Rhinocricidae Systematics I: The taxonomic placement of the species of *Zipyge* Chamberlin, 1925 and *Oxypygides* Chamberlin, 1922 (Diplopoda: Spirobolida: Rhinocricidae: Oxypyginae)

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Abstract

The rhinocricid genera *Zipyge* and *Oxypygides* are considered to be junior synonyms of the genus *Oxypyge*.The following new combinations are established:*Oxypyge lapidicina* (Chamberlin, 1922) and *Oxypyge mesites* (Chamberlin, 1922), both from *Oxypyg*ides. The current status of rhinocricid generic level taxonomy is introduced, the limits of *Oxypyge* Silvestri are discussed, and the type specimens of the type species of the nominal genera *Zipyge* and *Oxypygides* are redescribed.

Key Words: Diplopoda, milliped, Spirobolida, *Oxypyge*, millipede taxonomy, Rhinocricidae classification

Introduction

This paper is the first in a series, undertaken by the first author, which will begin to address the taxonomy and systematics of the worldwide rhinocricid genera. The primary aim of this series will be to simplify rhinocricid taxonomy by eliminating or redefining many of the problem genera that currently exist – an endeavor that coincides with a preparation of a more thorough, phylogenetic, treatment of the family.

Like many millipede taxa, the Rhinocricidae have both monotypic and paraphyletic/highly artificial genera. As relative newcomers to diplopod taxonomy, we find the criteria used by many millipede workers (past and present) for establishing higher taxa mysterious. It is apparent that the simple somatic and genitalic morphology of species placed in the family Rhinocricidae makes this group particularly challenging; also, this situation appears to be further confounded by the lack of any attempt to apply a phylogenetic approach to defining genera. At best, many genera appear to be delimited using phenetic criteria. That is, higher taxa are recognized on the basis of divergent somatic morphology. Such an approach that heavily weights autapomorphic characters likely produces a classification system that is a mire of paraphyletic and polyphyletic taxa. One could argue that autapomorphic higher taxa convey some information about the "level" of taxonomic divergence. However, higher–level taxa should be used to group taxa on the basis of recent common ancestry, not exclusionary divergence or overall similarity.

The past establishment of paraphyletic taxa based on autapomorphies in the Rhinocricidae is not nearly as problematic as the erection of genera for the purposes of convenience. For example, Jeekel (2001) has recently, with very little justification, erected two new genera (*Carlocricus* and *Australocricus*) for "the purpose of clarity in taxonomic position of certain well described species" (p. 20). Jeekel (2001) has also chosen to ignore Hoffman's (1974) well-supported synonymies of a number of likely artificial

Australasian genera. These unjustified nomenclatural changes made by Jeekel will be dealt with in subsequent papers.

The primary purpose of this short paper is to provide a brief taxonomic assessment of the rhinocricid genera attributed by Chamberlin (1922) to the subfamily Oxypyginae: *Oxypyge* Silvestri, 1896, *Zipyge* Chamberlin, 1925 and *Oxypygides* Chamberlin, 1922. We briefly redescribe *Oxypyge varicolor* Silvestri 1896 on the basis of putative conspecifics from Panama. The holotypes of *Oxypyge ferruginipes* Chamberlin, 1922 and *Oxypygides mesites* Chamberlin, 1922 (the type species of *Zipyge* and *Oxypygides*, respectively) are also redscribed. Both genera are considered here to be junior synonyms of *Oxypyge*. The redescriptions provided in this paper are simple and focus mainly on illustrating those characters that are likely to be useful for generic level diagnosis and summarise characters that document justification for the proposed taxonomic changes.

Terminology and Methods

All measurements are given in millimeters, ocelli counts are taken from the left side, labral setae counts are taken from the left and right side and denoted by a hyphen. Millipede size is estimated, when possible, by width measurements taken at three points (segment number given parenthetically after measurement), using digital calipers accurate to 0.01mm. Terminology used to describe male gonopodal structures is taken from Bond and Sierwald (2002). Although this terminology may not reflect true homologies, we retain this nomenclatural scheme to ease comparisons.

Taxonomy

Family Rhinocricidae Brölemann, 1913

Subfamiliy Oxypyginae Chamberlin, 1922

***Oxypyge* Silvestri, 1896**

Oxypyge Silvestri 1896. Bollettino dei Musei di Zoologia ed Anatomia comparata della R. Università di Torino. 11(254):4. Type species: *Oxypyge varicolor* Silvestri, 1896, by monotypy. Hoffman 1999. Checklist of the Millipeds of North and Middle America. p. 94.

Zipyge Chamberlin 1925. Proceedings of the Biological Society of Washington. 38:40. Type species: *Oxypyge ferruginipes* Chamberlin, 1922. Proceedings of the U.S. National Museum. 60(8): 27, by original designation. **syn. nov.**

Oxypygides Chamberlin 1922. Proceedings of the U.S. National Museum. 60(8):24. Type species: *Oxypygides mesites* Chamberlin, 1922. Proceedings of the U.S. National Museum. 60(8):25, by original designation. Hoffman 1999. Checklist of the Millipeds of North and Middle America. p. 95. **syn. nov.**

Diagnosis: Males with a simple, unmodified anterior gonopod (Figs. 1,2). Telopodite of posterior gonopod long (Fig. 3), extending 2–3 millimeters beyond modified sternal tergite (Fig. 4). Distal most aspect of telopodite acutely spatulate (differing from that of *Eurhinocricus* which is spatulate along its entire length). Solenomere slender (Fig. 3, Sm). Most specimens with anal valves of epiproct elongate and armed with a dorsal hook or acute point (Figs. 5, 6). Antennae with 4 to numerous sensory cones.

First ring segment (segment after collum) ventrally unmodified or modified with a distinct pit (2 species previously attributed to *Oxypygides*; see below).

***Oxypyge varicolor* Silvestri, 1896 (Figs. 1 – 6)**

Material examined: Three male and three female specimens from Panama, Pearl Island, coll. J.P.E. Morrison, 23 Aug 1944 (deposited in U.S. National Museum), det. by R. Hoffman 23 February 1960.

Male: Coloration of preserved material: head, antennae, and collum very light yellowish brown (Fig. 4). Collum slightly darker with lighter margins. All other segments distinctly banded. Prozonite light cream color, metazonite dark brown with light cream colored posterior margin.

Antennae with numerous sensory cones, flattened laterally, incrassate distally. 10 – 10 labral setae, clypeal groove dark and distinct, 37 ocelli. Width 3.36 (1) – 3.48 (16) – 3.32 (45), 47 ring segments. Distinct scobinae on segments 7–31, diminishing in size posteriorly. Tarsi lacking ventral pads. Epiproct short, not extending beyond paraprocts. Anal valves elongate, with dorsal hook (Figs. 5). Hypoproct long, triangular with blunt terminal end, not extending beyond paraprocts.

Anterior and posterior gonopods illustrated in Figs 1–3. Sternum narrow distally (Fig. 2), coxae (Cx) and telopodite (Tp) as in other related rhinocricids (Fig. 1). Posterior gonopod telopod (Tp, Fig. 3) long and spatulate distally with a membranous interior. Seminal canal (Sc) visible extending from the coxae (Cx) to the solenomere (Sm). Seventh segmental ring posteroventrally modified as a postgenital bar to accommodate gonopods (Fig. 1). Posterior gonopods *in situ* extending ~2.0 mm from gonopodal cavity.

Female: Coloration as described for males. Antennae with numerous sensory cones, 10 – 10 labral setae, clypeal groove distinct, 36 ocelli. Width 3.87 (1) – 4.35 (20) – 3.35 (48), 50 ring segments. Scobinae not formed as distinct pits but appearing on ~8th segment as a dorsal pair of light scars, much less prominent than in males. Anal valves and terminal ring segments as in males (Fig. 6).

Remarks: Silvestri's (1896) description and illustration of *Oxypyge* is not sufficient to confidently ascertain his concept of the genus. However, references to the elongate anal valves and the depiction of a spatulate posterior gonopod indicate that Chamberlin's (1922 and 1925) subsequent placement of a number of Central American species in the genus was probably justified. Kraus' placement of the Peruvian species, *O. tingomariae* Kraus, 1957, in *Oxypyge* seems biogeographically and morphologically questionable. Although the anal valve conformation illustrated by Kraus depicts a morphology similar to that of *Oxypyge*; though the anterior and posterior gonopod morphology, particularly that of the solenomere (very robust), does not support placement of this species in the genus. Moreover, anal valve modification is ubiquitous throughout Rhinocricidae and is likely very plastic among taxa--thus not a feature that should be used alone as a synapomorphy for a genus.

***Oxypyge ferruginipes* Chamberlin, 1922 (Figs. 7 – 11)**

Oxypyge ferruginipes Chamberlin 1922. Proceedings of the U.S. National Museum. 60(8):27, pl. 11, figs. 8-12.

Zipyge ferruginipes (Chamberlin 1922), Chamberlin 1925. Proceedings of the Biological Society of Washington. 38:40.

Type material examined: Male holotype from Guatemala, Cacao, coll. O.F. Cook, April 1906 (deposited in the USNM).

Additional material examined from near type locality: Male from Guatemala, Dept. Izabal, Finca Las Ilusiones (along Highway CA9), 26.8 km bearing 220° true N from Puerto Barrios, elev. 95 m, coll. J. Bond, 4 June 2000 (deposited in FMNH).

Male holotype: Color of preserved material badly faded, head, antennae, and collum very light yellowish brown (Fig. 7). Collum slightly darker with lighter margins. All other segments distinctly banded. Prozonite light cream color, metazonite dark brown with light cream colored posterior margin. Chamberlin (1922) described the coloration of this specimen as "olive black, running into brown" with ferruginous legs.

Antennae with 4 sensory cones, flattened laterally, incrassate distally. 10–10 labral setae, clypeal groove dark and distinct, 26 ocelli. Width 3.77 (collum), 4.43 (midbody), 3.89 (45), 50 ring segments. Distinct scobinae on segments ~7 – 46, diminishing in size posteriorly. Tarsi lacking ventral pads. Epiproct short, not extending beyond paraprocts. Anal valves elongate, with dorsal hook (Fig. 8). Hypoproct long, triangular with blunt terminal end, not extending beyond paraprocts.

Anterior gonopod and telopodite of posterior gonopod as illustrated in Figs. 9-11. Sternum narrow distally with distinct ridge along medial aspect (Fig. 10), Cx and Tp as in other rhinocricids (Fig. 9). Posterior gonopod telopod (Tp, Fig. 11) long and spatulate distally with a membranous interior. Seminal canal (Sc) visible, extending from the Cx to the Sm. Seventh segmental ring posteroventrally modified as a postgenital bar to accommodate gonopods. Posterior gonopods *in situ* extending ~2.0 mm from gonopodal cavity.

Remarks: Chamberlin (1925) separated this species from *Oxypyge* and established *Zipyge* because it had more slender antennae with only four sensory cones. As pointed out by Hoffman (1974) antennal characters, number of sensory cones in particular, are not "at all useful in the definition of "natural" genera in this family". The combination of gonopodal and terminal segment morphology support placement of this species in *Oxypyge*.

***Oxypyge mesites* (Chamberlin, 1922) comb. nov.**

Oxypygides mesites Chamberlin 1922. Proceedings of the U.S. National Museum. 60(8):25, pl. 10, figs. 11,12; pl. 11, figs. 1,2. Hoffman 1999.

Type material examined: Male holotype and female paratype from Guatemala, Cacao, coll. O.F. Cook, April 1906 (deposited in the USNM).

Additional material examined from near type locality: Male from Guatemala, Dept. Izabal, Finca Las Ilusiones (along Highway CA9), 26.8 km bearing 220° true N from Puerto Barrios, elev. 95 m, coll. J. Bond, 4 June 2000 (deposited in FMNH).

Male holotype: Specimen quite damaged (numerous segments detached and broken). Color of preserved material badly faded--head, antennae, and collum very light yellowish brown (Fig. 12). Segments appear to have had some banding. Chamberlin (1922) described the coloration of this specimen as black from above with the posterior of each segment fulvous to chestnut.

Antennae with only four sensory cones, flattened laterally, incrassate distally. 14–13 labral setae, clypeal groove dark and distinct, 33 ocelli. Width at collum 5.40 , ~50 ring segments. Distinct scobinae on numerous segments, apparentlydiminishing in size posteriorly. Tarsi lacking ventral pads. Epiproct short, not extending beyond paraprocts. Anal valves elongate, with dorsal hook (Fig. 13). Hypoproct long, triangular with blunt terminal end, not extending beyond paraprocts.

Anterior gonopod as illustrated in Figs. 14, 15. Sternum (Fig. 15), Cx and Tp as in other rhinocricids (Fig. 14). Posterior gonopod telopod (Tp, Fig. 16) long and spatulate distally with a membranous interior. Seminal canal (Sc) visible extending from the Cx to the solenomere Sm. Seventh segmental ring posteroventrally modified as a postgenital bar to accommodate gonopods.

***Oxypyge lapidicina* (Chamberlin, 1922) comb. nov. (Figs. 12 – 17)**

Oxypygides lapidicina Chamberlin 1922. Proceedings of the U.S. National Museum. 60(8):26, pl. 11, figs. 3-7. MALE HT (deposited in USNM, not examined). Guatemala: Dept. Alta Verapaz, Candelaria Rocks, Scamay Estuary. Hoffman 1999. Checklist of the Millipeds of North and Middle America. p. 96.

Remarks: Oxypygides represents, as noted by Hoffman (1999), "another highly artificial taxon". Chamberlin (1922) considered this genus to be separate from *Oxypyge* based on modifications to the first ring segment ("having a deep characteristic pit", Fig. 13) and having an anal tergite that is rounded rather than acute. The two species placed in *Oxypigydes* appear to be united as sister taxa based on the presence of these deep pits; the unique modification of the anal tergite is, however, not apparent. Although likely a good synapomorphy, both species share gonopod and anal valve features that place them solidly in *Oxypyge*, thus, *Oxypygides* is considered here to be paraphyletic with respect to *Oxypyge* and is therefore synonymized.

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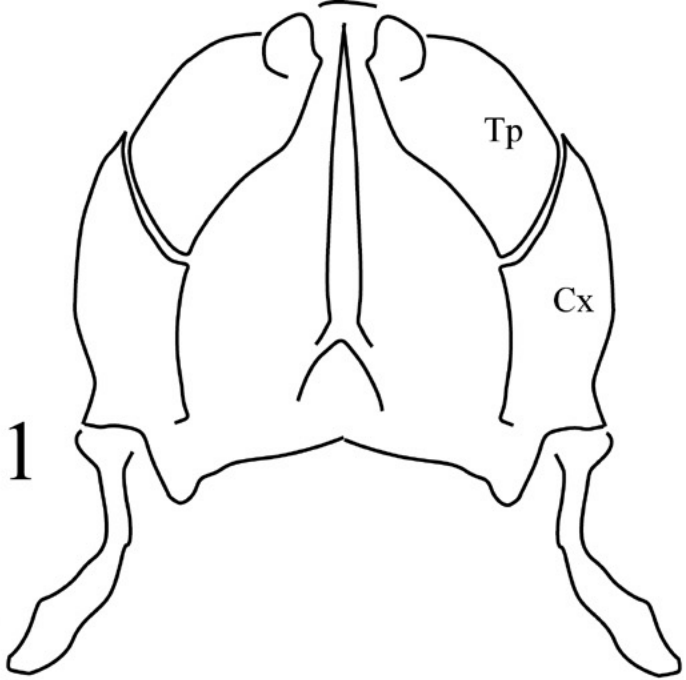
Figure Captions

Figures 1-6. *Oxypyge varicolor* Silvestri, 1896. 1, anterior gonopod, posterior view. 2, anterior gonopod, anterior view. 3, left posterior gonopod. 4, lateral view of male anterior segments, arrow points to gonopods. 5, posterior segments, male. 6, posterior segments, female. [Scale bar = 1.0 mm (Figs. 1 – 3)]

Figures 7-11. *Oxypyge ferruginipes* Chamberlin, 1922, male holotype. 7, lateral view of male anterior segments. 5, posterior segments, male. 9, anterior gonopod, posterior view. 10, anterior gonopod, anterior view. 11, left posterior gonopod. [Scale bar = 1.0 mm (Figs. 9 – 11)]

Figures 12-17. *Oxypyge mesites* (Chamberlin, 1922), male holotype. 12, lateral view of male anterior segments. 13, ventral view of anterior segments, arrow points to pits on first ring segment. 14, posterior segments, male. 15, anterior gonopod, posterior view. 16, anterior gonopod, anterior view. 17, left posterior gonopod. [Scale bar = 1.0 mm (Figs. 15 – 17)]



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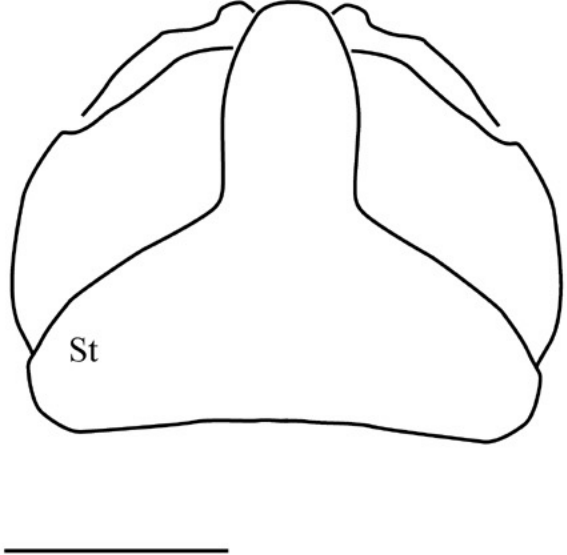

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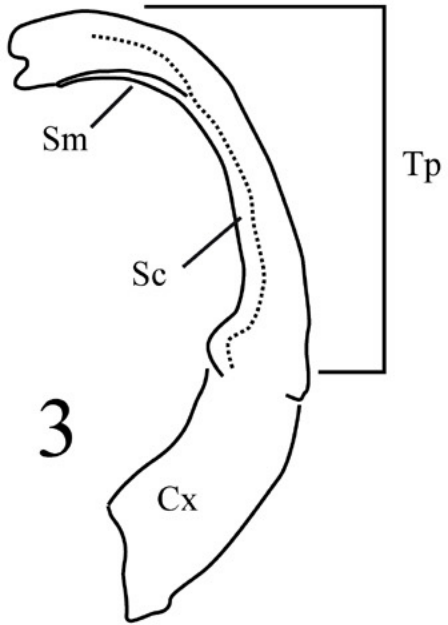

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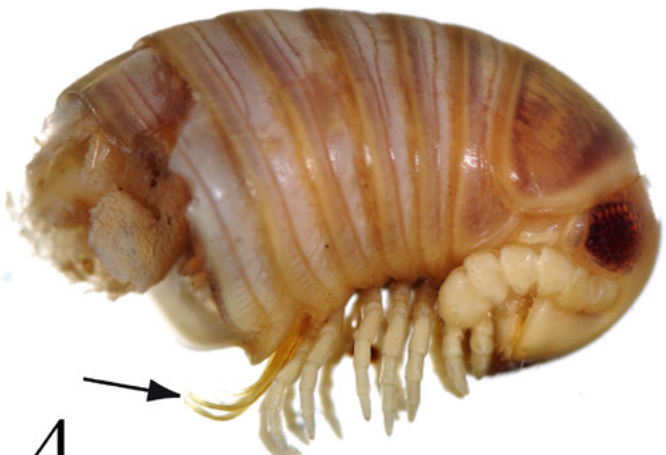

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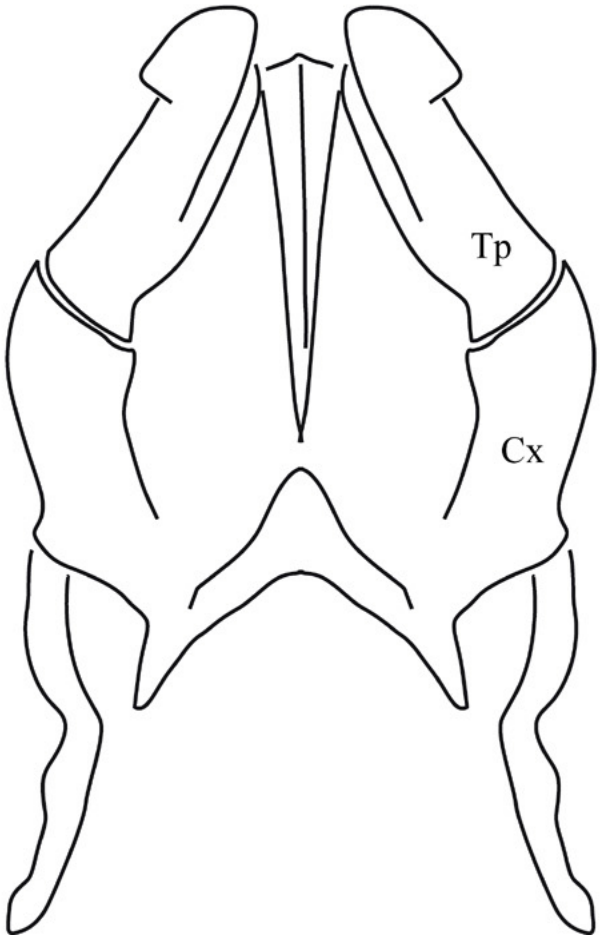

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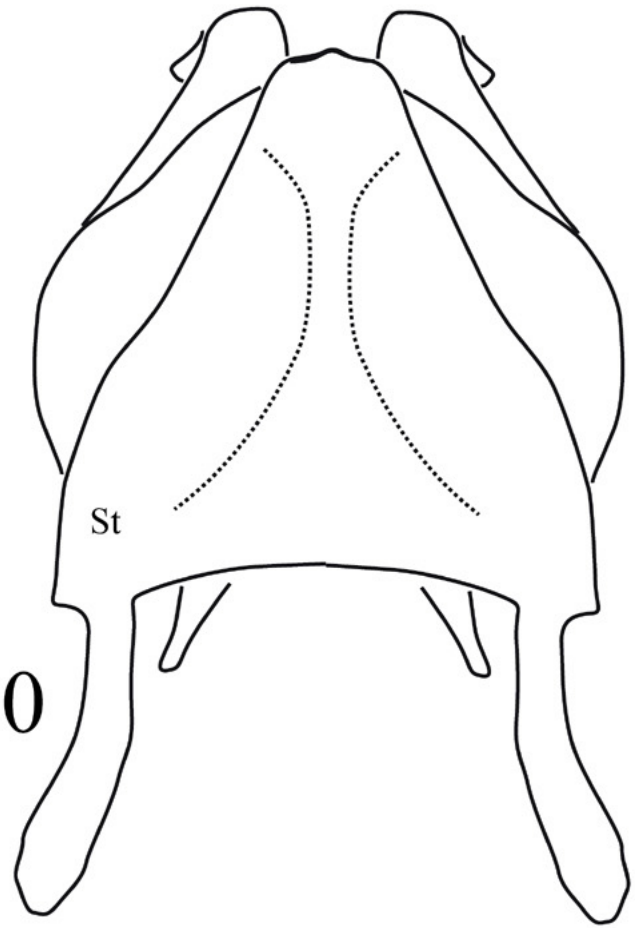

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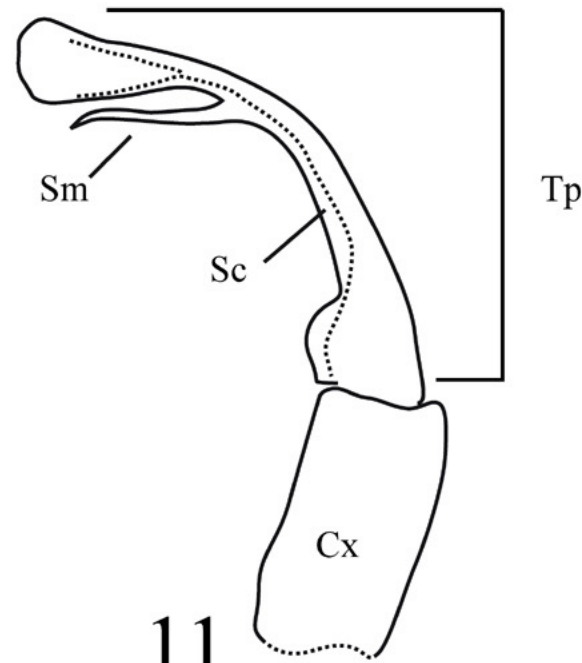

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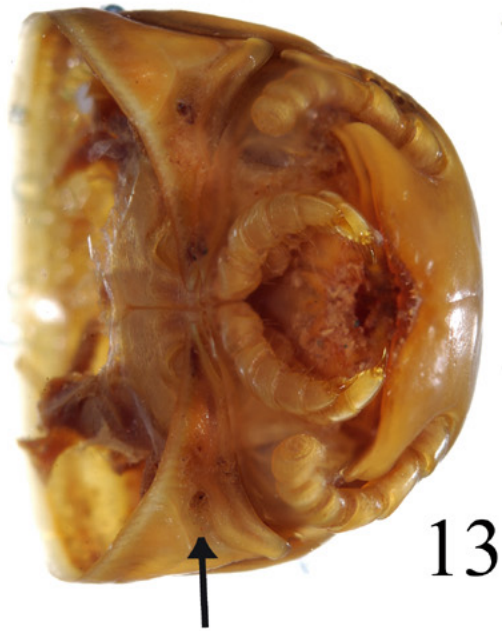

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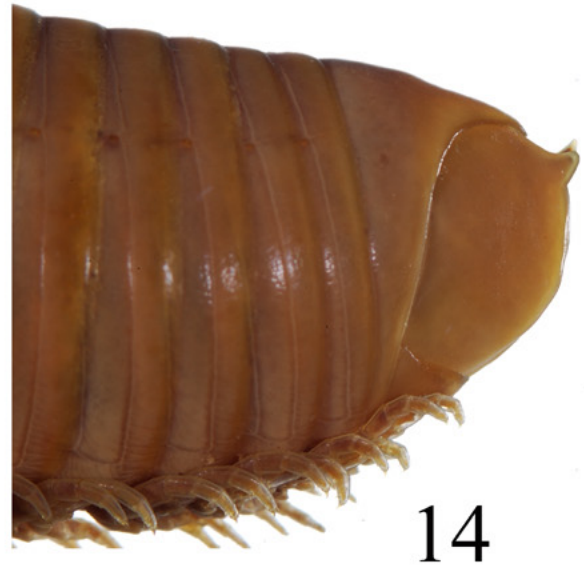

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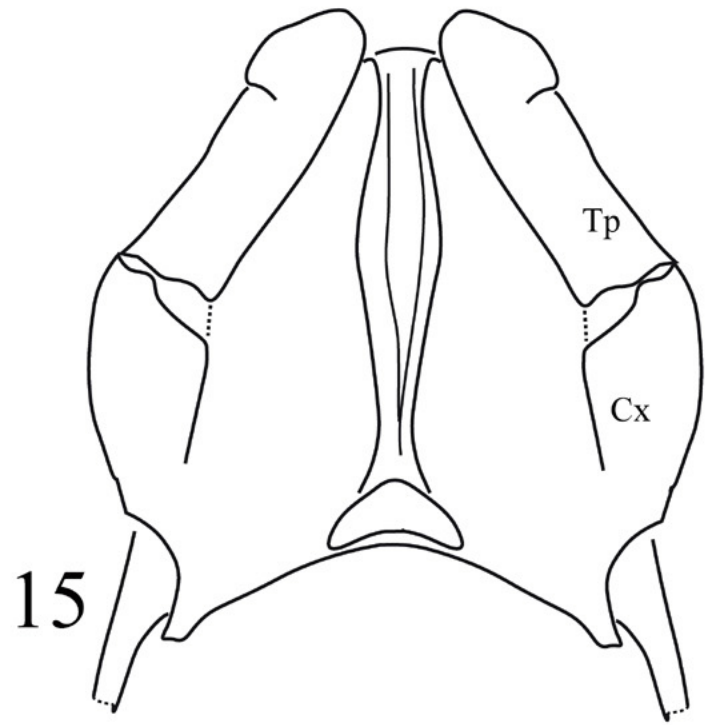

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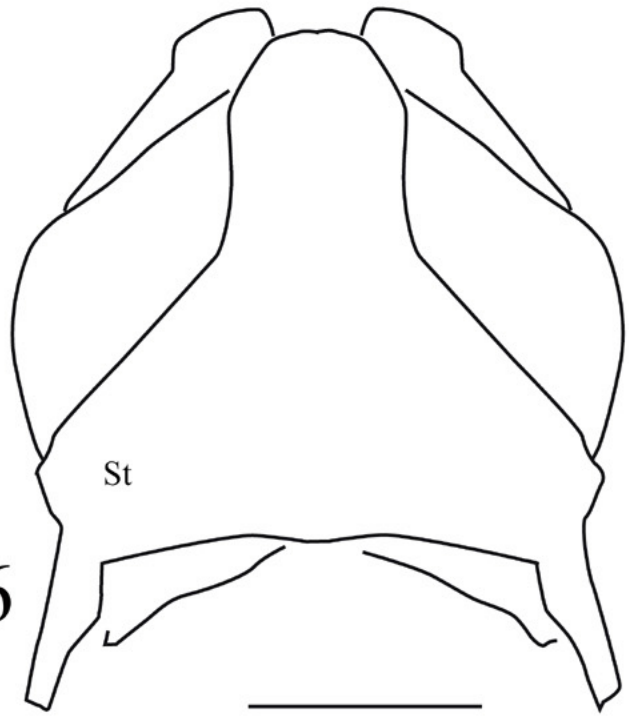

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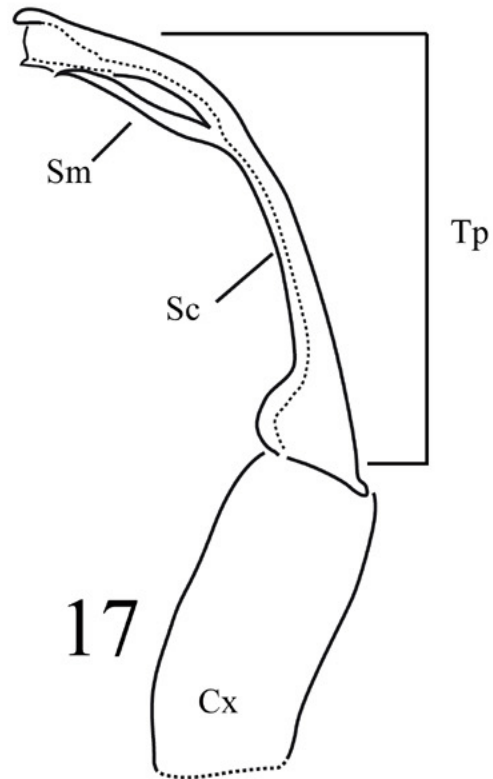

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