



Acanthagrion marinae sp. nov. (Zygoptera: Coenagrionidae): a new species of the *apicale* group

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ABSTRACT

Acanthagrion marinae sp. nov. (Holotype male: BRASIL, Mato Grosso do Sul, Campo Grande, UFMS, 20°29'56.26"S - 54°36'48.43"W, 547m, leg. M.E. Rodrigues, 03.ii.2015, collection code: VZYG437, MLP) is described and illustrated on the basis of 15 males. The new species belongs to the *apicale* species group by having horns on S10 and sclerotized hooks on tip of distal segment of the genital ligula. It can be easily distinguished from other species of the group by a combination of characters of the genital ligulae (presence of setae on segment two; absence of setae at flexure; distal lateral lobes of segment three absent). Notes on habitat and a modification of previous keys for the species of the *apicale* group are provided.

Key words: *Acanthagrion*, Coenagrionidae, Neotropics, Odonata, Zygoptera.

INTRODUCTION

The neotropical genus *Acanthagrion* was erected in 1876 by Baron Edmond Selys-Longchamps to include nine species of Coenagrionidae. Currently it includes 44 coenagrionids ranging from Texas (USA) to Buenos Aires (Argentina) (Garrison et al. 2010, Machado 2012). According to von Ellenrieder and Lozano (2008) and Garrison et al. (2010) species of *Acanthagrion* are small to medium size with wings generally hyaline, CuP of HW reaching posterior margin of wing; flexure of male genital ligula short with lateral lobes of segment 3, when present, distal to flexure; male

cerci decumbent forming an angle of 45° with posterior margin of S10, with dorso-basal tubercle; females without a well defined mesepisternal carina between mesostigmal plates and medio-dorsal carina, generally with mesepisternal fossae on the dorsum of the pterothorax and vulvar spine on abdominal segment S8.

Leonard (1977) provided the first revision of the genus in which he defined nine species groups. The three species originally included within the *apicale* species group (*A. apicale*, *A. obsoletum*, and *A. phallicorne*) share the presence of horns in S10 of males, elevated mesepisternal fossae in females, and presence of orange coloration in head and thorax of mature specimens. *Acanthagrion apicale* and *A. obsoletum* also share the presence

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of sclerotized hooks on either side of the tip of distal segment of genital ligula. Muzón and Lozano (2005) described *A. hartei* from Ecuador and included it within the *apicale* group, based on shared characters with its members. Recently Machado (2012) provided a revision of the group and added four new species (*A. chicomendesi*, *A. flaviae*, *A. kaori*, and *A. triangulare*), and accorded specific rank for Fraser's *A. apicale descendens*, bringing the total number of species of the group to nine.

In this contribution a new species of the *apicale* species group from Brazil and Paraguay is described, diagnosed and illustrated.

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MATERIALS AND METHODS

Specimens were studied with the aid of a Leica MS5 stereomicroscope in the Laboratorio de Biodiversidad y Genética Ambiental (BioGeA) of the Universidad Nacional de Avellaneda (UNDAV). Illustrations were made with the aid of digital camera coupled to the stereomicroscope and an open-source design program (Inkscape version 0.91. at www.inkscape.com) and are not to scale. Specimens for SEM were cleaned in acetone, air dried and mounted on SEM stubs with carbon-conductive adhesive tabs, and then sputter coated with gold/ palladium alloy and examined with a Jeol JSM 6360 LV scanning electron microscope in the Museo de La Plata, Buenos Aires, Argentina.

Wing venation follows Riek and Kukalová-Peck (1984), modified by Bechly (1996). Abbreviations for structures used throughout the text are as follows: FW: forewing; HW: hindwing; pt: pterostigma; Ax: antenodals; Px: postnodals; pt: pterostigma. S1–10: abdominal segments 1 to 10. Color pattern terminology of thorax follows

Westfall and May (2006). Color pattern of head and abdomen follows Lozano (2013).

Collection acronyms used in the text:

BioGeA: Laboratorio de Biodiversidad y Genética Ambiental, Avellaneda, Argentina

MLP: Departamento Científico Entomología, Museo de La Plata, La Plata, Argentina

UFMS: Universidade Federal de Mato Grosso do Sul, Mato Grosso do Sul, Brazil

UFSCAR: Universidade Federal de São Carlos, São Paulo, Brazil

Measurements are given in mm. A list of examined material is provided; country, department, state, province or any other political/administrative equivalent subdivision, locality (names of localities were transcribed from the label and are not translated to English), geographic coordinates and altitude, collector/s, date of collection, number and sex of specimens, and deposition of material are indicated. When geographic coordinates were not included in the original label, they were culled from the Global Gazetteer website (<http://www.fallingrain.com/world/>) with the aid of Google Earth version 7.1.7.2606, and these data are enclosed in braces ({}). The map was created electronically using QGIS version 2.16.3.

RESULTS

Acanthagrion marinae sp. nov.

ZooBank Life Science Identifier (LSID) - urn:lsid:zoobank.org:act:D1F0D354-41FC-444A-B57B-71CBA362904C

Types. Holotype ♂: BRASIL, Mato Grosso do Sul, Campo Grande, UFMS, 20°29'56.26''S - 54°36'48.43''W, 547m, leg. M.E. Rodrigues, 03.ii.2015, MLP. Paratypes 14 ♂: BRASIL, Mato Grosso do Sul: Campo Grande, Anhanduí, 20°30'24.18''S - 54°38'28.60''W, 507m, leg. M.E. Rodrigues, 24.xi.2014, 3♂, UFSCAR; Campo Grande, Brejo bonito, 20°32'05.96''S - 54°44'52.91''W, 493m, leg. M.E. Rodrigues,

15.xi.2014, 1♂, MLP; Campo Grande, Córrego Bandeira, 20°29'33.68"S - 54°34'44.50"W, 598m, leg. L.C. Alves, 16.i.2015, 1♂, MLP; Campo Grande, Cotia, 20°32'37.78"S - 54°41'29.08"W, 508m, leg. L.C. Alves, 22.i.2015, 3♂, MLP; Campo Grande, Lageado, 20°32'26.99"S - 54°38'23.64"W, 498m, leg. L.C. Alves, 20.i.2015, 1♂, MLP; Campo Grande, Morada do sol, 20°39'18.94"S - 54°21'59.53"W, 544m, leg. E.B. Moura, 16.i.2015, 1♂, MLP; Campo Grande, Norberto, 20°34'16.61"S - 54°36'31.33"W, 536m, leg. M.E. Rodrigues, 24.xi.2014, 2♂, BioGeA; Campo Grande, Prainha, 20°33'57.66"S - 54°30'21.21"W, 602m, leg. M.E. Rodrigues, 02.ii.2015, 1♂, MLP. PARAGUAY, Cerro Corá, {22°37'00"S - 55°59'00"W, 266m}, leg. L.A. Bulla, 30.xi.1973, 1♂, MLP.
Specimens examined. 15♂

ETYMOLOGY

The name *marinae* (Latinized genitive feminine noun) pays homage to the memory of Marina dos Santos Rodrigues, mother of Marciel E. Rodrigues one of the authors of this article.

DIAGNOSIS

Pale color areas of head and thorax are light blue; this can easily differentiate *A. marinae* from most other species included within the *apicale* group (except for *A. descendens* and some specimens of *A. obsoletum*). However, coloration has proven not to be a reliable character since other orange species within *Acanthagrion* (*A. obsoletum* and *A. ascendens*) have both morphs (Machado 2012). *Acanthagrion marinae* has horns on S10 with tips rounded, directed dorso-posteriorly and not surpassing distal margin of S10; this combination of characters is unique within the *apicale* group. Cerci with inner margin straight longer than the length of S10 can easily differentiate this species from *A. obsoletum*. Genital ligulae with setae on

segment 2 is only shared with *A. phallicorne*; from which it can be easily separated because *A. marinae* lacks setae on flexure. Tip of segment 3 with sclerotized hooks on either side.

Description of holotype male (Fig. 1):

Head. Labrum light blue postero-median spot black; anteclypeus light blue; postclypeus light blue with two black spots and posterior margin black; antefrons light blue; epicranium mostly black with two greenish light blue spots behind scape, a very diffuse greenish spot next to each ocellus, a T-shaped spot within ocellar triangle; occipital bar greenish light blue; antennifer and scape anteriorly light blue, posteriorly black; remainder of the antenna missing; postocular spots greenish light blue, subrectangular, approximately equal in size to ocellar triangle; most posterior point of head located at compound eyes; occipital area pale brown, except for two dark brown rounded spots on each side of occipital foramen.

Prothorax. Anterior lobe with central spot greenish light blue occupying almost all of dorsum, remainder of dorsum black, mostly black laterally except for narrow anterior greenish light blue spot; middle lobe entirely black, dorsolateral spots greenish light blue, propleuron greenish light blue; posterior lobe black with greenish light blue lateral streaks; lateral margins rounded lacking a medial projection.

Pterothorax (Fig. 1a). Predominantly greenish light blue. Mid-dorsal black stripe not interrupted at middorsal carina; antearial sinus black; antehumeral

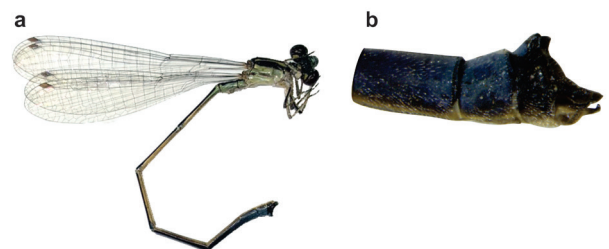


Figure 1 - a. Holotype, general view; b. Holotype, terminalia lateral view.

stripe light greenish blue, uninterrupted but not reaching antealar crest; anterior to posterior limit of mesinfraepisternum antehumeral stripe widening slightly; humeral stripe black; interpleural suture black; incomplete stripe on metapleural suture pale brown; mesinfraepisternum black with postero-ventral angle greenish light blue; metinfraepisternum pale greenish light blue; venter of thorax pale brown without black spots; mesostigmal plates without diagonal carina, with inner half black and outer half light blue, without modifications on posterior angle; interlaminar sinus black; anterior margin of sinus slightly convex; lateral tips rounded not projected anteriorly.

Legs. Coxae and trochanters pale brown; femora with extensor margin black, flexor margin pale brown; tibiae with extensor margin pale brown except for a longitudinal row of elongated black spots just behind row of external spurs, flexor margin black, femoral spurs shorter than intervening spaces, tibial spurs equal to intervening spaces; tarsi pale brown with tips black.

Wings (Fig. 2). CuP reaching posterior margin of wing; arculus opposite Ax2. FW left: Px 11; RP2 beginning between Px4 and Px5; IR1 beginning at Px8; four cells posterior to pt. FW right: Px 10; RP2 beginning at Px5; IR1 beginning at Px8; five cells posterior to pt. HW left: Px 9; RP2 beginning between Px3 and Px4; IR1 beginning at Px7; five cells posterior to pt. HW right: Px 9; RP2 beginning

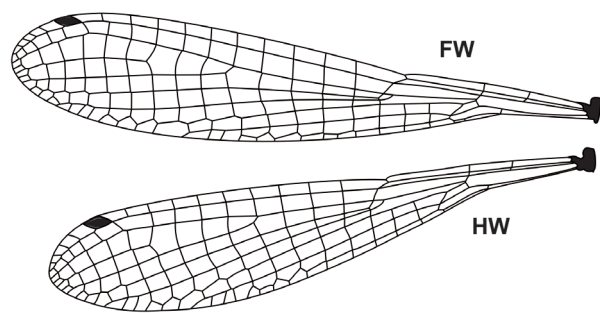


Figure 2 - Holotype, wings.

between Px3 and Px4; IR1 beginning at Px8; five cells posterior to pt.

Abdominal segments. S1: tergum: posterior margin of anterior spot in contact with posterior stripe of S1; posterior stripe complete, its central region in contact with posterior margin of tergum; lateral margins in contact with ventrolateral margins of tergum in lateral view; sternum: pale brown, with a triangular black spot on anterior margin; S2: tergum: dorsal spot subrectangular, widening posteriorly; anterior margin in contact with anterior margin of tergum; posterior margin in contact with posterior stripe of S2; posterior stripe in contact with posterior margin of tergum; lateral margins reaching halfway down terga in lateral view; sternum: anterior lamina and posterior hamuli pale brown; anterior hamuli greenish light blue; S3 to S6: terga: dorsal T-shaped spots reaching anterior margin through thin black line; anterior margins blunt; lateral arms directed anteriorly in S3 and S4, reaching halfway down terga in lateral view; posterior stripes visible in S3 and S4; sternum: pale brown with black midventral line; S7: tergum: subapical row of spines present; with a black subrectangular spot that occupies the anterior two thirds of tergum; posterior margin with a triangular concavity posterior third light blue, except for a thin black spot posterior to subapical row of spines; sternum: pale brown with black midventral stripe; S8 and 9 (Fig. 1b): Light blue except for a thin black spot posterior to subapical row of spines; subapical row of spines present; sternum: pale brown with black midventral stripe; S10 (Figs. 1b, 3c): tergum trapezoidal in lateral view; posterior margin with horns that do not surpass posterior margin of S10 in lateral view; tergum black with a mid-dorsal reniform light blue spot; venter pale brown. Height of S10 / height of S9 1.32.

Genital ligula (Fig. 3a-b). Segment 2 with setae on lateral margins; flexure shorter than segment 3, without setae. Segment 3 with lateral lobes located at 0.5 the length of segment 3;

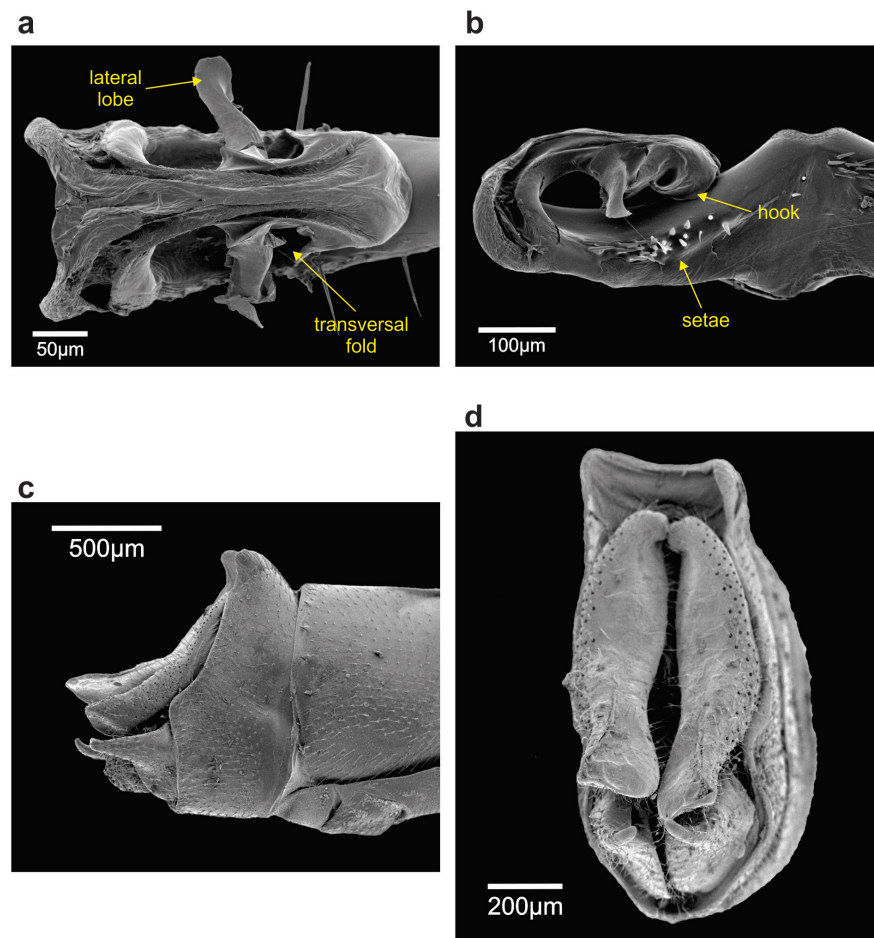


Figure 3 - a. Paratype Brazil, genital ligula ventral view; b. Paratype Brazil, genital ligula lateral view; c. Paratype Brazil, male terminalia lateral view; d. Paratype Brazil, male terminalia posterior view.

ental surface transversal fold between lateral lobes and apicolateral lobes (TL and ML sensu Machado 2012); distal margin without indentation; apicolateral lobes with sclerotized hook.

Cerci (Fig. 3c-d). Black with inner surface slightly paler. Basal tubercle rounded. Inner margin in dorso-medial view almost straight; tips rounded. Dorsal margin in lateral view with two constrictions.

Paraprocts (Fig. 3c-d). Base pale brown; apophysis black with tips acute, in lateral view with tips directed upwards, in ventral view tips directed inwards. Paraprocts not surpassing tip of cerci.

MEASUREMENTS

Head: max. length 0.94; width between compound eyes along anterior margin 1.37. **Legs:** femur 1 length 1.37; femur 2 length 1.75; femur 3 length 2.22. **Wings:** FW length left 16.81, right 16.94; HW length left 15.69, right 15.69. **Abdomen:** max. length 24.91; S1 max. length 0.57; S2 max. length 1.37; S3 max. length 4.11; S4 max. length 4.49; S5 max. length 4.58; S6 max. length 4.23; S7 max. length 3.31; S8 max. length 1.37; S9 max. length 0.76; S10 max. length 0.47; S9 height 0.90; S10 height 1.18. **Cerci:** length: 0.94; distance surpassing posterior margin of S10 in lateral view 0.38. **Paraprocts:** distance surpassing posterior

margin of S10 in lateral view 0.33. **Total length** 30.26.

VARIATIONS IN PARATYPES

Little variation was observed in the paratypes; minor differences in the extent of black color of head and thorax probably are due to age differences. No differences were observed in genital ligula or male terminalia. Wings: CuP reaching posterior margin of wing or CuP&AA'; arculus opposite Ax2 or slightly distal to it. FW left: Px 10 (60%) or 11 (40%); RP2 beginning between Px4 and Px5 (50%) or at Px5 (50%); IR1 beginning at Px7 (30%) or at Px8 (70%); four (70%) or five (30%) cells posterior to pt. FW right: Px 10 (50%) or 11 (50%); RP2 beginning between Px4 and Px5 (50%) or at Px5 (50%); IR1 beginning at Px7 (30%), at Px8 (60%) or at Px9 (10%); three (10%), four (40%), five (30%) or six (20%) cells posterior to pt. HW left: Px 8 (30%) or 9 (70%); RP2 beginning between Px3 and Px4 (40%) or at Px4 (60%); IR1 beginning at Px7 (100%); five (80%) or 6 (20%) cells posterior to pt. HW right: Px8 (30%), 9 (60%) or 10 (10%); RP2 beginning between Px3 and Px4 (60%), at Px4 (30%) or between Px4 and Px5 (10%); IR1 beginning at Px6 (10%), between Px6 and Px7 (10%) or at Px7 (80%); four (40%), five (50%) or six (10%) cells posterior to pt.

MEASUREMENTS (N=10)

Head: max. length 0.89 [0.80–0.94]; width between compound eyes along anterior margin 1.34 [1.23–1.42]. **Legs:** femur 1 length 1.30 [1.18–1.42]; femur 2 length 1.75 [1.56–1.84]; femur 3 length 2.12 [1.95–2.36]. **Wings:** FW length left 16.43 [15.44–18.06], right 16.42 [15.69–17.81]; HW length left 15.42 [14.57–17.06], right 15.62 [14.82–16.94]. **Abdomen:** max. length 24.31 [21.67–26.40]; S1 max. length 0.64 [0.60–0.71]; S2 max. length 1.33 [1.23–1.42]; S3 max. length 4.07 [3.73–4.44]; S4 max. length 4.39 [4.02–4.82]; S5

max. length 4.40 [3.92–4.91]; S6 max. length 4.15 [3.78–4.63]; S7 max. length 3.14 [2.83–3.40]; S8 max. length 1.34 [1.18–1.42]; S9 max. length 0.74 [0.70–0.80]; S10 max. length 0.48 [0.40–0.57]; S9 height 0.98 [0.87–1.09]; S10 height 1.21 [1.10–1.32]. **Cerci:** length: 0.94 [0.90–1.04]; distance surpassing posterior margin of S10 in lateral view 0.40 [0.33–0.52]. **Paraprocts:** distance surpassing posterior margin of S10 in lateral view 0.39 [0.29–0.47]. **Total length** 29.42± 1.56 [26.90–31.63].

FEMALE

Despite surveys in the area where males were collected no female has been found. Further research is needed in order to collect and describe the female.

HABITAT

Acanthagrion marinae has been recorded for Brazil and Paraguay (Fig. 4a). The specimens from Brazil were collected in the *Veredas* or palm swamps areas which are hygrophilous communities with an enormous floristic and structural complexity dominated by *Mauritia flexuosa* L. (Arecaceae). The *Veredas* feature special importance for water and biodiversity maintenance in the Cerrado biome (Alencar Fagundes and Ferreira 2016). The Brazilian Forest Code considers the *Veredas* as a permanent preservation zone (Law number 12.651/2012) due to the ecological services they provide. The Brazilian specimens were collected in urban and rural places of the municipality of Campo Grande, MS. The males were found perching on the vegetation along the stream banks or on emergent twigs within the streams (Fig. 4b), usually in sunlit clearings with dense canopy. No information is available for specimens collected in Paraguay.

DISCUSSION

Acanthagrion marinae belongs to the *apicale* species group, since it has horns on S10 and there

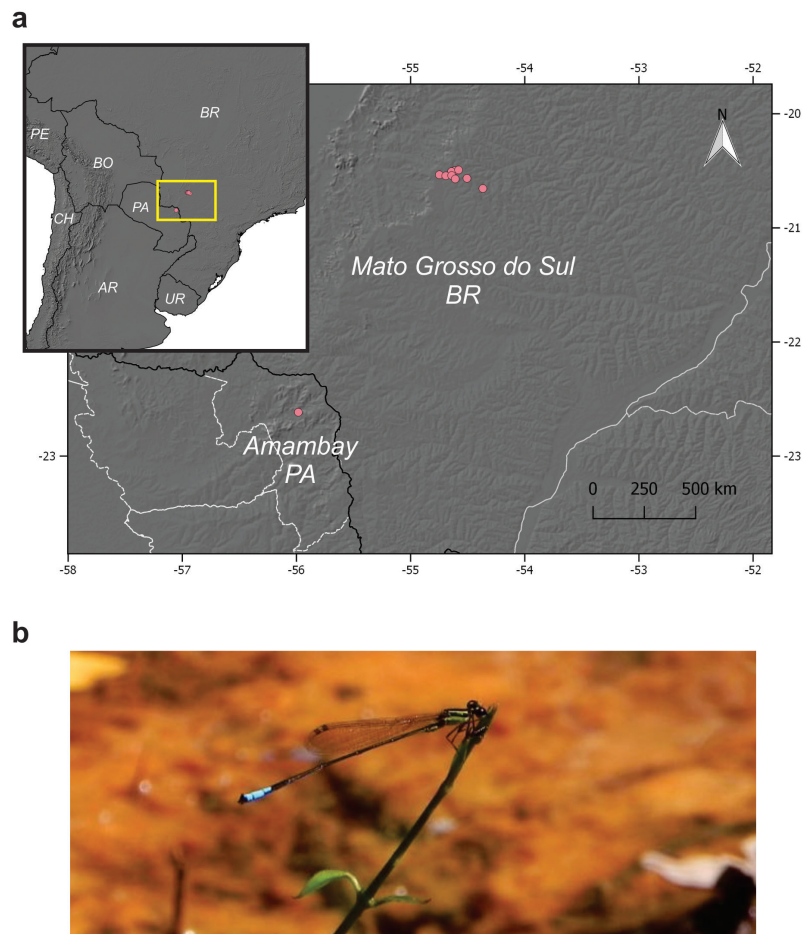


Figure 4 - a. Distribution map; b. Male perching on twig. Photo: Thiago Henrique Stefanello.

are sclerotized hooks on tip of distal segment. No orange coloration has been observed so far in the specimens of *A. marinae*. The presence of setae on segment two is only shared with *A. phallicorne*, from which can be easily differentiated because *A. phallicorne* has setae on the flexure of the genital ligulae and there are distal lateral lobes on the segment three of the penis.

According to the key provided by Machado (2012), males of *A. marinae* run to couplet 3. In order for the key to include this species we propose the following modification:

3. Penis segment 2 with a dense patch of setae on either side of midline ... 9

3' Penis segment 2 with no patch of setae ... 4
(See Machado 2012)

9. Flexure of genital ligula with setae ... *A. phallicorne*

9' Flexure of genital ligula without setae ... *A. n. sp*

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de Pessoal de Nível Superior (CAPES) nº 44/2014 – Propostas para Apoiar os Programas de Pós-Graduação no Estado de Mato Grosso do Sul (PAPOS-MS), Process: 23/200.638/2014.

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