rounded apex, bent strongly upward and inward, the apex flattened and a little reflexed. Furculae short and broad, triangular and flattened considerably separated. Fig. 9 a, b. . . . .  
 . . . . . *M. tuberculatus*.



FIGURE 7. *Melanoplus femurrubrum*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

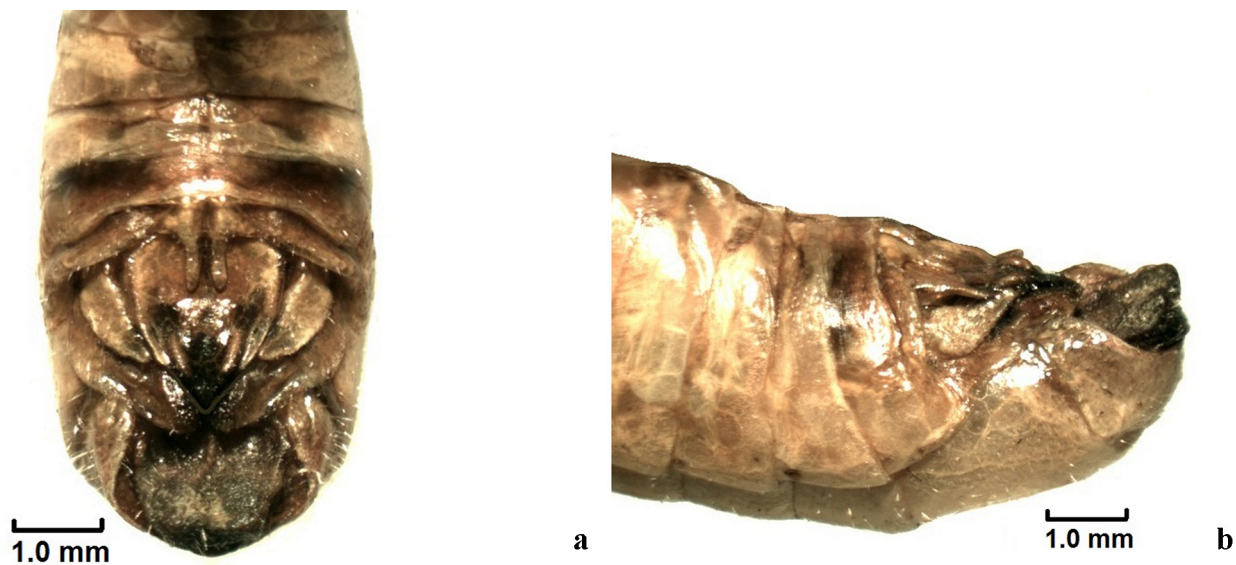


FIGURE 8. *Melanoplus regalis*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

- .- Tubercle of subgenital plate apical, twice wider than long. Cerci basally swollen and marked with a ridge; they taper markedly in the basal half and develop into a finger-like projection that extends upward and inward. Furculae short, small and with rounded tip. Fig. 10 a, b. . . . . *M. lakinus*.
- 12. Cerci moderately large and broad, compressed, incurved, laminate, a little more than three times as long as broad, a very little contracted messaly, the apical portion with its well-rounded tip more or less externally sulcate and narrower than the basal portion. Furculae about midlength of the supraanal plate, extensions diverging distally. Fig. 11 a, b. . . . . *M. arizonae*.
- .- Cerci broad basally, subtriangular, straight, slender, bluntly terminated equal finger extending backward and upward, starting from the lower posterior portion of the base. Furculae very broad basally, about midlength of the supraanal plate, extensions distally truncated. Fig. 12 a, b. . . . . *M. flavidus*.
- 13. Tegmina broad, oval, apically rounded. . . . . 14
- .- Tegmina lanceolate and sharply pointed. . . . . 17
- 14. Cerci are simple, lamelliform. Subgenital plate subconical and distally very elongated . . . . . 15
- .- Cerci complex and distally expanded . . . . . 16



FIGURE 9. *Melanoplus tuberculatus*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

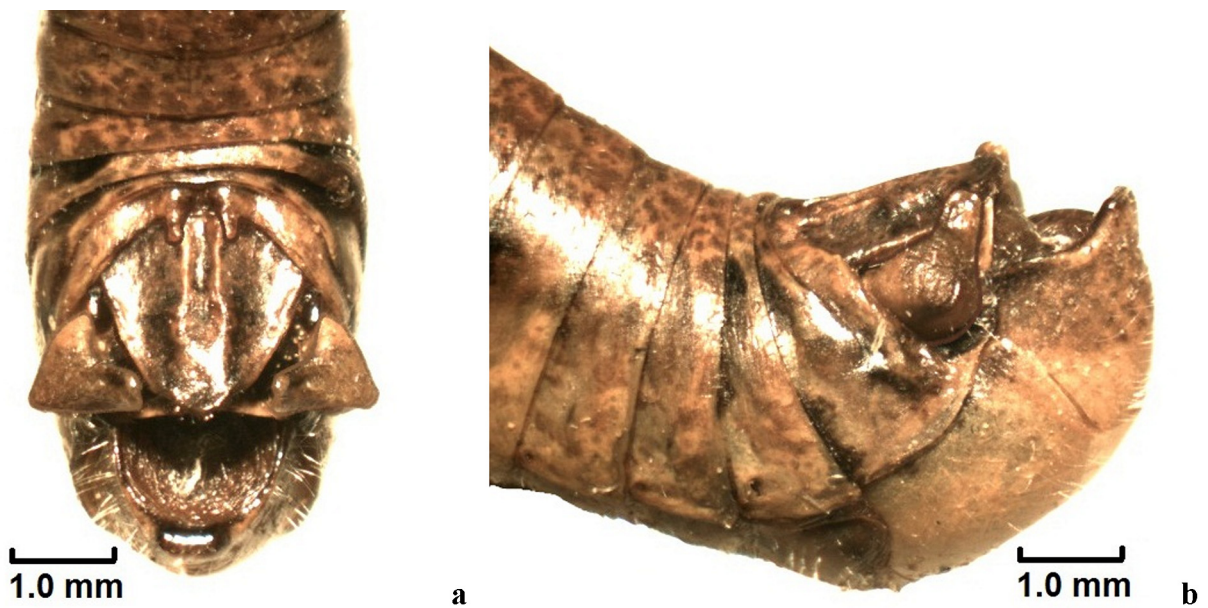


FIGURE 10. *Melanoplus lakinus*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

15. Small in size (14–15 mm). Cerci elongated, as long as the supra-anal plate incurved and narrowing about midlength, then widening, distally the upper margin bent conspicuously upwards and inwards. Furculae obsolete. Figs. 27 c, d; 28 a–c. . . . . *M. parvus* n. sp.
- .- Medium in size (18–19 mm). Cerci subrectangular, with rounded, flattened apex. Furculae represented by short lobes. Fig. 13 a, b. . . . . *M. meridionalis*.
16. Cerci spatulate, incurved and narrowing about midlength, distal portion about twice wider than the narrowest, the half distal exhibits two triangular projections, the superior process being in a different plane than the inferior one which is more prominent; the apex forming a sub triangular projection, area between projections and apex concave. The supra-anal plate triangular, broader than long. Furculae are inconspicuous, short, and subquadrate. Figs. 15 c, d; 16 a–c. . . . . *M. trachodes* n. sp.
- .- Male cerci sub-trapezoidal in lateral view and curved inside in dorsal view; the basal portion is subconical while the apical is concave and expanded; the concave portion of apex is subtriangular in a posterior view. Furculae represented by short, subtriangular and rounded lobes. Fig. 24 c, d. . . . . *M. reflexus*.



FIGURE 11. *Melanoplus arizonae*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

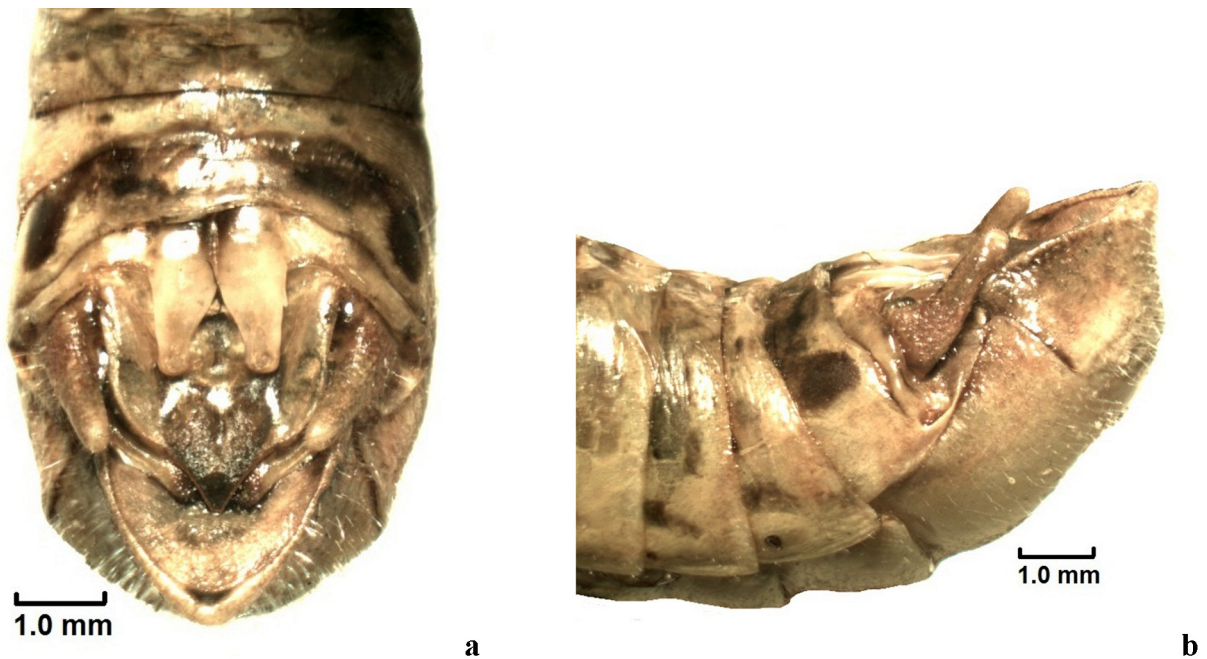


FIGURE 12. *Melanoplus flavidus*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

17. Small in size (16–17 mm). Cerci and furculae as described in 11. Apical tubercle of subgenital plate twice wider than long. Fig. 10 a, b. . . . . *M. lakinus*.  
 18. Medium in size (22–23 mm). Cerci broad basally, tapering about midlength, half distal portion spatulate. Furculae subobsolete. The subgenital plate subrectangulate, about twice wider, or slightly more, than long (top view). Fig. 14 a, b. . . . . *M. torridus*





FIGURE 13. *Melanoplus meridionalis*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

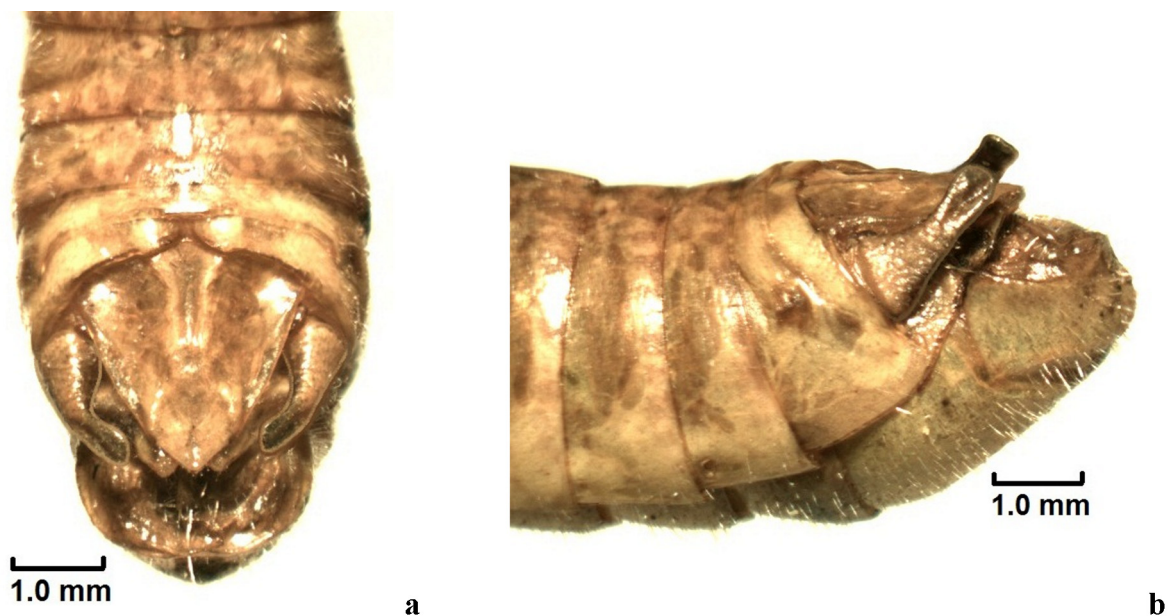


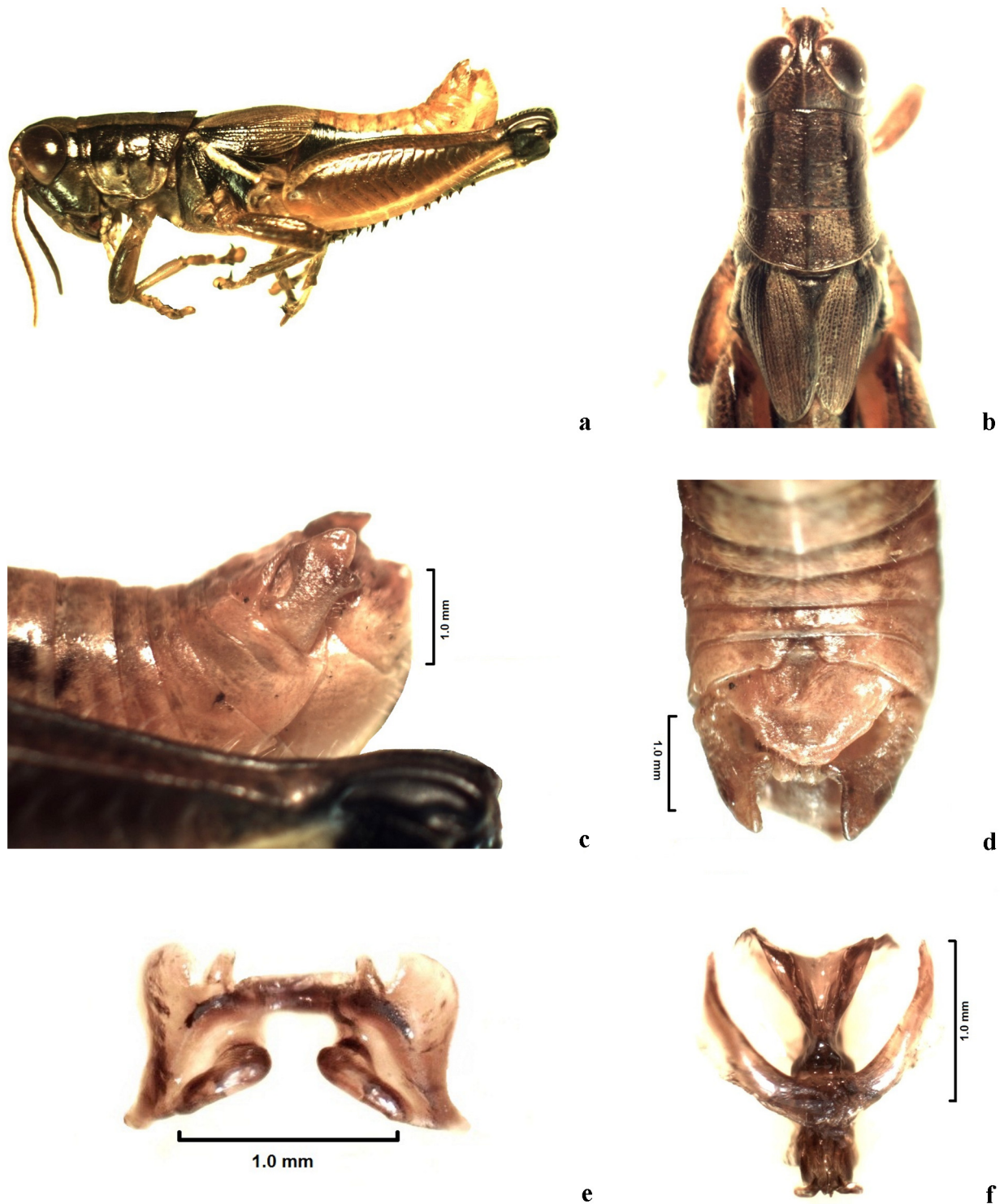
FIGURE 14. *Melanoplus torridus*, distal segments of male abdomen in dorsal view (a) and left lateral view (b).

***Melanoplus trachodes* Barrientos-Lozano & Rocha-Sánchez n. sp.**

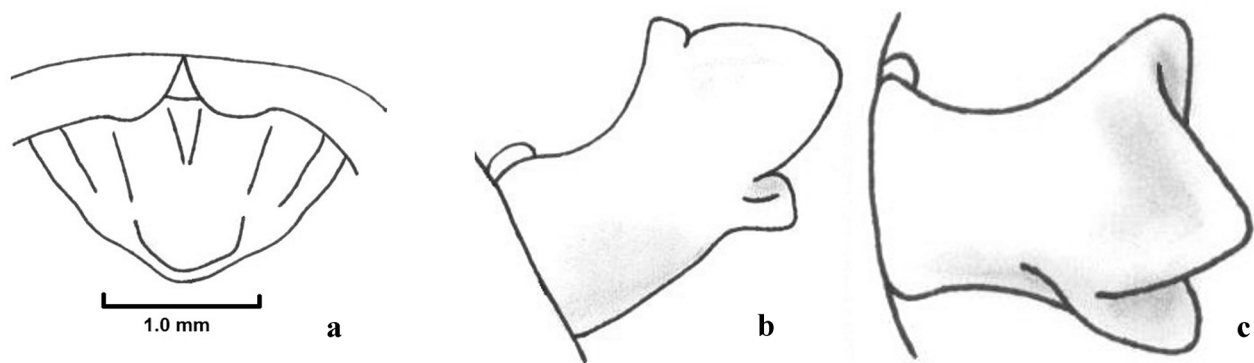
(Figs. 15–23)

**Type material.**—Holotype ♂ and allotype ♀. **Mexico, Tamaulipas:** Ejido (Ej.) La Gloria, Miquihuana. 3000 m. Lat. 23°42.336'N, Long. 99°43.436'W, 06.II.2012, Sánchez-González A.

**Paratypes, Tamaulipas.**—1 ♀, same data as holotype, coll. L. Barrientos-Lozano-ITCV. 1 ♀ and 2 ♂, Prior to Ej., El Aserradero, Miquihuana, 3044 m, Lat. 23°41.465'N, Long. 99°43.871'W, 31.III.2012, Barrientos-Lozano L. coll. L. Barrientos-Lozano-ITCV. 1 ♀ and 1 ♂, Ej. La Gloria, Miquihuana, 3244m, Lat. 23°42.336'N, Long. 99°43.436'W, 01.IV.2012, Barrientos-Lozano L., coll. L. Barrientos-Lozano-ITCV. 1 ♂ and 1 ♀, Ej. La Joya,



**FIGURE 15.** *Melanoplus trachodes* n. sp. Male head, pronotum, thorax in left lateral view (a) and head and pronotum in dorsal view (b); left cercus in lateral view (c); distal segments of male abdomen in dorsal view (d); epiphallus in dorsal view (e) and phallic complex without epiphallus in dorsal view (f).



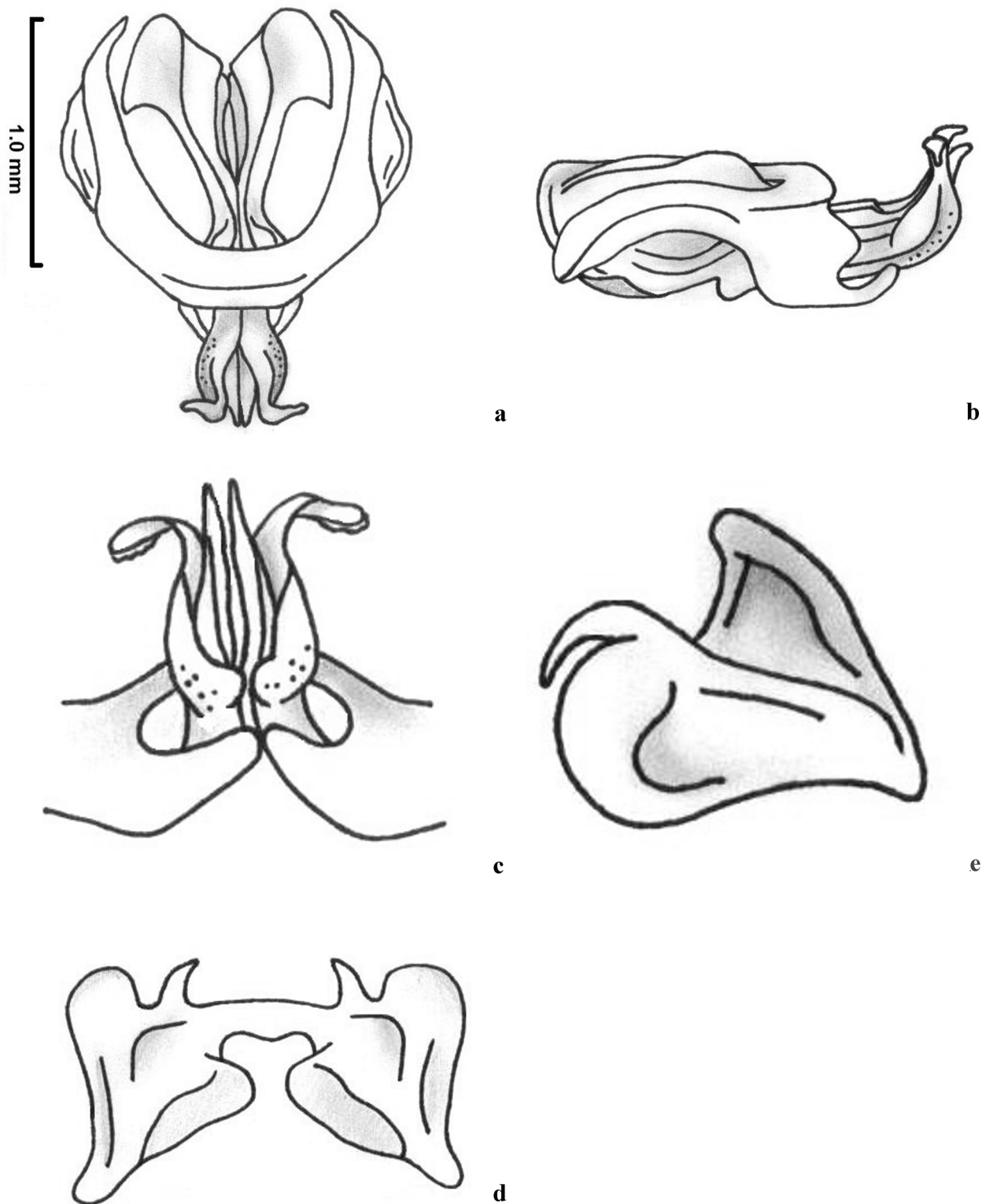
**FIGURE 16.** *Melanoplus trachodes* n. sp., male external genitalia: supra-anal plate in dorsal view (a) left cercus in lateral view (b, c).

**Diagnosis.** In general appearance and body color pattern *M. trachodes* n. sp., is most similar to *M. reflexus* Scudder, 1897. However, it may be easily distinguished from *M. reflexus* by the male cerci, supra-anal plate, furculae and internal genitalia, as shown in Figs. 15 c–f; 16 a–c; 17 a–e; 18 a–c vs. Figs. 24 c–f; 25 a–c.

**Description of male.**—Small size—average 15 mm, general body color brown, head medium size, face whitish-cream, antennae brownish, eyes large and moderately prominent, interocular space wide, fastigium of vertex gently descending, enlarging apically. Pronotum (Figs. 15 a, b; 20) compressed, brownish dorsally, moderately punctate, widening posteriorly very gently, anterior margin slightly emarginated, posterior margin rounded and weakly emarginated, median carina prominent—dark brown, postocular band dark brown-blackish extending on to metazona, mesoepimeron and anterior portion of metapleuron dark brown-blackish, a white stripe along metaepimeron, lower portion of lateral lobes whitish-cream with this color extending on to mesopleuron's lower portion, tegmina short, ovate, brownish, darker on lower half, slightly overlapping dorsally, veins cream-colored. Pro, meso and metathoracic femora brownish, tumescent, inner lower portion of metathoracic femur reddish, hind tibiae bluish-green. Abdomen bearing a dark brown band on each side—absent on the last abdominal tergites, extremity of the abdomen subconical with a medium size tubercle. Supra-anal plate (Figs. 15 d; 16 a) subtriangular, broader than long, side margins slightly sinuous, medio-longitudinal sulcus about mid length, shallow, proximally very broad, furculae inconspicuous, short, subquadrate. Cerci (Figs. 15 c, d; 16 b, c) spatulate, incurved and narrowing about mid portion, the widest distal portion about twice as wide as the narrowest, the distal half exhibits two triangular projections, the superior process being in a different plane than the inferior one, which is more prominent; the apex forming a subtriangular projection, area between projections and apex concave. Epiphallus (Figs. 15 e; 17 d, e) with medium size ancorae, distally-pointed and projecting inwards, anterior process well-developed, bridge narrow, lophi large and prominent, posterior process short and stout; phallic complex as shown in Figs. 15 f; 17 a, b, c. Aedeagal valves (Figs. 17 a–c; 18 a–c): Dorsal valvae expanded about mid portion, then tapers and bends outwards, slightly expanded and rounded apex; ventral valvae moderately broad proximally, tapering gradually towards the pointed apex.

**Description of female.**—Similar to the males (Figs. 22, 23), general body color brown-grayish. The head medium size, face and genae whitish cream, eyes medium size and moderately prominent, interocular space wider than in males, antennae brownish. Pronotum dorsally brownish-grayish, widening posteriorly more conspicuously than in males, median carina prominent, dark brown, posterior margin weakly emarginated, lower portion of pronotal lateral lobes and mesopleuron whitish cream, metapleuron dark brown, metaepimeron with a white stripe. The postocular band dark brown extending on to metazona, tegmina short, ovate, attingent, lower half dark-brown. Pro, meso and metathoracic femora light brown-grayish, hind femora with black apices, exposed dorsal surface and outer face dark brown, inner lower area reddish, hind tibiae bluish-green. Cerci and ovipositor' valves as shown in Fig. 19 a. Fig. 26 shows cerci and ovipositor' valves of *M. reflexus* for analogy.

**Measurements (mm). Males.**—Body length from vertex to end of hind femur: 15.0 (15.0–16.0). Pronotum length: 3.2 (3.0–3.4). Tegmina length: 3.2 (2.9–3.5). Hind femora length: 8.1 (7.8–8.6). **Females:** Body length: 18.0 (17.0–19.0). Pronotum length: 3.7 (3.4–3.9). Tegmina length: 3.8 (3.5–4.2). Hind femur length: 9.8 (9.3–10.5).

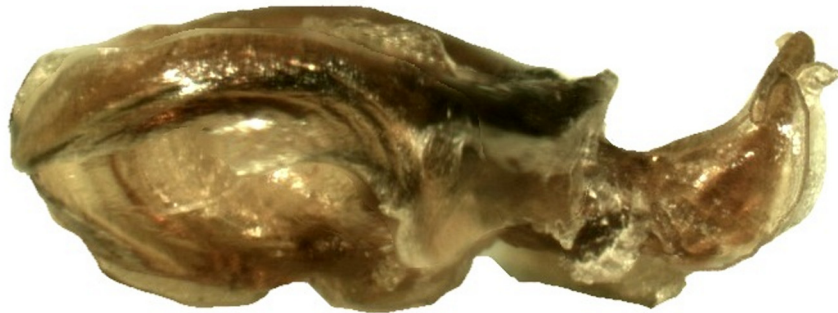


**FIGURE 17.** *Melanoplus trachodes* n. sp., male' internal genitalia: phallic complex without epiphallus in dorsal view (a), phallic complex without epiphallus in lateral view (b), distal portion of aedeagus' valves in ventral view (c), epiphallus in dorsal view (d), epiphallus in lateral view (e).



0.5 mm

a

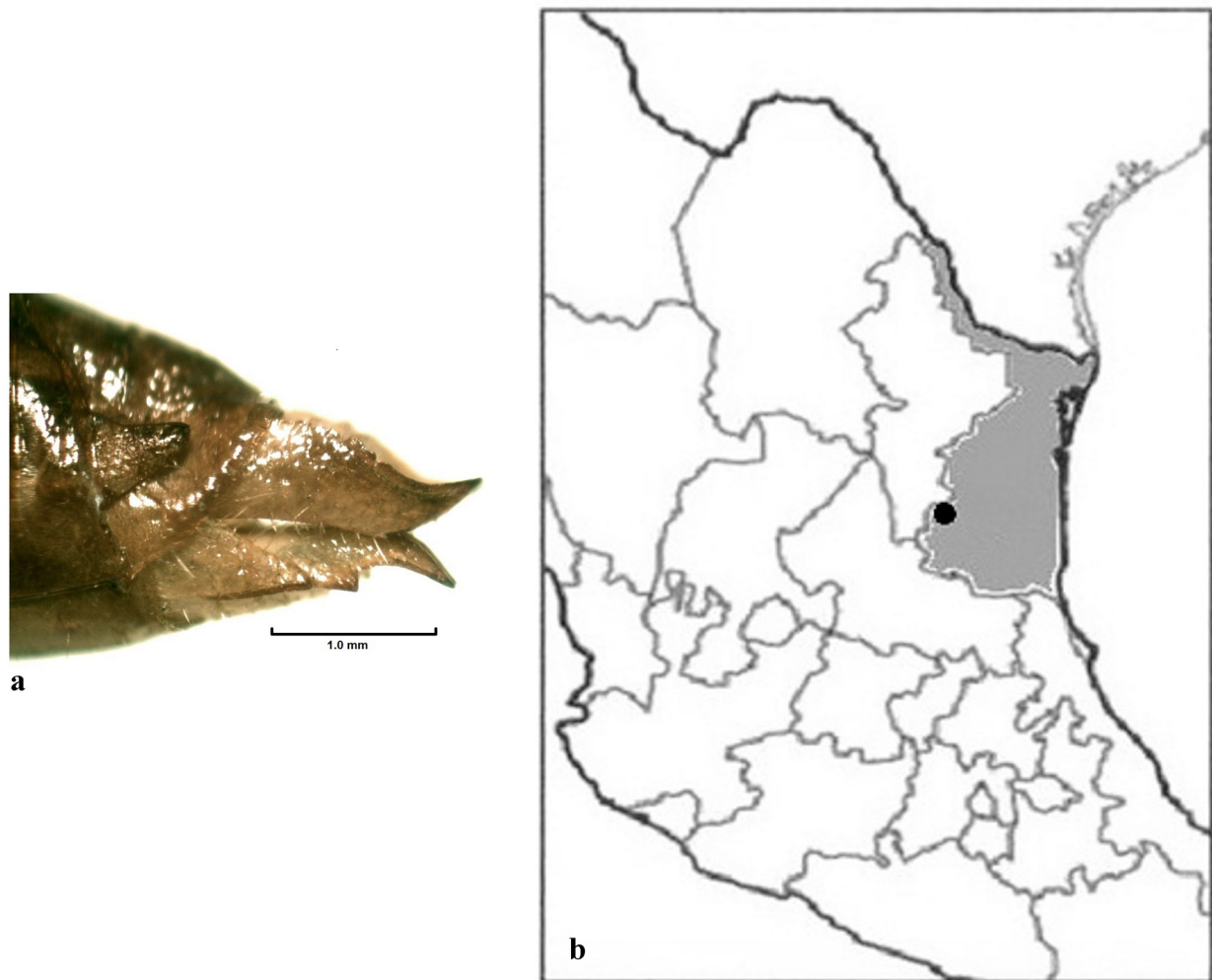


b



c

**FIGURE 18.** *Melanoplus trachodes* n. sp., distal portion of aedeagus' valves: dorsal view (a) lateral view (b), ventral view (c).



**FIGURE 19.** *Melanoplus trachodes* n. sp., female's cercus and ovipositor valvae (a), distribution map (b).

**Distribution.** —This species is known only from the type locality. It has been collected at an altitudinal range between 2000 to 3250 m (Fig. 19 b).

**Habitat.** —Miquihuana is located in southwest Tamaulipas and is set in the highlands of the Eastern Sierra Madre (ESM). This municipality is endowed with the second highest peak in northeastern Mexico, "Cerro Peña Nevada" (3,650 m). Climate in the area is temperate semiarid, with mid-summer rainfall and in winter the rainfall rate is less than 18%. Its mean annual temperature is 17.3°C while its mean annual precipitation is estimated to be 468 mm. Soils are a lithosol of limestone origin with moderate to steep slopes. The area is characterized by xeric or scrub rosette vegetation (Rzedowski 2006, González-Medrano 2003). The most abundant and common species are as follows: *Euphorbia antisyphilitica* Zucc. (Euphorbiaceae), *Chrysactinia mexicana* Gray (Asteraceae), *Dasyllirion miquihuanense* Bogler (Nolinaceae), *Agave lechuguilla* Torr., *A. striata* Zucc., *A. montana* Villarreal (Agavaceae). The forest is dominated by *Pinus nelsonii* Shaw, *P. cembroides* Zucc. (Pinaceae), and dwarf oaks, *Quercus miquihuanensis* Nixon & C. H. Muller (Fagaceae). Among the most common herbaceous plants we identified are *Gochnatia hypoleuca* (DC.) A. Gray (Asteraceae), *Malosma laurina* (Nutt.) (Anacardiaceae), *Anisacanthus* sp., (Acanthaceae), *Asphodelus* sp., (Liliaceae), *Aster* sp., (Asteraceae). *M. trachodes* n. sp., lives on these herbaceous plants, most commonly on *G. hypoleuca* (Fig. 21).

**Etymology.** —The specific name *trachodes* refers to the rough and extreme climatic conditions that characterizes the area where this species lives.



FIGURE 20. *Melanoplus trachodes* n. sp., living male.



FIGURE 21. *Melanoplus trachodes* n. sp., habitat Miquihuana, Tamaulipas, Mexico.

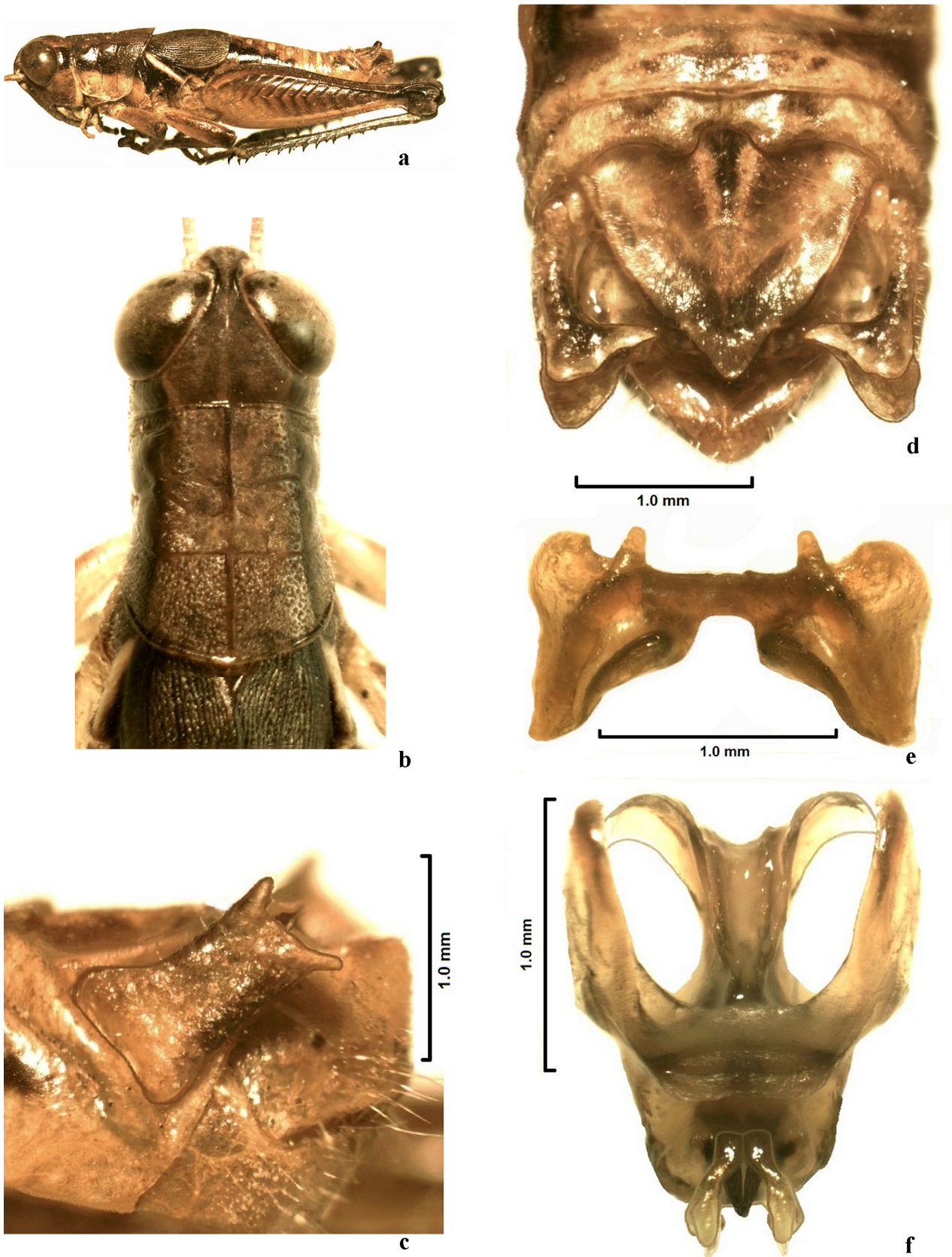


**FIGURE 22.** *Melanoplus trachodes* n. sp., living female.



**FIGURE 23.** *Melanoplus trachodes* n. sp., living female.





**FIGURE 24.** *Melanoplus reflexus*. Male head, pronotum, thorax in left lateral view (a) and head and pronotum in dorsal view (b); left cercus in lateral view (c); distal segments of male abdomen in dorsal view (d); epiphallus in dorsal view (e); phallic complex without epiphallus in dorsal view (f).

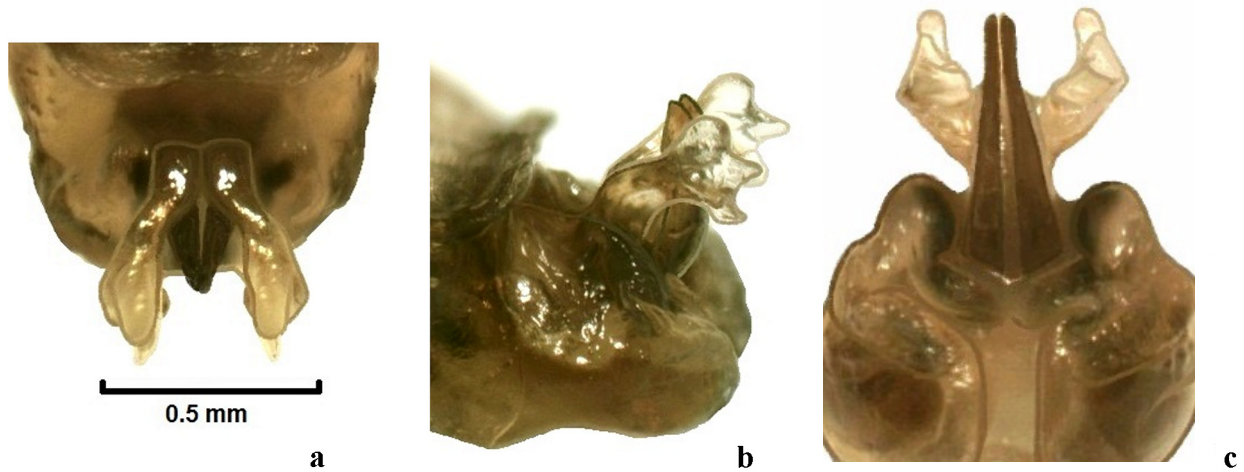


FIGURE 25. *Melanoplus reflexus* distal portion of aedeagus' valves: dorsal view (a) lateral view (b), ventral view (c).

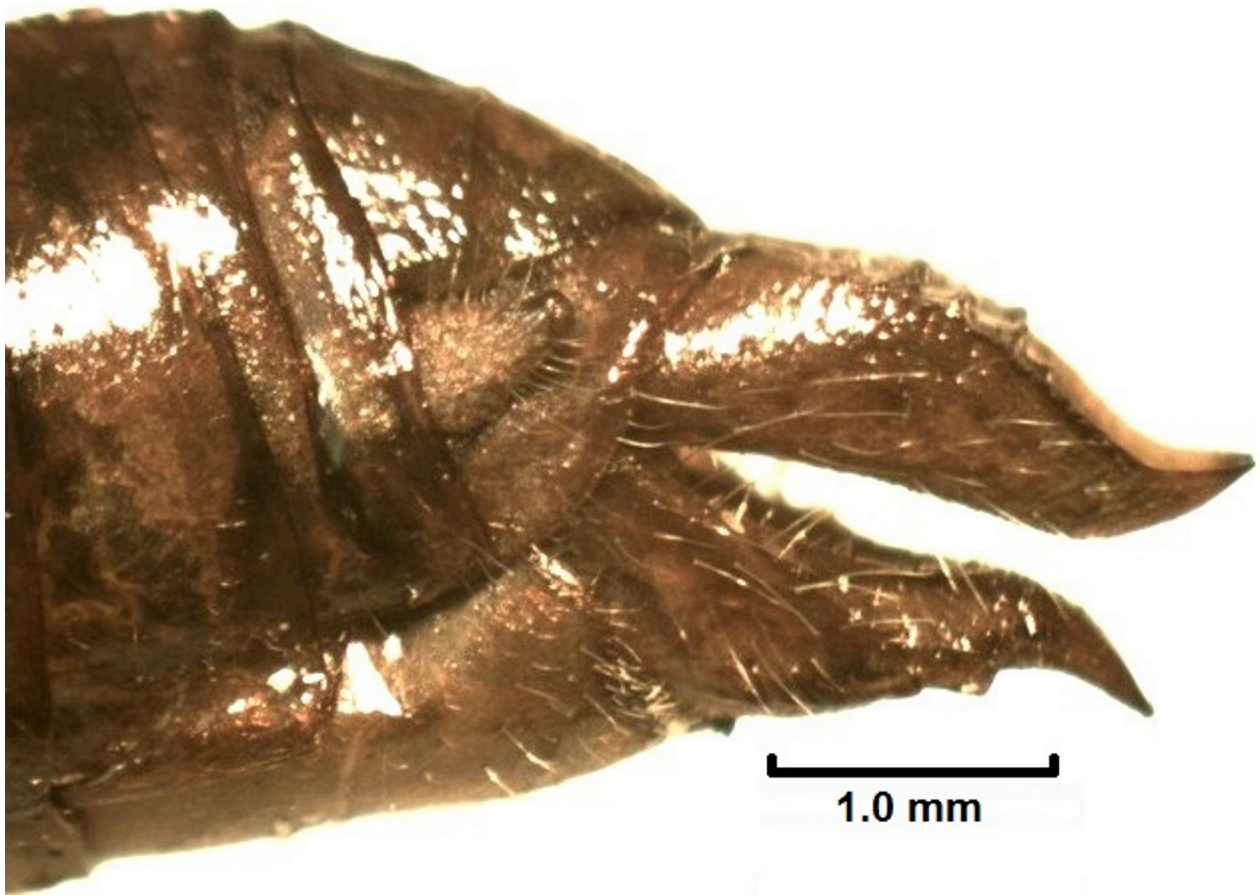
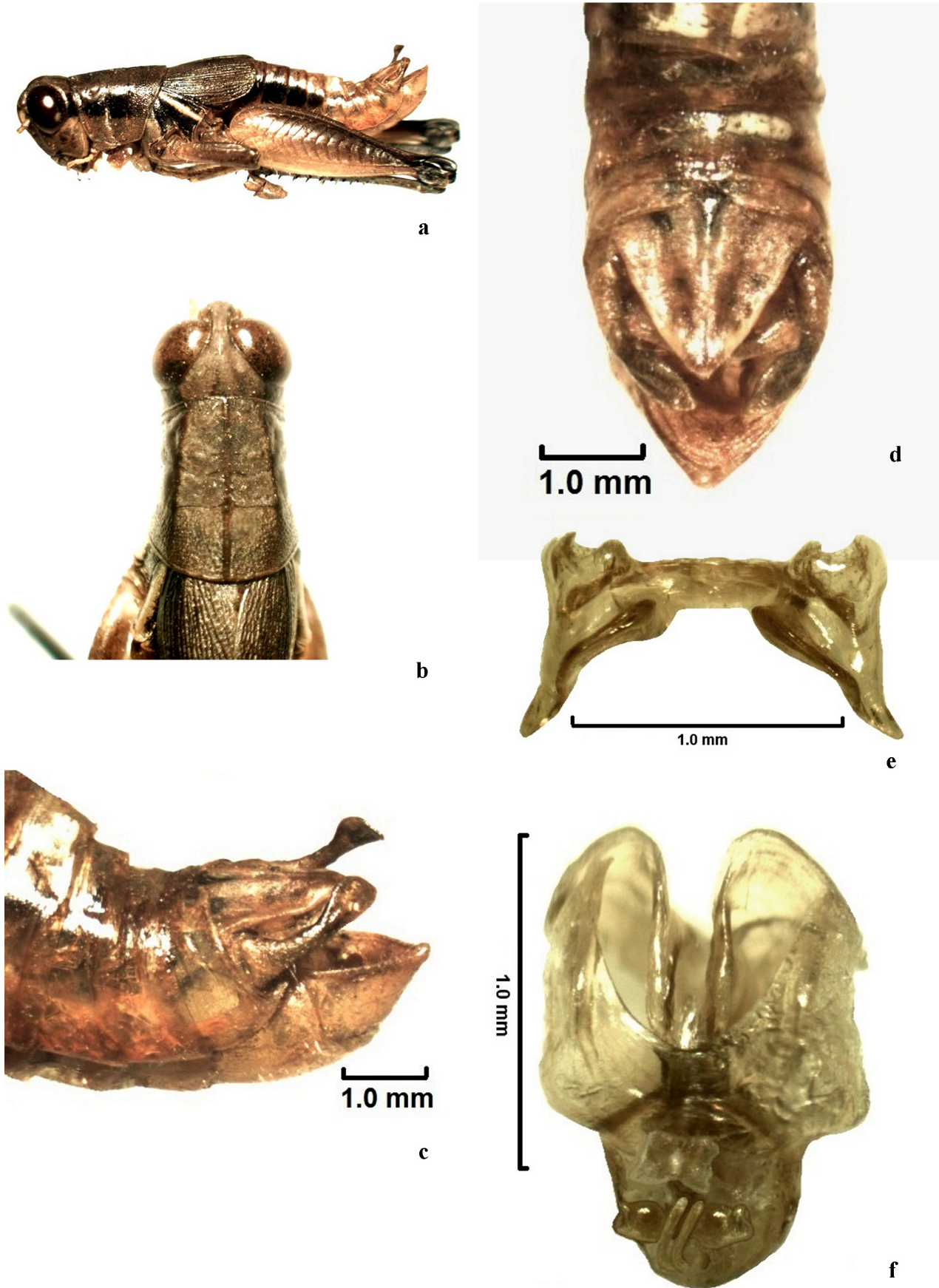


FIGURE 26. *Melanoplus reflexus*, female's cercus and ovipositor's valvae.

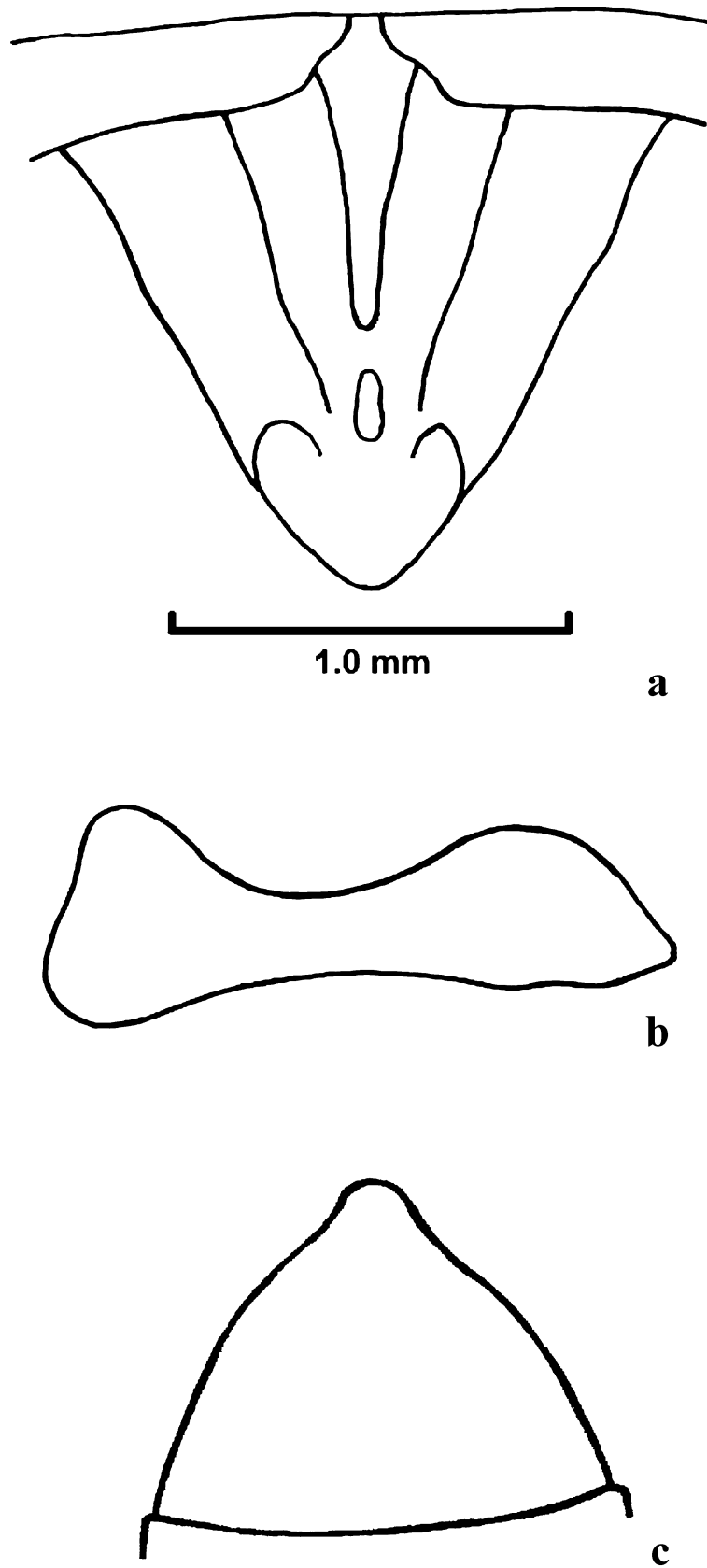
***Melanoplus parvus* Barrientos-Lozano & Rocha-Sánchez n. sp.**

(Figs. 27a-f-28 a-c; 30 a-e; 31 a-c, 32a)

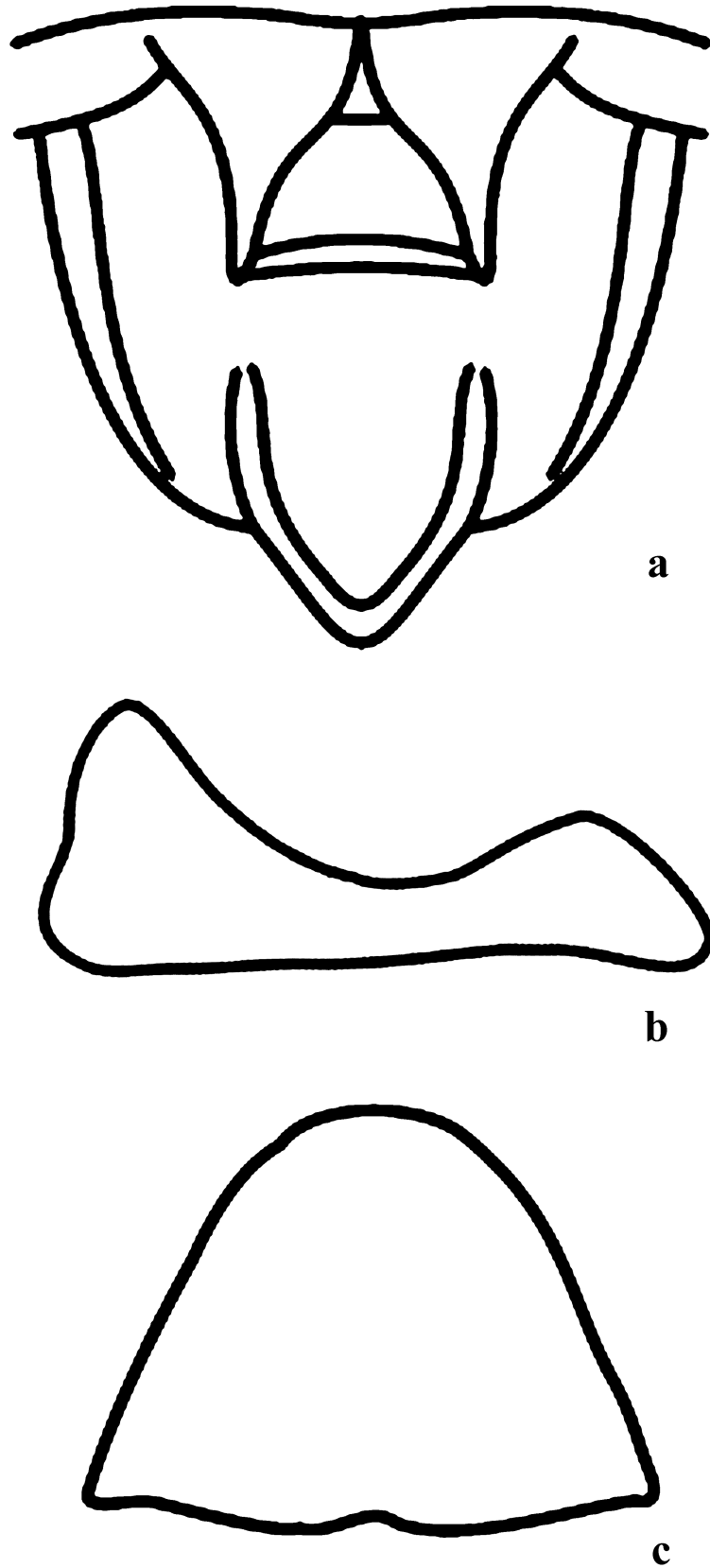
**Type material (material examined).**—Holotype ♂ and allotype ♀. **Mexico, Coahuila**, El Cascajal, Los Lirios, Arteaga, 1942 m, Lat. 25°22.591''N, Long. 100°46.17''W, 26.IX.2009, Barrientos-Lozano L., Méndez-Gómez B. R. & Rocha-Sánchez A. Y.



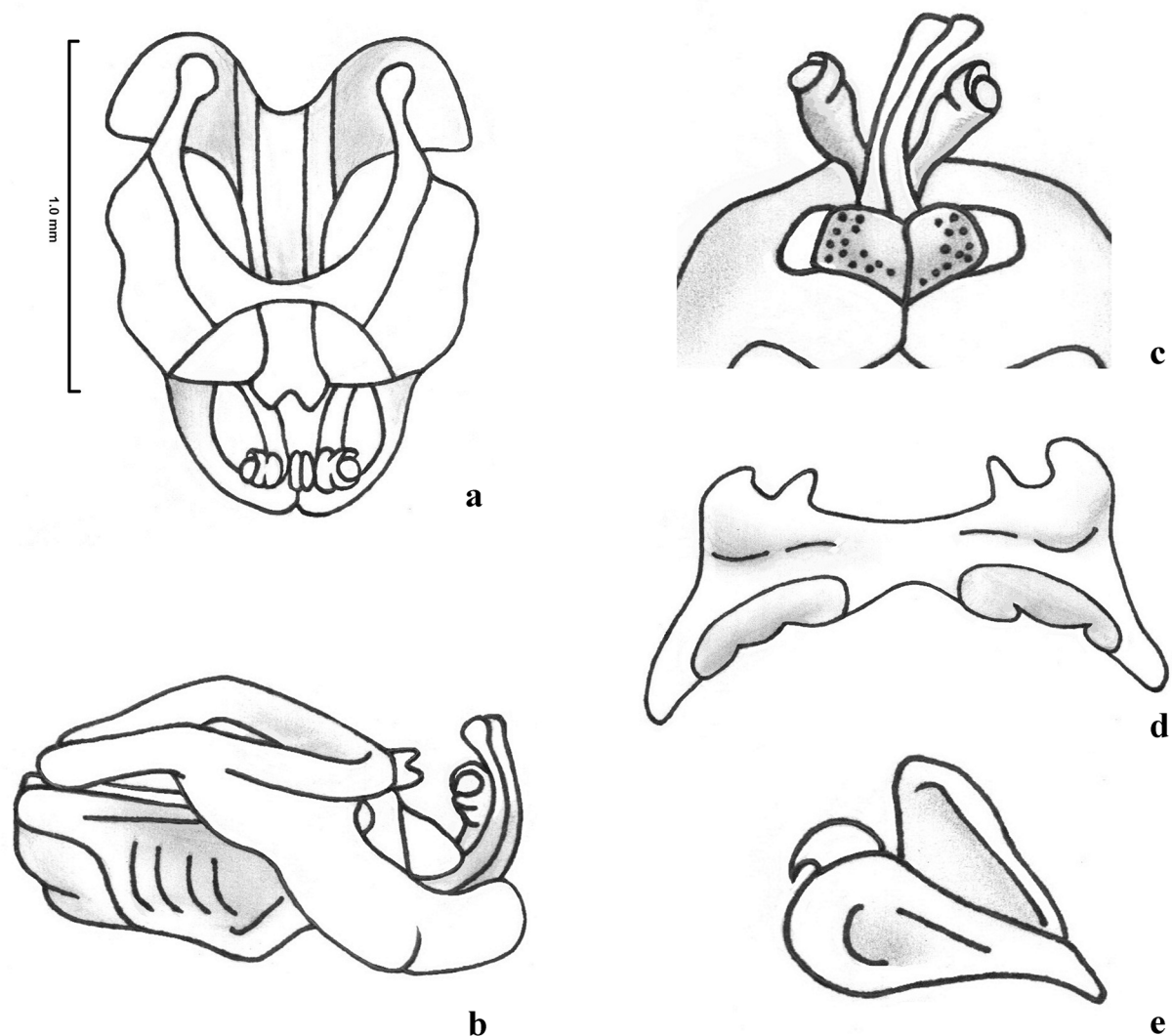
**FIGURE 27.** *Melanoplus parvus* n. sp. Male head, pronotum, thorax in left lateral view (a) and head and pronotum in dorsal view (b); left cercum in lateral view (c), distal segments of male abdomen in dorsal view (d); epiphallus in dorsal view (e) and phallic complex without epiphallus in dorsal view (f).



**FIGURE 28.** *Melanoplus parvus* n. sp., male external genitalia: supra-anal plate in dorsal view (a), left cercus in lateral view (b), subgenital plate in ventral view (c).



**FIGURE 29.** *Melanoplus strumosus*, male external genitalia: supra-anal plate in dorsal view (a), left cercus in lateral view (b), subgenital plate in ventral view (c). Figures after Capinera *et al.* (2001).



**FIGURE 30.** *Melanoplus parvus* n. sp., males' internal genitalia: phallic complex without epiphallus in dorsal view (a), phallic complex without epiphallus in lateral view (b), distal portion of aedeagus' valves in ventral view (c), epiphallus in dorsal view (d), epiphallus in lateral view (e).

**Paratypes, Coahuila.**—2 ♂, 1 ♀, same data as holotype, coll. L Barrientos-Lozano-ITCV; 1 ♀, Jamé, road (rd.) Nuncio-Rayones, 2394 m, Lat. 25°21.33"N, Long. 100°35.588"W, 27.IX.2009, Barrientos-Lozano L., Méndez-Gómez B. R. & Rocha-Sánchez A. Y, coll. L. Barrientos-Lozano-ITCV.

**Diagnosis.**—*M. parvus* n. sp., may be distinguished from congeneric species as follows: very unique elongated and stylized cerci (Figs 27 c, d; 28 b), as long as the supra-anal plate, broad basally, incurved and narrowing about mid portion, then widening, distally the upper margin bent conspicuously upwards and inwards; the upper margin rounded laterally and, in dorsal view, the ventral acute. The supra-anal plate triangular, proximally broad, furculae obsolete, side margins almost straight, medio-longitudinal sulcus broad proximally, moderately deep, about  $\frac{3}{4}$  the length of the supra-anal plate; the subgenital plate subconical, distinctly tuberculate apically (Figs. 27 d; 28 c). *M. parvus* n. sp., presents certain similarities with *M. strumosus* Morse, *i.e.*, in general appearance, size and cerci (Fig. 29 a–c). However, we are not comparing *M. parvus* n. sp. with *M. strumosus* because the latter species occurs only in southeastern United States, as all other members of the Puer Group, to which *M. strumosus* is assigned. Furthermore, characters that define the Puer Group are not clearly established.

**Description of male.**—A small species, average 15 mm in length. General body color brown, head medium size, face whitish-cream, antennae brownish, eyes relatively large for its size and prominent, interocular space

rather wide, fastigium of vertex gently declivent, enlarging apically. Pronotum (Fig. 27 a, b), light brown dorsally, moderately widening posteriorly, anterior margin emarginated, posterior margin rounded and emarginated, metazona densely punctate, median carina prominent-dark brown, postocular band dark brown-blackish, diverging gently posteriorly and fading on metazona, mesoepimeron and anterior portion of metapleuron dark brown-blackish, a white stripe along metaepimeron, lower portion of lateral lobes whitish-cream with this color extending on to lower portion of mesopleuron, tegmina short, ovate, attingent, brownish-half darker on lower portion, veins cream. Pro, meso and metathoracic femora tumescent, brownish, hind tibiae bluish. Abdomen with a dark brown band on each side-fading on the last three abdominal tergites, subgenital plate (Figs. 27 c, d; 28 c) subconical with a conspicuous tubercle apically. Supra-anal plate triangular, proximally broad, side margins almost straight, medio-longitudinal sulcus broad basally, moderately deep, beyond mid length, furculae obsolete (Figs. 27 d; 28 a). Cerci (Figs. 27 c, d; 28 b) elongated, as long as the supra-anal plate, broad basally, incurved and narrowing about mid portion, then widening, distally the upper margin bent conspicuously upwards and inwards; the upper margin rounded laterally and, in dorsal view, the ventral acute. Epiphallus (Figs. 27 e; 30 d, e) with medium size ancorae, shorter than the anterior process; anterior process moderately developed, distally pointed and projecting inwards; lophi large and prominent; broad bridge; posterior processes distally produced. Phallic complex as shown in Figs. 27 f; 30 a-c. Aedeagal valves (Fig. 31 a-c): Dorsal valvae tubular, distally broader and concave; ventral valvae elongated, basally broad, tapering gradually, half distal curved inwards, apex moderately expanded and rounded.

**Description of female.**—Similar to the males, average 17 mm in length, general body color brown. The head medium size, face and genae whitish cream, eyes medium size and moderately prominent, interocular space wider than in males, antennae brownish. Pronotum dorsally brown, weakly widening posteriorly, metazone punctate, median carina prominent-dark brown, posterior margin gently emarginated, postocular band dark brown fading on metazone, lower portion of pronotal lateral lobes whitish cream, mesopleuron dark brown, metaepimeron with a white stripe. Tegmina short, ovate, attingent, brownish, lower portion darker. Pro, meso and metathoracic femora light brown, hind femora darker along the upper half of the outer face, with black apices; hind tibiae bluish. Cerci and ovipositor valves as shown in Fig. 32 a.

**Measurements (mm). Males.**—Body length from vertex to end of hind femur: 15.0 (14.0–15.0). Pronotum length: 3.4 (3.1–3.8). Tegmina length: 2.8 (2.7–2.9). Hind femora length: 7.8 (7.8–7.9). **Females:** Body length: 17.0 (16.0–17.0). Pronotum length: 3.7 (3.5–3.9). Tegmina length: 3.2 (3.1–3.2). Hind femora length: 9.3 (9.2–9.4).

**Distribution.**—Species collected in Coahuila, Mexico, Sierra de Arteaga, at two localities: Jamé, 2394 m and El Cascajal, 1942 m (Fig. 32 b).

**Habitat.**—The Sierra de Arteaga in the state of Coahuila, is part of the mountain ranges that form the northern portion of the Easter Sierra Madre (ESM), located north of the Tropic of Cancer in the temperate latitudinal zone (Fig. 33). The forest here is in a transition zone between the semiarid High Plateau and cool-temperate mountains of the ESM. Elevation ranges from 1,900 to 3,400 m. The climate in the area is sub-humid temperate. The average annual temperature and rainfall are 17°C and 498 mm, respectively; rainfall is convective and matches with the warm months of the year (July–October). Lithosols are predominant and represent 49% of the area, while Rendzina prevails in the foothills and valleys and represent 29%. Vegetation types are represented by montane shrub, oak forest (*Quercus*), pine forest (pinyon pine forest.—*P. cembroides*), high altitude conifer forest (*Abies* and *Pseudotsuga*) and quaking aspen forest (*Populus*). *M. parvus* n. sp., lives on herbaceous plants such as *Piqueria trinervia*, *Anthemis* sp., *Senecio* sp., (Asteraceae); *Salvia* sp., *Mentha* sp., *Origanum* sp., (Lamiaceae); *Muhlenbergia* sp., *Buchloe dactyloides* (Poaceae).

**Etymology.**—The specific name *parvus*, alludes to the small size of this species.

## Conclusion

*Melanoplus trachodes* n. sp., is associated with the *M. reflexus* group (sensu Fontana & Buzzetti 2007), this group is known only from Mexico and is made up of seven species with the addition of *M. trachodes* n. sp. described in the present work. In assigning this new taxon to the *M. reflexus* group we considered the males' cerci and the internal genitalia as these characters are highly differentiated in shape and useful to separate congeneric species within the group.

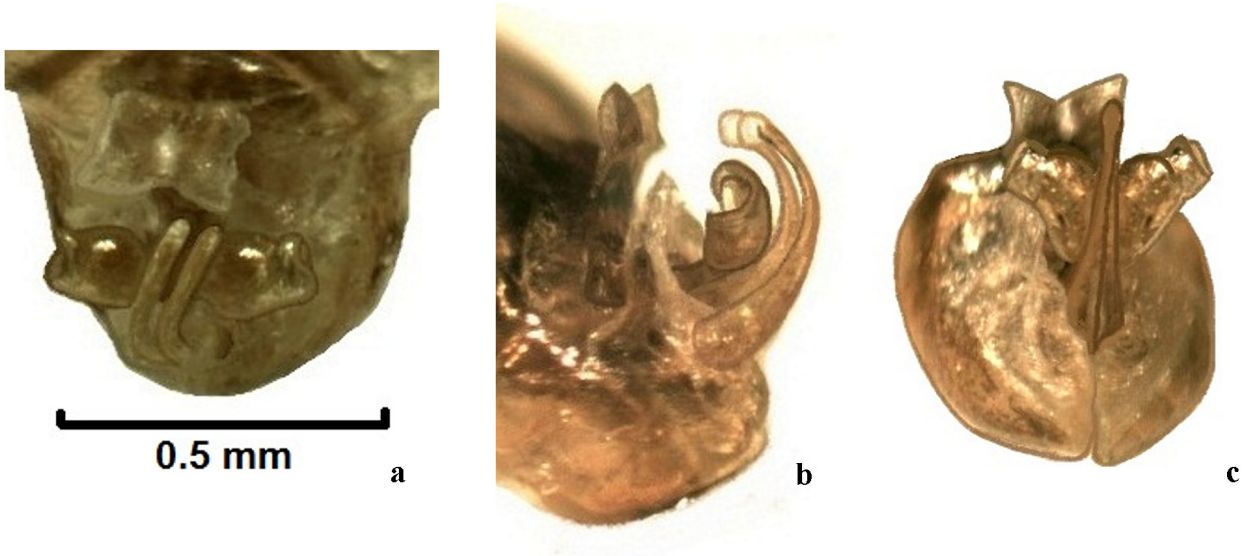


FIGURE 31. *Melanoplus parvus* n. sp., distal portion of aedeagus' valves: dorsal view (a) lateral view (b), ventral view (c).

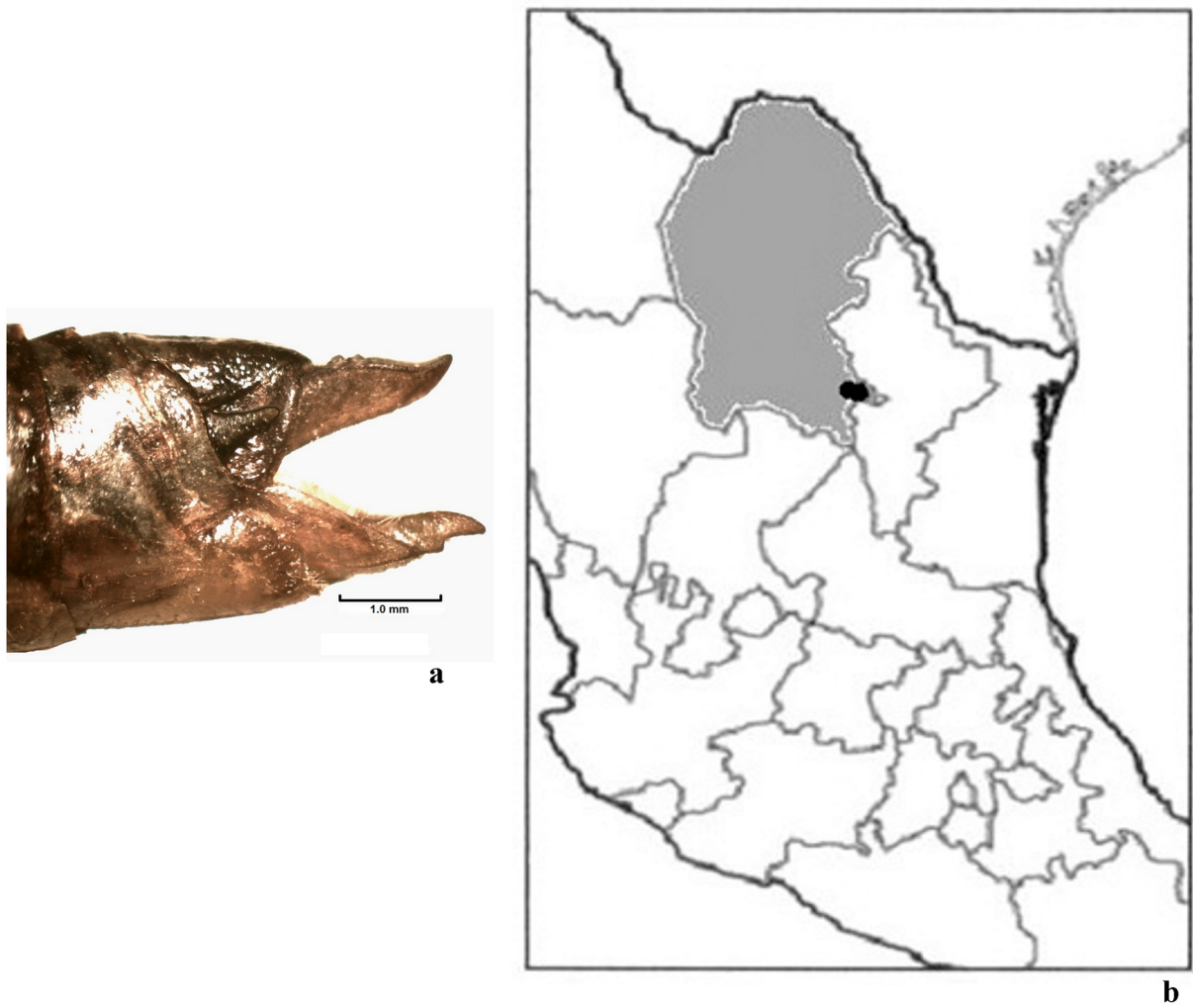


FIGURE 32. *Melanoplus parvus* n. sp., female's cercus and ovipositor's valves (a), distribution map (b).



*M. parvus* n. sp., is a unique species in the sense that is very small and the cerci are very stylized; primarily considering the shape of the cerci, this new taxon could possibly be associated with *M. strumosus* Morse, which belongs to the *M. puer* group. However, the characters that define this group are not clearly established and there is considerable variation within the species that compose the group, as stressed by Hubbell (1932). Both species *M. trachodes* n. sp., and *M. parvus* n. sp., are endemic to the ESM highlands inhabiting the temperate transition zone between the ESM and the arid High Plateau Biogeographic Provinces. Ecological conditions in this temperate transition zone are very rough with extreme temperatures and drought periods.



**FIGURE 33.** *Melanoplus parvus* n. sp., habitat. Los Lirios, Arteaga, Coahuila, Mexico

## Acknowledgements

This work was carried out within the framework of the following projects: Biological Diversity in Natural Protected Areas of Northeastern Mexico (4520.12-P), Redes Académicas and Cuerpos Académicos. These projects are funded by: Dirección General de Educación Superior Tecnológica (DGEST) and PROMEP.

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