



## Description of the final instar larva of *Rhionaeschna vigintipunctata* (Ris, 1918) (Odonata: Aeshnidae)

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### Abstract

The final instar larva of *Rhionaeschna vigintipunctata* (Ris) (Odonata, Aeshnidae) is described for the first time. The description is based on a series of mature female larvae collected in Tucumán (NW Argentina) and reared to imago. It shares the U-shaped distal excision of epiproct with other larvae of the *Marmaraeschna* group (only *R. pallipes* and *R. brevicercia* known from this stage); but the minute tubercle at each side of the cleft of ligula is absent. Other characters unique to *R. vigintipunctata* include: open ligula (vs. closed in other "*Marmaraeschna*"), and mandibular formula. A table to distinguish the larvae of the three species of "*Marmaraeschna*" and biological and distributional data of *R. vigintipunctata* are included.

**Key words:** *Rhionaeschna vigintipunctata*, larva, description, Anisoptera, *Marmaraeschna* group, South America

### Resumen

Se describe por primera vez el último estadio larval de *Rhionaeschna vigintipunctata* (Ris) (Odonata, Aeshnidae). La descripción se basa en una serie de larvas maduras hembras colectadas en Tucumán (noroeste de Argentina) y criadas a imago. La larva comparte con las otras especies del grupo *Marmaraeschna* (solo *R. pallipes* y *R. brevicercia* son conocidas en este estadio) la presencia de una hendidura distal en forma de U en el epiprocto, pero el pequeño tubérculo a ambos lados de la ranura media de la lígula está ausente. Otros caracteres son únicos para *R. vigintipunctata*: lígula abierta (vs. cerrada en otros "*Marmaraeschna*"), y fórmula mandibular. Se incluye una tabla para distinguir la larva de las tres especies de "*Marmaraeschna*" y se ofrecen datos biológicos y de distribución para *R. vigintipunctata*.

### Introduction

*Rhionaeschna* Förster is a New World genus with 41 described species distributed from S Canada to S Argentina (Garrison *et al.*, 2006; von Ellenrieder, 2003). The group is mainly neotropical with its highest diversity along the Andes (von Ellenrieder, 2003). The knowledge of the biology of most species of this genus is still scarce; the species of *Rhionaeschna* occur at almost any body of water (Garrison *et al.*, 2006).

The genus is characterized by having a conical tubercle bearing denticles on abdominal sternum I in the imago (von Ellenrieder, 2003), but unique characters for the larval stage are unknown.

Within the genus *Rhionaeschna* seven species belong to the Neotropical *Marmaraeschna* group (Muzón & von Ellenrieder 2001). These species are distributed mainly in the Andes from 400 to 4000 m (Muzón & von Ellenrieder, 2001) and are limited to South America. Currently, the larvae of only two species of the *Marmaraeschna* group are known: *R. pallipes* (Fraser) described by von Ellenrieder & Muzón (2003) and *R. brevicercia* (Muzón & von Ellenrieder), described by de Marmels (2001) as *Aeshna* (*M.*) *vigintipunctata* (later transferred to *R. brevicercia* by Muzón & von Ellenrieder, 2001).

The goal of this work is to describe and illustrate for the first time the larva of *R. vigintipunctata*. Some biological observations and distributional data are given.

## Material and methods

The description of the final instar larvae of *R. vigintipunctata* is based on specimens collected in a small stream from the Yungas biogeographic province, at an altitude dominated by mountain rain forest (Morrone, 2001).

The terminology used to describe morphological characters follows von Ellenrieder & Muzón (2003) and de Marmels (2001), and the larval mandibular formula follows Watson (1956). The identification of material, adults and larvae, was done using the identification guide and key of von Ellenrieder & Garrison (2007a, 2007b). The illustrations were made using a stereomicroscope (Nikon 20154) coupled with a camera lucida. Measurements are given in millimeters.

The reared imago specimens and the larvae are preserved in 96% ethanol and deposited in the collection of the Instituto de Biodiversidad Neotropical, Horco Molle, Tucumán, Argentina.

## Material examined

*Rhionaeschna vigintipunctata*: two reared imago females with the corresponding exuviae from ARGENTINA, Tucumán Province, Tafí Viejo, Tafí stream, 9 July 2013, 880m, 26° 43' 6" S, 65°17' 45" W, J. S. Rodríguez; one young female larva, same data as above; one last instar female larva, same data; and one young female larva, same data except date and collectors, 08 March 2014, J. S. Rodríguez & G. Hankel. *R. pallipes*: four female and one male larva, same data as above (Tafí stream). Two young female larvae: ARGENTINA, Catamarca province, Belén, Termas de Nacimiento, 3 October 2005, 2126m, 27° 9' 22" S, 66° 45' 31" W, C. Molineri.

## Results

Description of the final instar larva of *Rhionaeschna vigintipunctata* (see Table 1 for measurements)

**TABLE 1.** Morphological features of last instar larva/exuvia (n=3) of *R. vigintipunctata*. Arithmetical mean  $\pm$  SD [mm].

| Character                             | mean $\pm$ SD    |
|---------------------------------------|------------------|
| total length (with caudal appendages) | 42.33 $\pm$ 2.08 |
| length of abdomen                     | 20.47 $\pm$ 0.15 |
| lengths of lateral spines S 6         | 0.8 $\pm$ 0.1    |
| lengths of lateral spines S 7         | 1.25 $\pm$ 0.05  |
| lengths of lateral spines S 8         | 1.33 $\pm$ 0.03  |
| lengths of lateral spines S 9         | 1.07 $\pm$ 0.06  |
| head width                            | 9.6 $\pm$ 0.1    |
| head length                           | 5.5 $\pm$ 0.1    |
| total length of antenna               | 3.07 $\pm$ 0.18  |
| antennomere I                         | 0.27 $\pm$ 0.03  |
| antennomere II                        | 0.37 $\pm$ 0.03  |
| antennomere III                       | 1 $\pm$ 0        |
| antennomere IV                        | 0.38 $\pm$ 0.06  |
| antennomere V                         | 0.33 $\pm$ 0.03  |
| antennomere VI                        | 0.33 $\pm$ 0.03  |
| antennomere VII                       | 0.38 $\pm$ 0.03  |

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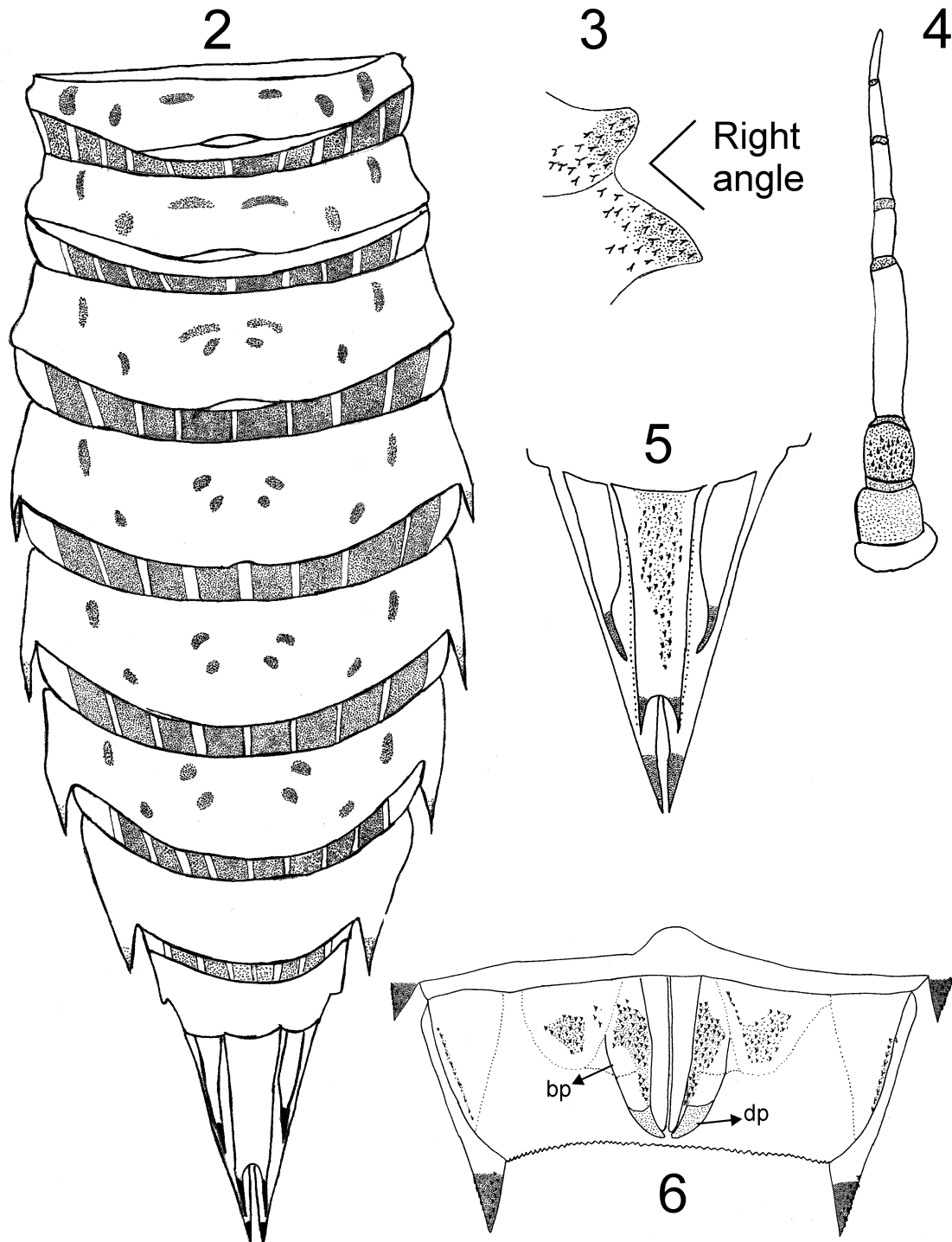
**TABLE 1.** (Continued)

| Character  | mean±SD     |
|--|-------------|
| length of prementum                                | 7.57 ± 0.12 |
| width of prementum                                 | 6.3 ± 0     |
| Palp movable hook                                  | 2.23 ± 0.06 |
| Palp inner margin                                  | 1.53 ± 0.06 |
| Ligula width                                       | 3 ± 0       |
| inner wingpad length                               | 9.73 ± 0.68 |
| outer wingpad length                               | 9.1 ± 0.53  |
| length femur I                                     | 5.63 ± 0.12 |
| length femur II                                    | 7.17 ± 0.15 |
| length femur III                                   | 8.43 ± 0.12 |
| length tibia I                                     | 6.7 ± 0.26  |
| length tibia II                                    | 7.53 ± 0.21 |
| length tibia III                                   | 8.9 ± 0.26  |
| length inner gonapophyses                          | 2.27 ± 0.25 |
| ratio gonapophyses / segment IX length             | 2.13 ± 0.27 |
| cerci length (external margin)                     | 2.87 ± 0.06 |
| length of paraproct (ventral view of inner margin) | 5.07 ± 0.12 |
| length of epiproct (ventral view of inner margin)  | 3.9 ± 0     |

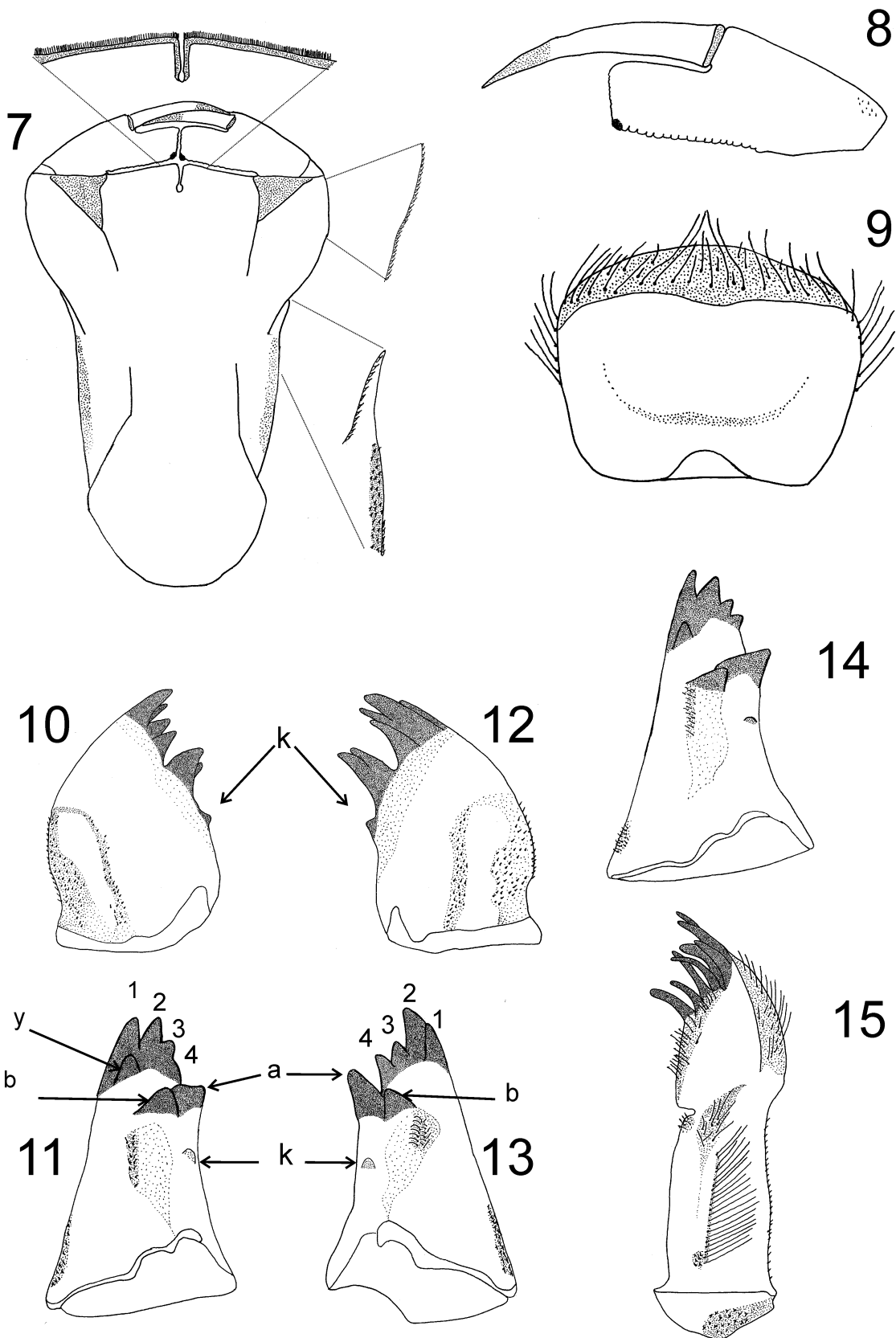
Exuvia light brown, with several spiniform and piliform setae; last instar larva brown in vivo turning light brown in alcohol (Fig. 1). Abdomen lanceolate with numerous dark dots and dashes as in Figs. 1–2.

**FIGURE 1.** *R. vigintipunctata*, dorsal view of mature female larva.

Head. Broader than thorax, approximately 1.7–1.8 times wider than long. Occipital margin concave, occipital lobes rounded with several spiniform setae in posterior margin, posterior margin of occiput concave. Compound eyes large. Antennae (Fig. 4) surpassing anterior margin of labrum (Fig. 1), 7-segmented, third antennomere longest; scape and pedicel slightly darker than flagellomeres and with spiniform setae on dorsal surface, flagellomeres smooth. Labium: prementum and postmentum articulation reaching caudal to second coxae. Prementum (Fig. 7) 1.2 times wider than long, lateral edge with small granules and on distal third with ventral row of short setae arising from spiniform basis (see details in Fig. 7). Ligula smoothly prominent (Fig. 7) anterior margin with fringe of piliform setae, ligula without minute tubercle on each side of cleft; cleft open. Labial palp (Fig. 8)



**FIGURES 2–6.** *R. vigintipunctata*, details in morphology of female exuvia. 2, Dorsal view of abdominal segments III–X; 3, Right prothoracic apophyses, dorsal view; 4, antenna, dorsal view; 5, Caudal appendages, dorsal view of epiproct, cerci and paraprocts; 6, Sternite IX and gonapophyses, ventral view (bp and dp = basal and dorsal portions).



**FIGURES 7–15.** *R. vigintipunctata*, details in morphology of female larva. 7, Prementum, dorsal view, with details of ligula (in ventral view) and lateral margin; 8, labial palp, dorsal view; 9, Hypopharynx, ventral view; 10, right mandible, lateral view; 11, same, inner view; 12, left mandible, lateral view; 13, same, inner view; 14, right mandible, inner view (different specimen); 15, maxilla.

subrectangular with small blunt infra-apical tooth, distal and inner margin crenulated, movable hook as long as palp. Labrum trapezoidal, completely covered with small granules dorsally except on a posteromedian subcircular smooth area; with row of ventral setae along anterior margin and with submedian group of setae on ventral surface. Hypopharynx (Fig. 9) ventral surface trapezoidal with protruded medial zone; dorsal surface covered with setae distally, setae more numerous toward lateral margins. Cardio and stipes of maxilla (Fig. 15) with small granules and short setae; galea pointed and covered with setae; lacinia with many setae on inner margin and with four sclerotized subapical denticles, apex three-pointed. Mandibles with small granules and short setae on dorsal and outer surface. Mandibular formula L 1234 0 a b (Fig. 11 and 14) / R 1234 y a b (Fig. 13); in both mandibles k tooth is expressed as small swollen and sclerotized area (Figs. 10 and 12).

Thorax. Apex of prothoracic apophyses blunt and angle between prothoracic apophyses right (Fig. 3). Inner wingpad (Fig. 1) reaching caudal posterior margin of abdominal segment IV; external wingpad reaching caudal anterior margin of abdominal segment V. Legs (Fig. 1) yellowish brown, with abundant spiniform setae, tarsal claw simple.

Abdomen. Lanceolate (Fig. 2), granulose on dorsal and ventral surface covered with abundant spiniform setae; lateral margin of segments II–IX with small spiniform setae, lateral margin of segments VI–IX ending in a robust spine, VIII and IX the longest; spine on IX surpassing half of segment X. Color pattern formed by a complex array of dark dots and dashes (Fig. 1) with lateral and dorsal dark spots on segment II–VIII; II–IV with two central dark spots and two lateral dark spots on each side, V–VIII with four central dark spots and two lateral dark spots on each side, and IX–X without dark spots. Female terminalia (Fig. 5): Female cerci rounded, each one terminated in a long spine. Epiproct ending in an apical long spine, dorsal margin with abundant spiniform setae decreasing in number to apical part, apical excision U-shaped. Paraproct ending in long spine, margins with row of spines (Fig. 5). Female gonapophyses (Fig. 6) reaching posterior margin of segment IX; central valvae smooth, lateral valvae as long as central, with abundant spiniform setae on basal portion, apical portion slightly convergent and smooth; central valvae parallel and without spiniform setae.

Distribution: The geographical range of *R. vigintipunctata* is within the Neotropical region of Argentina, Bolivia and Peru. Range: latitudinal 5° S–29° S, longitudinal 63° W–79° W, altitudinal 170–3139 m (von Ellenrieder, 2003).

Biology: *R. vigintipunctata* is a common species (von Ellenrieder, 2003), but a very good flyer which is difficult to catch. Adults were not observed during the collection of larvae. Larvae of the following species were collected together with *R. vigintipunctata*: *R. bonariensis*, *R. pallipes* and *R. planaltica* (Aeshnidae), *Brachymesia furcata*, *Brechmorhoga nubecula*, *B. vivax*, *Macrothemis imitans* (Libellulidae), *Progomphus joergenseni* (Gomphidae), *Mnesarete grisea* (Calopterygidae), *Argia jujuya*, and *A. joergenseni* (Coenagrionidae).

Last instar larvae described here were found under stones in a stream (Tafi stream) of Sierra de San Javier, a protected area, within a substrate composed mainly of fine gravel and large boulders. Three specimens collected on 9 July 2013 were maintained alive until emergence. This stream is one of many others that flow down from the peaks of the San Javier hill (1100–1500 m). The Rio Tafi is a second-order stream (1.5–2.5 m wide, 20–30 cm depth) with abundant riparian vegetation. The average flow rate is 0.325 m<sup>3</sup>s<sup>-1</sup> (Romero *et al.* 2010). The diversity of the benthic community is estimated at 98 taxa of aquatic arthropods (Romero *et al.* 2010).

## Discussion

The current knowledge of the larval stages of *Rhionaeschna* is poor. With the description of the larva of *R. vigintipunctata* given here, only three of the seven species in the *Marmaraeschna* group are known in this stage (Table 2). The remaining groups in the genus are in similar degrees of knowledge concerning descriptions of larvae (von Ellenrieder, 2003), about 41% of the species of *Rhionaeschna* being known from this stage. Unique larval characters or a unique combination of characters defining the genus were not proposed yet, so larval generic diagnosis is pending until a more comprehensive study is carried out. The three known larva of "*Marmaraeschna*" share the U-shaped distal excision of epiproct (versus biconcave or truncate in the other *Rhionaeschna*, von Ellenrieder & Muzón, 2003).

Nevertheless, at the specific level, the following combination of characters is useful to distinguish larvae of *R. vigintipunctata*: 1) antennae surpassing anterior margin of labrum (not surpassing in *R. brevicercia*); 2) short and

blunt apical hook present on labial palp (absent in *R. brevicercia*); 3) ligula with open medial cleft, without minute denticles at sides; 4) occipital lobes not bulging (bulging in *R. brevicercia*); 6) pronotum shield not strongly extended laterally (in *R. brevicercia* lateral angles are strongly extended in to a blunt point); 7) abdominal lateral spine IX surpassing half of abdominal segment X; 8) epiproct with U-shaped distal excision. Concerning the described "*Marmaraeschna*" larvae, character 3 is unique for *R. vigintipunctata*, while other species show a closed ligula.

**TABLE 2:** Comparison of species from the *Marmaraeschna* group (last instar / exuvia)

| character                                      | brevicercia<br>De Marmels (2001) | pallipes<br>n=7   | vigintipunctata<br>n=5                |
|--|----------------------------------|---|---------------------------------------|
| head, max width / max length                   | 1.4                              | 1.9   | 1.8                                   |
| prementum, max length / max width              | 1.1                              | 1.1   | 1.2                                   |
| mandibular formula                             | unknown                          | left: 1234 0 a b<br>right: 1234 y a (m <sup>1,2</sup> ) b | left: 1234 0 a b<br>right: 1234 y a b |
| prothoracic apophyses, tip of apexes and cleft | Sharp                            | Sharp in male, blunt in female                            | blunt, orthogonal                     |
| epiproct, distal excision                      | U-shaped                         | U-shaped  | U-shaped                              |
| appendages, ratio length cerci / paraprocts    | 0.5                              | 0.5   | 0.6                                   |

The presence of tooth "y" in the right mandible is shared with *R. pallipes* (in *R. brevicercia* this is not described). In the description of *R. pallipes* larva, von Ellenrieder & Muzón (2003) mentioned the absence of "y" tooth in this species, but its presence on the left mandible of all other "Aeschna". We studied seven larvae of *R. pallipes* that present this tooth in the right mandible, but not in the left. Intraspecific variation in mandibular dentition is not known in Aeshnidae, and as we had studied very few individuals, the differences reported should be treated tentatively. Table 2 may be useful to distinguish the known larvae of the group.

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