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Leptagrion cyanostigma sp. nov. from Brazil with a study of blue pterostigma in Zygoptera (Odonata: Coenagrionidae)

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A new species, *Leptagrion cyanostigma* sp. nov., is described and illustrated based on 1 ♂ and 1 ♀ collected in the State of Bahia, Brazil. The species is generically unique by having a blue pterostigma with a black center. A survey of other Zygoptera possessing blue pterostigmata is carried out.

Keywords: Odonata; dragonfly; Coenagrionidae; Zygoptera; Brazil; new species; pterostigma

1. Introduction

Santos (1966) demonstrated for the first time that the larvae of *Leptagrion* Selys, 1876 breed in bromeliad phytotelmata. This amply confirmed fact (Corbet, 2004) increased the interest in the genus, which now contains 16 species (Garrison, von Ellenrieder, & Louton 2010), of which 14 occur in Brazil (Lencioni, 2006). These were described by Burmeister (1839), Selys (1876), Calvert (1909), Santos (1961, 1965a, 1965b, 1968, 1978, 1979), and Machado (2006). The status of taxonomy in the genus is fairly good thanks mainly to the works of Costa and Garrison (2001) and De Marmels and Garrison (2005), the former with a key that allows for easy identification of the then known species. After these works, a single species *L. afonsoi* Machado, 2006 was described. Here I describe *Leptagrion cyanostigma* from the mountain region of Chapada Diamantina in the State of Bahia, Brazil. The new species is generically unique in having a blue pterostigma with a black center, a fact that motivated a preliminary survey of blue pterostigmata in other species of Zygoptera.

Leptagrion cyanostigma sp. nov. (Figures 1, 2)

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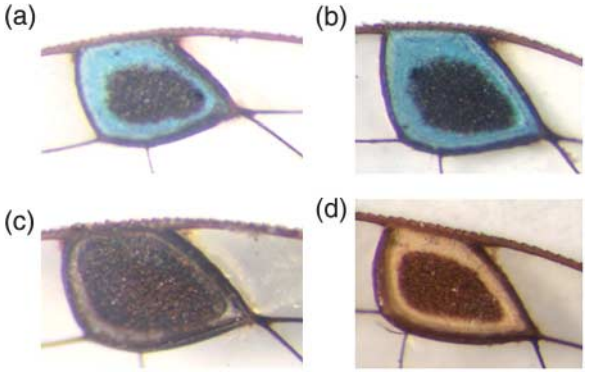

Figure 1. *Leptagrion cyanostigma* pterostigmata: male dorsal surface of (a) Fw and (b) Hw, and (c) ventral surface of Hw; (d) female dorsal surface of Fw. Photographed with digital camera attached to a Leitz Stereomicroscope.

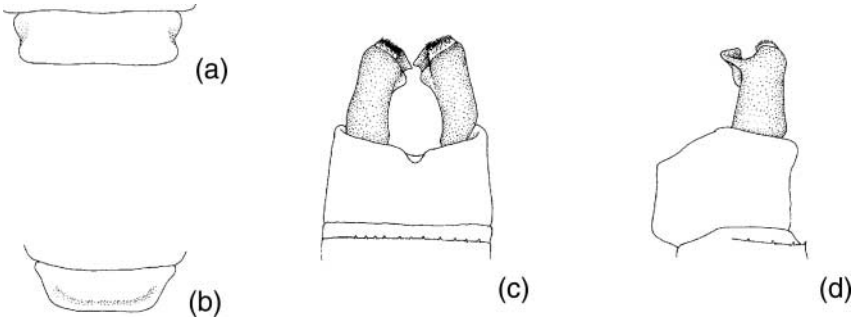

Figure 2. *Leptagrion cyanostigma*: dorsal view of hind prothoracic lobe in (a) male and (b) female; male cerci in (c) dorsal and (d) right lateral views. From camera lucida drawings.

Etymology

Cyanostigma, noun in apposition, from Greek *kyanos* (= blue), plus *stigma*, in reference to the predominantly sky-blue pterostigma on the dorsal surface in males.

Specimens examined

Holotype ♂ and allotype ♀: Brazil, State of Bahia, Lençois (12°34′ S, 41°23′ W), Chapada Diamantina, 2 April 1980, A. Row leg. Type in A. B. M. Machado collection to be transferred to the collection of the Department of Zoology, Federal University of Minas Gerais, Brazil.

Description of holotype male

Head. Labium yellow, face pale green except for greenish yellow border of labrum and middle portion of anteclypeus. Upper part of the head anterior to the median ocellus black, posteriorly reddish brown with an oblique black bar laterally to each lateral ocellus. Interocellar triangle and occipital bar pale green. Rear of head yellow with dark dorsomedial round spot.

Thorax. Prothorax: Tergum of anterior lobes pale green with a central rounded dark-brown spot. Tergum of median lobe reddish brown. Propleuron pale green. Pterothorax: Mesepisternum with medial half reddish brown, lateral half pale green. Mesepimeron laterally reddish brown, medially brown. Metapleuron grayish yellow. Legs yellow. Wings hyaline, venation dark, pterostigma

shaped as in Figure 1a–c, slightly larger in Hw (Figure 1b), dorsal surface sky blue with black center and whitish blue peripheral line (Figure 1a, b). Ventral surface (Figure 1c) brownish black surrounded by pale line. Px in Fw 11 in Hw 12, R3 (Tillyard-Fraser terminology) arising near Px 6 in both wings, pterostigma surmounting 1 1/3 cell in Fw, 1 1/4 cell in Hw.

Abdomen. S1–S2 dorsally brown, laterally grayish yellow. S3–S5 dorsolaterally orange, ventrally dark brown with a brown anteapical ring, S6–S8 dark brown, S9 and dorsum of S10 gray (possibly green in life), ventrolaterally black. Cercus dorsally gray with apex and ventral parts black.

Structural characters. Hind prothoracic lobe straight and slightly emarginate laterally (Figure 2a). Cercus in dorsal view (Figure 2c) with medial prominence immediately anterior to foliate tip. In lateral view (Figure 2d) bifurcate, dorsal branch more prominent with apex rounded, ventral branch foliate.

Measurements (mm). Abdomen 43.7 (including cercus), Hw 24.3.

Description of allotype female

Head. Labium light brown, face light brown with black markings in posteromedial and posterolateral parts of labrum. Upper part of head light brown except for orange on postfrons and postocullar regions. Rear of head light brown.

Thorax. Prothorax: Anterior lobe gray, notum of median lobe brown with C-shaped yellow stripe, posterior lobe gray with large central brownish orange spot. Propleuron gray with grayish green sub-triangular spot. Pterothorax: Mesepisternum with three longitudinal stripes on each side: median brown stripe encompassing mid-dorsal carina, intermedian stripe yellow, lateral stripe gray. Mesepimeron brown, metapleuron grayish brown (all gray areas of thorax may possibly have been blue in life). Legs yellow, wings hyaline, venation dark. Pterostigma shaped as in Figure 1d, on dorsal and ventral surfaces brownish surrounded by yellowish white (Figure 1d). Px 11 in both wings, R3 arising near Px 7 in both wings. Pterostigma surmounting 1 cell in Fw and 1 1/4 cell in Hw.

Abdomen. S1–S2 dorsally brown, laterally grayish brown with distal yellow ring at S2. S3–S5 and proximal half of S6 dorsally brown, laterally yellow. S3–S5 with subapical dark brown ring and apical yellow ring. S7–S10 missing.

Structural characters. Hind prothoracic lobe smoothly rounded (Figure 2b).

Measurements (mm). Abdomen (S1–S6) 31.2, Hw 25.4.

Taxonomic diagnosis

The male of *Leptagrion cyanostigma* belongs to the group of species whose male cercus lacks a tooth (Costa & Garrison, 2001). By the shape of cercus and pterostigma, it is very close to *L. garbei* Santos, 1961. It differs from it by the more abbreviated foliate ventral process of the cercus in dorsal view (Figure 2c), the presence of a small ventromedially directed process just in front of the foliate process, and mainly by the dorsal surface of the male pterostigma which is sky blue with a black center (totally black in *L. garbei*). This last character easily identifies this species. The pterostigma of the female of *L. cyanostigma* (Figure 1d) has a shape similar to that of the male, but it is brownish yellow with no blue; this shape is also similar to that of the female of *L. perlongum* Calvert, 1909.

Blue pterostigma in Zygoptera

The blue color of the pterostigma in male *L. cyanostigma* is unique in the genus *Leptagrion*, whose species have black or brown pterostigmata, except in *L. dardanoi* Santos, 1968 which is yellowish. In order to determine whether blue pterostigmata occurred in other species of Zygoptera, I sent a photograph of the blue pterostigma of *L. cyanostigma* to 21 odonatologists, together with a question as to whether they knew of any damselfly with a similarly blue pterostigma. Eleven specialists answered that they did not know of any Zygoptera with a blue pterostigma. Ten gave positive answers contributing to a list of 17 species as shown in Table 1.

Blue pterostigmata appear to be rare in Zygoptera; it has been noted in Calopterygidae (1), Chlorocyphidae (1) and Coenagrionidae (15). The genus with the most species with blue on the pterostigma was *Ischnura* with eight species, all of which had blue on the upper side of forewing pterostigma in mature males. However this blue occurs differently on different species. In *I. credula* Selys, 1876, *I. ultima* Ris, 1908, and *I. ramburii* Selys, 1850 the distal 1/3 of the pterostigma is whitish blue. According to Paulson (in litt) in *I. prognata* Hagen, 1861 the blue is distributed mostly around the edge while in *I. kellicotti* Williamson, 1898 an intense blue covers most of the pterostigma. After studying the descriptions of pterostigmata in the 22 New World species of *Ischnura* with the help of Westfall and May (2006), De Marmels (1987) and Realpe (2010) I verified that only the eight species listed in Table 1 have a blue pterostigma. Thus even in *Ischnura*, species with blue pterostigmata are rare. The blue pterostigmata of *Ischnura* differ from that of *L. cyanostigma* because they occur only in the forewings whereas in *L. cyanostigma* they

Table 1. List of Zygoptera with blue pterostigma.

Family	Species	Distribution	Specialist	Characteristics
Calopterygidae	*Umma distincta* Longfield	Africa	M. Schorr	♂, upper side, both wings
Chlorocyphidae	*Aristocypha chaoi* (Wilson)	Oriental region	A. G. Orr	♂, upper side, Hw
Coenagrionidae	*Agriocnemis nana* Laidlaw	Southeast Asia	R. W. Garrison	♂, upper side, Hw
Coenagrionidae	*Amorphostigma armstrongi* Fraser	Samoa	T. D. Donnelly	♂, both sides, Fw
Coenagrionidae	*Anisagrion trucatipenne* Calvert	Mexico, Guatemala	R. W. Garrison, D. Paulson	♂, upper side, both wings
Coenagrionidae	*Anisagrion allopterum* Selys	Central America	R. W. Garrison, D. Paulson	♂, upper side, both wings
Coenagrionidae	*Hesperagrion heterodoxum* (Selys)	USA, Mexico	D. Paulson	♂, both sides, both wings
Coenagrionidae	*Ischnura evansi* Morton	Oriental and Ethiopian regions	H. Dumont	♂, upper side, Fw
Coenagrionidae	*Ischnura fluviatilis* Selys	South America	A. B. M. Machado	♂, upper side, Fw
Coenagrionidae	*Ischnura fountaineae* Morton	Middle Eastern countries	H. Dumont	♂, upper side, Fw
Coenagrionidae	*Ischnura kellicotti* Williamson	USA	S. Dunkle, D. Paulson	♂, upper side, Fw
Coenagrionidae	*Ischnura prognatha* (Hagen)	USA	D. Paulson	♂, upper side, Fw
Coenagrionidae	*Ischnura ramburii* (Selys)	New World	D. Paulson	♂, upper side, Fw
Coenagrionidae	*Ischnura senegalensis* (Rambur)	Oriental and Ethiopian regions	V. J. Kalkman, M. Schorr	♂, upper side, Fw
Coenagrionidae	*Ischnura ultima* Ris	Argentina, Chile	A. B. M. Machado	♂, upper side, Fw
Coenagrionidae	*Proischnura rotundipennis* Ris	South Africa	M. Samways	♂, both sides, both wings
Coenagrionidae	*Leptagrion cyanostigma* Machado	Brazil, Bahia	A. B. M. Machado	♂, upper side, both wings

are present in both forewings and hindwings. The blue coloration in *Aristocypha chaoi* (Wilson, 2004) is located only on the Hw pterostigma (Orr, in litt.). In males of *Enacantha caribbea* Donnelly & Alayo, 1966, the pale area of the pterostigma is often blue or blue between dark and whitish regions, especially in Hw (Westfall & May, 2006). In most species listed in Table 1 the blue color is shown only on the upper surface of the pterostigma of male forewings; the lower surface being usually brown. In *Umma distincta* Longfield, 1933, however, the blue is shown on the upper surface of both wings (Schorr, in litt.). The biological significance of blue pterostigmata in Zygoptera, especially in *L. cyanostigma*, is unknown. The fact that in *L. cyanostigma* and in most of the species studied the blue pterostigma appears only on the upper wing surface indicates that whatever function it might have it will be manifested only during flight or when the wings are outspread. Two main behavioral functions could be suggested for a blue pterostigma: territorial defense and courtship display. Unfortunately, there are no published data about territoriality in *Leptagrion*. There is only a preliminary observation by De Marco (in litt.), who observed two males of *L. perlongum* interacting over a bromeliad in a way compatible with territoriality. The possibility that the blue pterostigma could be involved in courtship display cannot be ruled out. This type of behavior, although common in Chlorocyphidae and Calopterygidae, is very rare in Coenagrionidae (Corbet, 2004). Field studies aimed at revealing the behavioral significance of color in the damselfly pterostigma would be very welcome.

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