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The larva of *Perissolestes remotus* (Williamson & Williamson, 1924) (Zygoptera: Perilestidae)

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The larva of *Perissolestes remotus* is described for the first time based on Costa Rican specimens collected in forested streams with abundant organic matter. It is characterized by a slender, elongated body, with lateral keels on abdominal segments 1–9, and a middorsal row of spines on segments 4–10. We also provide additional notes on the larvae of *P. magdalena* using material from Panama. The larva is similar to the only other species of *Perissolestes* present in Mexico and Central America, *P. magdalena*, but can be separated by the articulation of the prementum–postmentum reaching the metacoxa (reaching the mesocoxa in *P. magdalena*) and the female gonapophyses exceeding past the posterior margin of S10 (just reaching posterior margin in *P. magdalena*). At the generic level, *Perissolestes* can be differentiated from *Perilestes* by the presence of abdominal keels on segments 1–9 (from 4–9 in *Perilestes*) and by having caudal gills with small spines along the medial trachea (spines absent in *Perilestes*).

Keywords: Odonata; larval description; taxonomy; Costa Rica; dragonflies

Introduction

Perilestidae is a small family of mostly Neotropical damselflies. They inhabit small streams in densely forested areas where the larvae are found in slow flowing areas or small pools with abundant detritus (Esquivel Herrera, 2005). Adults are slender and elongated, hard to observe among dense riparian vegetation, and apparently are present in streams for short periods during the year (Esquivel Herrera, 2005). The larvae are easily recognized by their slender, elongated bodies and by having a row of spines along the middorsal margin of the abdomen.

Two genera occur in the Central American region, *Perilestes* and *Perissolestes*, and both are poorly known as larvae. Only two of the eight species of *Perilestes* have been described as larvae, *P. fragilis* (Santos, 1969) and *P. attenuatus* (Neiss & Hamada, 2010). Similarly, only one of the 11 species of *Perissolestes* has been described, *P. magdalena* (Novelo-Gutiérrez & González-Soriano, 1986). Here we provide the description of *P. remotus* (Williamson & Williamson, 1924). *P. magdalena* and *P. remotus* are the only species of *Perissolestes* reported for Mexico and Central America. Therefore, we differentiate the two species and document differences in *P. magdalena* larvae using specimens from extremes of its geographic distribution.

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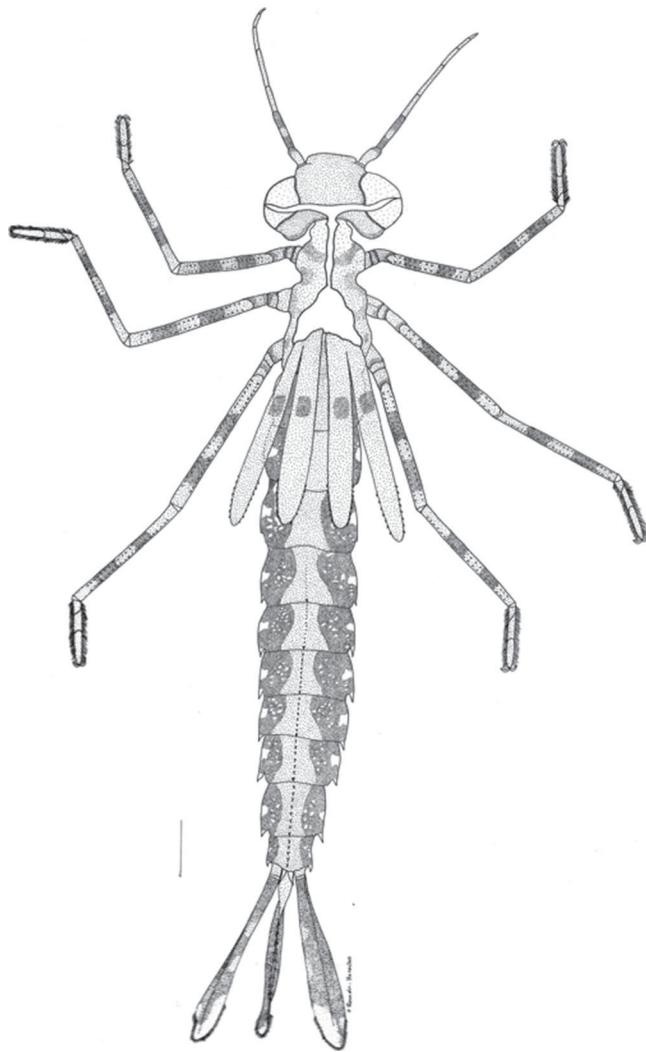


Figure 1. Dorsal view of Female larva of *Perissolestes remotus*.

Methods

Larvae were collected with an aquatic net and transported to the laboratory for rearing. Emerged adults were maintained alive for a few days and then preserved in ethanol (90%) together with their exuviae. Drawings were made with aid of a camera lucida on a stereomicroscope. Measurements (in mm) were made using a millimetric grid in the microscope.

Larva of *Perissolestes remotus*

(Figures 1–3)

Specimens examined

Two exuviae from emerged adults (one male, one female): Costa Rica: Heredia, Sarapiquí region, La Tirimbina Biological Reserve (10.48905 N, -84.11522; 214 m). One male and 1

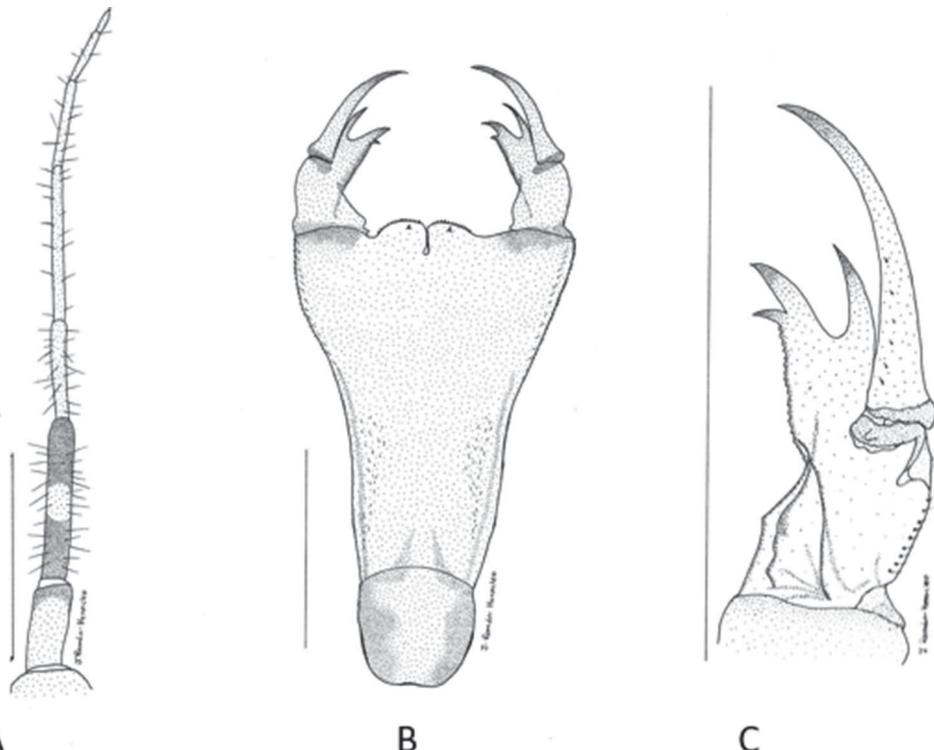


Figure 2. Details of larval morphology of *P. remotus*. (A) Left antenna, dorsal view; (B) labium, prementum, dorsal view; and (C) right labial palp, dorsal view.

female reared, 10 June 2017; male, 26 November 2017; 1 female reared and 2 males, 1 female, 17 February 2018. J. Román-Heracleo leg. All specimens deposited at Museo de Zoología, Universidad de Costa Rica (MZUCR). Abdominal segments are abbreviated as S.

Description

Larvae and exuviae mostly light brown with longitudinal dark bands on the abdomen and dark rings on legs (Figure 1).

Head. Head light brown, wider than long, occipital margin widely concave, cephalic lobes with small setae (Figure 1). Antenna long and filiform, with seven segments, the second the longest; first segment mostly light brown, segment two dark brown with a light-colored ring at mid-length, remaining segments mostly light brown or darkening distally (Figure 2A). Proportional length of antennomeres (from basal to apical): 0.7, 1.0, 0.7, 0.9, 0.5, 0.4, 0.1. Labrum setose. Mandibles with four incisive teeth and six molar teeth. Maxilla: galeolacinia with seven teeth, four dorsal teeth approximately of the same size, three ventral teeth of differing sizes, apical one longest. Labium yellowish brown. Prementum-postmentum articulation reaching the metacoxae. Prementum 0.60 times as wide as long, without setae; ligula with a deep medial cleft with a small spine at each side and its anterior margin finely serrate (Figure 2B). Premental palp with three end hooks shorter than movable hook, the innermost the smallest, internal margin of palp finely serrated, external margin with a row of small setae; palp without long setae (Figure 2C).

Thorax. In dorsal view, prothorax widest distally. Pronotum light brown, dark marks on the frontolateral margin; lateral margins finely serrated. Synthorax mostly light brown with a wide, dark band on posterior half of mesepimera. Wing sheaths light brown, in larvae both pairs reaching distal margin of S4, in exuviae the anterior pair reaching basal half of S3, posterior pair reaching distal half of S3. Legs slender (Figure 1), tip of metatibiae reach S4 when fully extended in both larvae and exuviae, with light and dark rings as follows: coxae pale with a dark ring, femora with two dark rings in the middle and a dark mark proximally and distally; tibiae with two dark bands; tarsi with two dark bands or completely pale (Figure 1). Femora with five carinae, forming a pentagon in cross section, each border finely serrate. Profemora with a double row of spines on dorsal carinae. Tibiae without well-defined carinae. Tarsi three-jointed, basal segment smallest, claws long and simple.

Abdomen. All segments of similar width, except for the distal three which are narrower. S1 wider than long, S2–7 as wide as long, S9–10 longer than wide. All segments with a dark lateral band, which has a clear spot on the middle of lateral margin. Lateral margins of S1–9 with a finely serrated lateral carinae or keel; lateral margin of S4–10 with short lateral spines (Figure 3A, B). Dorsal margin of S4–10 with a row of spines, curved distally, the posteriormost spine larger than others (Figure 3A). Along with the row of spines, a row of fine setae fills the space between each spine. Dorsal row of spines and setae on S4 only covering distal 0.25 of that segment. S10 with two strong dorsal spines on distal margin (Figure 3A). Male gonapophyses (Figure 3B) small, parallel, with pointed tips, not reaching posterior margin of S10. Female gonapophyses (Figure 3A) clearly exceeding posterior margin of S10, reaching the tip of cerci; lateral valves, in lateral view, with tips pointed and a ventral spine, with a finely serrated border. Cerci slightly curved dorsally (Figure 3A), more so in female. Male cerci as long as S10; female cerci 0.30 the length of S10. Caudal lamellae (Figure 3C) not petiolate, oval, flat, with rounded tips, light to dark brown with pale areas along margins; a row of spines runs along dorsal and ventral margins, basal and apical 0.25 of margin lacks spines; apical margin with a row of fine setae; medial trachea with row of spines.

Measurements (mm)

Larvae (2 males, 2 females): Total length (without caudal lamellae) 12–12.5 (18 in a poorly preserved male); maximum width of head 2.5; hind femur 4; abdomen 9 (13 in a poorly preserved male); lateral gills 3.5–4, medial gill 3.5–4. Exuviae (1 male, 2 female): Total length (without caudal lamellae) 15; maximum width of head 2.5–3; hind femur 4; abdomen 10–11; lateral 4; media 3.5–4.

Larva of *Perissolestes magdalena*ae

Specimens examined

One female reared: Panama: Campana National Park, Panama trail (8.69250 N, –80.06333; 835 m). 25 April 2015. A. Ramírez leg. Deposited at Museo de Zoología, Universidad de Costa Rica (MZUCR).

Diagnosis

Larvae similar to *P. remotus* except as noted below.

Head. Mandibles with five incisive teeth. Prementum-postmentum articulation reaching posterior end of mesocoxae.

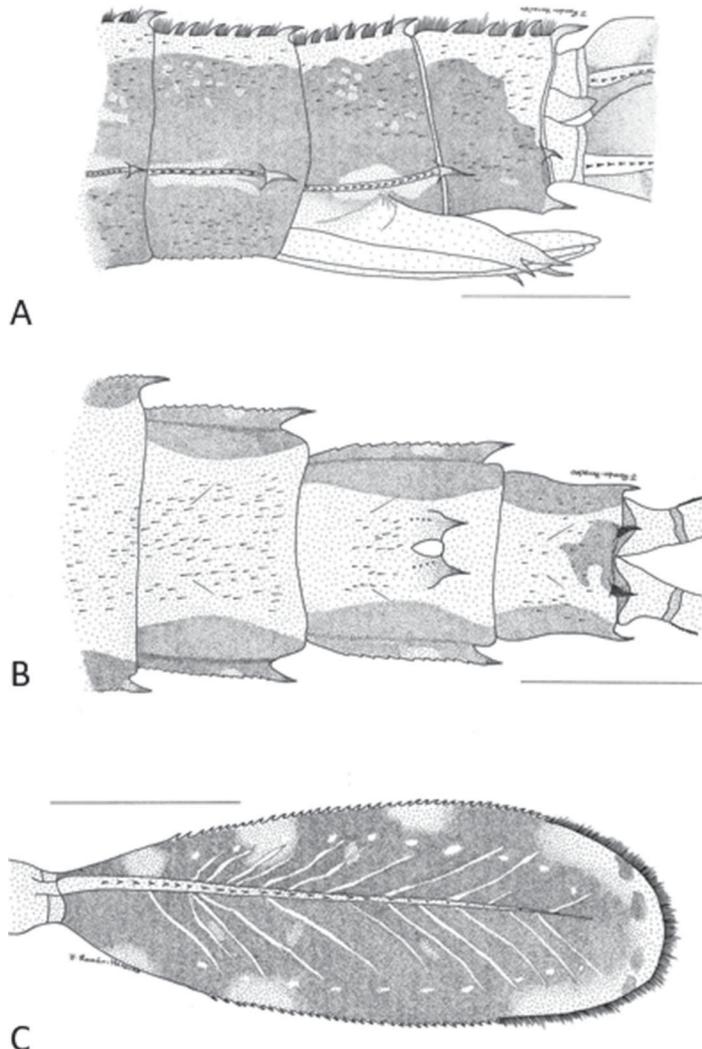


Figure 3. Details of larval morphology of *P. remotus*. (A) Tip of female abdomen, lateral view, showing gonapophyses; (B) male abdomen, ventral view, showing gonapophyses; (C) lateral gill, external view.

Thorax. Femora with four carinae in cross section, each border finely serrated.

Abdomen. The dorsal row on S4 absent in Panama specimens, but present in Mexican specimens (Novelo-Gutiérrez & González-Soriano, 1986). Male gonapophyses as in *P. remotus*. Female gonapophyses not surpassing the posterior margin of S10.

Measurements (mm).

Exuvia (1 female): Total length (without caudal lamellae) 17; maximum width of head 3; hind femur 4.5; abdomen 11; lateral 5; media 5.

Habitat of *Perisseolestes*

Larvae from both locations were found inhabiting small, first to second order streams (< 2 m width), favoring shaded areas. Most larvae were collected from places with abundant leaf litter and fine sediments (Figure 4).



Figure 4. Larval habitat, at La Tirimbina Biological Reserve, Sarapiquí, Costa Rica.

Discussion

The genus *Perissolestes* has 11 species, but only two of them occur in Middle America: *P. magdalena* (Mexico, Guatemala, Belize, and Panama), and *P. remotus* (Nicaragua, Costa Rica, and Panama). Larvae of both species are similar morphologically, as often occurs with sibling species in other genera. Mature larvae of *P. remotus* can be differentiated from *P. magdalena* by the larger size, the prementum-postmentum articulation reaching metacoxae (reaching mesocoxa in *P. magdalena*). Also, female gonapophyses surpass the posterior margin of S10.

Examination of *P. magdalena* larva from Panama provided evidence that larval characteristics can vary at the extremes of its geographic distribution. The lack of a dorsal row of spines on abdominal segment 4 in our Panamanian specimens differs from that of Mexican specimens in which the dorsal row is present (Novelo-Gutiérrez & González-Soriano, 1986). Similar observations have been made on other species, such as *Cora marina* (Ramírez, Altamiranda-Saavedra, Gutiérrez-Fonseca, & Springer, 2011), showing that larval specimens from populations at opposite ends of the species distribution have morphological differences, perhaps associated with limited gene flow or adaptation to different environmental conditions.

The larvae in this family remain poorly known, with only four out of 19 species described as larvae. Generic distinction can be achieved based on two main characteristics: *Perissolestes* has abdominal keels on segments 1–9, whereas *Perilestes* has keels on segments 4–9. Also, *Perissolestes* has caudal gills with small spines along the medial trachea, whereas such spines are absent in *Perilestes*.

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