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Description of the last instar larva of *Forcepsioneura sancta* (Hagen in Selys 1860) (Odonata: Protoneuridae)

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The Neotropical genus *Forcepsioneura* Lencioni 1999 is composed of six described species (Garrison *et al.* 2010) endemic to the Brazilian Atlantic forest (Machado 2001; Garrison *et al.* 2010). The knowledge of the immature stages is restricted to the inclusion of the genus in two keys of Protoneuridae genera (Costa *et al.* 2004; Neiss & Hamada 2012) and brief comments on labium characters (Costa *et al.* 2004), without formal description. Here we describe the last instar larva of *Forcepsioneura sancta* (Hagen in Selys 1860) based on specimens collected in Rio de Janeiro State, Brazil.

Forcepsioneura sancta (Hagen in Selys 1860)

(Figs. 1–9)

Protoneura sancta Hagen in Selys 1860: 34 (sp. nov., female description).

Psaironeura sancta, Williamson 1915: 620 (*Psaironeura*, gen. nov., comb. nov.).

Phasmoneura ciganae, Santos 1968: 221–226 (sp. nov., male and female description).

Phasmoneura sancta, Machado 1999: 37–38 (synonymy with *P. ciganae*).

Forcepsioneura ciganae, Lencioni 1999: 129, 132–136 (*Forcepsioneura*, gen. nov., comb. nov.; keys; cercus, genital ligula and wing illustrations and scannings).

Forcepsioneura sancta, Machado 2000: 132–133 (species included in *Forcepsioneura* key); Machado 2001: 845, 847–849, 853 (species included in *Forcepsioneura* key; diagnostic characters; cercus and prothorax of topotype illustrations); Pessacq 2008: 518–521, 523, 527 (species included in phylogenetic analysis); Garrison *et al.* 2010: 359–360 (illustration of male pronotum, genital ligula and cercus); Neiss & Hamada 2012: 38, 42 (additional comments and included in genera larval key).

Last instar larva description (Figs. 1–9). *Head* (Fig. 1) about 2.15 times as wide as long, posterolateral margins slightly concave or straight, occipital lobes rounded, not protruding laterally and covered with several thick spines. Posterior margin concave. Antenna seven-jointed; third flagellomere the longest, slightly shorter than first and second flagellomeres together. Premental articulation reaching first coxae; prementum (Fig. 2) short and broad, triangular, about 1.1 times as long as wide, anterior margin convex and slightly crenulated, with two long premental setae on each side and none, two, four or eight very short and thin setae posterior to the long ones; sides with a row of short spine-like setae at distal third. Palp (Fig. 3) with the typical curved end hook, with five (85%) or six (15%) long setae, external margin with no setae; apical margin with two or three small teeth on its inner side, irregularly crenulated on its external side, inner margin clearly crenulated on its apical half, barely crenulated on its basal half; movable hook slender and sharp, about half the length of external margin. Mandibular formula (Figs. 4a,b) (*sensu* Watson 1956) L 1+2 345 y ab; R 1+2 345 y a. *Thorax*: pronotum rounded laterally. Wing pads reaching middle length of S4. Legs light brown, irregularly covered with small hair-like setae. Femur I–III with a row of sparse, short spine-like setae on its dorsal and ventral margins, even more sparse on ventral margin, absent in two specimens. Tibia II–III with a row of sparse, short spine-like setae on ventral margin, absent in one specimen.

Abdomen: cylindrical, coloration light brown, without visible markings. Male cerci and gonapophyses as in figs. 5–6; with a dorsal row of distal spine-like setae on S7–10 more sparse or absent on segments 1–6. Female gonapophyses (Fig. 7) exceeding posterior margin of sternite 10, lateral valvae sharply pointed. Lateral caudal lamellae (Fig. 8) light brown, lanceolated, more than six times as long as wide, apex rounded or acute; without nodus or transverse suture;

dorsal margin with 10–35 spine-like setae, ventral margin with 15–70 short spine-like setae; central carina with 20–50 short spine-like setae. Central lamella (Fig. 9) light brown, lanceolated, about 5.5 times as long as wide, apex rounded; without nodus or transverse suture; dorsal margin with 7–50 spine-like setae, in some specimens restricted to basal half; ventral margin with 9–50 short spine-like setae; central carina with 7–55 short spine-like setae. In between all the spine-like setae on lateral and central lamellae, there are many hair-like setae. On central lamella of some specimens, spine-like setae restricted to basal half.

Measurements (in mm, n=5 males): head maximum width 2.79 ± 0.1 , head maximum length 1.27 ± 0.08 , prementum maximum length 1.59 ± 0.1 , prementum maximum width 1.61 ± 0.06 , femur I length 1.22 ± 0.16 , femur II 1.63 ± 0.03 , femur III 1.84 ± 0.1 , tibia I length 1.47 ± 0.1 , tibia II 1.63 ± 0.1 , tibia III 1.94 ± 0.1 , external wing pads length 3.15 ± 1.2 , internal wing pads length 3.4 ± 0.16 , cerci 0.1, lateral caudal lamellae 2.36 ± 0.1 , central caudal lamellae 2.04 ± 0.2 .

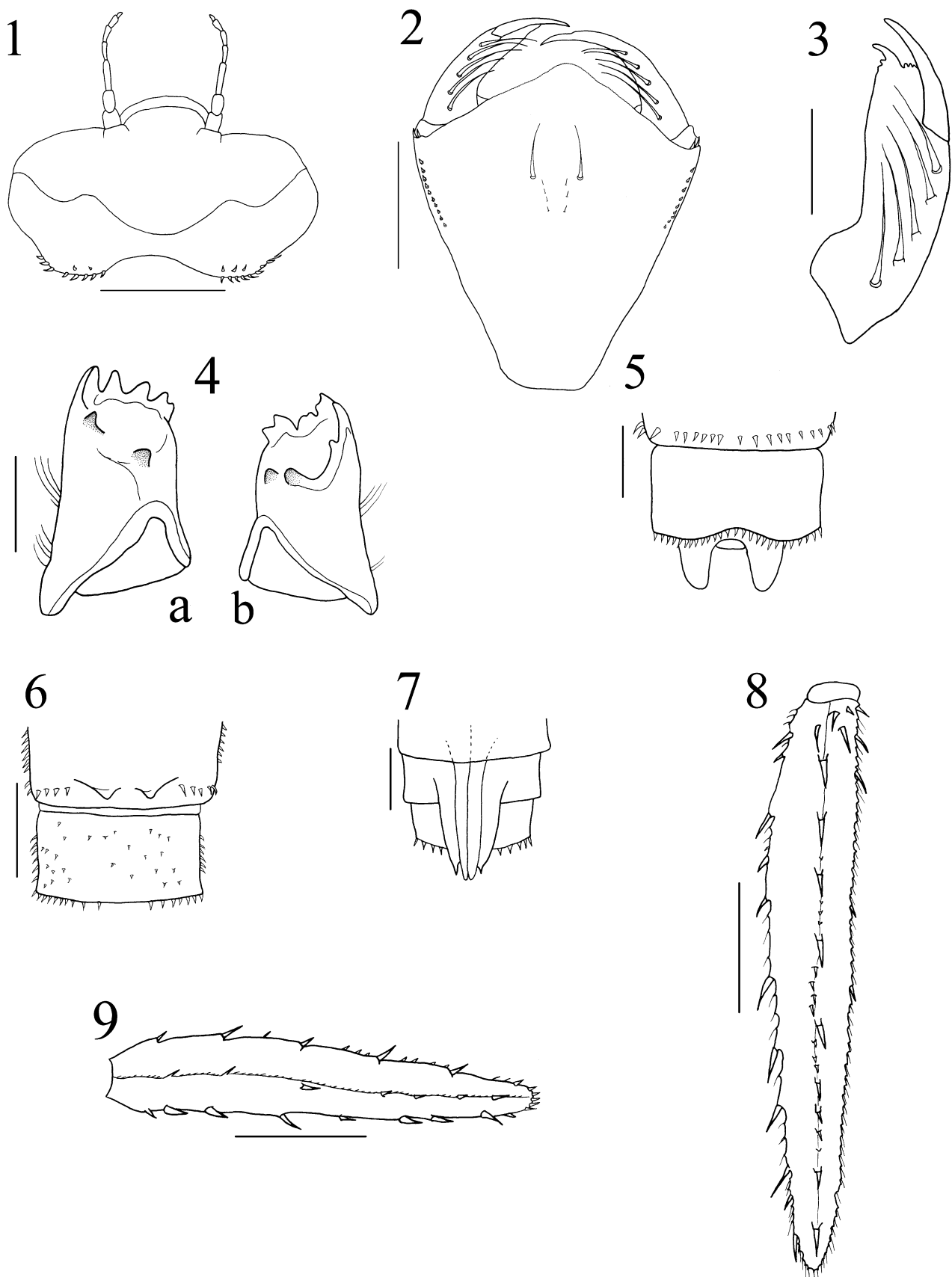
Specimens examined. BRAZIL – 1 male and last instar larva exuvia, Rio de Janeiro State, Toca da Onça, route Grajaú-Jacarepaguá, 12 ix 1976, emerged in laboratory 10 xi 1976, N.D. Santos leg. Same as previous, except emerged 7 x 1976. 4 males, 1 female, with last instar larva exuviae, Rio de Janeiro State, Mangaratiba, Reserva Ecológica Rio das Pedras (RERP) (about 22° 59' 23"S 44° 06' 07"W), 5 xii 2008, adults emerged at 5, 21, 23, 25 and 27 xii 2008, A.P. Pinto & A.L. Carvalho leg.

Remarks. This species has been recorded in the states of Minas Gerais, Rio de Janeiro and São Paulo (Lencioni 2005). The immatures inhabit streams with little current and sandy bottom, under stones (Costa *et al.* 2004). Costa *et al.* (2004) mentions a pair of premental setae and 6 palpal setae for the genus, and in the material examined we observed 2 long premental setae and 0–8 small thin setae posterior to it and 5 or 6 palpal setae. The known larvae of protoneurid genera can be distinguished by the key to neotropical genera in Neiss & Hamada (2012).

Neiss & Hamada (2012) divided the known larvae of protoneurid genera into two groups, the first with caudal lamellae divided into a basal and apical portion and with a well-defined nodus (*Microneura* Selys 1886, *Neoneura* Selys 1860 and *Protoneura* Selys in Sagra 1857), and the second with caudal lamellae not divided and without defined nodus (*Epipleoneura* Williamson 1915, *Idioneura* Selys 1860, *Peristicta* Hagen in Selys 1860 and *Roppaoneura* Santos 1966). The larva of *F. sancta* belongs to the second group, differing primarily from other larvae of this group by the lack of black bands on the legs. *Forcepsioneura* can be distinguished from *Epipleoneura* by the presence of five or six setae on labial palp; from *Idioneura* by the antenna seven-jointed, caudal lamellae not distinctly narrowed on their basal third; from *Peristicta* by the presence of caudal lamellae not oblong; from *Roppaoneura* by prementum triangular and five or six setae on labial palp. Other features of differentiation between larva of *Forcepsioneura* and other protoneurid genera are in Table 1.

TABLE 1. Main diagnostic characters for the known larvae of Neotropical Protoneuridae genera.

Genus	Number of antennomeres	Anterior margin of prementum	Number of premental setae	Number of labial palp setae	Dark bands on legs	Nodus on caudal lamellae	Caudal lamellae shape	Apex of caudal lamellae
<i>Epipleoneura</i>	7	Triangular	1 pair	3–4	Present	Absent	Lanceolated	Rounded
<i>Idioneura</i>	6	Triangular	3 pairs	5	Present	Absent	Lanceolated, narrow on its basal third	Rounded or acute
<i>Forcepsioneura</i>	7	Triangular	1 pairs	5–6	Absent	Absent	Lanceolated	Rounded or acute
<i>Microneura</i>	7	Semi-oval	1 pair	3–4	Present or absent	Present	Lanceolated	Acute
<i>Neoneura</i>	7	Semi-oval or triangular	1–2 pairs	3–5	Indefinite	Present	Lanceolated	Acute
<i>Peristicta</i>	6	Triangular	1 pair	5–6	Present	Absent	Oblong; Almost three times as long as wide	Straight to concave
<i>Protoneura</i>	7	Triangular	1 pair	5–6	Present	Present	Lanceolated	Acute
<i>Roppaoneura</i>	7	Semi-oval	2–3 pairs	8–9	present	Absent	Foliate	Acute



FIGURES 1–9. *Forcepsioneura sancta*. larva, male, female: 1) Head, dorsal view. 2) Prementum, dorsal view. 3) Premental palp, dorsal view. 4) a—Right mandible, inner view; b - left mandible, inner view. 5) S9–10 and cerci, dorsal view. 6) S9–10 and male gonapophyses, ventral view. 7) S8–10 and female gonapophyses, ventral view. 8) Lateral caudal lamella, lateral view. 9) Central lamella, lateral view. Scales: head: 1 mm; prementum, caudal and central lamella: 0.5 mm; premental palp, mandibles, cerci, male and female gonapophyses: 0.25 mm.

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