

Final instar larva of *Neocordulia volxemi* (Selys, 1874) (Odonata, Libelluloidea) from southeastern Brazil

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Abstract

Final instar larva of Neocordulia volxemi (Selys, 1874) (Odonata, Libelluloidea) from southeastern Brazil. *Neocordulia* is a Neotropical genus with 16 species distributed in the South and Central Americas. To date, only seven larvae of this genus have been described. Here we describe the final instar larva of *Neocordulia volxemi* (Selys, 1874), collected in the Environmental Protection Area of the Uberaba River Basin in the State of Minas Gerais, Brazil. The metallic–green adults were found flying in a forested area in a Conservation Unit, while the larvae were found in a waterfall and surrounding rocky walls. The Cerrado remnant area is currently threatened by degraded pastures and increasing areas of monoculture agriculture.

Key words: Dragonfly, Damselfly, Savannah, Cerrado, Freshwater, Indicator

Resumen

Último estadio larvario de Neocordulia volxemi (Selys, 1874) (Odonata, Libelluloidea) del sureste del Brasil. *Neocordulia* es un género neotropical que comprende 16 especies distribuidas en América del Sur y América Central. Hasta la fecha, solo se han descrito siete larvas de este género. En este artículo describimos el último estadio larvario de *Neocordulia volxemi* (Selys, 1874), recogida en la zona de protección ambiental de la cuenca del río Uberaba en el estado de Minas Gerais, en el Brasil. Se encontraron adultos de color verde metálico volando en una zona forestal de una unidad de conservación, mientras que la larva se encontró en una cascada rodeada de paredes rocosas. La zona, que es un vestigio de Cerrado, se encuentra actualmente amenazada por pastos degradados y el aumento de los monocultivos.

Palabras clave: Libélula, Caballito del diablo, Sabana, Cerrado, Agua dulce, Indicador

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Introduction

Neocordulia is a Neotropical dragonfly genus represented by 16 species (Paulson et al., 2021). The genus is divided in two subgenera: (i) *Mesocordulia*; and (ii) *Neocordulia (sensu stricto)* (May, 1991). While *Mesocordulia* is predominantly found in Central America (but not exclusively, González Soriano, 1985), *Neocordulia sensu stricto* is exclusively found in South America. *Neocordulia volxemi* (Selys, 1874) was first described based on a female specimen (Selys–Longchamps, 1874), which Calvert (1909) further associated with a male (see also the drawings provided by Martin 1906 and Costa and Santos, 2000a). This species occurs in Minas Gerais, Mato Grosso and Goiás states in Brazil (Costa and Santos, 2000a; Vilela et al., 2020). Within *Neocordulia sensu stricto*, larvae have only been described for *N. androgynis*, *N. setifera* (Costa and Santos, 2000b), *N. biancoi* (De Marmels, 1990), *N. machadoi* (Cariço et al., 2011) and *N. santacatarinensis* (Costa et al., 2008). Here we describe the final instar larva of *N. volxemi*.

Material and methods

The larva was collected emerging near the Vale Encantado Waterfall in the Vale Encantado Private Natural Heritage Reserve (RPPN–VE), Uberaba, Minas Gerais (19° 33' 13.8" S 47° 54' 02.5" W), in October 2021. The RPPN–VE, which was created in 2004, is a preserved area of 38.4 ha of Brazilian savannah remnants (i.e., Cerrado) located among large areas of pasture and plantations. The larva was placed in a plastic vial for a few hours until emergence was complete. The adult was then stored until sclerotization. The adult and exuvia were stored in 80% ethanol. The

adult was identified based on Garrison et al. (2006). Measurements were made using a digital caliper. Larval morphology was studied and photos were made using a Leica MZ95 stereomicroscope. Photographs were taken with a Canon 70D digital camera. Images were vectorized and rendered using Adobe Illustrator CS6. Terminology for mandibular formula follows Watson (1956). Specimens are deposited in the collection of the Lestes Lab (LESTES) at the Federal University of Triângulo Mineiro (UFTM). Abbreviations: S1–S10: abdominal segments. Measurements are in mm.

Results

Neocordulia volxemi (Selys, 1874)

Gomphomacromia volxemi Selys, 1874

Material examined

1 male exuvia (collected in field; fig. 1): Brazil, Uberaba, Vale Encantado waterfall (19° 33' 14" S, 47° 54' 02" W), 11 X 21, 878 m a.s.l., Guillermo–Ferreira leg.

Exuvia: general coloration dark brown; larva robust; rhomboid body; slender legs (fig. 2).

Head: about 1.5 x longer than wide, laterally elongated, oval in dorsal view; frons in a sharp transverse ridge; eyes small, rounded at the outer margin, occupying 1/3 of the head length (fig. 2). Posterior margin of occipital lobes covered with scale–like setae (fig. 2). Antennae 6 segmented, the first antennomere the longest (fig. 3). Submentum strongly constricted; distal margin of prementum bearing 11 setae preceding articulation (fig. 4); lateral margins of prementum with scale–like setae (fig. 4); distal margin of ligula covered with setae (fig. 4). Labial palp triangular with 7 crenulations, each bearing 5–6 spiniform setae

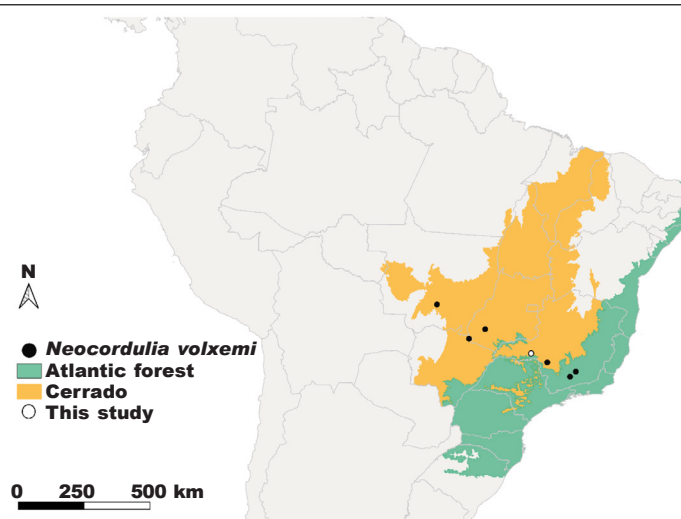


Fig. 1. Distribution of *Neocordulia volxemi* (Selys, 1874) (Odonata, Libelluloidea) in South America.

Fig. 1. Distribución de *Neocordulia volxemi* (Selys, 1874) (Odonata, Libelluloidea) en América del Sur.

(fig. 5); distal margin with a conical movable hook (fig. 5); outer margin coated with small setae (fig. 5). Labrum trapezoidal, covered with long and slighted hairs; mandibular formula L1233'4 0 abd/ R1234 y abd (fig. 6). Mandibular palps each with 4 sclerotized terminal claws with numerous spine-like setae (fig. 7).

Thorax: pronotum rectangular, lateral margins straight, lateral border covered with scale-like setae (fig. 2); anterior and posterior angles of pronotum rounded (fig. 2); lateral margin sinuated (fig. 2). Wing bud reaching the 4th abdominal segment. Legs long, posterior leg the longest, longer than the abdomen (fig. 2).

Abdomen: cylindrical longer than wider with 2 lateral spines (S8–S9) (fig. 2). Anal appendages triangular and sharply pointed (fig. 8); epiproct longer and wider than cerci, slightly convergent, shorter than epiproct (fig. 7, 8); paraprocts longer than epiproct and cerci (fig. 8).

Measurements: total length (27.0 mm), labial palp (4.3 mm), prementum (6.8 mm), antennae (2.0 mm), head width (6.8 mm), head length (4.8 mm), thorax width (5.6 mm), thorax length (6.2 mm), abdomen max width (7.4 mm), abdomen length (16.0 mm), anterior leg (13.3 mm), midleg (16.8 mm), posterior leg (18.7 mm).

Habitat and ecology

The specimen was found emerging in a humid ravine covered with bryophytes and pteridophytes on the rocky walls, less than one meter from the stream border, ca. 10:30 h. Adults were collected in the adjacent semi-deciduous forest (1 male and 1 female), along a dirt path.

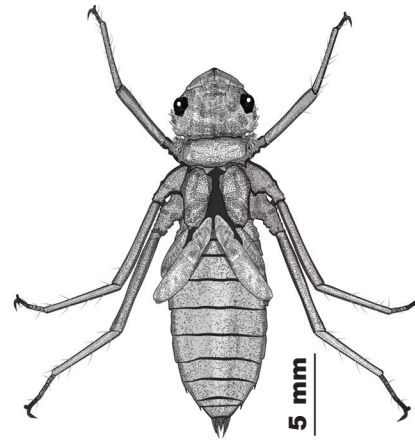


Fig. 2. *Neocordulia volxemi* (Selys, 1874), habitus, dorsal view.

Fig. 2. *Neocordulia volxemi* (Selys, 1874), habitus, vista dorsal.

Discussion

The first antennomere of *Neocordulia volxemi* is the longest, distinguishing it from other known *Neocordulia* larvae, except *N. androgynis* (Costa et al., 2008)

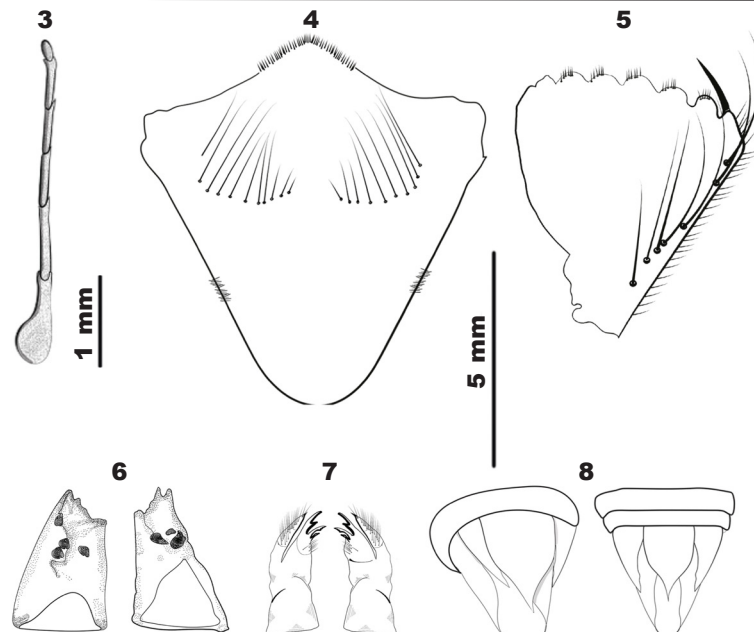


Fig. 3–8. *Neocordulia volxemi* (Selys, 1874): 3, antenna; 4, prementum; 5, labial palp; 6, right (R) and left (L) mandibulae; 7, right (R) and left (L) mandibular palp; 8, caudal appendages.

Fig. 3–8. *Neocordulia volxemi* (Selys, 1874): 3, antena; 4, premento; 5, palpo labial; 6, mandíbulas derecha (R) e izquierda (L); 7, palpos mandibulares derecho (R) e izquierdo (L); 8, apéndices caudales.

Key to *Neocordulia* larvae.

Clave para larvas de Neocordulia.

1	Presence of lateral spines on the abdomen	2
	Lacking lateral spines on the abdomen	<i>Neocordulia batesi</i>
2	First antennomere the longest	3
	Not as above	5
3	Long lateral spines on S8–S9	4
	Short lateral spines on S9–S10	<i>Neocordulia santacatarinensis</i>
4	Right mandible with 4 incisors	<i>Neocordulia volxemi</i>
	Right mandible with 5 incisors	<i>Neocordulia androgynis</i>
5	Apical blunted tooth on epiproct	6
	Not as above	<i>Neocordulia setifera</i>
6	Short or vestigial spines on S8–S9, cerci almost the same size as epiproct, sixth antennomere the longest	7
	Long lateral spines on S8–S9, cerci smaller than epiproct, fourth antennomere the longest	<i>Neocordulia biancoi</i>
7	Head rhomboidal, 8 palpal setae, 11 premental setae	<i>Neocordulia pedroi</i>
	Head trapezoidal with anterior crest projected and crenulated, 7 palpal setae, 12 premental setae	<i>Neocordulia machadoi</i>

(fig. 2; key to *Neocordulia* larvae). *Neocordulia volxemi* larva differs from *N. androgynis* by its mandibular formulae. The right mandible of *N. androgynis* exhibits 5 incisors and 3 molar teeth. The left mandible has 4 incisor teeth and 3 molar teeth. *Neocordulia volxemi* has 4 incisors in left and right mandible, and a smaller associated denticle in the third incisor of the left mandible (fig. 6; key to *Neocordulia* larvae). Prementum of *N. volxemi* bears 8 premental setae (fig. 3; key to *Neocordulia* larvae), more than *N. batesi* (Novelo–Gutiérrez and Ramírez, 1995) and *N. biancoi*; fewer than *N. machadoi*, *N. pedroi* (Costa et al., 2010), *N. santacatarinensis*, *N. setifera*. *Neocordulia volxemi* palp bears 7 long setae on the inner surface and 28 smaller setae on the outer margin (fig. 4; key to *Neocordulia* larvae). *Neocordulia androgynis* palp bears 12 + 15 setae (key to *Neocordulia* larvae). Palpal crenulations are similar in all described species and should not be considered diagnostic traits.

The Brazilian Cerrado is a biodiversity hotspot but most of it is under threat of vast monocultures and cattle herding. The locality of this study is no different. The waterfall and the shallow stream are locally known as a refuge for wildlife (Fonseca et al., 2016). The Environmental Protection Area of Uberaba River Basin (EPA–UR), where the stream is located, is under high impact of degraded pastures despite recent conservation measures being taken recently conducted in the region (do Valle Júnior et al., 2019; Oliveira et al., 2019). Species like *N. volxemi*, whose adults were exclusively found inside forest remnants, therefore highlight the importance of such wildlife refuges in the Cerrado and the EPA–UR. Future studies should address whether this species and other rare aquatic insects may become good indicators of environmental health inside the EPA–UR.

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