

**ECDYONURUS SUBMONTANUS, HEPTAGENIA QUADRILINEATA,  
RHITHROGENA HERCYNIA — NEW SPECIES OF MAYFLIES  
(EPHEMEROPTERA) OF THE FAMILY HEPTAGENIIDAE  
FROM CZECHOSLOVAKIA**

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Several new species of mayflies were found during the past 15 years when the distribution and seasonal dynamics of mayflies in Czechoslovakia were studied (LANDA, 1964, 1968, 1969). Three species of the family *Heptageniidae* are described in the present paper.

*Ecdyonurus submontanus* sp. n.

(Tab. I)

Adult male: Head and thorax pitch-brown to pitch-black. The dorsal as well as ventral side of abdomen bistre to reddish brown with darker posterior margins of tergites I—VIII and entirely dark tergites IX—X. No oblique bands on sides. Two paler, divergent lines and two dots on sternites. Wings brownish, pterostigma conspicuously brown, its veins forming scattered fields. Venation as well as three anterior longitudinal veins reddish brown. Fore legs dark brown. Tarsus about as long as 1.5 the tibia or only a little longer. Tarsal segment 1 slightly longer than half the segment 2. Middle and hind legs light reddish brown, tarsi darker. Forceps pitch-brown, forceps-base lighter in the middle. The posterior margin of the forceps-base straight or only very slightly convex; a short, sharp tooth is situated on each side near the forceps. Penis light brown. Lobes of penis only slightly produced laterally. Outer sclerite broadly rounded, apical sclerite overlapping the apical margin of the penis lobe. Inner sclerite with 3 (3—4)\* teeth on its hind inner angle. The outer as well as hind margin of the basal sclerite rounded, with minute teeth and spines. Cerci dark brown, distally paler, with indistinct, reddish brown annulation.

Adult female: Reddish, oblique, not very well defined bands on the sides of tergites. Markings on the ventral side of abdomen more distinct. Wings slightly brownish, pterostigma brown, paler than in the male.

Body length: Male 13 (12—14) mm, female 14 (12—15) mm; length of cerci: male 30 (25—32) mm, female 25 (23—27) mm.

Subimago: Wings unicolourous, light brown without blackish transverse bands. Transverse veins with a distinct dark border.

Larva: Body brown or greenish brown, thorax with pale spots and smudges. Usual markings formed by four rows of pale spots on the dorsal

\* The range given in parentheses has been ascertained by the study of other specimens.

side of abdomen. The inner ones converge in a V-shape. Tergites VIII and IX paler, tergite X always dark. A wide brown band on the ventral side, with not very distinct markings formed by two divergent lines and dots. Head as wide as pronotum. Lateral lobes convex, rounded in the front, rather flatly posteriorly. Their length (c) is shorter than the width of pronotum (a). Tooth on the anterior margin is distinct, projected. Hind pre-

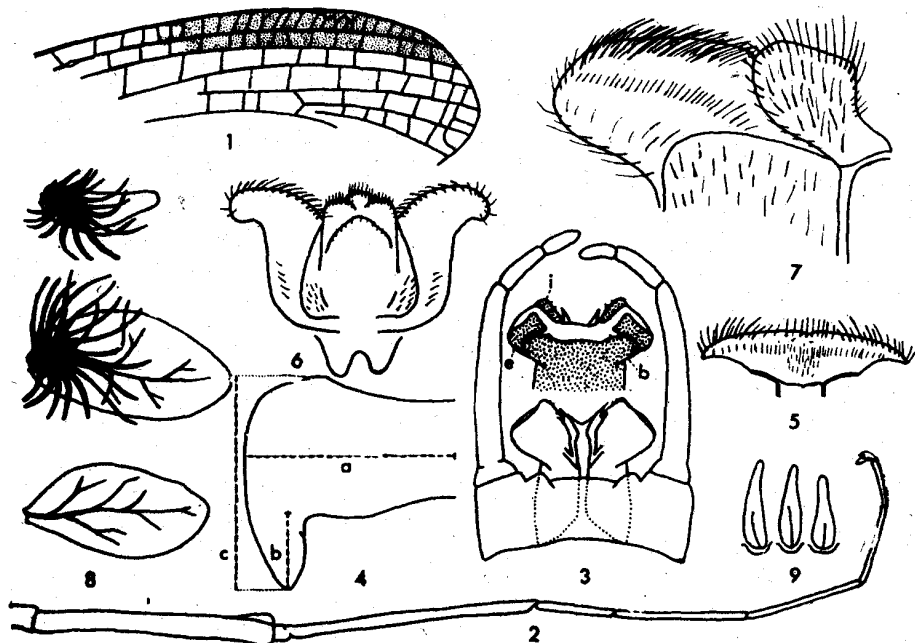


Table 1: *Ecdyonurus submontanus* sp. n.: 1 - pterostigma on fore wings of an adult, 2 - fore leg of adult male, 3 - forceps and penis of adult male (i - inner sclerite, e - outer sclerite, b - basal sclerite), 4 - pronotal wing of larva, 5 - labrum of larva, 6 - hypopharynx of larva, 7 - labial glossa and paraglossa of larva, 8 - gills 1, 3 and 7 of larva, 9 - spines on femur of larva.

cesses of wings (b) between  $1/3$  and  $1/2$  of the total length, produced into a point, the inner edge convex, but on the whole parallel with the longitudinal axis of the body. Broad, sharp, long spines alternate with short ones on the posterior margins of tergites. The sides of labrum produced into narrow lobes, bent backwards. 9 (8-9) branching setae on mandibles near incisors. Inner incisor distally rugged. Maxilla with 24 (22-24) bristles. Segment 3 of maxillary palps about twice as long as wide at base. Lateral lobes of hypopharynx produced and bent backwards. Labial glossae almost rectangular with round angles. Femora dark, tibiae pale with a wide dark band in the middle, tarsi dark at both ends. Setae on the hind margins of femora short, blunt as well as pointed spines on the upper surface. Claws with 3-4 teeth. First gill shorter than  $3/4$  of the 3rd, almost straight, only slightly bent, tongue-shaped. Gills 2-7 oval, produced into a point, broad. Gills 1-6 with tufts of filaments, gill 7 without one. Cerci brown, not ringed.

Holotype (adult male), paratype (adult female), paratype (male subimago), paratype (male larva): Bohemia: Lomnice, Kyselka (Karlový Vary), 25. 9. 1956 (adult male, female, subimago), 20. 8. 1956 (larva), leg. Landa, coll. Landa, Institute of Entomology, Czechoslovak Academy of Sciences, Prague. Further paratypes from the localities listed under "Distribution".

Differential diagnosis: *Ecdyonurus submontanus* belongs in a species-group with *E. torrentis* KIMMINS and *E. dispar* (CURTIS). Different adult characters are apparent from this key to males:

Body length 12 (10–12) mm, cerci a little shorter than body.

- |       |  |                              |
|-------|--|------------------------------|
| 1 (2) | Lobes of penis laterally produced in the shape of bluntly pointed regular triangles. Branching veins form a dense net in pterostigma. Brown or reddish-brown oblique bands on the sides of tergites II–VIII. Wings of subimago with transverse dark wedges. (Tarsus of fore leg almost twice as long as tibia) . . . . . | <i>E. torrentis</i>          |
| 2 (1) | Lobes of penis with very round angles, slightly produced laterally. Veins in pterostigma only thinly branched. Sides of abdomen without dark oblique bands or with indistinct bands. Wings of subimago unicolourous, without dark wedges.  |                              |
| 3 (4) | First three longitudinal veins pale, others pitch-brown. Pterostigma slightly brownish. Basal sclerites of the lobes of penis flatly convex on their posterior margin, inner sclerites bearing 1–3 spines on their inner edge. Tarsus of fore leg almost twice as long as tibia . . . . .                                | <i>E. dispar</i>             |
| 4 (3) | All longitudinal veins reddish or pitch-brown. Pterostigma dark brown. Basal sclerites of the lobes of penis arched, inner sclerites bearing 3–4 spines on their inner edge. Tarsus of fore leg 1.5 times as long as tibia . . . . .   | <i>E. submontanus</i> sp. n. |

In the larvae of *E. dispar* and *E. submontanus* the pronotal lobes are short, in contrast to *E. torrentis*. They are shorter (c) than half the length of pronotum (a). Both species differ from each other by these distinct characters:

- |       |   |                              |
|-------|---|------------------------------|
| 1 (2) | Gill 1 wide, longer than 3/4 of gill 3, slightly bent. Outer margins of pronotal projections regularly rounded. Hind processes of the projections with a straight inner margin . . . . .  | <i>E. dispar</i>             |
| 2 (1) | Gill 1 narrow, slightly bent, tongue-shaped, shorter than 3/4 of gill 3. Outer margins of pronotal projections more flatly rounded in the posterior half than in the anterior one. Inner margin of hind processes of pronotal projections slightly convex . . . . . | <i>E. submontanus</i> sp. n. |

Bionomy: Summer species with 1 generation a year, quickly developing in summer months. Older larvae (larvae from about the 10th instar with all larval characters developed) from July to September, adults at the end of August and in September. Larvae live in submontane streams with rich permanent water and a stony bottom. Abundant to very abundant where it occurs.

Distribution: This species is moderately abundant in highlands all over Czechoslovakia, but does not occur in mountains and lowlands.

Examples of localities: Bohemia: Ubislavský brook, Stachy; stream Františkov; Lomnice, Kyselka; Teplá, Karlový Vary; Střela, Dolní Hradiště Telnický brook, Adolfov. Slovakia: Malý Poprad, Štrba; Orava, Kralovany Javorinka, Podspády.

*Heptagenia quadrilineata* sp. n.

(Tab. II)

Adult male: Head and thorax black-brown, mesothorax and meta thorax darker. A pale spot before the bases of wings, pale bands on the margins of scutum. Abdomen light brown with a reddish brown bright

pattern: a broad border, laterally extending posteriorly in two lobes near the median suture, with 2 dark triangles near the hind margins. The ventral side of abdomen darker, with dark spots on the sides and a pale pattern of divergent lines and dots. Wings tinged with pale brown, pterostigma opaque. Veins brown, 18—20 veins connected at vein C in pterostigma. Legs brown, fore ones darker. Tibiae of middle and hind legs paler. All

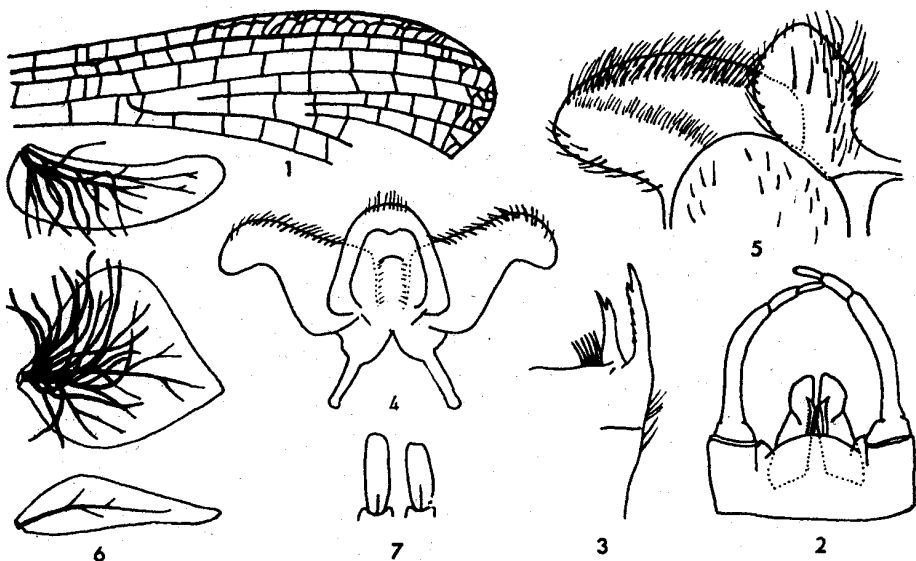


Table II: *Heptagenia quadrilineata* sp. n.: 1 — pterostigma on fore wings of an adult, 2 — forceps and penis of adult male, 3 — incisors of right mandible of larva, 4 — hypopharynx of larva, 5 — labial glossa and paraglossa of larva, 6 — gills 1, 3, 7 of larva, 7 — spines on femur of larva.

femora with a dark brown band in the middle. Forceps-base posteriorly convex, with tubercles on its sides. Lobes of penis convergent, tongue-shaped, arcuated on the outer side. Lateral spines short, blunt, with several teeth on outer sides. Cerci brown, not annulate.

Adult female: Markings on abdomen paler, less conspicuous. Bands on legs contrastingly conspicuous.

Body length: Male 12 (11—12) mm, female 14 (13—15) mm; length of cerci: male 24 (20—24) mm, female 20 (17—20) mm.

Subimago: Scutum pale in the middle. Wings brown, transverse veins with a narrow dark border.

Larva: Basic colour of body brown, with numerous pale spots on head and thorax, largest at the base of wings and on the outer margins of pronotum. A group of five spots, variously dispersed on individual segments, is situated on abdominal tergites. Vertical dark spots on the borders of segments. Pronotal projections narrow, slightly widening anteriorly. On the hind margins of tergites long spines regularly alternate with short ones. Apart from these there are other rows of shorter spines on the margin. Labrum cut out in the middle, laterally extending into thin lobes. Outer and inner mandibles not tapered, blunt teeth on the inner side of the outer

ones. 4—6 strong setae near incisors roughly branched, short reaching to about the middle of inner incisors. Mandibles wide, with 14 (12—14) bristles at their ends. The last segment of palps narrow, pointed, about twice as long as wide.

Lateral lobes of hypopharynx tapered and bent backwards. Labial glossae widening distally, paraglossae narrow and laterally produced. Four dark bands on femora parallel, but converging a little in a V-shape. A distinct dark spot on the lower side of femur. Tibiae dark with paler ends, tarsi dark as well, paler in the middle. On the posterior margins of femora long setae, reaching over half the width of femora, near the hind margin 1—2 rows of comparatively densely grouped, strong spines. Spines on the upper surface of femora distally rounded, shovel-like. Gill 1 narrow, tongue-shaped, bent upwards. Gills 2—6 broad, distally pointed, gill 7 narrow, posteriorly tapered. Gills 1—6 with flat, thin tufts of filaments, the last one without the tufts. Cerci brown, not annulate.

Body length: 12 (10—14) mm, cerci as long as body.

Holotype (adult male), paratype (adult female), paratype (male subimago), paratype (male larva): Bohemia: Klíčava, deer park, Lány, 15. 5. 1947. leg. Landa, coll. Landa, Institute of Entomology, Czechoslovak Academy of Science, Prague. Further paratypes from the localities listed under "Distribution".

Differential diagnosis: *Heptagenia quadrilineata* belongs in a species-group with *H. lateralis* (CURTIS) and *H. affinis* (EATON). Different adult characters are apparent from this key to males:

- 1 (2) Cerci whitish, red-brown annulation. Wings transparent with light brown venation. (Lobes of penis formed as minute, egg-shaped shovels.) Markings on tergites consist of seven red-brown spots . . . . . *H. affinis*
- 2 (1) Cerci brown, not annulate. Wings brownish with brown veins.
- 3 (4) Lobes of penis of a regular quadrangular shape, with rounded posterior angles. Veins in pterostigma not connected. Conspicuous vertical lateral spots on the borders of abdominal segments . . . . . *H. lateralis*
- 4 (3) Lobes of penis rather crescent-shaped, with the outer posterior angle rounded. Veins in pterostigma connected at C. Markings consisting of a longitudinal band near the anterior margins of tergites, which is posteriorly produced in two lobes, and spots in the hind angles . . . . . *H. quadrilineata* sp. n.

Larvae are distinguished mainly by the following characters:

- 1 (4) Body with conspicuous pale spots. On femora 4 dark long spots in two pairs, parallel or slightly convergent. Spines on the upper side of femur shovel-shaped, narrow and oval or slightly tapering. Cerci brown, not annulate.
- 2 (3) First gills broad, directed backwards. Spines on the upper surface of femur tapering, bluntly pointed. 14—18 bristles on the ends of maxillae. 8—9 strong setae near mandibular incisors, smooth or only finely branching, reaching to about 3/4 of inner incisors . . . . . *H. lateralis*
- 3 (2) First gills narrow, bent upwards. Spines on the upper side of femur shovel-shaped or narrow and oval. 12—14 bristles at the ends of maxillae. Near incisors 4—6 setae, roughly and densely branched, reaching to about 1/2 of inner incisor . . . . . *H. quadrilineata* sp. n.
- 4 (1) Body and legs without conspicuous markings. Cerci with reddish annulation. Spines on the femoral surface sharply pointed . . . . . *H. affinis*

Bionomy: A species with one generation a year. Older larvae develop from October to May, to a lesser degree during winter. They live in larger brooks with permanent water, where rapids alternate with pools, under stones like *H. lateralis*.

Distribution: At present known only from the northern half of Bohemia (Bohemian Cretaceous Plateau, Berounka Highlands) at the localities: Klíčava, deer park, Lány; Kralovický brook, Dolní Hradiště; stream, Pazuchy.

*Rhithrogena hercynia* sp. n.

(Tab. III)

Adult male: Head and thorax chestnut to bistre-brown, compound eyes pale, tawny, their outer parts black. Dorsal side of abdomen black-brown, paler on ventral side. No conspicuous markings on sternites. Nerve ganglia without pigmentation, opaque. Wings brownish, particularly in their basal part. Pterostigma and partly also fields c and sc clouded brown.

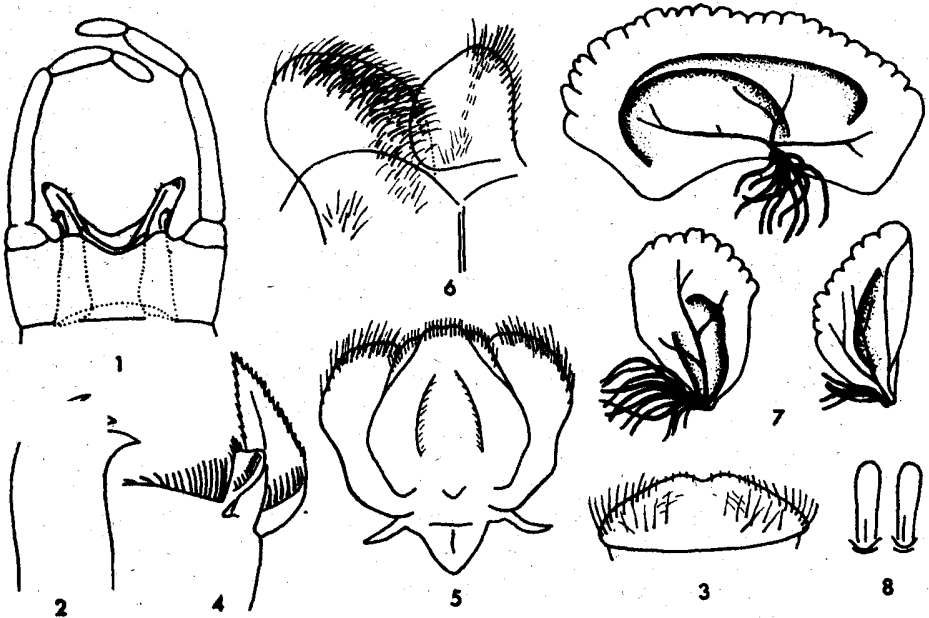


Table III: *Rhithrogena hercynia* sp. n.: 1 - forceps and penis of adult male, 2 - lateral spine of adult male, 3 - labrum of larva, 4 - incisors of the right mandible of larva, 5 - hypopharynx of larva, 6 - labial glossa and paraglossa of larva, 7 - gills 1, 3, 7 of larva, 8 - spines on femur of larva.

Longitudinal as well as transverse veins brown, conspicuous. Transverse veins in pterostigma not branched, often not even reaching to C. Bulla pale, inconspicuous. Fore legs dark reddish brown, middle and hind ones pale, greenish yellow. A wide, dark, transverse band in the middle of femora. Forceps-base and forceps reddish brown, with blackish teeth. Hind margin of the base bearing two conspicuous low tubercles; a broad cut-out appears between them. Lobes of penis laterally produced and rounded. A short spur directed upwards on the outer angle, 1-2 minute spines on the inner one. Lateral spines tongue-shaped, widening at their ends, with 3-4 teeth. Cerci brown, not annulate.

Adult female: Paler, wings with a lighter tinge and conspicuous brown venation.

Body length: Male 13 (12-14) mm, female 14 (14-15) mm; length of cerci: male 24 (20-25) mm, female 20 (18-22) mm.

Subimago: Unknown.

**Larva:** Basic colour brown-green. Anterior angles of pronotum and wing sheaths pale as well as spots on mesonotum. Abdominal tergites I—III, VIII and IX pale, others dark with a darker band in the median suture. Ventral side of abdomen light grey-brown, distally darker. A wide dark band in the middle. Nerve ganglia opaque, not pigmented. A transverse line in the posterior halves of sternites, diverging pale lines in the anterior ones. Pronotal projections laterally extended, widest in their anterior half. Thin long teeth, approximately of the same length, on the posterior margins of tergites. Labrum only twice as wide as long, cut out in the middle, densely haired, scattered long straight hairs on its upper surface. Outer mandibular incisors with distinct teeth arranged in a herringbone pattern, inner ones reach to about their middle and in the inner angle they are drawn out into a point. 9—10 bristles in the distal part of maxilla. Segment 1 of maxillary palps wide at the base, conically tapering distally. The slightly indicated segment 3, drawn out into a sharp point, is more than twice as long as wide at the base. Lateral lobes of hypopharynx overlapping the sides of the central lobe by more than half their width. Labial glossae short and wide, outer ones a little produced laterally, trapezoidal with rounded angles. Legs of the same colour as body. On femora dark frames with pale centres. An inconspicuous, diffused band in these central areas. The hind margins of femora bearing bent setae; shovel-shaped, long, distally rounded spines on the surface of femora. Gills strong, 1st gill kidney-shaped, others broad, shovel-shaped, all with rough tufts of filaments and with characteristically crenulated outer margins. Cerci light brown, with long and dense setae in the middle part.

Body length: 14 (12—14) mm; cerci of about 3/4 of the body length.

Holotype (male larva): Bohemia: Otava, Sušice, 25. 3. 1966, leg. Landa. Paratype (adult male), paratype (adult female): Bohemia: Křemelná, Čenikova Pila, 10. 5. 1956, leg. Landa, coll. Landa, Institute of Entomology, Czechoslovak Academy of Sciences, Prague. Further paratypes from the localities listed under "Distribution".

**Differential diagnosis:** *Rhithrogena hercynia* is in a comparatively independent position. Imaginal characters, particularly the arrangement of the penis, approach those of the species *R. germanica* EATON and *R. hybrida* EATON. Differences are apparent from this key to males:

- 1 (2) Lobes of penis tongue-like, with inner hind angles drawn out. Lateral spines distally distending, with 7—8 teeth. Hind margin of forceps-base cut out in the middle in a U-shape. A longitudinal spot on femur . . . . . *R. germanica*
- 2 (1) Outer hind angles of lobes of penis drawn out. Lateral spines not widening distally, with 2—4 teeth. Posterior margin of forceps-base broadly convex. Femora without longitudinal spots.
- 3 (4) Longitudinal as well as transverse veins brown. Inner hind angles of lobes of penis bearing 2 minute spines; lateral spines with 3—4 teeth. A dark transverse band in the middle of femora. Cerci brown, without annulation . . . . . *R. hercynia* sp. n.
- 4 (3) First three longitudinal veins pale, others pitch-brown. Each inner hind angle of lobes of penis bearing one minute spine, lateral spines with 2—3 teeth. Femora without a spot or band. Cerci brown, indistinctly annulate . . . . . *R. hybrida*

The larvae with their conspicuous character, crenulated gills, approach the species *R. hybrida* EATON and *R. tatrixa* ZELINKA. They differ mainly by these characters:

- 1 (2) Reddish oval or angular spots (hyaline pigmented ganglia) in the middle of abdominal sternites. Spines on femora oval . . . . . *R. tatrixa*

- 2 (1) No reddish spots in the middle of abdominal sternites. Spines on femora long, shovel-shaped.
- 3 (4) Abdominal tergites unicolourous, without markings. Femora without a trace of a transverse band in the middle. Labrum narrow (1/4 of length), incisor about 1/3 of the length of outer one . . . . . *R. hybrida*
- 4 (3) Abdominal tergites I–III, ends of wing sheaths and tergites VIII, IX distinctly lighter than the others. An indistinct, dark transverse band in the middle of femora. Labrum wide (1/2 of its length), inner incisor about 1/2 of the length of the outer one . . . . . *R. hercynia* sp. n.

**Bionomy:** One generation a year. Older larvae from September to April. Development going on in winter, too, but the main period of growth is in spring. Adults fly at the end of April and the beginning of May. Larvae live in mountain streams with stony bottoms, sufficient water and strong flow. Rare to solitary at localities.

**Distribution:** Solitary to rare in submontane regions of Bohemia, i.e. on the slopes of the Bohemian Forest (Šumava), Giant Mountains (Krkonoše) and Eagle Mountains (Orlické hory) at the localities: Vltava, Slatiny; Otava, Sušice; Křemelná, Čeňkova Pila; Blanice, Blažejovice; Orlička, Orličky; Labe, Dobrá Myslivna.

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