

Studies on Neotropical Protoneuridae. 21. The status of *Amazonaura* Machado, 2004 (Odonata: Protoneuridae)

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Abstract

The genus *Amazonaura* Machado, 2004, regarded by Lencioni (2005) as a junior synonym of *Forcepsioneura* Lencioni, 1999, is revalidated based on morphological and zoogeographic evidence.

Keywords: Zygoptera, *Forcepsioneura*, zoogeography, Atlantic Forest, Amazonian Forest, taxonomy, revalidation.

Introduction

The genus *Forcepsioneura* was erected by Lencioni (1999) with the following species: *F. garrisoni* Lencioni, 1999 (type species), *F. ephippigera* (Selys, 1886), *F. itatiaiae* (Santos, 1971), and *F. ciganae* (Santos, 1968), the latter a junior synonym of *Protoneura sancta* (Selys, 1886) (Machado, 1999). To these, Machado (2000, 2001, 2005) added *F. haerteli* Machado, 2001; *F. lucia* Machado, 2000; *F. westfalli* Machado, 2000, and *F. grossiorum* Machado, 2005. Machado (2004), based on four morphological characters, partitioned *Forcepsioneura* into two genera, *Forcepsioneura sensu stricto*, comprising species from the Atlantic Forest, and *Amazonaura*, comprising species of the Amazonian Forest: *A. westfalli* and *A. ephippigera* plus a new species *A. juruaensis* Machado, 2004 (type species). In his book on Brazilian damselflies, Lencioni (2005), based on the presence of a character so far known only in *Amazonaura* (prothoracic tubercles absent or very small) in an undescribed species from the Atlantic Forest, considered this genus a junior synonym of *Forcepsioneura*. However, in a study on the phylogeny of neotropical Protoneuridae and based on the examination of *F. sancta* and *A. ephippigera*, Pessacq (2008) stated that these two genera appeared different and that to reach a valid conclusion on the status of *Forcepsioneura* all species involved should be studied and new characters should be examined. In order to contribute to the solution of this problem, I examined 42 specimens of all species of *Forcepsioneura sensu* Lencioni (2005) (except the type species, *F. garrisoni*), including holotypes of *F. haerteli*, *F. grossiorum*, *F. lucia*, *F. westfalli*, *F. juruaensis*, lectotype of *F. ephippigera* and a topotype of *F. sancta*. Based on morphological and zoogeographic evidence I came to the conclusion that *Amazonaura* is not congeneric with *Forcepsioneura*.

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Morphological evidence

Characters separating *Amazonaura* from *Forcepsioneura* are given in Tab. I. They include four characters already used in the definition or separation of these two genera (Lencioni, 1999, 2005; Machado 2004; Heckman, 2008; Pessacq, 2008; von Ellenrieder & Garrison, 2009) plus four new characters, including one for females (Figs 1a-c).

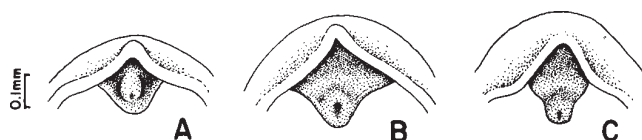


Figure 1 - Dorsoposterior view of the female epiproct in: a) *Forcepsioneura lucia*; b) *Forcepsioneura sancta*; and c) *Amazonaura westfalli*.

Zoogeographic and ecological evidence

Distributions of *Forcepsioneura* and *Amazonaura* are shown in Fig. 2. Both genera are separated by a gap of 3,400 kilometers, in great part occupied by the enormous area of cerrado (Brazilian savanna) of Central Brazil, partly converted into pastures. Such a large disjunction does not occur within other neotropical protoneurid genera and likely neither in other neotropical Zygoptera. Their disjunct distribution coupled with morphological differences listed in Tab. 1, suggest that *Forcepsioneura* and *Amazonaura* are distinct genera. According to Morrone (2001), the Atlantic forest belongs to the Paranaense subregion and the Amazonian forest to the Amazonian subregion of the Neotropical region. The odonatological faunas of these two subregions are very different. The Amazonian subregion contains two Zygopteran families (Polythoridae and Amphipterygidae) and seven protoneurid genera that do not

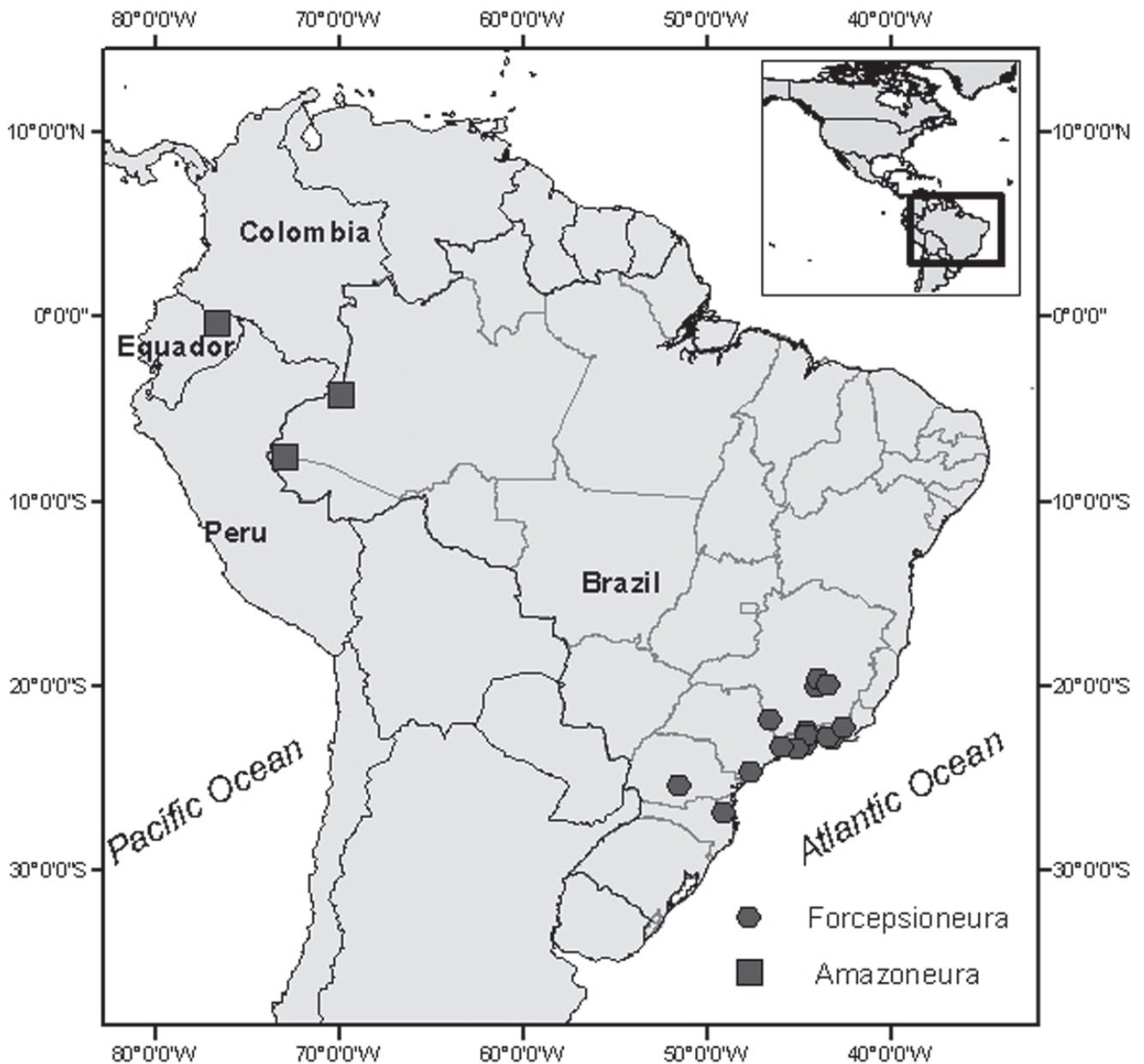


Figure 2 - Distributional map of *Amazoneura* and *Forcepsioneura*.

occur in the Atlantic Forest of the Paranense subregion, which, in turn, contains three endemic genera. The only protoneurid genera common to both Amazonian and Atlantic forests and cerrado are *Neoneura* and *Epipleoneura*. The species of these genera fly along the open marginal vegetation of virtually all Brazilian rivers and most streams (except in Southern Brazil for *Epipleoneura*), a habitat very different from the shady sluggish forest streams and mostly shaded marshy areas or rivulets where the species of *Forcepsioneura* and *Amazoneura* occur.

Discussion

The two main characters thus far used to separate *Forcepsioneura* from *Amazoneura* were size of posterolateral tubercles of hind prothoracic lobe and presence of a ventral black stripe behind metacoxae. The former is no longer a character unique for *Forcepsioneura* as it is shared with *Lamproneura* De Marmels, 2003. The prothoracic tubercles lost their diagnostic value by the finding of a yet undescribed species

Table 1 - Characters separating the genera *Amazoneura* Machado, 2004 from *Forcepsioneura* Lencioni, 1999.

Characters ¹	<i>Amazoneura</i> ²	<i>Forcepsioneura</i> ³
Frons in profile	Rounded	Angulate
Posterolateral tubercles of hind prothoracic lobe	Poorly developed or absent	Well developed ⁴
Ventral branch of cercus	Mammillary or truncated with no chitinized curved tip.	Not mammillary or truncate. Tip curved and chitinized
Length of ventral branch of cercus	Not overpassing 1/2 the distance to ventral border of S10	Reaching or almost reaching the ventral border of S10 ⁵
Female epiproct	Small (0.17 mm in length) with a central cleft prominence (Fig. 1 a)	Large (0.28-0.29 mm in length) with a distal cleft prominence (Figs 1b, c)
First antenodal costal spaces	Longer or much longer than 3rd	Equal or shorter than 3rd
Rear of the head	Black	Pale
Dark metepimeral stripe on mature males	Present and extending ventrally behind metacoxae	Absent

¹ Illustrations of structural characters can be found in Lencioni (1999, 2005), Machado (1985, 2000, 2001, 2004, 2005), Santos (1968), and Heckman (2008).

² Three species, 10 specimens.

³ Five species, 32 specimens.

⁴ Except in an undescribed species of the Atlantic Forest.

⁵ Except in *F. lucia*.

of *Forcepsioneura* from the Atlantic Forest (Lencioni, 2005), in which they are absent or reduced. This requires broadening the generic concept of *Forcepsioneura* to include species with prothoracic tubercles small or absent. However, the black ventral stripe behind male metacoxae is unique among Neotropical Protoneuridae (Machado, 2004; Pessacq, 2008), and allows for immediate identification of mature males of *Amazoneura*. Of the four characters now used here to separate *Forcepsioneura* from *Amazoneura*, the most important one is the shape of the frons because it is largely used in the generic taxonomy of Zygoptera. The frons is angulated in the six *Forcepsioneura* species and in an undescribed species (Garrison, pers. comm.) and rounded in two species of *Amazoneura* (not examined in *A. epphipigera*). Due to its rounded frons, *Amazoneura* keys out to *Phasmoneura* in Pessacq (2008) and von Ellenrieder & Garrison (2009) but differs from that genus by several structural and color characters. In conclusion, the morphological and zoogeographic evidence presented here suggest that *Amazoneura* is a good genus distinct from *Forcepsioneura*. Indeed, there is a tendency to split insect taxa (e.g. bees) previously considered to have wide distribution encompassing both Amazonian and Atlantic rain forest areas, into distinct taxa endemic to each of these forests (see Nemésio, 2007).

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