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TWO NEW SPECIES OF RHITHROGENA EATON (EPHEMEROPTERA, HEPTAGENIIDAE) FROM CENTRAL EUROPE

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Abstract. Two new species, Rhithrogena landai sp.n. /adult male and female, egg/ from the French Alps, Šumava and Krkonoše Mts. and Rh. zelinkai sp.n. /nymph, egg/ from the Krkonoše, the Tatra Mts., in Czechoslovakia and from Austria Inferior, are described and figured. Former species belongs to the alpestris species-group being confused with Rh. alpestris Etn. It is distinguished by more rounded eyes, shape of sclerites of penis in ventral and caudal view and size of titilator, shape of female subgenital plate and details of egg sculpturing. Latter species belonging to the loyolaea species-group is closely related to Rh. gorganica Klap. in nymphal characters. It is distinguished mainly by shape of gill lamellae 1 - 6, shape and number of spines on hind femurs and tibiae and sculpturing of cerci segments surface. Notes on distribution and life cycles of these species are presented.

Taxonomy, diagnoses, egg morphology, distribution

As far as taxonomy and biology of mayflies are concerned, Central Europe represents one of the best-known areas in the world. In spite of relatively extensive knowledge of most species taxonomical situation of some genera requires serious analyses and revisions. This concerns mainly some genera of the family Heptageniidae and especially the genus Rhithrogena Eaton. Centre of the species diversity of this genus is represented by the zones of alpine meadows and spruce forest below timberline of the Alps and Carpathians where, according to our opinion, a lot of species are yet to be described. This paper deals with a description of two of these species. One of them was confused with R. alpestris Eaton for a long time (cf. Lan-

da 1969), the second species seems to be related to R. gorganica Klapálek. Restricted number of specimens studied comprises those collected by the junior author in Czechoslovakia as well as specimens from the collections of Prof. Ch. Degrange (Grenoble), Dr. Marta Margreiter (Innsbruck) and Dr. V. Puthz (Schlitz). We would like to express our sincere thanks to these colleagues who made available their collections and offered valuable discussion on species in question.

We are honoured to name two new species for outstanding specialists in study of European mayflies, Prof. Vladimír Landa (České Budějovice) and Dr. Miloš Zelinka (Brno). Holotypes are deposited in the collection of Institute of Entomology, Czechoslovak Academy of Sciences, České Budějovice, Czechoslovakia.

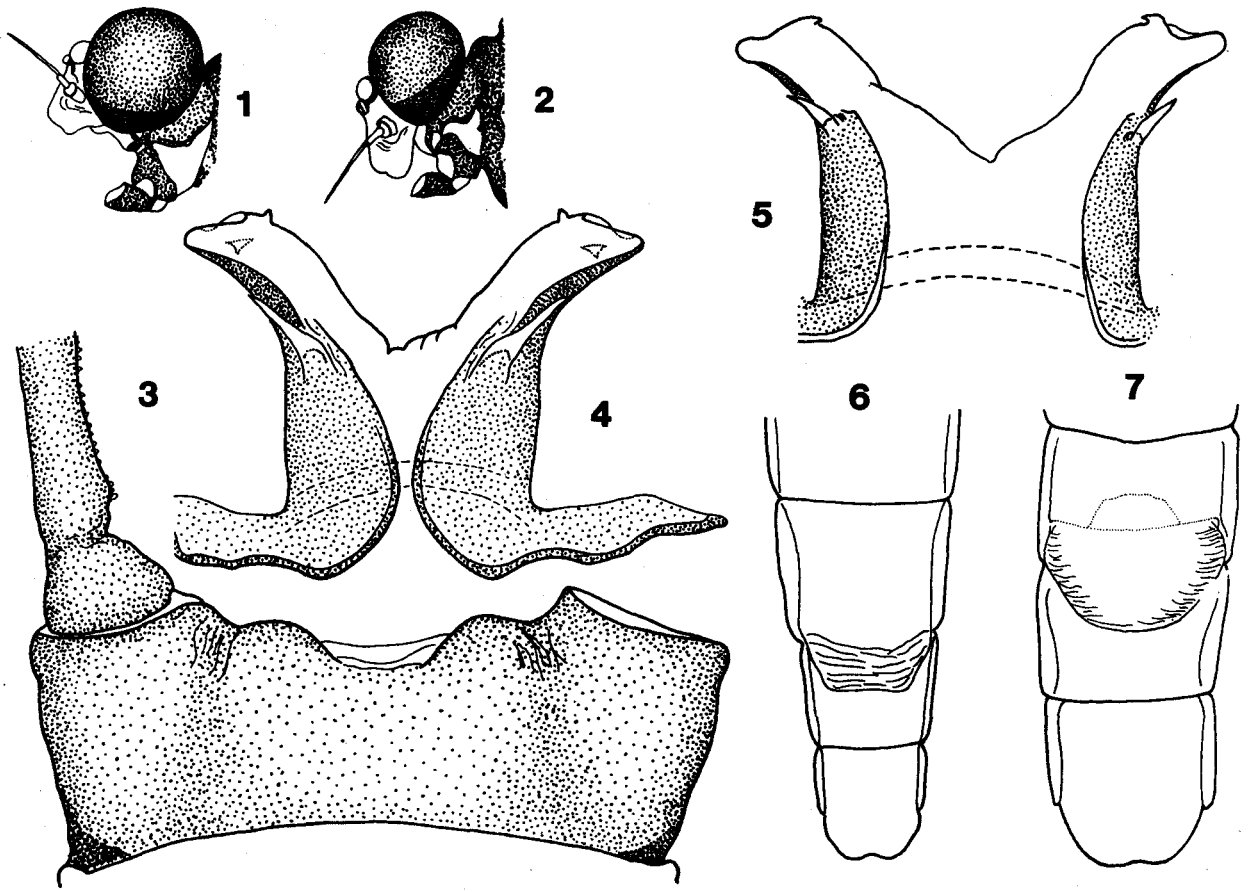
Rhithrogena landai sp.n. (alcohol 75 %)(Figs. 1, 3, 4, 6, 8-11)

Rhithrogena alpestris: Landa, 1969: 165, pro parte (imago, nec larva

Adult male: Body length 8 - 10 mm, length of fore wing 8 - - 10 mm, length of cerci 19 - 21 mm. Head dark brown, eyes grey, greyish blue near the basis, larger and more rounded in comparison with those of R. alpestris (Figs. 1, 2); ocelli black, antennae light brown. Thorax dark brown. Forewings transparent, veins C and Sc brownish, Rs ochraceous, other veins light brown; cross veins colourless, translucent, moderately well apparent in the basal half of costal membrane; pterostigma light greyish milky with simple cross veins; large transversal vein partially lighter, dark at the sides of Sc. Fore legs lost; middle and hind legs pale yellowish, without dark spots on femora; segment 1 of tarsi of middle legs slightly shorter than segment 2, segment 1 of tarsi of hind legs longer than segment 2. Lateral and ventral area of thorax unicolorous, without any special markings. Abdominal terga brown, sterna paler; terga 2 - 8 with a pair of dark inconspicuous bands directed obliquely to their posterior margins; posterior margin of terga a little darker, terga 8 - 10 dark brown. Neural ganglia pale, hardly visible. Cerci rusty brownish at bases, inconspicuously annulated, paler and unicolorous in the apical part.

Genitalia. Posterior margin of styliger conspicuously arcuately incurved in the middle (Fig. 3). Segment 1 of forceps distinctly separated from segment 2. Apical part of penis lobes obliquely truncate in ventral view; outer part of penis lobe apex bluntly pointed, hind margin simple (Fig. 4), internal tooth inserted a little below the apex, external tooth approximately equal in size, shifted to dorsal portion of the penis lobe. In lateral view, penis lobe moderately dorsally incurved at the apex, in caudal view apex of penis lobe triangular (oblong-shaped in R. alpestris - see Puthz 1975: Figs. 5 - 6) with relatively small gonoporus. Titilator acutely pointed, long and simple, sometimes slightly bent (titilator of R. alpestris much shorter (Fig. 5).

Adult female: Body length 9 mm, length of fore wing 9 mm,



Figs. 1 - 7: Rhithrogena landai sp.n. /1,3,4,6/ and R. alpestris Etn. /2,5,7/. 1,2 - head of male in lateral view. 3 - forceps base and part of forceps, ventral view. 4,5 - penis, ventral view. 6,7 - posterior abdominal segments of female, ventral view.

cerci lost. Head pale yellowish, eyes dark; thorax pale brown without special markings. Wing venation as in male, cross veins less apparent, coloration of large transversal vein as in male. Abdomen pale yellow, anterior abdominal terga with inconspicuously indicated transversal rusty violet markings near the posterior margin. Subgenital plate with hind margin straight (Fig. 6), legs and cerci lost.

Egg (dissected from adult female): Length without adhesive elements, 173 - 178 µm, width 108 - 110 µm. Egg stout with thin chorion. Adhesive coils evenly distributed on the entire egg surface. Coils of one of the poles much larger, grouped to a polar cap. Exochorion surface covered with very minute tubercles; these tubercles sparse, not grouped. Micropyle in the equatorial area, its margins bordered with well defined thickened rim. Egg of R. alpestris of the similar structure and size (length 201 - 208 µm without adhesive coils; width 128 - 134 µm). It is distinguished by the following characters: adhesive coils of a little different shape and smaller than

those of R. landai sp.n. (Figs. 8, 9); exochorion surface, apart from very minute tubercles, provided with also larger tubercles which tend to group themselves into irregular rows (Figs. 10, 11); micropyle smaller (Fig. 10), its margins thickened rim.

Nymph unknown.

Material examined: Holotype (adult male): shore of the Lake Annecy, 448 m, Haute Savoie, France, September 21, 1959 leg. Ch. Degrange /genitalia detached, this specimen cited by Puthz (1975: 328) as R. alpestris Etn./; paratypes: 2 males, 1 female, Labe (stream), U Dívčí lávky, Špindlerův Mlýn, 850 m, Krkonoše (Giant Mts.), Czechoslovakia, July 15, 1970; 1 male, Křemelná riv., Čeňkova pila, 750 m, Šumava (Bohemian Forest Mts.), Czechoslovakia, July 28, 1976 leg. T. Soldán. In order to compare R. landai sp.n. with R. alpestris Etn. we studied the following specimens of this species: 1 male, Gurgler Ache stream above Obergurgl, Austria, August 21, 1973; 1 male, 1 female, Ötztaler stream, Solgen, Austria, September 19, 1979 leg. M. Margreiter; 3 mature nymphs of both sexes, Stillach, Allgäuer Alpen, 1000 - 1200 m, August 22, 1968 leg. S. Mendl.

Differential diagnosis and discussion: R. landai belongs to the alpestris species-group and is closely related to this species. It is distinguished mainly by the following critical characters: (1) large and apparently more rounded eyes, (2) shape of penis lobes in ventral view, (3) triangular shape of penis lobe in caudal view, (4) length of titilator, (5) shape of the posterior margin of subgenital plate in female, and (6) structure and ornamenting of egg exochorion. Female of R. landai is closely related to that of R. alpestris as well. Thorax of the latter species is darker, terga of abdomen sometimes with oblique violetish bands (much more inconspicuous than those in R. diaphana Navás). Females of these species can be distinguished according to shape of subgenital plate posterior margin (Figs. 6, 7).

Most likely the nymph of R. landai closely resembles that of R. alpestris but, since it remains unknown, we fail to compare these species in the nymphal stage. Nymphs of alpestris species-group are characterized by crenulated gills, lateral sclerites of the first abdominal sternite directed distinctly cranially, in most of cases by presence of long bristles not only on the posterior but also on the anterior margin of femora and by robust body shape (see Sowa, 1984). We fully agree

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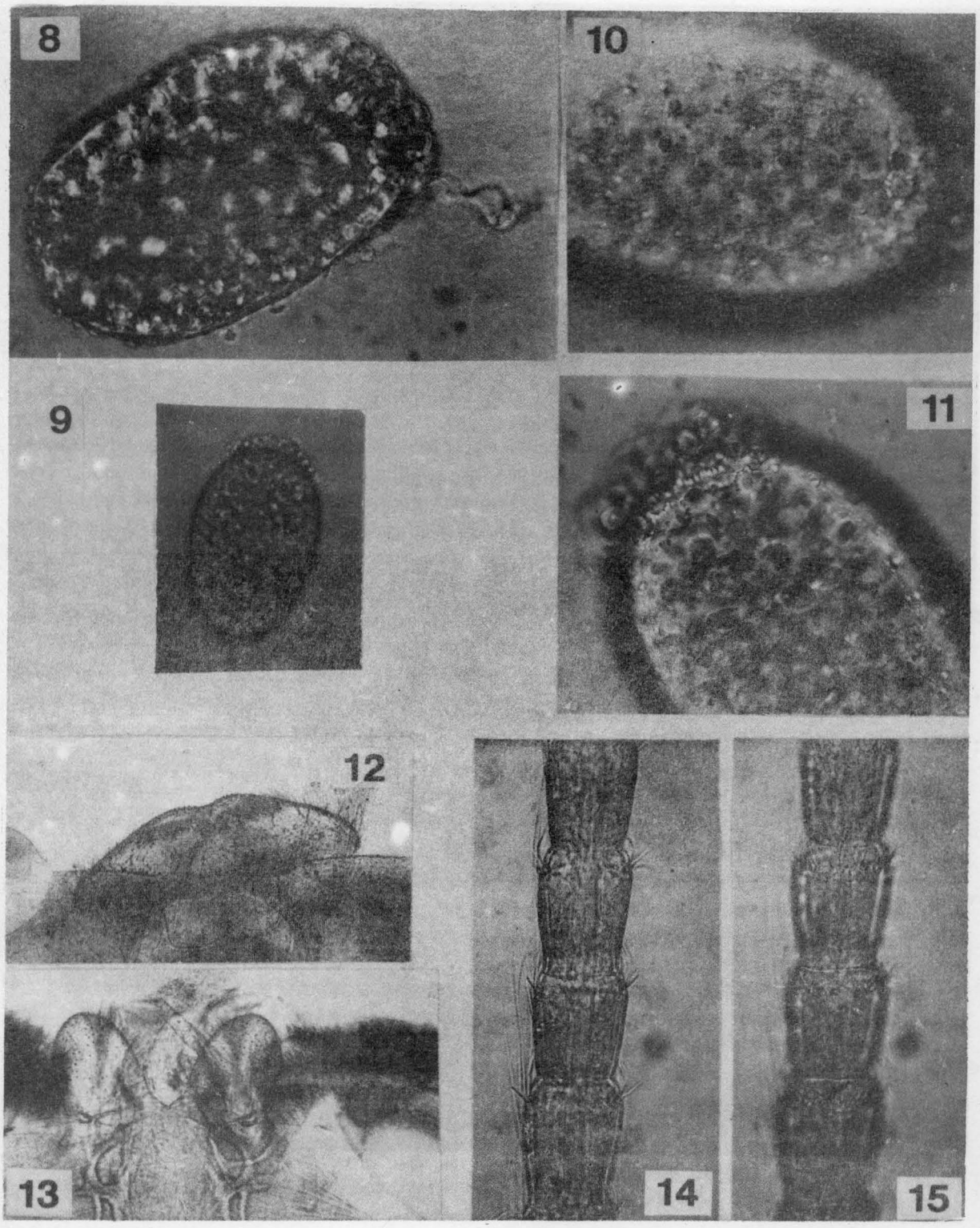
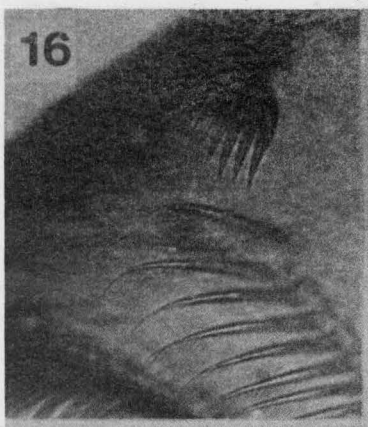
Figs. 8 - 15: R. landai sp.n. /8/, R. alpestris /9 - 11/ and R. zelinkai sp.n. /12 - 15/, egg and nymph. 8,9 - egg, general view. 10, 11 - ornamenting of exochorion. 12 - labrum. 13 - glossae and paraglossae. 14, 15 - segments of cerci from terminal portion /same place/.



Figs. 16 - 24: R. reticulat spec., nymph (16 - 18,22,23/- and egg (19 - 21, 24/. 16 - portion of galeolacinia of maxilla, 17 - posterofistal portion of hind femur, 18 - first abdominal tergum, 19 - egg, general view, 20 - detail of egg surface, 21, 24 - details of exochorion ornamenting, 22 - antage of pe- dis tibe, 23 - nymphal filiator.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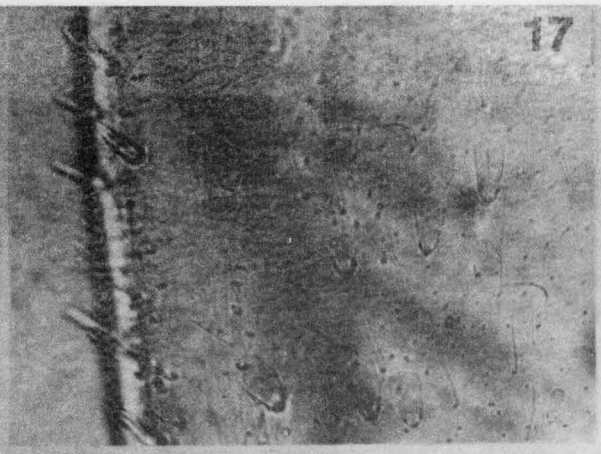
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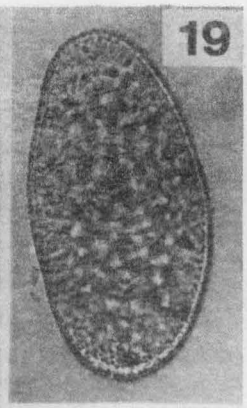
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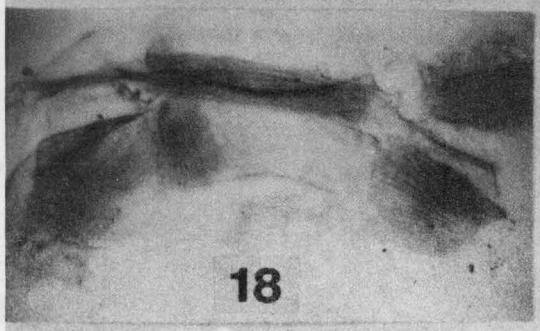
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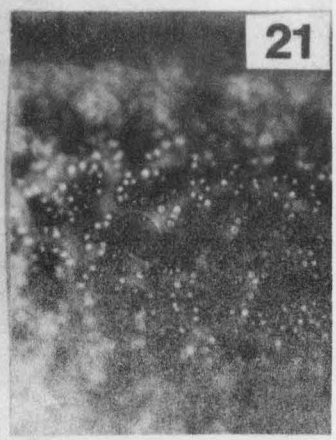
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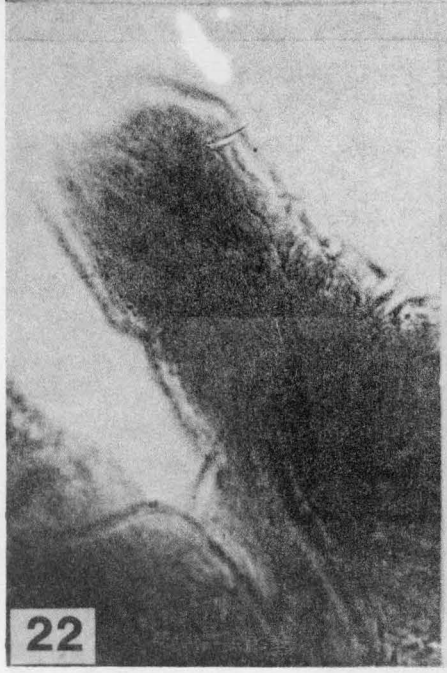
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with Puthz's (1975: 328) opinion that the nymph described by Landa (1969: 162) as R. alpestris actually belongs to other species although, according to our opinion, more probably to R. iridina Kol. than to R. diaphana Nav.

Rhithrogena zelinkai sp.n. (alcohol 75 % with acetic acid) (Figs. 12 - 28)

Mature nymph: Body length 10 - 12 mm, length of cerci 10 - 11 mm. Head oval, oblique, antennae slightly moniliform. Labrum oval at the sides (Fig. 12) with small teeth in the middle of anterior margin; internal incisors of mandibles relatively narrow (specimens from the Labe) or a little larger (specimens from the Tatra and Alps); galeolacinia of maxilla with 8 pectinate spines, central spines with 8 - 11 teeth (Fig. 16); labial paraglossae bluntly pointed at apex (Fig. 13). Femora and tibiae relatively wide; dorsal surface with numerous scales rounded or bluntly pointed at apex (Fig. 17). Posterior margins of femora with relatively short swimming bristles, bristles evidently shorter than maximal width of respective tibiae; anterior margins of femora with only short spines. Dorsal row of spines on hind tibiae consisting of 25 - 30 spines. Claws most often with 2 denticles, distal one longer than proximal one, rarely with only a single denticle. Lateral sclerites of the first abdominal sternite directed slightly caudally (Fig. 18). Lamellae of all gills crenulated; surface of gill 1 with rounded or slightly semilunar plica (Fig. 25), lamella of gill 2 relatively narrow, oblong-shaped or quadrate (Fig. 26), lamellae of gills 3 - 6 with concave fore margins and convex hind margins (Fig. 27), lamella of gill 7 sparsely crenulated (Fig. 28). Surface of caudal filaments segments smooth, pointed microtrichia apparent only near the posterior margins of segments (Figs. 14, 15).

Coloration: Body light brown or dark yellowish without conspicuous markings. Abdominal terga sometimes with a pair of lateromedial lighter great spots; tergum 10 usually darker than anterior terga. Bright field on femora relatively narrow with rusty violet darker spot slightly indicated in the middle in some specimens. Some specimens possess violet stippling on head near the eyes and on the sides of thorax and several anterior abdominal segments; smaller diffuse violet spots also near the fore margins of some terga. Neural ganglia with distinct violet pigmentation.

Figs. 16 - 24: R. zelinkai sp.n., nymph /16 - 18,22,23/ and egg /19 - 21, 24/. 16 - portion of galeolacinia of maxilla, 17 - anterodistal portion of hind femur, 18 - first abdominal sternum, 19 - egg, general view. 20 - detail of egg surface. 21, 24 - details of exochorion ornamenting. 22 - anlage of penis lobe. 23 - nymphal titilator.

Nymphal male genitalia. Lobes of styliger large, oriented outwards. Penis with violet stippling; penis lobes with rounded apex (Fig. 22), outer tooth of penis lobe much larger than the inner one, both teeth inserted below the apex of lobe near gonoporus. Titilator large and wide, with 3 - 4 apical teeth and further teeth on its surface (Fig. 23).

Egg (dissected from mature female nymph): Length 225 - 238 µm, width 106 - 116 µm. Egg longitudinally oval (Fig. 19). Chorion rough, surface of exochorion densely granulated (Figs. 21, 24); adhesive coils on both poles, 2 - 3 micropyle situated in the equatorial area, its margins smooth, without thickened rim.

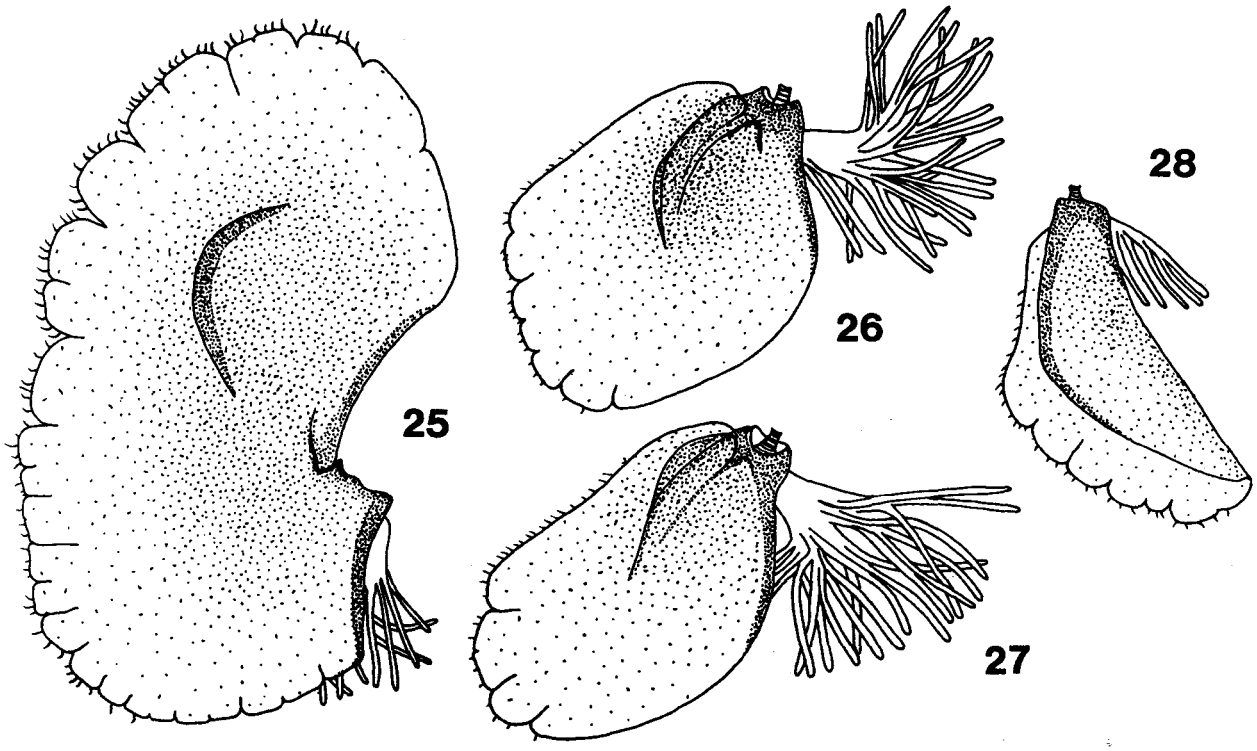
Imago and subimago unknown.

Material examined: Holotype (mature male nymph, parts on slides) and paratype (mature female nymph, parts on slides): spring area of the Labe, Labský důl, Krkonoše (Giant Mts.), 890 m, Czechoslovakia, August 24, 1975 leg. T. Soldán; further paratypes: 1 female nymph, Javorinka stream, Javorina, 910 m, High Tatra Mts., Czechoslovakia, July 5, 1973 leg. T. Soldán; 30 nymphs of both sexes, including mature ones, Miesau Grabe, cca 2 km of Moos Lassing (near Hochkarstrasse), Austria Inferior, September 2, 1975 leg. V. Puthz.

Differential diagnosis and discussion: R. zelinkai sp.n. is, in nymphal stage, closely related to R. gorganica Klap. (Klapálek, 1907) and R. loyolaea Nav. It can be distinguished, among other characters, mainly by the shape and crenulation of gills, shape and number of spines on femora surface and structure of the surface of segments of caudal filaments from the above species. R. zelinkai sp.n. cannot be compared with R. henschi Klap. since this species, described from the territory of Czechoslovakia (Kežmarok) as well, is known only in imaginal stage (Klapálek, 1906). It was redescribed by Puthz (1975) who considered this species as closely related to R. loyolaea Nav. (=R. tatrica Zelinka) (Zelinka, 1953). Although it is very difficult to compare the imaginal external genitalia we believe that these species are well defined and differ each other. Body length, wing venation and characters of external genitalia (e.g. shape of penis and of external and internal penis lobe tooth and others) show apparent relationships of R. henschi to the R. alpestris or R. hybrida species-groups. Moreover, the nymphal titilator of R. zelinkai sp.n. closely resembles that of R. gorganica and markedly differs from the titilator of R. henschi.

Notes on zoogeography and biology of R. landai and R. zelinkai

R. landai sp.n. is a species widely distributed in Central Europe inhabiting larger streams and smaller rivers in mountains below the altitudes of 1000 m (approx. altitude of timberline). On the other hand, R. alpestris seems to be connected mainly with high mountain streams in the Alps, above the altitudes of 1000 m, reaching even the zone of alpine meadows.



Figs. 25 - 28: R. zelinkai sp.n.,nymph, gills: 25 - gill 1, 26 - gill 2. 27 - gill 6. 28 - gill 7.

Nymphs were collected most often round the altitudes of 1600 m. The occurrence of R. alpestris in other mountain ranges including the Carpathians will have to be confirmed by further findings or revised material. R. zelinkai sp.n. is most probably connected with montane streams of middle altitudes (700 - 1000 m). It seems to prefer smaller streams.

All the above three species possess most likely only a single generation a year. R. zelinkai overwinter undoubtedly in the nymphal stage being collected at localities during the winter months. On the contrary, R. landai and probably also R. alpetris overwinter in the stage of egg. Both new species seem to be solitary to rare at localities in Czechoslovakia.

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