

Description of the Imagines of *Rhithrogena goeldlini* Sartori and Sowa, 1988, and Keys for the Identification of Imagines of the European Species of the *R. diaphana*-Subgroup (Ephemeroptera: Heptageniidae)

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The male and female imagines of *Rhithrogena goeldlini* Sartori and Sowa, 1988 are described and drawn on the basis of material collected in Portugal close to the type locality. Features distinguishing male imagines of the European species of the *R. diaphana*-subgroup are keyed.

Keywords: Taxonomy, keys, Ephemeroptera, *Rhithrogena diaphana*-subgroup.

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INTRODUCTION

Up to now, 11 European species of the *Rhithrogena diaphana*-group as defined by Sowa (1984) have been described. Keys for the identification of male imagines and nymphs were published by Alba-Tercedor and Sowa (1987). Sartori and Sowa (1988) described the nymph of *R. diaphana* Navás and the nymphs, subimagines and eggs of a new species, *R. goeldlini*, including updated keys for the identification of nymphs of 8 European species of the *diaphana*-group.

On the basis of morphological and biochemical characteristics, the species in the genus *Rhithrogena* were assigned to two major groups, the *R. laevigata*-group and the *R. lobata*-group. Subsequently, Sowa's *R. diaphana*-group was considered as a subgroup of the *R. laevigata*-group (Zurwerra et al., 1987).

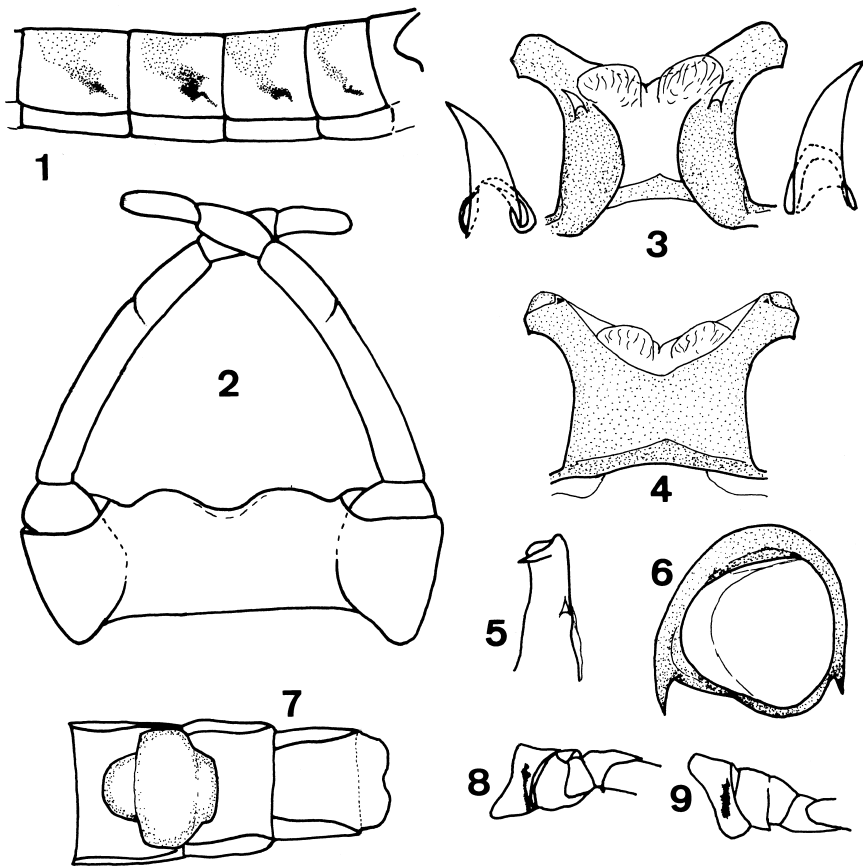
By studying material from Portugal, collected in the same river basin and not far away from the type locality of *R. goeldlini*, we identified imagines (males and females) of this species. An accurate identification was possible comparing eggs from female imagines with the original description and figures. Since imagines were unknown, we take the opportunity to describe them. In addition, we provide a key for the identification of the male imagines of the 11 known species of the *diaphana*-subgroup.

Recently Tomka and Rasch (1993) compiled the available information on the nymphs of 44 European species and provided a highly useful key. However,

although local fauna publications are available (ie. Studemann et al., 1992) there is no key to identify imagines from all of Europe. Thus, this paper represents an attempt at this purpose.

Rhithrogena goeldini Sartori and Sowa, 1987 (Figs. 1–9)

Male imago. Body length: 9–9.5 mm, forewings: 9–9.5 mm, cerci: ca. 11 mm. General body colour light pale yellow, with dark markings and pattern very similar to that of *R. diaphana* but clearly paler, less evident, and with the follow-



Figs. 1–9. *Rhithrogena goeldini*, male imago (1–6, 8) and female imago (7, 9): anterior part of abdomen in lateral view (1); styliger and forceps (2); penis and titillators in ventral view (3); penis in dorsal view (4) and in lateral view (5); apical part of penial lobe in caudal view (6); posterior part of abdomen in ventral view (7); basal part of 2nd leg (katepisternum, coxa and trochanter) (8, 9).

ing differences: without a transverse stripe basally to the antennal insertion (only a small one at the base of each antenna); in front of the hind coxae and behind the intermediate coxae without any stripe; middle and hind coxae without a blackish dot on the external face, only a fine stripe basally to the coxae (on the katepisternum; after Kluge, 1994) (Fig. 8); bands on lateral parts of abdominal segments II to VII (in our material no marks are visible on segment VIII, but according to the original description the male subimago has faint marks on this segment) (Fig. 1).

Genitalia (Figs. 2–6): posterior margin of styliger having a pair of rounded projections delimiting a shallow notch, 2nd segment of forceps having a deep distal incision giving the appearance of an extra segment (Fig. 2); penial lobes quite divergent, apically rounded both in ventral and dorsal view (Figs. 3, 4), but somewhat truncated in lateral view (Fig. 5), and separated by a shallow emargination, roughly U-shaped and forming an obtuse angle. Internal subapical tooth of each lobe not visible from the ventral side, external one being well visible. Apical contour and gonoporous as in Fig. 6. Ventral vesicular part of penis well developed, extending beyond the tip of titillators. Titillators pointed and gradually narrowing towards the tip. Transverso-basal sclerite of the dorsal side of penis pointed in the middle.

Female imago: Body length: 9–10 mm, forewings: 9.5–10.5 mm, cerci: 11.5–13 mm. According to Sartori and Sowa (1987), the general colour and pattern should be similar to the male imago; however, in our material, except for the pattern on the katepisternum of meso- and metathorax (Fig. 9), no lateral marks appear on the abdomen as in males. Subgenital plate clearly wider than long (Fig. 7).

Material: 3 male and 3 female imagines, rio Zêzere, Fonte Santa, Serra Estrela, Portugal, 8-VI.1978, P. Malzacher leg., in coll. Alba-Tercedor, Universidad de Granada.

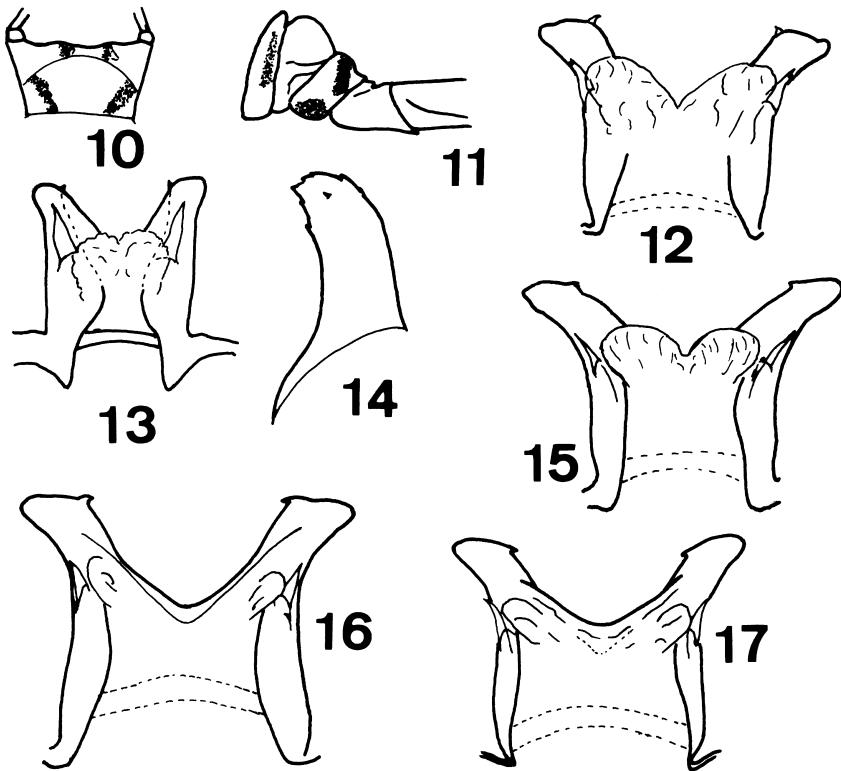
KEYS FOR THE IDENTIFICATION OF MALE IMAGINES OF THE EUROPEAN SPECIES OF THE *RHITHROGENA DIAPHANA*-SUBGROUP

According to Zurwerra et al. (1987: table 3 and fig. 3), species of the *R. laevigata*-group can be distinguished from the *R. lobata*-group by the form of the apical edge of the ejaculatory duct of the penis lobe. Thus, in species of the *laevigata*-group the protruding apical edge is at the same level and surrounding the funnel-shaped ejaculatory, and the sloping of the funnel-shaped edge is steady all-around (see Fig. 6). In contrast, in the *lobata*-group the protruding apical edge is not placed at the same level; it is only visible on the ventral side of the often rift-shaped orifices of the ejaculatory duct, and the hemispherical dorsal edge slopes gradually to the ventral part of the orifice.

Within the *laevigata*-group, the *Rhithrogena diaphana*-subgroup according to Sowa (1984) can easily be distinguished by the following combination of characters: presence of lateral oblique dark bands on abdominal segments, dark stripes

or dots on the basal parts of legs and generally in their proximity, hyaline forewings, abdominal ganglia not pigmented and titillators pointed. The following exceptions to the above characteristics are observed: in *R. adrianae*, the oblique latero-abdominal bands are lacking, and *R. thracica* has rounded or blunty pointed titillators, with several spines on the marginal surface.

In the key, two of Navás' species are included. Originally, both were known only from the very general descriptions and rough drawings by this author. However, the genitalia and some characters (abdominal segments and basal part of legs) of the holotype male imago of *R. cincta* Navás, 1921 were redescribed and drawn by Thomas (1968) (Fig. 11). *R. oscensis* Navás, 1927 is included because, according to the original description, it presents a conspicuous pattern on the abdominal sternites (Fig. 10), that easily distinguishes it from the other species.



Figs. 10–17. *Rhithrogena* spp: Ventral view of the male abdominal tip of *R. oscensis* (10). Basal part of 2nd leg (katepisternum, coxa and trochanter) of *R. cincta* (11). Penis of *R. savoienensis* (12). Ventral view of penis of: *R. zernyi* (13); *R. marcosi* (15); *R. diaphana* (16); *R. beskidensis* (17). Titillator of *R. thracica* (14). Figures have been redrawn after: Navás, 1927 (10), Thomas, 1988 (11), Bauernfeind, 1991 (13), Sowa et al., 1988 (14), and Alba-Tercedor and Sowa, 1987 (12 and 15–17).

1. Abdominal sternites with two elongated dark flecks, inconspicuous on basal segments and highly conspicuous on the apical ones (Fig. 10) (Iberian Peninsula) *R. oscensis* Navás, 1927
- Abdominal sternites without those dark marks 2
2. Penial lobes slightly flared. Titillators very long (ca. 1/3 the length of penial lobe) (Fig. 13) (Mostar/Herzegowina) *R. zernyi* Bauernfeind, 1991
- Penial lobes clearly flared. Titillators shorter (Figs. 3, 4, 12, and 15–17) 3
3. Two conspicuous dots on the coxae, and a black stripe on the katepisternum (Fig. 11) (Iberian Peninsula) *R. cincta* Navás, 1921.
- Without the above characteristics. 4
4. Intensive red markings on thorax and trochanters. Apical part of titillators rounded or with blunt tips, and with several spines on the marginal surface (Fig. 14) (Eastern Balkans/Bulgaria).....
..... *R. thracica* Sowa et al., 1988
- Without red markings. Titillators sharply pointed, sometimes bidentate, and without spines.. 5
5. Vesicular part at the basis of penial lobe big, exceeding half the internal length of lobes. Apico-external parts of penial lobe prominent and well differentiated. Titillators often bidentate at the tip. (Fig. 12) (Central Europe/ West Carpathian) .. *R. savoienis* Alba-Tercedor and Sowa, 1987
- Vesicular part at the basis of penial lobes smaller, not exceeding half the internal length of lobes. Apico-external part of lobe not well differentiated. Titillators generally acuminate at the tip (Figs.: 3, 4 and 15–17) 6
6. Apical part of penial lobes rounded, with external subapical tooth well visible ventrally (Fig. 3) 7
- Apical part of penial lobes more or less acuminate, with external subapical tooth not visible ventrally (Figs. 15 and 17). 9
7. Abdominal segments without lateral bands. Titillators sharply narrowed towards the tip (Alba-Tercedor and Sowa, 1987: p. 79, fig. 60) (Italy). *R. adrianae* Belfiore, 1983
- Abdominal segments with lateral bands (Fig. 1). Titillators gradually narrowing towards the tip (Fig. 3) 8
8. Penial lobes separated by a deep V-shaped emargination forming an acute angle. Gonoporous twice longer than wide (Braasch et al., 1985: p. 126, figs. 3, 4). (Eastern Balkans/Bulgaria)
..... *R. bulgarica* Braasch et al., 1985
- Penial lobes separated by a shallow emargination, roughly U-shaped, forming an obtuse angle (Fig. 4). Gonoporous almost as long as wide or only slightly longer (Fig. 6) (Iberian Peninsula).
..... *R. goeldlini* Sartori and Sowa 1988
9. Penial lobes quite divergent. Vesicular part at the basis of penial lobes strongly prominent and forming a narrow incision between lobes in central part of penis (Fig. 15) (Iberian Peninsula)..
..... *R. marcosi* Alba-Tercedor and Sowa, 1987
- Penial lobes less divergent. Vesicular part at the basis of penial lobes not very prominent and not forming a narrow incision between the lobes in central part of penis (Figs. 16, 17)..... 10
10. Penial lobes truncate at the end, a tooth in apical position well visible on the inside of each lobe in ventral view (Fig.16) (Iberian Peninsula) *R. diaphana* Navás, 1917
- Penial lobes narrowly rounded, but extended, at the end; a tooth clearly situated in a subapical position. (Fig. 17) (Alps/Beskids)..... *R. beskidensis* Alba-Tercedor and Sowa, 1987

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