Argia angelae (Odonata: Zygoptera: Coenagrionidae) sp. nov. from Chapada dos Guimarães, Mato Grosso, Brazil

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Abstract

Argia angelae sp. nov. (Holotype ♂, BRAZIL, Mato Grosso, Chapada dos Guimarães, Rio Salgadeira (15°21’25” S, 55°49’51” W, 305 m), 1 xi 2015, D. S. Vilela leg., in LESTES, Cod. ACR 8173A) from Chapada dos Guimarães, Brazil is described, illustrated and diagnosed based on comparison with other known sympatric species of the genus. This species inhabits streams throughout the National Park and a map of its known distribution is provided.

Key words: Damselfly, Brazil, Neotropical

Introduction

The genus Argia was erected by Rambur (1842) to include Argia impura, A. quadrimaculata (now Disparoneura quadrimaculata (Rambur, 1842)), A. obscura (now synonym of A. fumipennis Burmeister, 1839) and A. australis (now Argiolestes australis (Guérin-Méneville, 1830)). After several revisions and new descriptions which were made over the past 170 years, Argia became one of the most speciose genus among the Coenagrionidae, with over 130 described species (Selys 1865; Calvert 1902, 1907, 1909; Fraser 1946; Gloyd 1968a, b; Garrison 1994, 1996; Garrison & von Ellenrieder 2013, 2015, 2017).

In Brazil Argia comprises almost 50 species and at least four more are yet to be described (Rosser Garrison pers. comm.). We made a collection within Chapada dos Guimarães National Park, Mato Grosso State, Brazil, in late 2015 (October–November), the same area where Calvert (1909) described several Argia species. Our aim was to collect some of Calvert’s species, some of which were presently known only from the type series (A. botacudo Calvert, 1909) or others that were poorly known (e. g. A. bicellulata Calvert, 1909 and A. tupi Calvert, 1909). We found over 100 species of Odonata, ten species of Argia, including the new species described here, rediscovered A. bicellulata and collected the female of A. tupi, both of which will be treated in a further study. We failed to find A. botacudo that is thus far known only from the type series.

Materials and methods

We follow Garrison et al. (2010) for body morphology nomenclature. All measurements are in mm; total length and length of abdomen include cerci. Laboratory photographs were taken with a Canon Eos M and Eos M5 with a
Canon 28mm macro lens by ACR. Field photographs were taken with a Canon Eos 7D Mark II with a Canon 100mm macro lens by ACR. SEM images were taken in CACTI (Univ. de Vigo), by ACR. Drawings were executed by Rosser W. Garrison. Abbreviations for structures used throughout the text are as follows: S1–10: abdominal segments 1 to 10, Fw: forewing, Hw: hindwing. For wing venation we followed Riek & Kukalová-Peck (1984). The map (Fig. 1) for *Argia angelae* was made using QGIS Desktop 2.18.13 with Open Layers plug-in. Acronyms used for collections are as follows:

**LESTES**—Laboratory of Ecological Studies on Ethology and Evolution, UFSCar, Brazil

**RWG**—Rosser W. Garrison, Sacramento, California, USA.

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**FIGURE 1.** *Argia angelae*. Distribution throughout the National Park of Chapada dos Guimarães (black dots inside the greener area). Outside the Park are the Balneário Rio Paciência (black dot at left of the greener area) and Balneário Som do Mato, Rio Claro (black dot at right of the greener area).

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**Results**

*Argia angelae* sp. nov. (Figs. 2–31)


**Etymology.** Named *angelae* (noun in the genitive case) after biologist Angela Helena Torezan Silingardi (1940–2016) who directed our Professors Kleber Del-Claro and Helena Maura Torezan-Silingardi during their biology career.
Description of holotype. Head. Epicranium largely black; labrum, ante- and postclypeus pale brown; antefrons violet, postocular spots violet, not confluent with eye margin, small elongate violet spots lateral to lateral ocelli; antennae black, occipital bar black; border of postocular lobes pale; rear of head black with narrow pale margin bordering eye margin.

Thorax. Prothorax largely black, anterior lobe violet, middle lobe with large violet spot medio-laterally, posterior lobe black, propleuron black dusted with pruinosity, with an ill-defined pale spot and with ventral margin pale. Mesothorax with dorsal half of mesepisternum black and lateral half with a violet stripe narrowing slightly toward antealar crest; black parallel-sided humeral stripe broad, enclosing a small violet spot dorsally below carina, confluent with obsolete interpleural suture, extending from base of mesinfraepisternum and connecting above by a narrow line below antealar crest with middorsal stripe. Remainder of thorax including venter pale violet, almost white, except for narrow black metapleural stripe; ventral margin of thorax dusted with white pruinosity; coxae and trochanters pale, anterior margins of tibiae pale, remainder of legs including armature black.

Wings. Hyaline, venation dark brown, pterostigma dark surmounting 1.5 cell in left Fw, 1 cell in remaining wings; postnodals 14/13 in Fw, 13/11 in Hw; postquadrangular cells 3/3 in Fw, 2/2 in Hw; RP₂ branching at postnodal 6 in Fw, at postnodal 5 in Hw.

Abdomen. Mostly black dusted with with pruinosity laterally, S₁ black dorsally pale laterally with basal and apical margin black, S₂ black with a violet dorsal spot constricted at posterior fourth and ending at black annulus, S₃ black with a violet dorsal spot covering more than 3/4 segment length, S₄ similar to S₃ but with violet dorsal stripe reaching 2/3 segment length, S₅–7 black except for pale basal ring, S₈–9 black with a large dorsal rectangular violet spot with a small constriction at the apex on S₈, S₁₀ black with a dorsal violet spot.

Genital ligula. Small microspinulate patch on ental surface of genital ligula (Fig. 3e–f), with small sets of 5–7 spines throughout the single long curved flagellum (Fig. 3e–f), with no lateral lobes (Fig. 4e–f).

Caudal appendages. Torus transversely oval occupying entire ventral margin of torifer but not overlapping whitish blue bilobed epiproct; area surrounding epiproct black, appendages black, almost approximate at base; cercus robust dusted with white pruinosity at tip, quadrate in dorsal view (Fig. 4b), slightly concave dorsally and armed medio-externally with a medio-ventrally directed tooth (Fig. 4a, d), cercus in lateral view triangular and about 0.60 length of paraproct (Fig. 4c); paraproct slightly bifid, dorsal branch rounded in mediadorsal and lateral view with tip slightly curved medio-dorsally (Fig. 4a, c), short ventral branch broadly rounded (Fig. 4a).

Measurements (in mm). Fw 17.7, Hw 17.4, abdomen 24.2, total length 30.3.

Variations in males. Slight color variation in paratypes likely due to ontogenetic development (Figs. 5–17). Male postocular spots show color variation (e.g. Figs. 11–14) and shape and coloration also varies on terminal
abdomen segments (Figs. 15–17). Young males (Figs. 5, 8) have less body pruinosity compared to older males (Figs. 6, 7, 9, 10). In some males (Figs. 12, 13) the transverse postfrontal stripe is not continuous as in other males (Figs. 11, 14). Wing length varied as follows (n = 23): Fw 17–18.5 (17.5±0.4), Hw 16.2–17.4 (16.8±0.5), abdomen 19.7–24.5 (22.9±1), total length 26.1–30.8 mm (29.1±1.1); wing venation in males varies on the number of postnodal cells: 12/11, 13/12 in Hw, 14/11 in Fw; one male branching Hw RP₂ at postnodal 4, one at 6; two males branching Fw RP₂ at postnodal 7. Anal appendages and genital ligula of paratypes examined are similar to the holotype.

**FIGURE 3.** *Argia angelae.* Male genital ligula of paratypes from Chapada dos Guimarães, Brazil, in lateral view (a-ACR 03299, b-ACR 03300), sets of spines on the flagellum (c-ACR 03299, d-ACR 03300), spinate patch of the ental surface (e, f, both ACR 03299).

**Allotype (Fig. 18):** Head similar to male but pale colors ochre and more extensive blue post ocular spots.

Thorax. Prothorax as in male but more extensive pale colors ochre, mesostigmal lobes not developed, continuous with distal margin of the plate (Fig. 19b), medially forming a raised glabrous elongate carina arching
NEW ARGIA FROM BRAZIL

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posteriorly toward middorsal carina but abruptly ending in a rounded tubercle (Fig. 19a–c); pterothorax similar to male but pale colors ochre, coxae and trochanters pale, pro- and mesofemora black anteriorly, pale with pruinosity posteriorly, metafemur pale on basal half, black on the distal half, tibiae black, pale externally, tarsi and armature black.

4 a-d. Argia angelae: BRAZIL: Chapada dos Guimarães (paratype ACR 03224) caudal appendages

4 e-f. Argia angelae: BRAZIL: Chapada dos Guimarães (paratype ACR 03224) genital ligula

FIGURE 4. Argia angelae. Caudal appendages in mediiodorsal (a), dorsal (b), lateral (c) and ventral (d) views and genital ligula in ectal (e) and lateral (f) views of paratype (ACR 03224) from Chapada dos Guimarães, Brazil.

Wings. Hyaline with dark brown venation as in male holotype, pterostigma brown; postnodals 14/12 in Fw, 12/11 in Hw; postquadrangular cells 3/3 in Fw, 2/2 in Hw; RP, branching at postnodal 7 in Fw, at postnodal 6 in Hw.

Abdomen. S1 ochre basal ring black, S2 ochre with a broad brown stripe laterally enlarged at apical fifth and connecting above, apical annulus black; S3 with pale basal annulus otherwise similar to S2 but black lateral stripe longer and broader above thus constricting parallel pale dorsal stripe above; S4–7 similar to S3 but brown lateral stripe more extensive, almost confluent above with pale dorsal stripe becoming a thin line; S8 black with a pale blue trident like dorsal spot with acuminate tips, S9 similar to S8 except from tips of the spot rounded, S10 pale blue; cerci black, ovipositor pale laterally, ventral margin black.

Measurements (in mm). Fw 16.9, Hw 16.6, abdomen 20.6, total length 26.2.
Variations in females. Females (n = 6) showed little coloration and/or pattern differences (Figs. 20–31). No variations on mesostigmal plates were noticed; size variations: Fw 17.2–18.2 (17.8±0.5), Hw 16.6–17.7 (17.1±0.5), abdomen 20.6–21.9 (21.4±0.7), total length 26.2–27.9 (27.3±1).

Differential diagnosis. This species is superficially similar to A. botacudo in coloration and dimensions (Calvert 1909) and was initially thought to be this species when first collected. Rosser Garrison provided us with detailed illustrations of syntypic material of A. botacudo (Figs. 19d–f ♀ and 32a–d ♂) which we reproduce here allowing us to diagnose these two species as follows: The male paraprocts of both species are similar (Figs. 4a, d A. angelae; 32a, c, d A. botacudo) but A. angelae differs from A. botacudo by the larger more medially directed apical tooth (Figs. 4a, b) and absence of the extern-basal tooth in A. botacudo (Figs. 32a, d). Additionally, in dorsal view, the cerci of A. botacudo are narrower, rounded apically and the distal teeth are not noticeable (Fig. 32b); in A. angelae the cerci are broader, roundly quadrate with the distal teeth visible (Fig. 4b). The genital ligula is similar to the Ecuadorian A. schneideri Garrison & von Ellenrieder, 2017, the widespread A. fumigata (Hagen in Selys, 1865) and A. guyanica (Garrison & von Ellenrieder, 2015) by having a single long flagellum (Fig. 4f), and is similar to A. guyanica in having a small spinate patch on the ental face (Fig. 3e–f), differing from those species on the anal appendage morphology. The single long flagellum of the genital ligula of A. angelae differs from sympatric species A. indicatrix Calvert, 1902 and A. oculata Hagen in Selys, 1865, for these two species have a bifurcated ligula (Garrison & von Ellenrieder 2015). In addition, the male caudal appendages differ considerably from A. angelae.
FIGURE 18. *Argia angela*. Female allotype from Chapada dos Guimarães, Brazil.

FIGURE 19. Female mesostigmal plates in dorsal view of *Argia angela* from Chapada dos Guimarães, Brazil (a-c, ACR 03392) and *Argia botacudo* from Chapada dos Guimarães (d-f), detailing the mesostigmal lobes.
FIGURES 20-31. *Argia angela*: BRAZIL: Chapada dos Guimarães

20. thorax, ♀ (ACR 3303)  
21. thorax, ♀ (ACR 03315)  
22. thorax, ♀ (ACR 03298)

23. S1–10, ♀ (ACR 03315)  
24. S1–10, ♀ (ACR 03298)  
25. S1–10, ♀ (ACR 3303)

26. S7–10, ♀ (ACR 03298)  
27. S7–10, ♀ (ACR 3303)  
28. S7–10, ♀ (03315)

29. head, ♀ (ACR 03298)  
30. head, ♀ (ACR 03315)  
31. head, ♀ (ACR 3303)

Specimens: ACR 3303 (Figs. 20, 25, 27, 31), ACR 03315 (Figs. 21, 23, 28, 30), ACR 03298 (Figs. 22, 24, 26, 29).
The abortive mesostigmal lobes and raised glabrous elongate carina arching posteriorly toward middorsal carina but abruptly ending in a rounded tubercle, are unique for female *A. angelae*. Mesostigmal plate of *A. botacudo* (Fig. 19d–f) is well developed and forms an arcuate lobe abruptly ending at medial margin of plate; mesostigmal plates of *A. indicatrix* and *Argia oculata* (Garrison & von Ellenrieder 2015) similarly differ and females of all of these species lack the glabrous swelling characteristic of *A. angelae*.

**Habitats and Ecology.** This species was found inhabiting palm swamps (i.e. veredas, Vilela *et al.* 2016) and streams in both open and little shaded areas (Fig. 33a–d). Collections were made at an elevation range from 236 m (Balneário Som do Mato, Rio Claro) to 305 m (Rio Salgadeira). We observed some mating couples (Fig. 34), but no oviposition events.

**FIGURE 32.** Caudal appendages in mediodorsal (a, d), dorsal (b) and lateral (c) views of *Argia botacudo* syntype from Chapada dos Guimarães, Brazil.
FIGURE 33. Some of the natural habitats of *Argia angelae* at Chapada dos Guimarães: Small stream at Rio Paciência, near a Palm Swamp habitat (a), Rio Claro (b), Rio Salgadeira (c) and Balneário Som do Mato (d).

FIGURE 34. A couple of *Argia angelae* at Rio Paciência, one of their natural habitats at Chapada dos Guimarães, Brazil.
Discussion

The discovery of this new species in a National Park palm swamp area reinforces the importance of conservation actions in Cerrado biome, which has been suffering considerably due to habitat loss caused mainly by human activities over the last 40 years (Françoso et al. 2015). Palm swamp areas are highly associated with freshwater bodies and they are characterized by having permanently water saturated soils (Fonseca 2005) which hold a great vegetation and animal biodiversity (Araújo et al. 2002, 2013; Oliveira & Marquis 2002) and have by one of its characteristics a low capacity of resilience upon disturbing events (Fonseca 2005). Recently, studies have demonstrated that Cerrado area losses are responsible for declines in the Odonata community richness (Juen et al. 2014; Pereira-Mendes et al. 2017), which can lead to the extinction of species that depend on areas like the palm swamps (Vilela et al. 2016). Further collections in the National Park of Chapada dos Guimarães and throughout poorly explored areas of Brazil are needed, which will give us a better understanding of the diversity of species of Argia within Brazil.

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