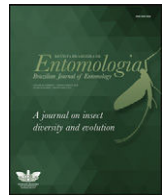




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***Paxiximya sulmatogrossensis*, a new genus and species of Tachinidae (Diptera) reared from *Urucumania borellii* (Giglio-Tos, 1897) (Phasmatodea: Pseudophasmatidae) collected in the state of Mato Grosso do Sul, Brazil**



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ABSTRACT

A new genus and species of Tachinidae (Diptera), *Paxiximya sulmatogrossensis* **n. gen.** and **n. sp.**, and its puparium are described. It was reared from the walking stick, *Urucumania borellii* (Giglio-Tos, 1897), collected in Aquidauana, Mato Grosso do Sul, Brazil.

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Introduction

A new genus and species of Tachinidae, *Paxiximya sulmatogrossensis* **n. gen.** and **n. sp.**, reared from adult *Urucumania borellii* (Giglio-Tos, 1897) (Pseudophasmatidae), is described in this paper. According to Guimarães (1977, 1978, 1982) and Cortés (1968), a few Tachinidae genera are known as parasitoids of Phasmatodea and Orthoptera in the Neotropical Region, most of them belonging to the Acemyini, Ormiini, and Blondeliini tribes. Most Acemyini are parasitoids of Acrididae. Members of Ormiini have been reared from Gryllidae and Tettigoniidae. Most species of Blondeliini have been recorded parasitizing either larvae and adults of Coleoptera and larvae of Lepidoptera, while a few have been documented parasitizing sawflies, crane flies, and wasp larvae, as well as immature and adult Blattodea, Phasmatodea, and Orthoptera (Wood, 1985; Wood and Zumbado, 2010).

The *Oedematocera* genus group, as treated here, corresponds mostly with the former tribe Oedematocerini, which included the following New World genera: *Miamimyia* Townsend, 1916, *Miamimylops* Townsend, 1939, *Neophasmophaga* Guimarães, 1982,

Nepophasmophaga Townsend, 1927, *Oedematocera* Townsend, 1916, *Phasmovora* Cortés, 1968, *Tamanamyia* Thompson, 1963 and *Tettigoniophaga* Guimarães, 1978 (Guimarães, 1971, 1978, 1982). Most of these genera parasitize Polyneoptera (Guimarães, 1971, 1978, 1982). Currently they are placed in the Blondeliini tribe and many are synonyms of *Phasmophaga* Townsend, 1909 (= *Phasmovora*) or *Anisia* Wulp, 1890 (= *Nepophasmophaga*, *Oedematocera*, *Tamanamyia*) (Wood, 1985; Wood and Zumbado, 2010). *Paxiximya* **n. gen.** resembles genera in this group. According to Wood (1985), *Oedematocera*-group, including *Meigenielloides* Townsend, 1919, external morphology and host preference suggest its genera may be related.

The new genus belongs to Blondeliini, with which it shares the following combination of characteristics mentioned by Wood (1985) in his conspectus of the Blondeliini of North and Central America and West Indies: prosternum setose, first postsutural supra-alar seta smaller than first postsutural dorsocentral seta, bend of vein M rounded, subapical scutellar setae long and divergent, vein R₄₊₅ ending at or near wing tip, body elongated, and mid-dorsal depression of abdominal syntergite 1 + 2 not reaching hind margin.

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Material and methods

Host collection

Four male and three female adult *U. borellii* specimens were collected in Morro do Paxixi, Aquidauana, Mato Grosso do Sul, Brazil (20°27'00.5"S/55°37'20.8"W) on January 19, 2017. The collection was carried out with permission from the *Instituto Chico Mendes de Conservação da Biodiversidade* (ICMBio authorization number 49550-1).

Specimen measurements, description, and deposit in collections

Morphological terminology of structures follows McAlpine (1981) and Wood and Zumbado (2010). Head structures were measured according to Toma and Guimarães (2002). Images of body structures and measurements of tachinid flies were taken under a Leica M205C stereomicroscope with a coupled Leica DFC420 camera, and analyzed using Leica Application Suite V. 3.8.0 imaging software. Images and measurements of the hosts and puparium were taken under a Zeiss Discovery V20 stereomicroscope with a coupled Zeiss AxioCam ICc5 camera, using AxioCam IC-ZEN pro 2012 software.

Paxiximya sulmatogrossensis n. gen. and n. sp. type specimens were deposited in the Coleção Zoológica de Referência at the Universidade Federal de Mato Grosso do Sul (ZUFMS) in Campo Grande and the Diptera Collection at the Museu de Zoologia da Universidade de São Paulo (MZUSP) in São Paulo. All *U. borellii* specimens were deposited with ZUFMS.

Distribution map

Observation records of the host species were obtained from the second author's collections, literature and databases (Brook et al., 2017; Conle and Hennemann, 2002; Giglio-Tos, 1897), as well as personal communication with Lívia Cordeiro. The geographic distribution of *U. borellii* and *Paxiximya sulmatogrossensis* n. gen. and n. sp. was mapped with Quantum GIS version 1.8.0 software (Quantum GIS, 2012).

Taxonomy

Family Tachinidae
Subfamily Exoristinae
Tribe Blondeliini

Paxiximya Toma & Olivier, n. gen. (Figs. 1–8).

Type species. *Paxiximya sulmatogrossensis* n. sp., by present designation.

Recognition. In the Central American key to Tachinidae (Wood and Zumbado, 2010), the specimens *P. sulmatogrossensis* n. sp. run to Blondeliini with haired prosternum in couplets 115–119, but do not fit into any these specific couplets. In Wood's (1985) key, the specimens run to *Meigenielloides* Townsend, 1919, but *Paxiximya* n. gen. differs from this genus in having distinctly longer anteriormost reclinate orbital setae than uppermost frontal setae and vein R_{4+5} being setose almost to crossvein r-m.

Within the *Oedematocera*-group, *Paxiximya* n. gen. appears similar to *Neophasmophaga* and *Miamimyia* because both veins R_1 and R_{4+5} are dorsally setulose on at least the basal third. The new genus is distinguished from these two genera by lack of proclinate orbital setae on fronto-orbital plate, facial ridge with a few setae on lower third above vibrissa, and a pair of abdominal discal setae on tergites 3 and 4. Male *Paxiximya* n. gen. genitalia is distinctive with inner cerci surface deeply excavated and haired and surstyli elongated and narrow, precluding its consideration as congeneric with *Neophasmophaga* and *Miamimyia* species or species pertaining to

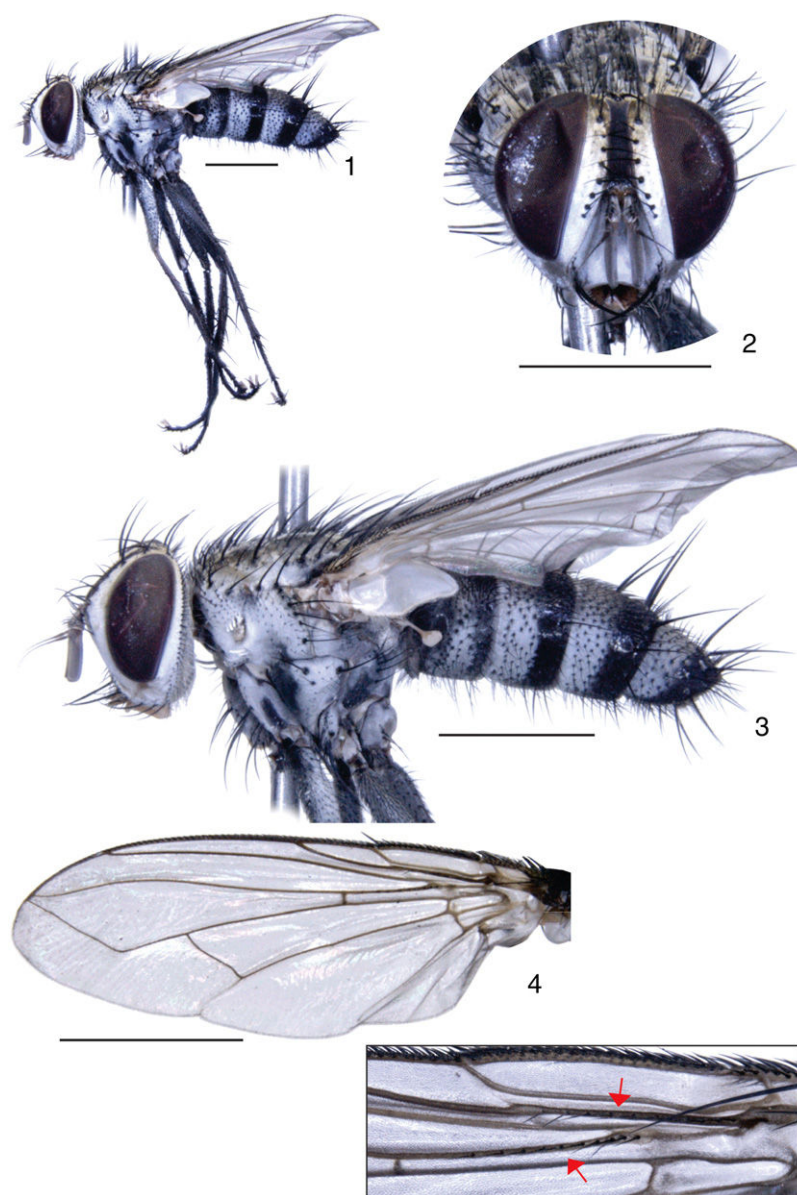
other *Oedematocera*-group genera with known genitalia morphologies.

Paxiximya n. gen. differs from *Anisia* and *Phasmophaga* by katepisternum with three setae and mid tibia with two anterodorsal setae. According to Wood (1985), *Tettigoniophaga* Guimarães, 1978 appears to belong to *Anisia*. He suggested that the absence of proclinate orbital setae and narrow frons in the male would not be enough to separate them. Wood (op. cit.) included *Tettigoniophaga* in the range of variation presented by *Anisia* species, but he did not formalize the synonymy. *Paxiximya* n. gen. can be differentiated from *Tettigoniophaga* in the same manner as *Anisia*. The new genus differs from *Miamimyops* in proclinate orbital setae absent on fronto-orbital plate, facial ridge with a few setae on lower third above vibrissa, a pair of median marginal setae on syntergite 1+2 and tergite 3, and a pair of median discal setae on tergites 3 and 4.

Description. Characteristics follow Wood (1985). **Head** (Figs. 1–3): Fronto-orbital plate without proclinate orbital setae and with two reclinate orbital setae, anteriormost reclinate orbital seta distinctly longer than posteriormost reclinate orbital seta and uppermost frontal seta; ocellar setae long and divergent; eye bare; parafacial bare; lower margin of face at level of vibrissa not visible in profile; arista longer than first flagellomere; facial ridge with a few setae on lower third above vibrissa; subvibrissal ridge short with two or three setae; anteroventral margin of gena bearing at least three stout setae. **Thorax** (Figs. 1, 3, 4): prosternum with a few fine setulae; proepisternum bare; postpronotum with three basal and one short anterior setae, middle basal seta displaced slightly forward in line with outer basal and anterior setae; katepisternum with three setae, anteroventral seta shorter and weaker than anterior and posterior setae; scutellum with one pair each of basal, lateral, subapical, apical, and discal setae, lateral setae subparallel and shorter than basal and subapical setae, the latter ones slightly divergent, apical setae very short, setula-like and subparallel; fore tibia with two posterior setae; mid tibia with two anterodorsal setae; dorsally vein R_1 setose on basal half and vein R_{4+5} setose almost to crossvein r-m; ventrally one to three setulae at bifurcation of veins R_{2+3} and R_{4+5} ; veins R_{4+5} and M both ending before wing apex. **Abdomen** (Fig. 3): middorsal depression not reaching hind margin of syntergite 1+2; abdominal syntergite 1+2 and tergite 3 each with one pair of well-developed median marginal setae and one pair of lateral marginal setae; tergite 4 with a row of median marginal setae; tergites 3 and 4 each with one pair of median discal setae. **Terminalia** (Figs. 5 and 6): Epiphallus developed; cerci with deeply excavated and haired inner surface, well separated almost along entire length and fused basally in posterior view; surstyli elongated and narrow.

Etymology. The root of the compound name *Paxiximya* refers to the locality where the hosts of this tachinid fly were collected ("Morro do Paxixi"). The suffix "myia" is the Greek word for fly.

Remarks. In the New World, there are some records of Polyneoptera parasitism by genera in the *Oedematocera* genus group. *Phasmophaga* has been reared from *Agathemera crassa* (Blanchard, 1851) and *Anisomorpha buprestoides* (Stoll, 1813) (Phasmatodea: Agathemeridae and Pseudophasmatidae) (Neff and Eisner, 1960; Cortés, 1968). *Anisia* has been reared from *Schistocerca americana* (Drury, 1770), *S. paranensis* (Burmeister, 1861), *Romalea microptera* (Beauvois, 1817), and *Ceuthophilus latibuli* Scudder, 1894 (Orthoptera: Acrididae, Romaleidae and Gryllidae) (Aldrich, 1927, 1928; Guimarães, 1977; Wood and Zumbado, 2010), recorded in cockroaches *Parcoblatta* sp. or spp. (Blattodea: Ectobiidae) (Gemeno et al., 2002) and in earwigs (Forficuloidea: Forficulidae) (Parker, 1953). *Tettigoniophaga* is known as parasitoid of *Cycloptera aurantifolia* (Stoll, 1787) (Orthoptera: Tettigoniidae) (Guimarães, 1978). *Miamimyops* hosts are unknown, while *Miamimyia* and *Neophasmophaga* are documented as parasitoids of the cockroach, *Periplaneta americana* (Linnaeus, 1758)



Figs. 1–4. *Paxiximyia sulmatogrossensis* Toma & Olivier **n. gen.** and **n. sp.** Paratype male: (1 and 3) body in lateral view; (2) head in frontal view; (4) left wing, in detail setae on veins R_1 and R_{4+5} . Scale bar: 2 mm.

(Blattodea: Blattidae), and the walking stick, *Prisopus sacra-tus* (Olivier, 1792) (Phasmatodea: Prisopodidae), respectively (Arnaud, 1978; Guimarães, 1982). The new taxon described here, *P. sulmatogrossensis* **n. gen.** and **n. sp.**, reared from *U. borellii*, is the first record of parasitism in this host by a tachinid fly.

Paxiximyia sulmatogrossensis Toma & Olivier, **n. sp.** (Figs. 1–8).

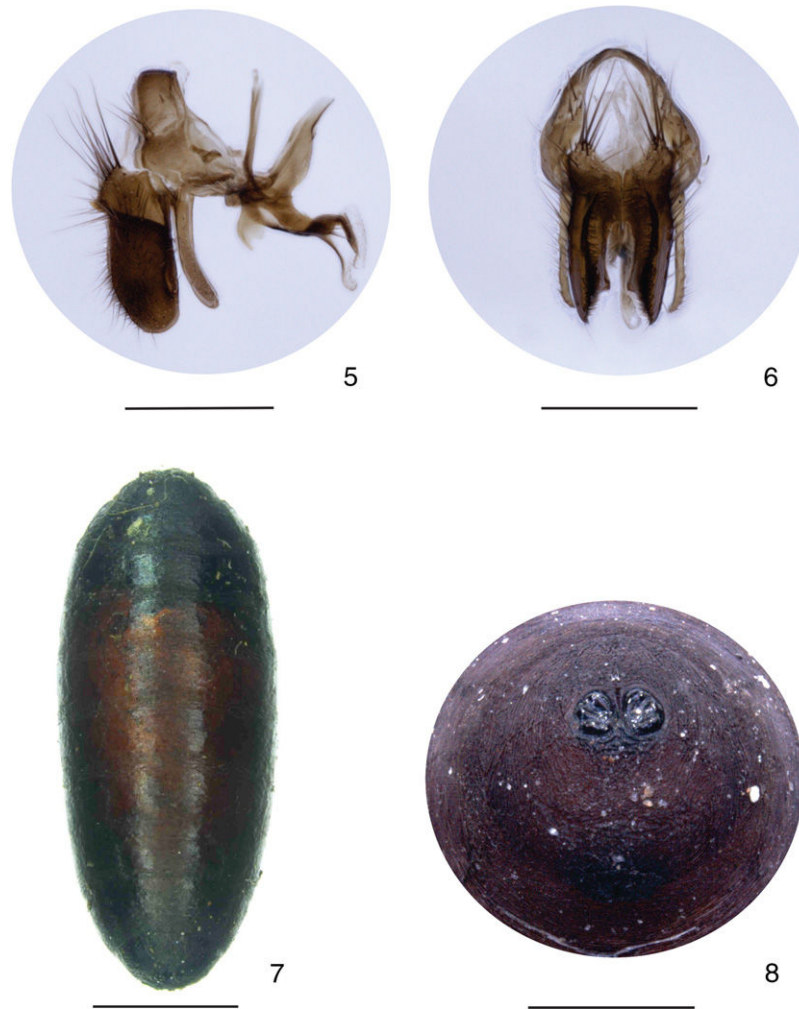
Type series: One male labeled: HOLOTYPE [red label] \ *Paxiximyia sulmatogrossensis* Toma & Olivier **n. gen.** and **n. sp.** \ Brasil, Mato Grosso do Sul, Aquidauana, Camisão, M. do Paxixi, 394 m, 20°27'00.5"S/55°37'20.8"W, 19.I.2017, Olivier, R., Chamorro, J. & Costa, P.J. col. \ Host *Urucumania borellii* (Giglio-Tos, 1897) ♀, Emerg. from host: 20.jan.2017, Emerg. from puparium 04.fev.2017 \ ZUFMSDIP00002; three males labeled: PARATYPE [yellow label] \ *Paxiximyia sulmatogrossensis* Toma & Olivier **n. gen.** and **n. sp.** \ Brasil, Mato Grosso do Sul, Aquidauana, Camisão, M. do Paxixi, 394 m, 20°27'00.5"S/55°37'20.8"W, 19.I.2017, Olivier, R., Chamorro, J. & Costa, P.J. col. \ Host *Urucumania borellii* (Giglio-Tos, 1897) ♀, Emerg. from host: 21.jan.2017, Emerg. from puparium: 04.fev.2017 \ ZUFMSDIP00003–00005 [specimen ZUFMSDIP00005

donate to MZUSP]; one male labeled: PARATYPE [yellow label] \ *Paxiximyia sulmatogrossensis* Toma & Olivier **n. gen.** and **n. sp.** \ Brasil, Mato Grosso do Sul, Aquidauana, Camisão, M. do Paxixi, 394 m, 20°27'00.5"S/55°37'20.8"W, 19.I.2017, Olivier, R., Chamorro, J. & Costa, P.J. col. \ Host *Urucumania borellii* (Giglio-Tos, 1897) ♀, Emerg. from host: 21.jan.2017, Emerg. from puparium 05.fev.2017 \ ZUFMSDIP00006; one male labeled: PARATYPE [yellow label] \ *Paxiximyia sulmatogrossensis* Toma & Olivier **n. gen.** and **n. sp.** \ Brasil, Mato Grosso do Sul, Aquidauana, Camisão, M. do Paxixi, 394 m, 20°27'00.5"S/55°37'20.8"W, 19.I.2017, Olivier, R., Chamorro, J. & Costa, P.J. col. \ Host *Urucumania borellii* (Giglio-Tos, 1897) ♀, Emerg. from host: 24.jan.2017, Emerg. from puparium 07.fev.2017 \ ZUFMSDIP00007.

Type locality. Morro do Paxixi, Aquidauana, Mato Grosso do Sul, Brazil (20°27'00.5"S/55°37'20.8"W).

Description. Male. Measurements (mm): body length: 9.82; wing length: 7.06.

Coloration (Figs. 1–4): Head pale yellow in background color covered with silvery pruinosity, except vertex, ocellar triangle, and



Figs. 5–8. *Paxiximya sulmatogrossensis* Toma & Olivier **n. gen.** and **n. sp.** (5) genitalia in lateral view; (6) genitalia in posterior view; (7) puparium; and (8) posterior spiracles of puparium. Scale bars: 5 and 6 = 500 μm , 7 = 2 mm, 8 = 1 mm.

fronto-orbital plate appearing brown from certain angles, overlaid with pale golden or golden pruinosity; frontal vitta dark brown; scape reddish brown; pedicel and first flagellomere dark brown, except apex of the pedicel and basal fourth of the first flagellomere yellowish; palpus yellow; proboscis brown; thorax dark brown in background color, except postpronotum and sides of scutum and scutellum lighter brown. Thorax covered with silvery pruinosity, except part of postpronotum, scutum, and scutellum pale golden pruinose. Scutum in posterodorsal view with four dark brown stripes, two lateral on the dorsocentral rows and two lateral on the acrostichal rows, the latter not reaching posterior margin of scutum; wing hyaline with yellowish veins; calipters whitish; halter yellow; leg black with moderate silvery pruinosity on tibia; abdomen dark brown in background color overlaid with silvery pruinosity (sometimes with slightly gold pruinosity at certain angles) on at least basal half of syntergite 1 + 2 and tergites 3, 4, and 5, except dorsal depression of syntergite 1 + 2.

Head (Figs. 2, 3): Vertex about 0.24 head width in dorsal view; inner vertical seta developed and slightly reclinate; outer vertical seta about 0.57 length of inner vertical setae; ocellar seta almost as long as inner vertical seta; fronto-orbital plate with about seven setae, the uppermost seta shorter; the lowermost seta at the level of apex of pedicel; two reclinate orbital setae, the anteriormost about 1.6 \times length of the posteriormost; first flagellomere length about 2.6 \times of pedicel; arismere 3 length about 1.7 \times of first flagellomere; facial ridge with setae on lower fourth, setae 0.2–0.32 length

of vibrissa; subvibrissal ridge with one or two setae; ventral margin of gena with three or four stout setae. **Thorax** (Figs. 5 and 6): Postpronotum with three basal and one short anterior setae, the middle basal seta displaced slightly frontward in line with the outer basal and the anterior setae; acrostichal setae 2 + 3 with posteriormost presutural seta about 1.4 \times length of preceding seta and posteriormost postsutural seta about 1.6 \times length of preceding seta; dorsocentral setae 2 + 3 with posteriormost postsutural seta about 1.3 \times length of preceding seta; intra-alar setae 1 + 3 or 2 + 3, anteriormost presutural if present less than half length of the posteriormost presutural seta; the posteriormost postsutural seta about 1.45 \times length of preceding seta; supra-alar setae 0 + 3 with the second postsutural seta longest, about 3.5 \times length of preceding seta and about 2.2 \times length of posteriormost seta; three postalar setae, the second seta longest, about twice length of preceding seta and about three times length of posteriormost seta; intrapostalar seta slightly shorter than the posteriormost postsutural acrostichal seta; katepisternum with three setae: the anterior and posterior katepisternal setae longer and stouter than anteroventral katepisternal seta; scutellum with the lateral scutellar setae about half as long as the subapical setae, but longer than the apical setae; mid tibia with one long anterodorsal seta, flanked by one or two smaller setae; hind tibia with three or four stout anterodorsal setae increasing in size from the base to the middle of the tibia, followed by the fourth minor seta (sometimes absent); hind tibia with one long posterodorsal seta and two or three smaller and more basal

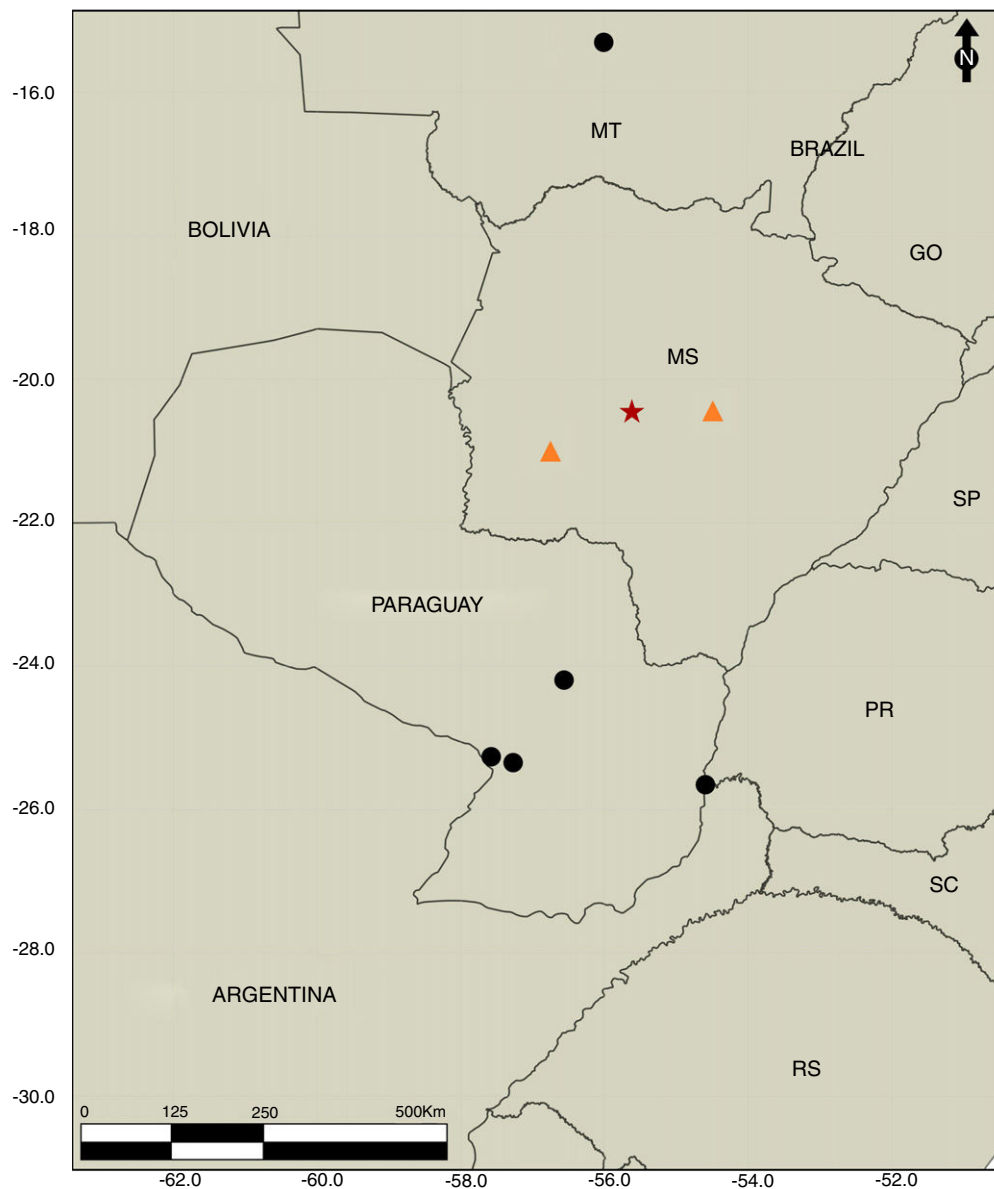


Fig. 9. Geographical distribution map of *Urucumania borellii* (Giglio-Tos, 1897). Black circles (●) are previous records, orange triangles (▲) are new records, and red star (★) is the type locality of *Paxiximya sulmatogrossensis* Toma & Olivier n. gen. and n. sp.

setae. *Abdomen* and *Terminalia* (Figs. 3, 5, 6): Syntergyte 1 + 2 and tergite 3 with one pair of median marginal setae and one pair of lateral marginal setae; tergite 4 and 5 with a row of median marginal setae; tergites 3 and 4 with one pair of discal setae; tergite 5 with a row of discal setae close to the row of median marginal setae on this tergite; sternite 5 with U-shaped median cleft; pregonite tapering and slightly curved outward and downward; in profile cercus broad along its entire length, slightly wider than dorsal portion of epandrium and rounded apically; inner surface of the cerci with a patch of short hairs on its posterior border and apical third; anterior margin of the cerci folded inwards and visible in posterior view; in profile surstyli slightly arched, about 0.8 length of cerci.

Female: unknown.

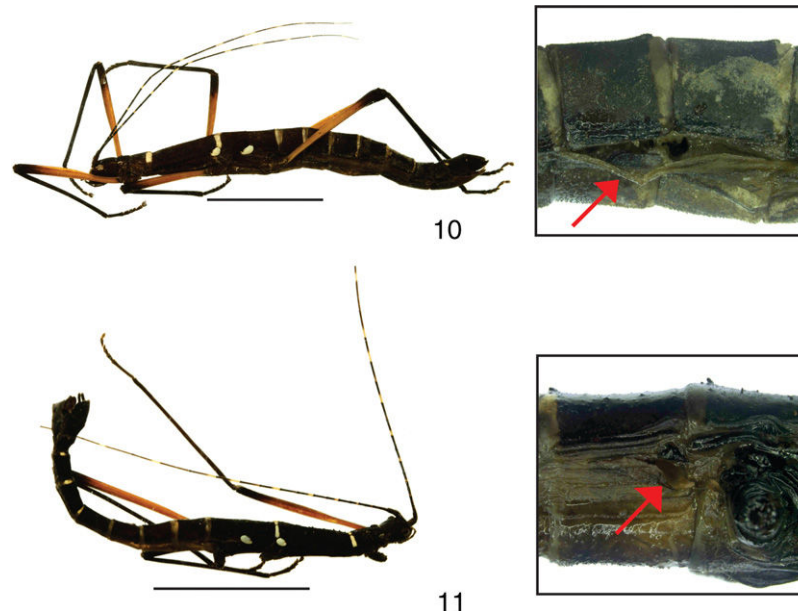
Measurements of type specimens. Type specimens withered after mounting and only one specimen preserved its body length, which was used in the description. The other measurements (mm) after the drying were ($n=4$): body length: 7.77–8.09 (7.89); wing length: 6.44–7.05 (6.67).

Description of puparium (Figs. 7 and 8): Measurements of puparia ($n=2$): Puparium I. length = 7.23 mm, width = 3.02 mm; Puparium II. length = 7.30 mm, width = 2.87 mm. Puparium reddish brown; subelliptical with both ends rounded; posterior spiracles narrowly separated, only slightly raised above the surface, located above horizontal axis, color dark brown except for three reddish brown slits, each one located on top of a small ridge. Anal opening far below posterior spiracles.

Etymology. The specific epithet refers to the Brazilian state in which the host was collected.

Geographic distribution. Brazil (Mato Grosso do Sul: Aquidauana) (Fig. 9).

Remarks. Emergence and viability of the tachinid larvae: five larvae emerged from an aperture (length = 7.40 mm) between second and third abdominal pleurites on the left side of the body (length = 75.00 mm) of a female host (Fig. 10) (ZUFMSPA00001), three on January 20 and two on January 21, 2017. All larvae from the female host became adult flies. Three larvae emerged from an aperture (length = 3.70 mm) in the first abdominal pleurite on the



Figs. 10 and 11. *Urucumania borellii* (Giglio-Tos, 1897). 10–11 specimens parasitized by *Paximyia sulmatogrossensis* Toma & Olivier **n. gen.** and **n. sp.** (10) Female; (11) Male. Detail of apertures for emergence of larvae on abdominal pleurites. Scale bar = 2 mm.

right side of body (length = 64.00 mm) (Fig. 2) of a male host (Fig. 11) (ZUFMSPA00002) on January 24, 2017, but only one became an adult fly. Development time from emergence of larvae to emergence of adult flies was 14–15 days.

Geographical distribution of the host. *Urucumania borellii* was described from Paraguay in 1897 by Giglio-Tos and all records before the present study were from Assunción, San Pedro, San Bernardino, and Puerto Bertoni in that country and Cuiabá in the state of Mato Grosso, Brazil. This paper presents new records from Brazil of specimens collected and/or photographed in the following cities: Aquidauana, Campo Grande, Bodoquena (Cordeiro, L., pers. comm., April 2017) (Fig. 9). The records obtained for this walking stick species are mainly from Cerrado phytophysionomies, such as “cerradão”, but also from riparian forests and transitions between plateau (Cerrado) and lowlands (Pantanal), for example in Aquidauana. Probably *U. borellii* is widely distributed in the Cerrado domain, which would potentially increase the geographic distribution of *P. sulmatogrossensis* **n. gen.** and **n. sp.**

Conflicts of interest

The authors declare no conflicts of interest.

Acknowledgments

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