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A review of the American species of *Xenelmis* Hinton (Coleoptera: Elmidae), with a new species from Argentina

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Abstract

The genus *Xenelmis* Hinton is taxonomically reviewed. A new species of riffle beetle from Argentina, *Xenelmis uruzuensis* **sp**. **nov.** is described and illustrated from adults of both sexes and the larva. Ten additional species of *Xenelmis* are treated: *X. sandersoni* Brown, *X. bufo* (Sharp), *X. rufipes* Delève, X. *leechi* Perkins & Steiner, *X. marcapata* Perkins & Steiner, *X. tarsalis* Hinton, X. *teres* Hinton, *X. audax* Hinton, *X. comis* Hinton and *X. laura* Brown. Male genitalia of each species are illustrated, some of them for the first time. Distributional records, diagnoses and a key to distinguish the species of *Xenelmis* are included.

Key words: riffle beetles, Elmidae, Elminae, *Xenelmis*, South America

Introduction

The elmid fauna of South America is poorly studied and only a few of the South American genera are clearly defined. In addition to this, no cladistic analyses at a generic level have ever been performed. There is only a preliminary phylogenetic analysis presented by Costa et al. (1999) on Byrrhoidea *sensu* Lawrence and Newton (1995) where the family Elmidae, as currently defined, appears as paraphyletic. The family comprises two subfamilies, Larainae and Elminae; the genus *Xenelmis* Hinton, belongs to the subfamily Elminae.

Xenelmis includes minute riffle beetles ranging from southern North America to northern Argentina. With the species described here there are currently 13 species recognized in the genus. Hinton (1936) erected *Xenelmis* for *Elmis bufo* described by Sharp (1882) from Panama. Hinton (1940) redescribed *Xenelmis*, diagnosed *X. tarsalis* and included two species originally described by Grouvelle (1889) in *Elmis*, *X. granata* and *X. micros*, both from Brazil. A few years later Hinton (1946) described 3 new species, *X. teres* from Brazil, *X. audax* from Brazil and Argentina and *X. comis* from Paraguay,

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Brazil and Argentina, and he provided the first complete description of *X. tarsalis*. In this paper Hinton also divided the genus into three species-groups: a) the *granata*-group, with well developed sublateral pronotal carinae; b) the *micros*-group with a submedian row of granules on the pronotal disc; c) the *bufo*-group without carinae or rows of granules. Finally Hinton, in the same paper, provided a key for all known species of *Xenelmis*, and illustrated the male genitalia of *X. micros* and *X. comis*.

Delève (1968) described *X. rufipes* from Ecuador, and later (Delève 1970), published an incomplete drawing of genitalia and posterior leg of the male of *X. granata*, but he did not include a redescription of this species. Brown (1970) described *X. laura* from Brazil and adapted Hinton's key to include the new species. Perkins and Steiner (1981) described *X. leechi* and *X. marcapata* from Peru. Finally Brown (1985) described *X. sandersoni* from Mexico and the USA.

Preimaginal stages of Elmidae are poorly studied for the Neotropical region. *Xenelmis bufo* and *X. sandersoni* are the only species with known larvae within the genus.

Xenelmis has never been revised and no additional species were described in the last 20 years. In this paper *Xenelmis* is clearly diagnosed and a new species of this genus is described with both adults and larvae examined. Original descriptions or redescriptions of all the species are adequate; therefore only diagnosis of each species and drawings of some important features not included in the original descriptions are provided here. Male genitalia of *X. audax* are illustrated for the first time. Male genitalia of: *X. tarsalis*, *X. comis*, *X. rufipes*, *X. leechi*, *X. marcapata*, *X. laura*, and female genitalia of *X. sandersoni* are shown in more detail than that of original descriptions.

Material and methods

Holotypes and paratypes of eight species of *Xenelmis* and specimens of two additional species (*X. laura* and *X. sandersoni*) were examined. *Xenelmis granata* and *X. micros* were not examined. The type material of both species are deposited in Muséum national d'Histoire naturelle de Paris. These types were requested during the preparation of this paper, however a response was not received.

Specimens of the new species, larvae and adults, were fixed in the field and stored in 75% ethyl alcohol. Some specimens of the new species were dissected to illustrate the male and female genitalia. Genitalia of *X. audax*, *X. tarsalis* and *X. uruzuensis* and larvae of this species were cleared with concentrated lactic acid for several days before examination. Drawings were done with an Olympus BH-2 microscope and a Leica Wild M3Z stereomicroscope, both with camera lucida. Larval morphological nomenclature follows Lawrence (1991).

Thirty specimens of 11 species were studied; they were from the: USA, Panama, Mexico, Ecuador, Peru, Paraguay, Brazil and Argentina. Specimens were borrowed from the following institutions: National Museum of Natural History (Smithsonian Institution),

D. Furth; Institut Royal des Sciences Naturelles de Belgique, G. Wauthy; The Natural History Museum, London , M. Kerley; and The University of Oklahoma, Department of Zoology, Dr H. P. Brown.

Genus *Xenelmis* Hinton 1936

Xenelmis Hinton, 1936: 427; Hinton, 1940: 295; Hinton, 1946: 237; Delève, 1968: 233; Brown, 1970: 61; Delève, 1970; Brown, 1971: 95; Perkins & Steiner, 1981: 306; Brown, 1985: 53.

Type species: *Xenelmis bufo* (= *Elmis bufo* Sharp 1882)

The genus was erected by Hinton (1936). In this paper he gave an incomplete diagnosis of the genus. The same author (Hinton 1940), redescribed *Xenelmis*, added new specific characters to his generic diagnosis, and provided a list of secondary sexual characters that he observed in the known species of the genus. According to Hinton's descriptions, and the specimens examined in this study, *Xenelmis* is distinguished from the other genera of Elmidae by the following combination of characters: 1) dorsal surface of head with granules; 2) genae without tomentum; 3) pronotum tomentose; 4) prosternal process almost as wide as long; 5) all abdominal sternae with granules; 6) aedeagus with parameres shorter than penis.

Xenelmis uruzuensis sp. nov.

(Figs. 1–3, 17, 18 and 24)

Diagnosis

This new species can be distinguished from all other known *Xenelmis* species by the following combination of characters: (1) hind tibia of the male with a row of large granules on inner lateral margin and (2) disc of the first ventrite of male with prominent carina, extending the length of the ventrite.

Description

Holotype male, 2.20 mm long, 1.20 mm wide (at midlength of elytra). Body broadly ovate and convex. Cuticle shiny, dorsum and venter nearly black, antennae and legs dark red.

Head: surface densely microreticulate, with dispersed setae and granules; each side with row of granules extending from base of antennae to near mid-dorsal line on vertex. Frontoclypeal suture straight and deep. Labrum with apical margin feebly arcuate, smooth; margin with setae, setae more than 2/3 as long as labrum. Antennae as long as pronotum, 11-segmented, apical segment longest.

Pronotum: 0.70 mm long, 0.85 mm wide at base, tomentose. Surface microreticulate, with granules, granules as wide as facets of eyes, separated by 1–2 times their diameter, each granule with long seta. Base trisinuate, lateral margin bordered by granules separated by 0.5X times their diameter. Disc with two parallel longitudinal rows of oblong granules, extending from near base, almost reaching apical margin (Fig. 24). Surface between rows without granules, with punctures larger than facet, separated by 2–3 times their diameter. Hypomera tomentose, with granules like those on pronotum. Prosternal process almost as wide as long, quadrate (0.45 mm long, 0.40 mm wide), posterior angles rounded; surface with granules like those on pronotum. Mesosternum shiny with dispersed small granules, as wide as facets, separated by 2–4 times their diameter; with groove for reception of the prosternal process. Metasternum with granules like those on mesosternum and deep punctures, with dispersed short setae.

Elytra: 1.50 mm long, 1.20 mm wide. Lateral margins crenulate; apices feebly conjointly produced and rounded; surface with dispersed setae. Each elytron with seven coarse striae formed by deep, round punctures separated by 0.25X their diameter. Intervals convex, microreticulated; third interval with a feeble row of inconspicuous granules (10–12) extending from near base to 4/5 of elytral length. Intervals 5 and 7 each with a row of granules extending from base to almost apex. Epipleura tomentose, microreticulated, without granules. Scutellum subtriangular, flat, longer than broad; surface smooth.

Abdomen: lateral margins tomentose; all sternites with small granules like those of mesosternum and separated by 2–3 times their diameter. Surface between granules microreticulate. Disc of first ventrite with median longitudinal carina, posterior end of the carina concave and prominent (spoon-like) (Fig. 18).

Legs: coxae, trochanters and femora tomentose, surface with small granules separated by 1–4 times their diameter, with short and dispersed setae. Protibia with feeble row of fine granules on inner lateral margin, a short cleaning fringe on apical third of inner lateral margin. Mesotibia with cleaning fringe and a row of large granules on apical two-thirds of inner lateral margin. Metatibia with apical two-thirds having a row of large granules (more than three times the diameter of those of pronotum) and a cleaning fringe (Fig. 17). All tibiae with dispersed short setae, without tomentum. All tarsi with short apical setae. Claws not modified.

Male genitalia: aedeagus (Figs. 1 and 2) long and moderately broad. Penis elongate, apex constricted and folded; ventral sac well developed in mid area of the penis; basal apophyses very long, apices converging toward midline. Parameres distinctly shorter than penis; phallobase moderately large, shorter than penis, closed.

Female: externally similar to male except as follows: (1) pronotum with area in front of scutellum moderately prominent, (2) first abdominal ventrite without carina, (3) row of teeth on fore tibia very feeble, (4) row of granules on hind tibia small and, (5) body lighter in color. Female genitalia as illustrated in Fig. 3.

Type data

Holotype male. ARGENTINA. Misiones province, Parque Provincial Urugua-í, Aº Uruzú S 25º 51' 29" W 54º 10' 10", 322 m, 30/XI/2001, Domínguez, Nieto & Orce cols.. Paratypes: 5♂♂ and 4♀♀ with same data as holotype; 1♂ and 1♀ collected in Misiones province, Aº afluente de Tateto, Paraje María Soledad S 25º 51' 39" W 53º 58' 56", XI/30/2001, Domínguez, Nieto & Orce cols. Holotype and paratypes deposited in the collection Instituto — Fundación Miguel Lillo, Tucumán, Argentina

Other specimens

1 larva with same data as holotype and 3 larvae collected in Misiones province; Parque Provincial Urugua-í, 500 m, S 25º 44' 51" W 54º 03' 37", 1/XII/2001, Domínguez, Nieto & Orce cols. All material deposited in the collection Instituto — Fundación Miguel Lillo, Tucumán, Argentina.

Etymology

Uruzuensis, is a noun in apposition and refers to the Rio Uruzú, the river from which the type specimens were collected.

Comparative notes

Males of *X. uruzuensis* can easily be distinguished from all the other species of the genus by the presence of a longitudinal carina along the disc of first abdominal ventrite, and hind tibia of male with a row of large granules on inner lateral margin. According to Hinton (1946) *X. uruzuensis* should belong to the *micros*-group due to the presence of a submedian row of granules on the pronotal disc. Nevertheless a preliminary phylogenetic analysis that included all the species of *Xenelmis* (Manzo, in prep.) suggests that the groups of species proposed by Hinton are not valid. Additionally, the presence of a pronotal row of granules does not appear to be constant among different specimens of the same species as, for example, in *X. laura*. Some specimens exhibit the submedian row of pronotal granules while others lack it (Brown 1970).

Habitat

Xenelmis uruzuensis was collected from three rivers at altitudes ranging from 300 to 400 meters and from a depth of 50 cm. All specimens were found where the substrates consisted of large rocks or gravel, cobbles and boulders. The following elmid genera were found associated with specimens of this species: larvae and adults of *Heterelmis*, *Neoelmis*, *Macrelmis* and *Microcylloepus*, and larvae of *Hexanchorus*.

***Xenelmis bufo* (Sharp)**

Elmis bufo Sharp 1882: 140; *Xenelmis bufo* Hinton, 1936: 427; Hinton, 1936: 427, Hinton 1940: 298; Brown 1970: 64.

Diagnosis

This species may be distinguished from all other known *Xenelmis* species by the following combination of characters: (1) row of granules on each side of head ending near base of antenna (Fig.26); (2) third elytral interval without row of granules.

Distribution

Panama and Mexico.

Type data

The female holotype has the following labels: "♀", "V. de Chiriqui, 2-3000 ft Champion", B.C.A. Col. I.2. Elmis bufo Sharp"

***Xenelmis tarsalis* Hinton**

Xenelmis tarsalis Hinton 1940: 296, Hinton 1946: 237, Brown 1970: 64

Diagnosis

This species may be distinguished from all other known *Xenelmis* species by the following combination of characters: (1) fifth metatarsus dilated, (2) lateral sides of the fifth metatarsus with long setae (Fig. 21). Male genitalia as illustrated in Figs. 4 and 5.

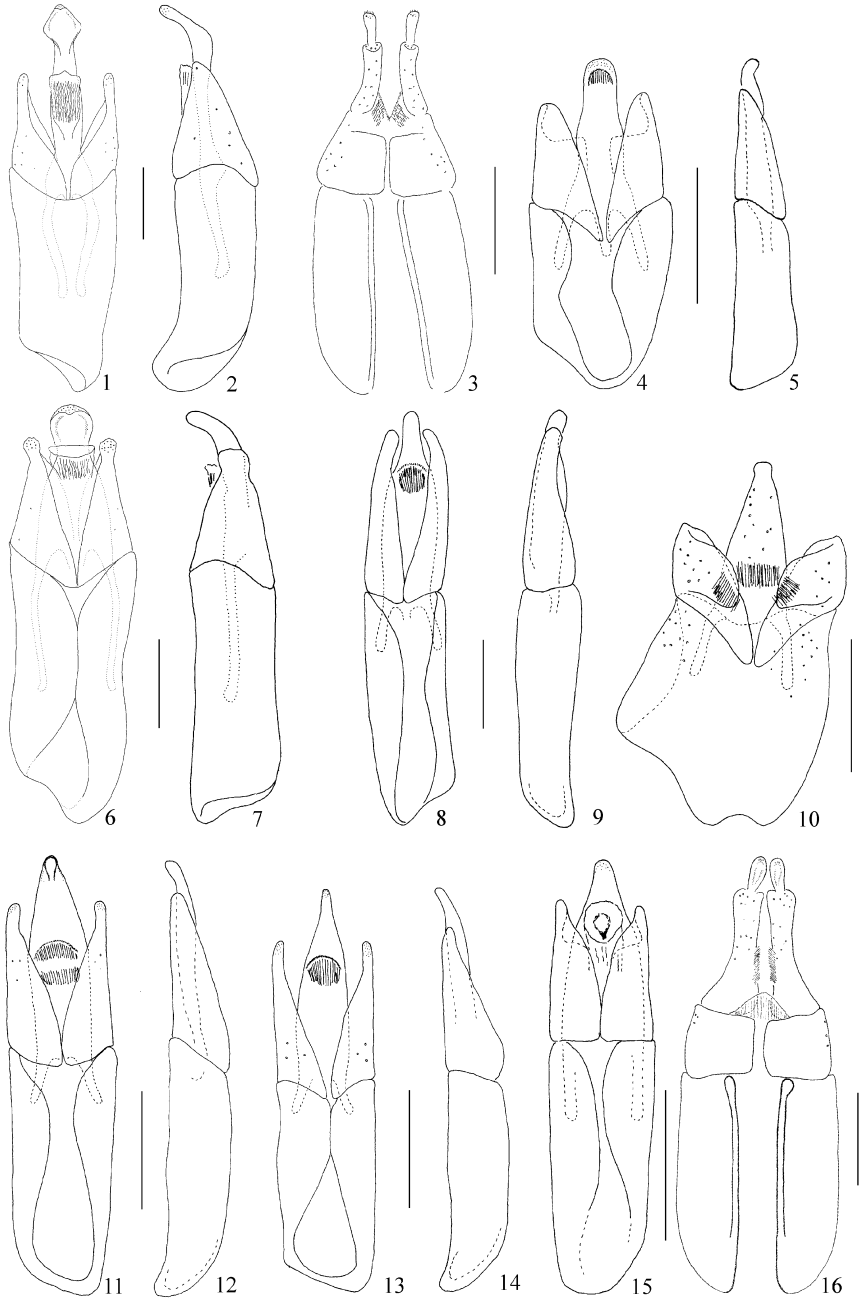
Distribution

Brazil.

Type data

The male holotype has the following labels: "Type" "♂" BRAZIL: Porto Velho iix-ix-1937 H.E. Hinton" "Hinton Col. B.M. 1939-583" Type *Xenelmis tarsalis* Hinton"

Paratype data: the paratypes have the following labels: "♀" "BRAZIL Porto Velho iix-ix-1937 H. E. Hinton" "P — Type *Xenelmis tarsalis* Hinton"; "♀""BRAZIL Porto Velho iix-ix-1937 H. E. Hinton" " P — type *Xenelmis tarsalis* Hinton" " H. E. Hinton collection. BM 1977-566"; "♂" "P. Velho iix-ix-1937 Br" "P- type *Xenelmis tarsalis* Hinton"; "♀" "BRAZIL Porto Velho" "iix-ix-1937 H. E. Hinton" "P — type *Xenelmis tarsalis* Hinton"; "♂" "BRAZIL Porto Velho iix-ix-1937 H. E. Hinton" " P — type *Xenelmis tarsalis* Hinton" " H. E. Hinton collection. BM 1977-566"; "♂""BRAZIL Porto Velho iix-ix-1937 H. E. Hinton" " P — type *Xenelmis tarsalis* Hinton" " H. E. Hinton collection. BM 1977-566"; "♂""BRAZIL Porto Velho iix-ix-1937 H. E. Hinton" " P — type *Xenelmis tarsalis* Hinton" " Hinton coll. BM 1977-566."



FIGURES 1–16. 1–3, *Xenelmis uruzuensis* **sp. nov.**: 1, male genitalia, ventral view; 2, lateral view of same; 3, female genitalia. 4–5, *X. tarsalis* (paratype): 4, male genitalia, ventral view; 5, lateral view of same. 6–7, *X. audax* (paratype): 6, male genitalia, ventral view; 7, lateral view of same. 8–9, *X. comis* (paratype): 8, male genitalia, ventral view; 9, lateral view of same. 10, *X. rufipes* (type): male genitalia, ventral view. 11–12, *X. leechi* (type): 11, male genitalia, ventral view; 12, lateral view of same. 13–14, *X. marcapata* (type): 13, male genitalia, ventral view; 14, lateral view of same. 15, *X. laura* (paratype): male genitalia, ventral view. 16, *X. sandersoni*: female genitalia, ventral view. Scale bars = 0.10 mm, Fig. 3 = 0.20 mm.

Xenelmis teres Hinton

Xenelmis teres Hinton 1946: 240; Brown 1970: 56.

This species was described from a female and since 1946 no new record was reported. Males of this species are unknown.

Diagnosis

This species may be distinguished from all other known *Xenelmis* species by the following combination of characters: (1) two weak, parallel rows of granules on disc of pronotum; (2) granules of pronotum smaller than facets, separated by 2–2 ½ times their diameter; (3) pronotum without punctures; (4) elytral intervals smooth, and strial punctures very small (5) third elytral interval with row of 19–20 granules.

Distribution

Brazil.

Type data

The female holotype has the following labels: "♀" "BRAZIL Porto Velho iix-ix-1937 H. E. Hinton" "Hinton Coll. B. M. 1939-583" "Type *Xenelmis teres* Hinton"

Xenelmis audax Hinton

Xenelmis audax Hinton 1946: 239; Brown 1970: 65

Diagnosis

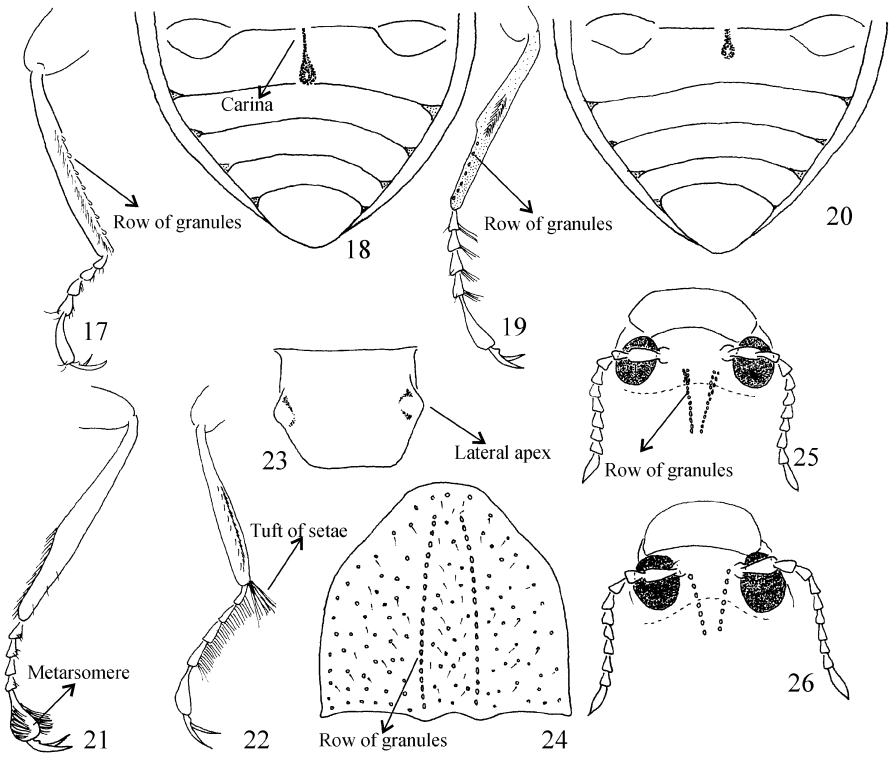
This species may be distinguished from all other known *Xenelmis* species by the following combination of characters: (1) hind tibia of male flat, with row of large granules on inner lateral margin (Fig. 19), (2) disc of first ventrite of male with short and prominent carina (Fig. 20). Male genitalia as illustrated in Figs. 6 and 7.

Distribution

Argentina and Brazil.

Type data

The male holotype has the following labels: "♂" "Type" "Misiones — Argentina — dep. Concep. — Sta Maria, M. J. Viana" "Type *Xenelmis audaz*." Paratype data: the paratype male has the following labels data: "♂" "N. Teutonia Braz. 1934 Plaum." "P — Type *X. audax* Hinton"; "♀" "Misiones — Argentina — Dep. Concep — Sta Maria M. J. Viana" "11" "P — Type *Xenelmis audax* Hinton".



FIGURES 17–26. 17–18 and 24, *Xenelmis uruzuensis* **sp. nov**. male (type): 17, hind leg;18, abdomen; 24, pronotum. Figs.19–20, *X. audax* male (type): 19, hind leg; 20, abdomen. 21, *X. tarsalis* male: hind leg. 22, *X. laura* male: hind leg. Fig. 23, *X. comis* male (type): 23, prosternal process. 25, *X. marcapata* male: head. 26, *X. bufo* female (type): head.

Xenelmis comis Hinton

Xenelmis comis Hinton 1946: 238; Brown 1970: 65.

Diagnosis

This species may be distinguished from all other known *Xenelmis* species by the prosternal process with lateral apex angulate (Fig. 23). Male genitalia as illustrated in Figs. 8 and 9.

Distribution

Brazil, Paraguay and Argentina.

Type data

The male holotype has the following labels: "♂" "Type" "Paraguay" "Type *Xenelmis comis* Hinton"

Xenelmis rufipes Delève

Xenelmis rufipes Delève, 1968: 233; Perkins and Steiner, 1981: 312

Diagnosis

This species can be recognized by the following combination of characters: (1) disc of pronotum without row of granules; (2) granules of pronotum larger than facets and separated by more than two times their diameter; (3) elytral striae indistinct, (4) parameres with membranous lobe (Fig. 10).

Distribution

Ecuador.

Type data

The male holotype has the following labels: “Holotype”, “Ecuador: Prov. Canar, Rte Guayaquil — Cuenca (Km 87 a 90) IX-1964. N. Leleup” “ Forêt de transition 1500 m. Sous pierres immerges dans ru à courant rapide”, “ Prèpar. genit. Nº 30 7057”, “J. Delève det., 1966 *Xenelmis rufipes* n. sp.”.

Xenelmis leechi Perkins & Steiner

Xenelmis leechi Perkins & Steiner, 1981: 306

Diagnosis

This species may be distinguished from all other known *Xenelmis* species by the following combination of characters: (1) setae of pronotum very short; (2) elytra very convex, (3) body dark. Male genitalia as illustrated in Figs. 11 and 12. Perkins & Steiner (1981) described this species but a few additions are in order. Tomentum distributed on lateral margins of pronotum, hypomera, epipleura, lateral margins of all abdominal ventrites, coxae and femora.

Distribution

Peru

Type data

The male holotype has the following labels: “Peru: Cuzco. Quince Mil, 26 Jun 1979. W.E. Steiner”, “HOLOTYPE ♂ *Xenelmis leechi* Perkins & Steiner USNH # 76696”

Xenelmis marcapata Perkins & Steiner

Xenelmis marcapata Perkins & Steineer, 1981: 309.

Diagnosis

This species may be distinguished from all other known *Xenelmis* species by the following combination of characters: (1) setae of pronotum long (as long as third antennomere); (2) elytra convex, (3) body with bronze cast. Male genitalia as illustrated in Figs. 13 and 14.

Distribution

Peru.

Type data

Male holotype has the following labels: “Peru: Cuzco. Quince Mil, 26 Jun 1979. W.E. Steiner”, “HOLOTYPE ♂ *Xenelmis marcapata* Perkins & Steiner USNH # 76697”

Xenelmis laura Brown

Xenelmis laura Brown 1970: 62

Diagnosis

This species can be recognized by the following combination of characters: (1) pronotum with reniform granules; (2) parallel row of granules on pronotal disc absent; (3) hind wings absent; (4) apical tufts of setae on mid and hind tibiae (Fig. 22); (5) rows of hairs on the first four tarsal segments. Male genitalia as illustrated in Fig. 15.

Distribution

Brazil

Material examined

1 male from Brazil, Para, 79 km N of Maraba, 8/x/1971 M. B. Davis and H. Brown Colls.

Xenelmis sandersoni Brown

Xenelmis sandersoni Brown 1985: 53

Diagnosis

This species may be distinguished from all other known *Xenelmis* species by the

following combination of characters: (1) third strial interval of elytra raised, with row of tubercles; (2) characters unique for the male genitalia: penis triangular with bisinuate sides and apex enlarged; parameres subtriangular shorter than penis; phallobasis open and longer than parameres. Female genitalia as illustrated in Fig. 16.

Distribution

USA and Mexico.

Material examined

1 female Mexico, Chihuahua, 4 miles south of Galeana, vii/22/1973. HP Brown coll.

A key to males of the genus *Xenelmis*

In the following key all species of the genus *Xenelmis* are included. The type material of *X. granata* and *X. micros* are not available, therefore the information used for these species comes from the original descriptions and drawings published by Hinton (1946) and Delève (1970).

1. Pronotum with lateral carinae. Brazil ..... *X. granata* (Grouvelle, 1889)
- Pronotum without lateral carinae 2
2. First abdominal ventrite with midlongitudinal carina (Figs 18, 20) 3
- First abdominal ventrite without carina 4
3. Hind tibia of male not flattened and with row of large granules (Fig. 17); first abdominal ventrite with carina extending on all the length of ventrite (Fig. 18). Argentina .... *X. uruzuensis* **sp. nov.**
- Hind tibia of male flattened and with row of small granules (Fig. 19); first abdominal ventrite with carina on 2/3 of the length of ventrite (Fig. 20) Brazil and Argentina .... X. *audax* Hinton, 1946
4. Male with last metatarsomere broadly dilated and pubescent (Fig. 21). Brazil..... .....*X. tarsalis* Hinton, 1940
- Male without last metatarsomere broadly dilated and pubescent 5
5. Disc of pronotum without two median longitudinal rows of granules 6
- Disc of pronotum with two median longitudinal rows of granules..... 12
6. Prosternal process with angulated lateral apex (Fig. 23). Brazil, Paraguay and Argentina..... *X. comis* Hinton, 1940
- Prosternal process without angulated lateral apex 7
7. Mid and hind tibiae with apical tufts of setae and all tarsi with segments 1–4 bearing rows of setae on ventral surface (Fig. 22). Brazil ..... *X. laura* Brown, 1970
- Mid and hind tibiae without apical tufts of setae, setae on ventral surface of tarsomeres 1 – 4 absent..... 8

8. Aedeagus with membranous lobe on parameres (Fig. 10). Ecuador..... ..... *X. rufipes* Delève, 1968
- Aedeagus without membranous lobe on parameres..... 9
9. Third elytral interval without row of granules 10
- Third elytral interval raised, with row of tubercles. USA and Mexico..... ..... *X. sandersoni* Brown, 1985
10. Head with row of granules not reaching base of antenna, ending between upper margins of eyes (Fig. 25)..... 11
- Head on each side with row of granules ending near base of antenna (Fig. 26). Mexico and Panama .....*X. bufo* (Sharp, 1882)
11. Setae of pronotum long (as long as third antennomere), elytra convex, body with bronze cast. Peru ..... *X. marcapata* Perkins & Steiner, 1981
- Setae of pronotum very short, elytra very convex, body dark. Peru..... .....*X. leechi* Perkins & Steiner, 1981
12. Elytra with row of granules on third interval extending to middle and consisting of 19–20 granules. Brazil .....*X. teres* Hinton, 1946
- Elytra without row of granules on third interval. Brazil ...*X. micros* (Grouvelle, 1889)

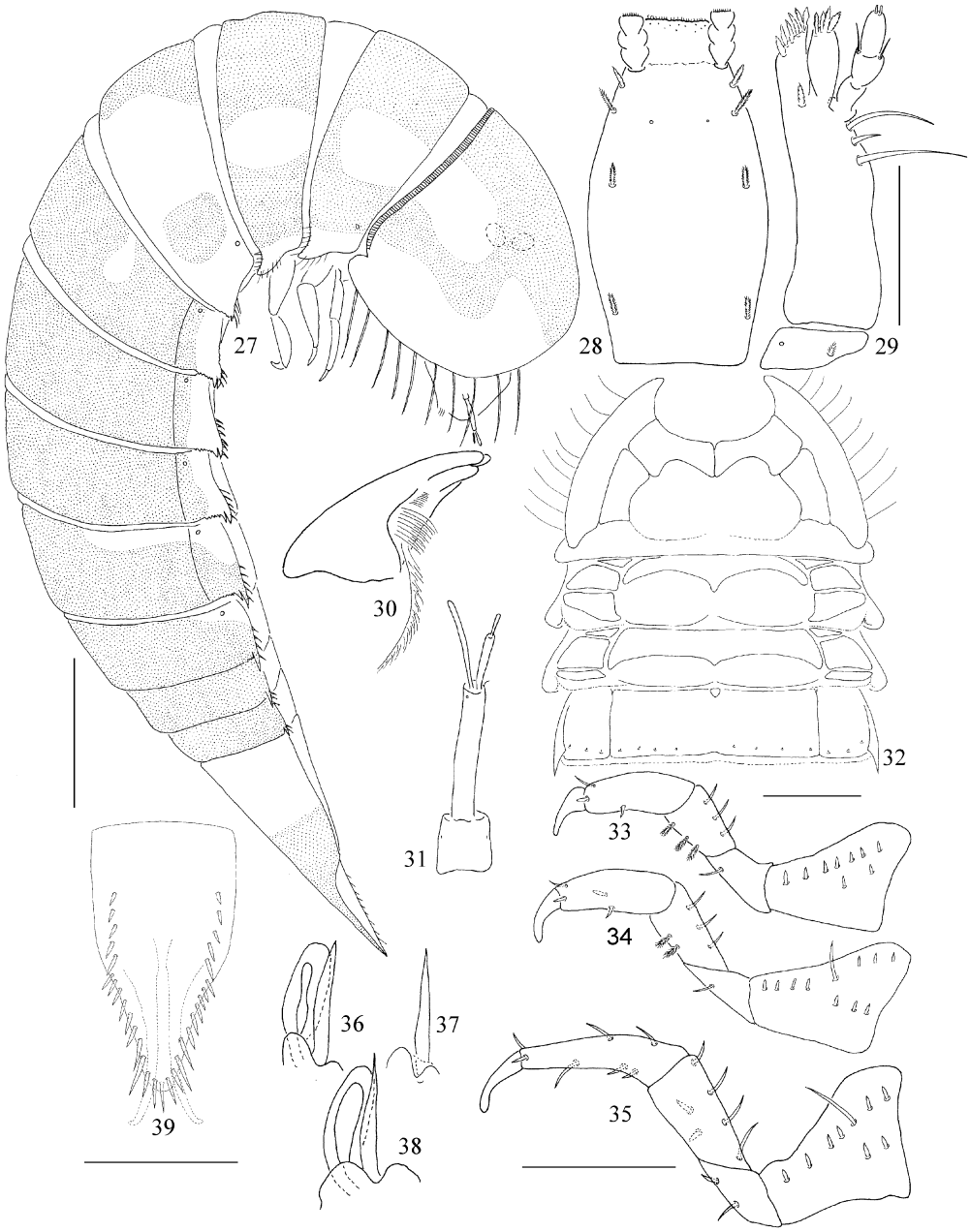
Immature stages

Larvae of *Xenelmis* present some additional characters shared with other American genera (Brown, 1971 and 1985): 6 pairs of abdominal pleura, bipartite propleura, procoxal cavities open posteriorly and apex of ninth segment emarginate. The larvae of *Xenelmis* were described for the first time by Brown (1971), and he provided generic characters for these larvae: tripartite meso- and metapleura, prominent spines along the lateral margins of the abdominal segments and body very convex. The larva of *X. uruzuensis* is described here.

Xenelmis uruzuensis
(Figs. 27–39)

Body convex, rounded anteriorly, hemispheric in cross-section (Fig. 27), length 3.4 mm, width 0.9 mm. Thoracic segments and first abdominal segments subequal in width, remaining abdominal segments progressively narrower. Cuticle dark brown; antennae, mouthparts and legs lighter in color.

Head: concealed by pronotum, anterior margin without teeth. Coronal suture short; frontal sutures long and curved, extending to base of antennae, frontoclypeal suture absent; margins of head capsule with several long setae. Gula well developed. Labrum subrectangular, transverse, with rounded anterior angles, basal third with row of short,



FIGURES 27–39. *X. uruzuensis* **sp. nov.** larva: 27, habitus; 28, labium, 29, right maxilla; 30, left mandible; 31, right antenna; 32, thorax and first abdominal segment, ventral view; 33, prothoracic leg; 34, mesothoracic leg; 35, metathoracic leg; Figs. 36–38, setae from thorax and abdomen; 39, operculum, dorsal view. Scale bars: Fig. 27 = 0.50 mm, Figs. 28, 29 and 39 = 0.10 mm, Figs. 33, 34 and 35 = 0.20 mm.

ramose setae; distal margin with short setae and lateral margin with long setae. Labium (Fig. 28) large, formed by prementum and postmentum. Postmentum large,

subrectangular, longer than wide, basal and medial area with one pair of ramose setae; distal area with two pairs of ramose setae. Prementum membranous, short, transverse, anterior margin with short setae. Palpi three-segmented, segments subequal, apex of the last segment with short setae. Maxillae (Fig. 29) with cardo subrectangular. Stipes long, subrectangular, distal third with three long setae on outer margin. Lacinia and galea well developed, lacinia as a strong lobe with 7 –8 blunt setae on mesal margin, galea one-segmented, elongated, with 4 apical setae. Palpi four-segmented, basal segment short, wider than long, second segment subrectangular, third segment slightly longer than second, with two apical setae, one on each side, last segment longest, rounded at apex with two sensoria. Mandibles (Fig. 30) symmetrical, apex tridentate; inner margin with long, densely setose prostheca. Antennae (Fig.31) short, three-segmented. Basal segment stout, second segment the longest, slender with distal long sensory filament. Third segment small, with short distal seta.

Thorax: (Fig. 32) strongly sclerotized. Pro-, meso- and metathoraces with light and dark areas as shown in figure 27, tergal plates with sagittal line. Pronotum convex, about twice as wide as long, with rounded angles, lateral margin with long setae (9 – 10); terga with setiferous tubercles as in figs 36, 37 and 38; on each side of sagittal line with two suboval patches devoid of setae (dotted line); pleural sclerite large, formed by episternum and epimeron, episterna meeting anteriorly at the midline, without posteromedial sclerite, procoxae open. Mesonotum and metanotum with sharp angles, produced posteriorly with several small marginal setae; pleural sclerite with epimeron and episternum divided into two parts. Meso- and metasterna subtriangular, anterior margin almost straight. Legs (Figs. 33, 34 and 35) five-segmented, similar in shape, those of prothorax the shortest. Coxa subtriangular, trochanter small, subtriangular, femur long and slender, tibia the longest segment, bearing hooked tarsungulus, all segments with setae as in figs 33–35.

Abdomen: Nine-segmented. Terga with setiferous tubercles like those of pronotum; terga 1–4 with sagittal line. Posterior angle of terga of first segment produced posteriorly with several small marginal spines; posterior angles of segments 2–7 with two strong spines and small setae; segment 8 with one spine and small setae. Ninth segment elongated and strongly emarginated, ending in two long lateral spinose processes. Segments 1–6 with pleura bounded by tergo and sterno pleural sutures; these sutures converging at apex of sixth segment. Sternal plate of first segment with small setae as in figure 32. Pleural and sternal sclerites with sparse setiferous tubercles. Ninth segment bearing gill chamber and operculum. Operculum pentagonal, outer surface with setae as in Fig. 39.

Comparative notes

Based on original descriptions and drawings of *X. bufo*, and description of *X. sandersoni*, the larvae of *X. uruzuensis* can be distinguished from those species by: (1) long setae on lateral margin of pronotum; (2) posterior angles of pronotum emarginate; (3) posterior angles of the meso- and metanotum sharp, produced posteriorly, with short setae without spines and (4) body largest.

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