

Description of the final instar larva of *Rhionaeschna elsia* (Calvert, 1952) (Odonata: Aeshnidae)

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Abstract

The final instar larva of *Rhionaeschna elsia*, a species endemic to the coastal desert of Peru, is described and depicted for the first time and compared with the last larval instars / exuviae of the closely related species of the 'Neureclipta group'. Whereas the prementum is very similar in all five species, exuviae of *R. elsia* can be clearly distinguished from those of *R. absoluta*, *R. bonariensis* and *R. diffinis* by its comparatively long cerci and the very short lateral spines on segments 6 to 9. Especially, the lateral spine on segment 6 is significantly shorter than that of the other species and was even missing completely in two of the six exuviae investigated. In both features *R. elsia* is very similar to *R. galapagoensis*, as described by NEEDHAM (1904).

Resumen

Descripción de la larva de último estado de *Rhionaeschna elsia* (Calvert, 1952) (Odonata: Aeshnidae) – El último estado larval de *Rhionaeschna elsia*, una especie endémica del desierto costero de Perú y del extremo norte de Chile, es descrita y figurada por primera vez, y comparada con las larvas de las especies estrechamente relacionadas del grupo 'Neureclipta'. Mientras que el prementum es muy similar en todas las cinco especies, las exuvias de *R. elsia* difieren en comparación con los de *R. absoluta*, *R. bonariensis* y *R. diffinis* por sus cerci relativamente largos y las espinas laterales muy cortas en el sexto hasta el noveno segmento. Especialmente la espina lateral en el sexto segmento es mucho más corta en *R. elsia* que en las especies mencionadas y es completamente ausente en tres de los 14 exuvias examinadas. En ambas características, la exuvia sin embargo, es similar a *R. galapagoensis* descrito por NEEDHAM (1904).

Zusammenfassung

Beschreibung des letzten Larvenstadiums von *Rhionaeschna elsia* (Calvert, 1952) (Odonata: Aeshnidae) – Das letzte Larvenstadium von *Rhionaeschna elsia*, einer in der Küstenwüs-

te Perus endemischen Art, wird erstmals beschrieben und abgebildet und mit den Larven bzw. Exuvien der nahe verwandten Arten der ‚Neureclipa-Gruppe‘ verglichen. Während das Prämentum bei allen fünf Arten sehr ähnlich ist, unterscheiden sich die Exuvien von *R. elsia* gegenüber jenen von *R. absoluta*, *R. bonariensis* und *R. diffinis* durch ihre relativ langen Cerci und die sehr kurzen Lateraldorne an den Segmenten 6 bis 9; besonders der Seitendorn am sechsten Segment ist bei *R. elsia* deutlich kürzer als bei den genannten Arten und fehlt bei zwei der sechs untersuchten Exuvien sogar vollständig. In beiden Merkmalen ähnelt die Exuvie jedoch der von *R. galapagoensis*, wie sie von NEEDHAM (1904) beschrieben wurde.

Introduction

The genus *Rhionaeschna* occurs from southern Argentina to southern Canada (VON ELLENRIEDER 2003). They are mainly Neotropical species, whose highest diversity can be found along the Andes. Considering the high amount of species, detailed morphological descriptions for a correct diagnosis of specimens are necessary.

From a global perspective, larvae and exuviae of most Odonata species are still unknown. This also affects the species of the new world genus *Rhionaeschna*. Larvae are already known for only approximately half (VON ELLENRIEDER 2003) of the 41 *Rhionaeschna* species hitherto described (GARRISON et al. 2006). An identification key referring to 16 species of the genus is provided by HECKMAN (2006). One of the species, for which the larvae are still unknown, is *Rhionaeschna elsia* (Calvert, 1952) (Fig. 1), a species endemic to the coastal desert of Peru (VON ELLENRIEDER 2003). Within the genus *Rhionaeschna*, *R. elsia* and four other species belong to the Neotropical ‘Neureclipa group’ introduced by NAVÁS (1911) and relegated by CALVERT (1952). This is characterized «by the absence of cross veins in the supratriangle, abdominal segment X of male with a dorsal tooth, and male cerci bearing a subbasal tooth» (VON ELLENRIEDER 2003). In the following we describe the larva of *R. elsia* to improve the understanding of the final instar larva / exuvia of *Rhionaeschna*, which in the long term may expand into a complete identification key for this genus.

Material and Methods

On 22 September 2006, six larvae of *Rhionaeschna elsia* were collected (authorization to collect and export by INRENA – Ministerio de Agricultura, Instituto Nacional de Recursos Naturales, No. 68 – TUPA 014-2006 AG) during a field trip led by Joachim Hoffmann at Laguna Morón (Locality Bernales, District Humay, Province Pisco, Region Ica, Peru, 13°45’35.2’’S, 75°58’48.3’’W), a shallow lake with a maximum water depth of 2.3 m, located in the coastal desert of south-western Peru, 25 km east of the city of Pisco, at 285 m a.s.l. The lake was surrounded

by shifting sand dunes (Fig. 2). The shore vegetation was dominated by *Typha domingensis*, *Distichlis spicata*, *Casuarina equisetifolia*, and different species of rushes. In the shallow water of an influent rivulet (max. water depth 0.7 m), submerse and semi-submerse vegetation was present, comprising *Luzula* sp., *Polygonum interruptus*, *Portulaca* sp. and other herbaceous species (Fig. 3). The shore line was covered by the salt tolerant *Samolus* sp. and *D. spicata*, and a salt crust was evident.

The following hydrological parameters were measured: Water temperature at 1 m depth 19.1°C, surface temperature 20.2°C, pH 7.74, oxygen 5.9 mg/l, conductivity 1510 mS/cm, carbon hardness 212.3 mg/l CaCO₃.

The six collected larvae of *R. elsia* (2 males, 4 females) were reared in the laboratory in Germany; they emerged at 13-ix-2006, 06-i-2007, 22-i-2007, 07-ii-2007, 08-ii-2007 and 25-ii-2007, respectively. Following the keys of GARRISON et al. (2006) and VON ELLENRIEDER (2003), the emerged dragonflies were determined as *Rhionaeschna elsia*. Eight exuviae of *R. elsia*, collected during a second field trip on 28-ii-2007 at the same site as described above, were used additionally for the measurement of morphological features.



Figure 1: Male of *Rhionaeschna elsia* at the Laguna Morón near Pisco, western Peru. (28-ii-2007). – Abbildung 1: Männchen von *Rhionaeschna elsia* an der Laguna Morón bei Pisco im westlichen Peru (28.02.2007). Photo: FJS

Morphological description of the final instar larva of *Rhionaeschna elsia*

Habitus. Body elongated (Fig. 4A, B), exuviae are brownish-yellow with slightly darker patterns, surface of the whole body without hairs except very short setae on some parts of the body.

Head. The posterior margin of occiput concave, the eyes more than half the size of the lateral margin of the head, occipital margin concave (Fig. 4A), with 4 to 6 small tuberculated patches on each side. Antennae 7-segmented, all segments nearly cylindrical, without any visible setae, first and second segment short and strong, the third segment being the longest. The hinge of the labium reaches posteriorly to the second coxae. The median lobe of the prementum slightly longer than broad (Fig. 4A, C), anterior margin of the lobe with a row of short setae and a very small blunt tooth at both sides of a closed cleft (Fig. 4C). Labial palps nearly rectangular, inner margin notched with a very small apical tooth, movable hooks long and curved inwards.



Figure 2: Laguna Morón, embedded in the shifting sand dunes of the coastal desert of western Peru, 25 km east of Pisco. The reed vegetation is dominated by *Typha* cf. *domingensis* (28-ii-2007). – Abbildung 1: Laguna Morón bei Pisco, eingebettet in Wanderdünen der Küstenwüste des westlichen Perus. Das Röhricht wird von *Typha* cf. *domingensis* dominiert (28.02.2007). Photo: FJS

Thorax. Prothoracic projections bilobed and angular, posterior process longer and stouter than anterior one (Fig. 4D). Wing cases reaching distal end of abdominal segment 5. Legs with sparsely pigmented rings on femora and tibiae, the extended hind leg reaches distal end of segment 5, all tarsi three-segmented.

Abdomen. Abdomen slender and fusiform, widest on segment 6 (Fig. 4A, B). Colour pattern as in Figure 4B, two central and one lateral dark pigmented spots on each side of the tergites and a pale shadow on mid dorsal line of segments 5 to 8. Short lateral spines on segments 6 to 9, it lacks in 3 of the 14 exuviae completely on segment 6, dorsal spines absent. Gonapophysis of female not reaching the posterior margin of segment 9 (Fig. 4F). The ratio between the length of gonapophyses and the length of segment 9 is 0.850 ± 0.05 . Epiproct shorter than paraprocts with a middorsal ridge and two apical spines, cerci almost as long as the epiproct (Fig. 4E), male basal lamina of epiproct pointed, approximately as long as half of cerci length.



Figure 3: Influent rivulet of Laguna Morón near Pisco, western Peru, where six larvae of *Rhionaeschna elsia* were collected (28-ii-2007). – Abbildung 2: Abfluss der Laguna Morón bei Pisco, westliches Peru, in dem sechs Larven von *Rhionaeschna elsia* gesammelt wurden (28.02.2007). Photo: FJS

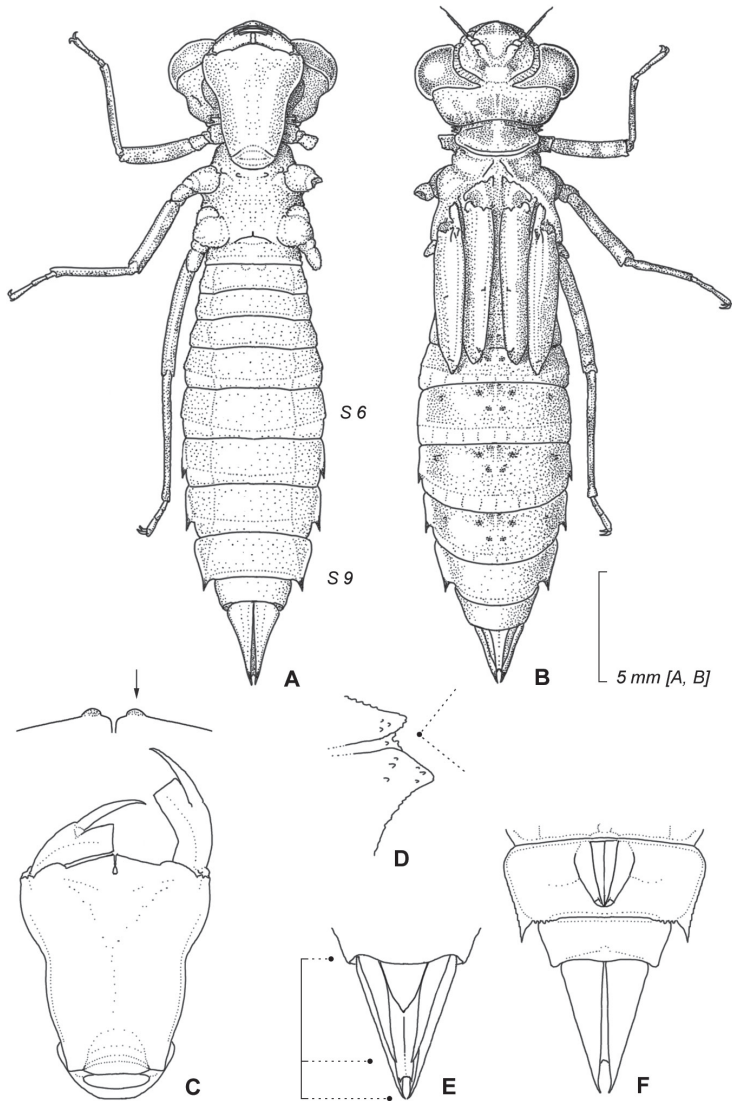


Figure 4: Larva of *Rhionaeschna elsia*. – Abbildung 4: Larve von *Rhionaeschna elsia*. A male habitus, Habitus des Männchens; B female habitus, Habitus des Weibchens; C prementum, Prämentum; D prothoracic apophyses, Fortsätze der Vorderbrust; E male appendages, Hinterleibsanhänge des Männchens; F female abdomen with ovipositor, Abdomenende des Weibchens mit Legebohrer (A, C, F in ventral view, Ventralansicht; B, D, E in dorsal view, Dorsalansicht).

Table 1. Morphological features of the final instar larva of *Rhionaeschna elsia*. Arithmetical mean \pm SD [mm]. – Tabelle 1. Morphologische Merkmale des letzten Larvenstadiums von *Rhionaeschna elsia*. Arithmetisches Mittel \pm S.D. [mm].

morphological feature	females (n = 8)	males (n = 6)
total body length	29.06 \pm 2.12	28.15 \pm 0.61
head width	06.81 \pm 0.16	06.83 \pm 0.16
head length	04.93 \pm 0.38	04.79 \pm 0.15
length of prementum	04.43 \pm 0.09	04.37 \pm 0.05
width of prementum	04.06 \pm 0.14	04.04 \pm 0.14
inner wingpad length	07.67 \pm 0.35	07.80 \pm 0.30
outer wingpad length	07.11 \pm 0.66	07.23 \pm 0.22
length of abdomen	19.14 \pm 1.78	18.73 \pm 1.06
length of male basal lamina of epiproct	–	01.05 \pm 0.14
length of gonapophyses	01.54 \pm 0.13	–
length of paraproct (ventral view of inner margin)	03.22 \pm 0.11	03.24 \pm 0.15
length of cerci (dorsal view of inner margin)	02.18 \pm 0.25	01.98 \pm 0.23
length of epiproct (dorsal view of inner margin)	02.73 \pm 0.24	02.32 \pm 0.27

Discussion

The collection of exuviae is an established method in dragonfly research. Sampling of exuviae supplements adult observations and improves detectability of Odonata species even under conditions unsuitable for the search for adults. Furthermore, the record of an exuvia is the best proof of successful reproduction of a species in a surveyed water body (e.g., GERKEN & STERNBERG 1999). However, the method requires that larvae and exuviae have already been described, and that a precise determination of the collected exuviae is possible.

Here we give diagnostically relevant features of the larvae of *Rhionaeschna elsia* in comparison to the other four related species of the 'Neureplica group' (CALVERT 1952). Larvae of *R. absoluta*, *R. diffinis* and *R. bonariensis* were described by VON ELLENRIEDER (2001) in a very detailed way. *Rhionaeschna galapagoensis* does also belong to the 'Neureplica group', and its larva has been described by NEEDHAM (1904). However, because of its endemic status on Galapagos, the species is isolated geographically from the other species. *Rhionaeschna elsia* and *R. galapagoensis* are distinguished from the remaining species under consideration of some of their imaginal features, for example the clypeal lobes and the shape of appendages in both sexes (VON ELLENRIEDER 2003).

The final instar larvae / exuviae of all five species in the 'Neureplica group' are compared in Table 2.

Table 2. Comparison of final instar larvae of the *Rhionaeschna* species in the 'Neureclipta group'. – Tabelle 2. Vergleich des letzten Larvenstadiums von *Rhionaeschna* Arten in der 'Neureclipta-Gruppe'. * after, nach VON ELLENRIEDER (2001); ** after, nach NEEDHAM (1904).

Character	<i>R. absoluta</i> (n = 8)*	<i>R. bonariensis</i> (n = 14)*	<i>R. diffinis</i> (n = 2)*	<i>R. elsia</i> (n = 14)	<i>R. galapagoensis</i> (n = 1)**
Prementum: relation max. length/max. width	1.02	1.20	1.11	1.09	1.15
prothoracic apophyses: tip of apex cleft between apophyses	pointed acute	blunt orthogonal	pointed acute	blunt orthogonal	not specified
length of lateral spines [mm]:					
on S 6	0.3	0.42	0.22	0.10 or absent	«obsolete»
on S 7	0.58	0.78	0.52	0.40	«small»
on S 8	0.78	0.98	0.60	0.63	«well developed»
on S 9	0.68	0.91	0.62	0.63	«well developed»
Appendages: relation length of cerci/length of paraprocts	0.56	0.54	0.53	0.64	0.75-0.80

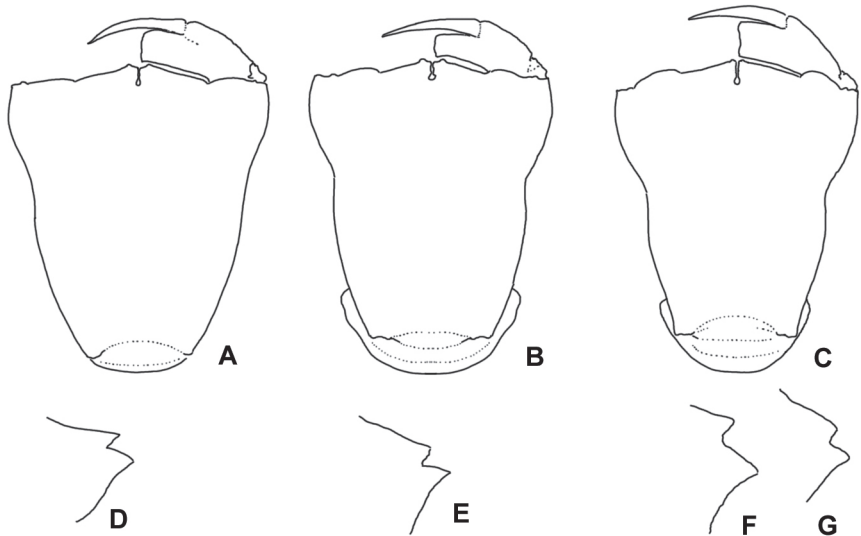


Figure 5: Comparison of *Rhionaeschna* species from the 'Neureclipta group'. – Abbildung 5: Vergleich der *Rhionaeschna*-Arten aus der 'Neureclipta-Gruppe'. Prementum, Prämentum: A *R. absoluta*, B *R. diffinis*, C *R. elsia*; Prothoracic apophyses, Fortsätze der Vorderbrust: D *R. absoluta*, E *R. diffinis*, F *R. elsia*, G *R. bonariensis* (A, B, D, E, G: redrawn after, nach VON ELLENRIEDER 2001)

The proportions of length to width of the prementum are fairly similar for all five *Rhionaeschna* species of the 'Neureclipta group'. Furthermore, the species do not significantly differ in the shape of their prementum (Fig. 5). Therefore the prementum seems to be an unsuitable character for discrimination of the species. Another possible distinguishing mark refers to the prothoracic apophysis: Whereas they are pointed in the larvae of *R. absoluta* and *R. diffinis*, they are rather blunt in that of *R. elsia* and *R. bonariensis*. The angles between anterior and posterior apices do also differ: *R. absoluta* and *R. diffinis* have acute angles (Fig. 5 D, E), whereas the apices of *R. elsia* and *R. bonariensis* have a right angle (Fig. 5 F, G).

Comparing the larvae of the species described by VON ELLENRIEDER (2001), the striking features are the very long cerci and the very short lateral spines on segments 6 to 9 of *R. elsia* (Tab. 2). Two of the six reared individuals of *R. elsia* are lacking any lateral spines on segment 6, as does the single described larva of *R. galapagoensis* (NEEDHAM 1904). In contrast, these spines are clearly expressed in the larvae of the other three species investigated.

In spite of clearly separated distribution areas, which lay more than 1,000 km apart at a WNW-ESE axis (VON ELLENRIEDER 2003), *R. elsia* and *R. galapagoensis* bear striking resemblances in some aspects. In both species, several morphological features of the adult are similar (VON ELLENRIEDER 2003), and the same applies to the larva of *R. galapagoensis* (VON ELLENRIEDER 2001) as compared to that of *R. elsia*. Furthermore, they also show conspicuous analogies in their ecological requirements: Both species are endemic to coastal deserts, and their larvae inhabit brackish water. Therefore, further investigations seem to be worthwhile.

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