



## Description of the last instar larva of *Neoneura kiautai* Machado (Odonata: Protoneuridae)

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The Neotropical genus *Neoneura* Selys, with 29 described species (Garrison *et al.*, 2010) is the largest one within Protoneuridae. Its species are distributed from southern North America to northern Argentina, but the region of the Amazonas River shows the highest diversity (Machado, 2005). The immature stages of the genus are poorly known, with only the larvae of *N. carnatica* Selys, 1886, *N. fulvicollis* Selys, 1886, *N. joana* Williamson, 1917, and *N. maria* (Scudder, 1866) described (Needham, 1939; De Marmels, 2007; Geijskes, 1954; Westfall, 1964), representing 14% of the known species. The larva of *N. aaroni* Calvert, 1903 is included in the key of Westfall and May (2006), but it was not formally described. The larva of *N. ethela* Williamson, 1917 is currently being described (Souza & Pepinelli, pers. comm.). All known *Neoneura* larvae possess one pair of premental setae and a well marked nodus on the caudal lamellae.

Here we describe the last instar larva of *Neoneura kiautai* Machado, 2007 based on specimens collected in Rio de Janeiro State, Brazil, therefore increasing the known distribution area of this species formerly known only from Minas Gerais and Espírito Santo States (Machado, 2007).

### *Neoneura kiautai* Machado, 2007

(Figs. 1–8)

*Neoneura kiautai* Machado 2007: 25–32, figs.1–10 (description of male and female; illustration of head, thorax, male S10 and female prothorax).

**Last instar larva description** (Figs. 1–8). *Head* (Fig. 1): almost two times as wide as long, posterolateral margins concave, occipital lobes rounded, not protruding laterally and covered with several short spines. Posterior margin concave. Antenna seven-jointed; third flagellomere the longest, longer than first and second flagellomeres together. Premental articulation reaching first coxae, prementum (Fig. 2) short and broad, semi-oval, about 1.1 times as long as wide, anterior margin strongly convex and slightly crenulated, with two premental setae on each side; lateral sides with a row of short spine-like setae at distal half. Palp (Fig. 3) external margin with a row of short spine-like setae and three long setae, apical margin with typical curved end hook and three small teeth external to it, movable hook slender and sharp, about half the length of external margin. Mandibular formula (Figs. 4–5) as follows (*sensu* Watson, 1956): L 1+2 345 0 ab; R 1+2 345 y a.

*Thorax*: pronotum rounded laterally. Wing pads reaching anterior margin of S4. Legs light brown. Femur I entire length with one row of spine-like setae on extensor margin and two rows on flexor margin, femora II and III entire length with a row of spine-like setae on extensor and flexor margins; tibiae with distal hair-like seta on flexor margin; ventral side of tarsi covered by hair-like setae.

*Abdomen*: cylindrical, light brown, without visible marking. Male cerci and gonapophyses as in figs. 6–7. Row of lateral and distal spine-like setae on S7–10. Lateral caudal lamellae (Fig. 8) light brown, lanceolated, almost six times as long as wide, apex acute; nodus at about mid-length, with a transverse suture separating a more sclerotized basal half from a less sclerotized distal half. Basal half of ventral margin with 25 short spine-like setae; basal half of dorsal margin with 5–6 basal short spine-like setae and a few distal hair-like setae, distal half of ventral margin with a few basal spine-like setae and several distal hair-like setae; central carina with 14–27 short spine-like setae on its basal half. Central lamella: distal half lost, dorsal and ventral margin with 3–4 spine-like setae, central carina with 7–12 spine-like setae.

**Measurements** (in mm with range and mean, n=2): head maximum width: 3.03–3.11, 3.07, head maximum length: 1.95–1.96, 1.95; prementum maximum length: 2.21–2.69, 2.45, prementum maximum width 2.50–2.55, 2.52; femur I length: 2.04–2.16, 2.1, femur II: 2.51–2.53, 2.52, femur III: 3.11–3.15, 3.13; tibia I length: 2.33–2.52, 2.42, tibia II: 2.44–2.63, 2.53, tibia III: 3.04–3.09, 3.06; external wing pads length: 3.63–4.02, 3.82; internal wing pads length: 3.55–3.79, 3.67; cerci: 0.1; lateral caudal lamellae: 6.14–6.35, 6.24.

**Specimens examined.** BRAZIL—Rio de Janeiro State, Rio Claro City, Rio Piraí 15 iii 1978, N.D. Santos leg., one ultimate instar male exuviae with emerged adult, emerged in laboratory 26 vi 1979. Same as previous, but 11 iii 1977, D.J. Fernandes leg., adult emerged in laboratory 01 iv 1977.

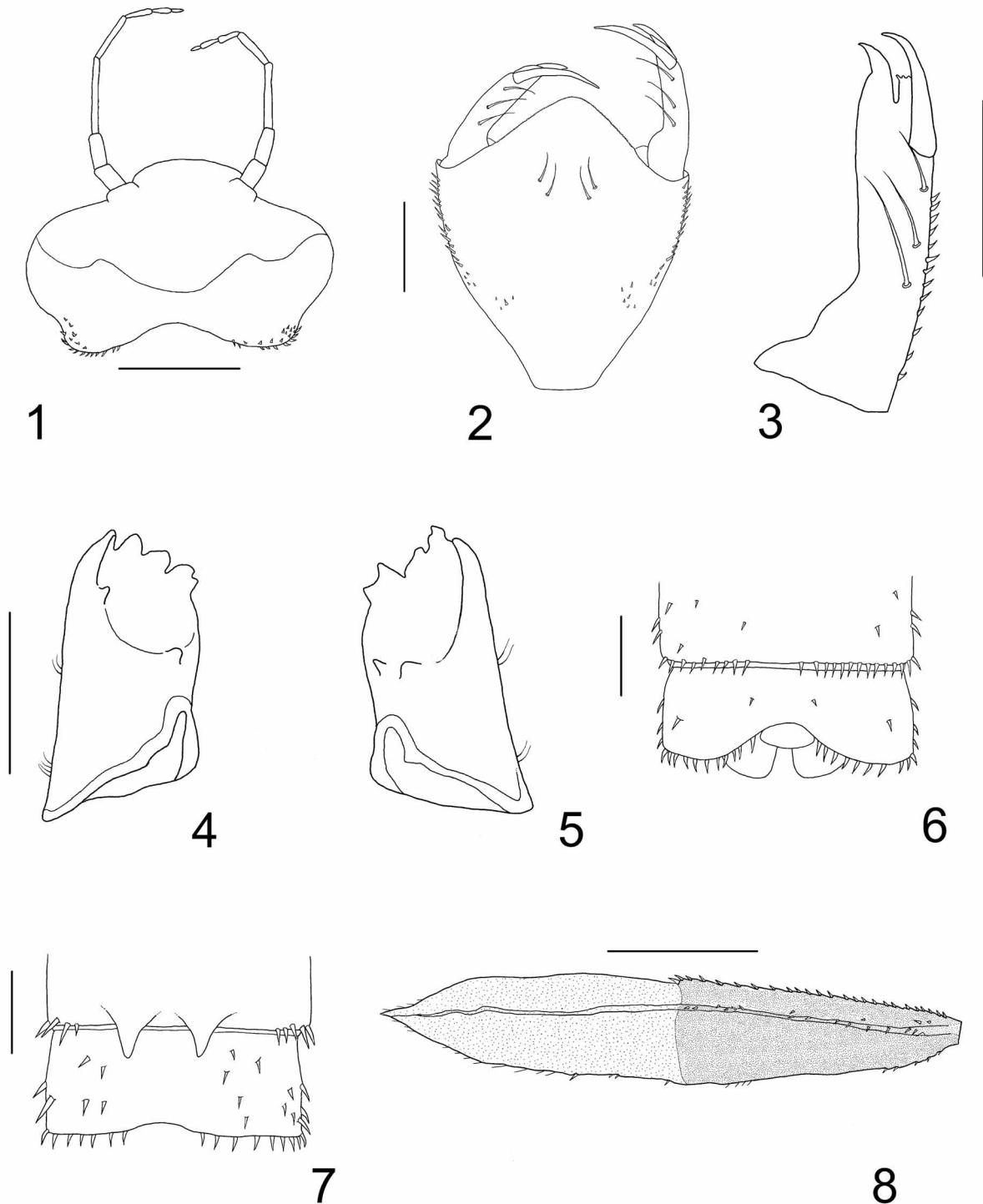
**Distribution:** this species was formerly known to occur in Minas Gerais and Espírito Santo States only (Machado, 2007); this is the first record of the species from Rio de Janeiro State.

**Diagnosis.** All known larvae of the genus have a seven-jointed antenna, usually three or rarely four palpal setae (intraspecifically variable), occipital lobes covered with short spine-like setae and a well developed nodus in the caudal lamellae. Head, premental setae, pronotum, and caudal lamellae provide characters that allow separation of species. All these characters are summarized in table 1 for the larvae known to date.

**TABLE 1.** Diagnostic characters for the known larvae of *Neoneura*. Characters of *N. carnatica* taken from its original larval description (Needham, 1939) and comments in Westfall (1964). \*: character illustrated but not described by Needham (1939). +: Westfall & May (2006) in their key mention nodus of *N. carnatica* as straight and transverse, nevertheless, Needham (1939) drawings show a diagonal line between basal and distal halves of caudal lamellae.

	<i>N. aaroni</i>	<i>N. carnatica</i>	<i>N. ethela</i>	<i>N. fulvicollis</i>	<i>N. joana</i>	<i>N. kiautai</i>	<i>N. maria</i>
Shape of prementum	?	Semi-oval	Triangular	Semi-oval	Triangular	Semi-oval	Semi-oval
Number of premental seta	?	2	2	2	2	4	2
Palpal seta	4–5	3–4	4	3–4	4–5	3	3–4
Posterolateral margin of head	?	Concave	Concave	Concave	Concave	Concave	Convex*
Occipital lobes	?	Rounded	Rounded	Angulated	Angulated	Rounded	Rounded
Prothorax pointed projection	?	Absent	Absent	Present	Absent	Absent	Absent
Brush of long hair-like setae on tibia	?	Present	Absent	Absent	Absent	Absent	Present
Spine-like setae on distal margin of segments:	?	10	8–10	5/6–10	5/6–10	8–10	?
Number of seta on the ventral margin of lateral lamella	?	40–45 in basal half	About 24 in basal half	About 11 in basal half	About 19 in basal half	About 25 in basal half	28–35 in basal half
Line between basal and distal part of caudal lamella	Sinuate	Diagonal, sinuate/Nearly straight +	?	Diagonal, sinuate	Diagonal, sinuate	Transverse, straight	Diagonal, sinuate
Nodus position in lamellae	Not beyond 1/2	At about 2/3	At about 1/3	At about 1/2	At about 1/2	At about 1/2	Almost at 2/3
Lateral lamellae	?	Distinctly shorter than abdomen	Almost as long as abdomen	Distinctly shorter than abdomen	As long as abdomen	Almost as long as abdomen	Distinctly shorter than abdomen
Apex of ovipositor	?	Surpassing apex of S10	?	Reaching but not surpassing apex of S10	Surpassing apex of S10	?	Surpassing apex of S10

The larva of *Neoneura kiautai* can be easily distinguished from those of the other known species by the presence of two pairs of premental setae (one pair in all remaining species) and the vertical transverse line between basal and distal halves of lateral caudal lamella (diagonal in other species).



**FIGURES 1–8.** *Neoneura kiautai* larva, male. 1, head, dorsal view. 2, prementum, dorsal view. 3, premental palp, dorsal view. 4, right mandible, inner view. 5, left mandible, inner view. 6, S9-10 and cerci, dorsal view. 7, S9-10 and gonapophyses, ventral view. 8, lateral caudal lamella, dorsal view. Scales: mandibles: 0.25 mm; abdomen, caudal lamella, and head: 1 mm; prementum and premental palp: 0.5 mm.

The larva of *N. fulvicollis* has a unique pronotum with triangular pointed projection protruding laterally (De Marmels, 2007), which is absent or not triangular and pointed in remaining species. Larvae of *N. carnatica* and *N. maria* can be recognized by the following combination of characters: rounded occipital lobes, caudal lamellae nodus located

between mid-length and apical third, and high number of setae on ventral margin of lateral caudal lamella (28 to 45). These two larvae are, as well as their adults, strikingly similar, and only the caudal lamellae seem to provide characters allowing differentiation between them (Westfall, 1964).

The larva of *N. joana* can be identified by the following character combination: angulated occipital lobes, 19 setae on ventral margin of lateral caudal lamellae, and nodus located at about mid-length of caudal lamellae.

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