

# *ECDYONURUS RIZUNI* SP. NOV. (EPHEMEROPTERA: HEPTAGENIIDAE) FROM THE EASTERN CARPATHIANS

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**Abstract.**— *Ecdyonurus rizuni* sp. nov. is described and illustrated from the Chornohora mountain-range of the Eastern Carpathians (Ukraine) (male imago and subimago, mature larvae and eggs). The new species belongs to the *Ecdyonurus helveticus*-group and is closely related to *Ecdyonurus subalpinus* Klapálek, 1907. Some data concerning its affinities, distribution and biology are discussed.



**Key words.**— Ephemeroptera, Heptageniidae, *Ecdyonurus helveticus*-group, new species, taxonomy, Eastern Carpathians.

## INTRODUCTION

Kimmins (1958) described *Ecdyonurus austriacus* Kimmins, 1958 and provided the additional description of imago and subimago *Ecdyonurus helveticus* (Eaton 1885) and *Ecdyonurus zelleri* (Eaton 1885), attributing all mentioned species to *Ecdyonurus helveticus* Complex. Bogoescu and Tabacaru (1962) defined the diagnostic characters which differentiated the species of the *E. helveticus*-group from the *E. venosus*- and *E. lateralis*-group. The first taxonomic revision of species of the *E. helveticus*-group was made by Jacob and Braasch (1984). Hefti et al. (1986, 1987) described two new species of this group from the Alps, and the existent data on the taxonomy and distribution of European species of the *E. helveticus*-group was generalized by Hefti et al. (1989, 1991).

Since the time Klapálek (1907) had described *E. subalpinus* Klapálek, 1907 from the Gorgany mountain-range, four more species of the *E. helveticus*-group were recorded from the Eastern Carpathians: *Ecdyonurus picteti* (Meyer-Dür, 1864), *E. helveticus*, *E. austriacus* and *Ecdyonurus carpathicus* Sowa, 1973. *Ecdyonurus picteti* is known from the Chornohora mountain-range and was described as *Heptagenia nigrescens* Klapálek, 1908 (Dziędziewiczy and Klapálek 1908a, 1908b). The records of *E. helveticus* from the Ukrainian Carpathians have been cited in many

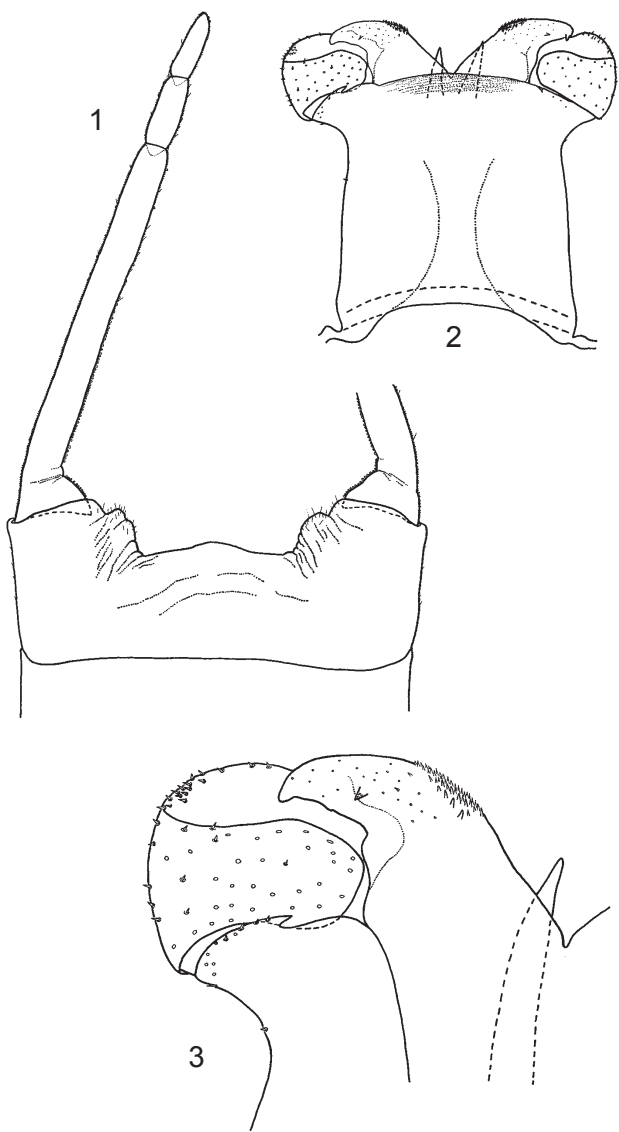
faunistic works (Klapálek 1907, Dziędziewiczy 1919, Mikulski 1935, 1936, Pawłowski 1959, Godunko 1999). *E. carpathicus* was found in the Ukrainian Carpathians (Beskydy mountain-range) for the first time by Godunko (1997) as *Ecdyonurus carpathicus carpathicus*. All information published on the distribution of *E. austriacus* in the Ukrainian area probably regards to one or more new subspecies and species of the *E. helveticus*-group (Godunko 1997, Godunko 2000).

The aim of this paper is the description and illustration of the new species of the *E. helveticus*-group from Chornohora mountain-range (Eastern Carpathians, the Ukraine). A combination of distinguishing characters of male imago and subimago and mature larvae, separating *E. rizuni* sp. nov. from closely related species is given.

## TAXONOMY

*Ecdyonurus rizuni* sp. nov.  
(Figs 1–20)

**Description.** Male imago. Head yellowish-brown, facial keel yellowish with an unclear dark spot. Antennae brown. Eyes gray, submarginal part lighter with two dark-gray stripes. Ocelli white in the apical part, with a black band in the border.



Figures 1–3. *Ecdyonurus rizuni* sp. nov., male imago. (1) Forceps base, ventral view, (2) male genitalia, dorsal view, (3) penis lobe, dorsal view.

**Thorax.** General color of the thorax yellowish to yellowish gray with yellowish-brown and brown spots in the dorsal side. Lateral and ventral sides of the thorax unicolorous, slightly pale. Fore wings translucent, unicolorous, slightly yellowish with yellowish-brown venation. Pterostigma opaque with some yellowish reflections. Costal and subcostal area slightly yellowish proximally. Hind wing hyaline. Fore legs dark, yellowish-brown to brown. Coxae and trochanters brown. Femora brown with dark spots distally. Tibiae yellowish-brown. Tarsi same color as the tibiae or slightly paler, yellowish-brown with light grayish reflections. Middle and hind legs unicolorous, yellow with slightly darker tibiae and tarsi.

**Abdomen.** General color yellow to yellowish-brown. Posterior margin of abdominal terga 1–8 with a distinct

brown band. Lateral sides of abdominal terga 1–8 with reddish spots around which is a typical pattern for the species of the *Ecdyonurus helveticus*-group. Terga 9 and 10 without bands and lateral patterns (tergite 9 sometimes with small, indistinct reddish spots laterally). Sterna pale, yellow to light yellowish-brown with well-visible dark nerve ganglia. Caudal filaments brown.

**Genitalia.** Styliger pale, yellow to light yellowish-brown, forceps segments slightly darker, light brown. Forceps base with two strong asymmetrical lateral protuberances (Fig. 1). Penis lobes pale, yellowish-brown. In dorsal view the outline of the penis lobes are clearly divergent and stretched laterally (Fig. 2). External part of the penis lobes relatively roundish with conspicuous protuberance. Apical sclerite massive, bluntly pointed at the apex with conspicuous external denticulation. Apex of apical sclerite directed towards the middle of the lobes or perpendicular to the axis of symmetry of the penis lobes. Inner border of the apical sclerite with only a slight projection. Dorsal side of apical sclerite with one strong tooth directed towards to the middle of lobes or perpendicular to the axis of symmetry of the penis lobes. Lateral sclerite relatively large, without deep narrowing in the external part, rounded distally. Basal sclerite relatively massive with 1–2 strong teeth oriented perpendicular to the axis of symmetry of the penis lobes and with some small spines. Small spines also present on the forceps and external proximal part of penis lobes (Fig. 3). Penis stem without a hump. Titilators yellowish-brown.

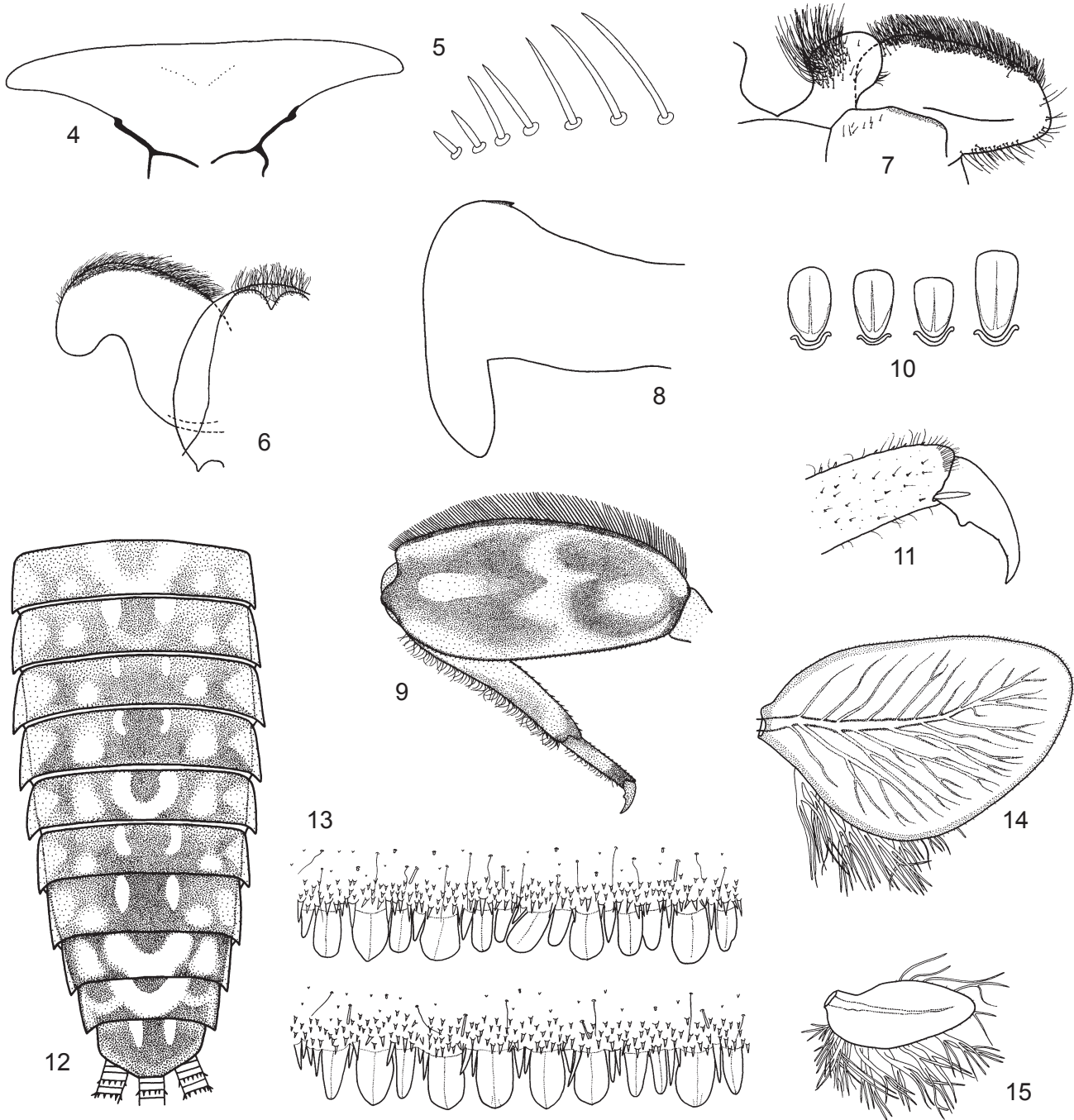
**Male subimago.** General color of body yellowish-brown with some light yellowish-gray reflection. Color of the abdominal segments similar to the male imago. Wings unicolorous, relatively transparent, yellowish. Pterostigma opaque and slightly yellowish-gray. Fore legs darker than other ones. Characteristics of sclerites of penis lobes similar to male imago but less visible and distinct.

**Male measurements:** body length 7.0–9.1 mm; fore wings 8.7–11.0 mm; caudal filaments 8.0–14.2 mm (subimago), 22.5 mm (imago).

**Female imago and subimago.** Unknown.

**Mature larva.** Measurements: body length 8.4–12.5 mm; caudal filaments 5.8–9.2 mm. General color of body pale, yellowish, brownish-gray to brown.

**Head.** Coloration uniformly yellowish-brown to brown, with small pale spots. Antennae light brown. Eyes and ocelli black. Labrum distinct, wide, lateral lobes not stretched laterally (Fig. 4). 7–8 bristles on the ventral side of the labrum relatively massive, bluntly pointed and arranged in a single row (Fig. 5). Maxilla: fore margin of the first segment of the palpus without bristles and setae; 20–40 long bristles on the outer margin and 5–30 long bristles on the dorsal part of the outer forecorner of the galea-lacinia; comb-shaped bristles with 10–15 teeth. Superlinguae of the hypopharynx relatively massive, clearly stretched laterally (Fig. 6). Glossae and paraglossae as Fig. 7.



Figures 4–15. *Ecdyonurus rizuni* sp. nov., mature larva. (4) Outline of labrum, (5) bristles on the ventral side of labrum, (6) hypopharynx, (7) fragment of labium with glossa and paraglossa, (8) lateral pronotum expansion, (9) hind leg, (10) spines of central part of dorsal surface of the femora, (11) tarsal claw, (12) abdomen, dorsal view, (13) central part of posterior margin of fifth abdominal tergum (variation), (14) fourth gill, (15) first gill.

Thorax. General coloration yellowish-brown, brownish-gray to brownish, with pale spots and bands. Pronotum expansion elongated and slightly pointed at the apex (Fig. 8). Apex of pronotum expansion strong, directed towards to the body of larva. Legs yellowish-brown to brown. Tibiae slightly paler distally. Tarsi darker distally. Trochanters yellowish-brown. Femora

broad, length/width ratio of the metafemora are in mean 2.34 ( $\sigma = 0.249$ ;  $n = 10$ ). Dorsal surface of the femora with a distinct marking on a yellowish-brown or brownish-gray background: one pale proximal spot, central pale transversal zigzag-shape spot and elongate pale spot distally (Fig. 9). Distal elongated pale spot without any spatulate setae on the surface. Femoral spines mainly

rounded and clearly widen towards the apex (Fig. 10). External margin of the femora with long setae and distinct spines (more than 20 bluntly pointed spines present on the external margin of the femora). Tarsal claws without teeth (Fig. 11).

**Abdomen.** General coloration of the abdominal terga darker than the head and thorax, brownish-gray to brown. Lateral part of terga 1–7 with triangular pale smudges. In dorsal view the central part of the surface of the terga with a distinct marking: terga 1–2 generally with two central pale spots or with a V-shaped central pale spot; terga 3–4 and 6–7 uniformly colored with two central elongated pale spots, a small spot near the anterior margin of the terga, and two pale spots laterally, tergite 5 generally with a central V-shaped pale spot only and two pale spots laterally (sometimes tergite 5 is of similar color to terga 3–4 and 6–7); tergite 8 with a V-shaped central pale spot (sometimes with three spots) and with two pale spots laterally; tergite 9 generally with a V-shaped central pale spot and some lateral smudges; segment 10 with two central elongated pale spots only (Fig. 12). Lateral sides of the abdominal terga with yellowish to brownish spots. Posterior margin of the terga with large, massive, rounded and slightly apically pointed at the apex spines and with small pointed spines (Fig. 13). Surface of the terga with sparse small spines and spatulate setae, and with long fine setae. Tracheal gills yellowish to yellowish-gray. Gills 1 large, wide in the central part (Fig. 15). Gills 4 large, asymmetric and wide (Fig. 14). Length/width ratio of gills 4 are in mean 1.61 ( $\sigma = 0.160$ ;  $n = 10$ ). Sterna yellowish-gray to yellowish-brown. Nerve ganglia dark violet. Caudal filaments yellowish-brown to brown.

**Egg.** Measurements: length 146–154  $\mu\text{m}$ ; width 110–121  $\mu\text{m}$ . Chorionic surface with attachment structures, numerous tubercles and delicate small granules (Fig. 16). Attachment structures are characterized by knob-terminated coiled threads (KCTs) (Koss and Edmunds, 1974). They are small (1.6–2.0  $\mu\text{m}$  in diameter) and rather densely and regularly cover the whole chorionic surface (6–14  $\mu\text{m}$  distance between them) (Fig. 18a). There are no concentrations of KCT attachment structures on the poles of the egg (Fig. 17). The whole chorionic surface is with many tubercles; they are cone-shaped, with a rounded apex (0.5–0.7  $\mu\text{m}$  in diameter, 0.8–1.6  $\mu\text{m}$  in height), distance between them are 0.5–3.3  $\mu\text{m}$  (Figs. 18a, b). Visible between these tubercles are very small granules (0.14–0.18  $\mu\text{m}$  in diameter), covering the whole chorionic surface of the egg (Fig. 19). Three to five micropyles in the subequatorial area. Sperm guide ovoidal, 7.1–8.6  $\mu\text{m}$  in length and 5.9–6.4  $\mu\text{m}$  in width; a micropylar opening is situated to the side. Micropylar rim narrow, with rather sparsely distributed tubercles similar to those from the chorionic surface, but much lower (Fig. 20).

**Types.** Holotype: mature female larva, Ukraine, Zakarpats'ka Region, Rakhiv town, Rakhivs'ki Mts.,

small brook without a name on a slope of the Lisina Mt., near the quarter office of the Carpathians Biosphere Reserve, 1000 m. a.s.l., Long. 47°57'25" E, Lat. 24°9'28" N, 14.07.2001, leg. R. J. Godunko.

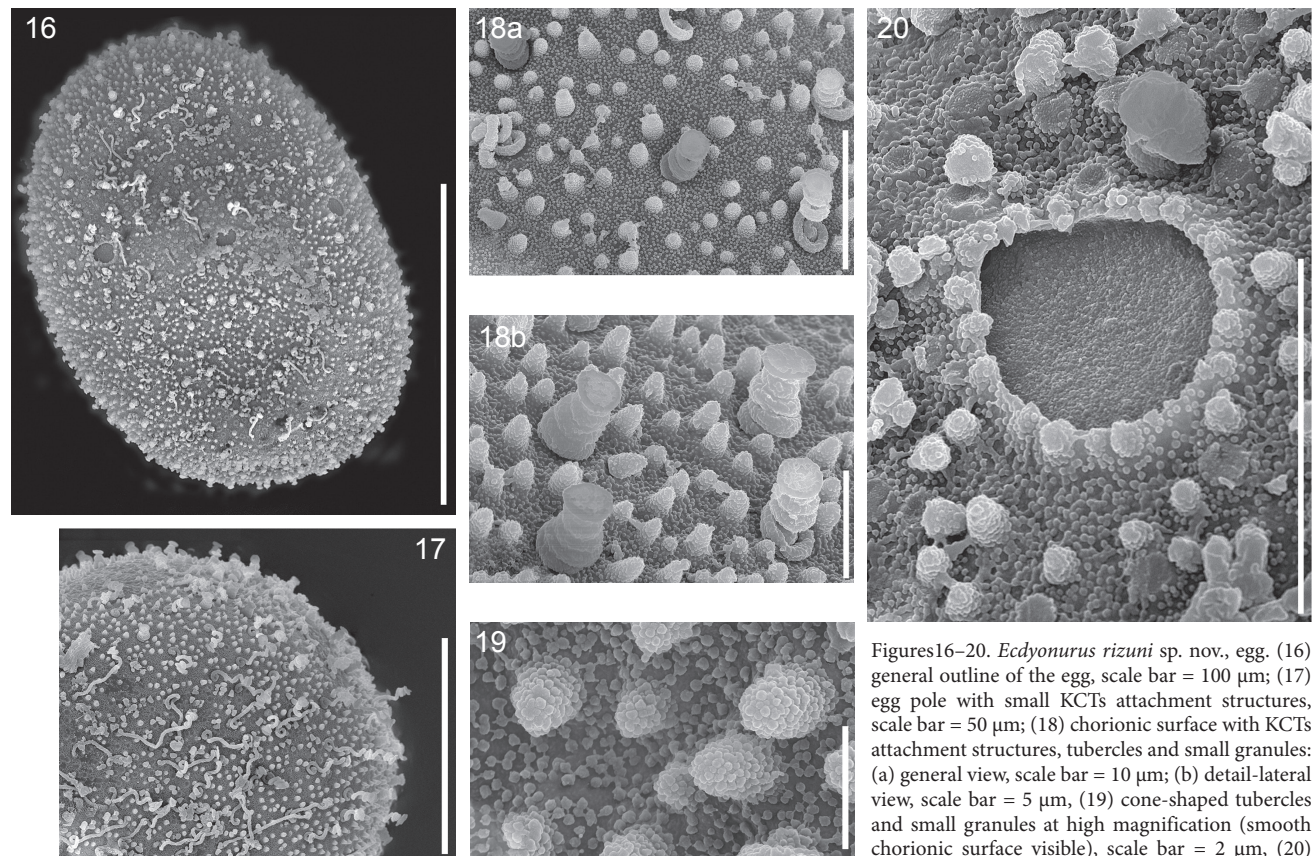
Paratypes: 27 larvae, same locality as holotype, 20.02.2001, leg. V. B. Rizun; 13 larvae, same locality and data as holotype, leg. R. J. Godunko; 2 larvae, same locality as holotype, 20.07.2002, leg. R. J. Godunko; 5 larvae, Ukraine, Zakarpats'ka Region, Chornohora mountain-range (Carpathians Biosphere Reserve), south slope of Menchul Mt., small brook without a name on a slope of the Menchul Mt., tributaries of the Bilyii brook, 1350 m. a.s.l., Long. 48°7'12" E, Lat. 24°26'53" N, 21.07.2000, leg. M. Klonowska-Olejnik; 2 male subimagines (reared from larvae), 7 larvae, same locality, 29.07.2002, leg. M. Klonowska-Olejnik and R. J. Godunko; 1 male imago (reared from larva, with larva and subimaginal skins), 1 male subimago (reared from larva), 3 mature male larvae, 3 mature female larvae, 20 larvae, same locality, 30.07.2002, leg. M. Klonowska-Olejnik and R. J. Godunko; 2 male subimagines, 8 larvae, same locality as holotype, 31.07.2002, leg. M. Klonowska-Olejnik and R. J. Godunko.

All adults have been reared from mature larvae. The specimens were preserved in 75% alcohol. The holotype and 51 paratypes are housed in the collection in the State Museum of Natural History, National Academy of Sciences of Ukraine, Lviv, Ukraine; 32 paratypes are deposited in Department of Hydrobiology, Institute of Environmental Sciences, Jagiellonian University, Kraków, Poland and 12 paratypes in the Institute of Entomology, Academy of Sciences of the Czech Republic, České Budějovice, Czech Republic.

**Other material examined.** 41 larvae, Ukraine, Zakarpats'ka Region, Rakhiv town, Rakhivs'ki Mts., small brook without a name on a slope of the Lisina Mt., directorate of the Carpathians Biosphere Reserve, 1000 m. a.s.l., Long. 47°57'25" E, Lat. 24°9'28" N, 31.07.2002, M. Klonowska-Olejnik and R. J. Godunko leg.; 26 larvae, Ukraine, Zakarpats'ka Region, Chornohora mountain-range (Carpathians Biosphere Reserve), south slope of Menchul Mt., small brook without a name on a slope of the Menchul Mt., tributaries of the Bilyii stream, 1350 m. a.s.l., Long. 48°7'12" E, Lat. 24°26'53" N, 21.07.2000, leg. M. Klonowska-Olejnik; 86 larvae, same locality, 29–30.07.2002, leg. M. Klonowska-Olejnik and R. J. Godunko; 7 larvae, Ukraine, Zakarpats'ka Region, Chornohora mountain-range, small brook without a name, tributaries of Brebeneskul brook, 850 m. a. s. l., Long. 48°5'11" E, Lat. 24°11'8" N, 27.07.2002, leg. M. Klonowska-Olejnik and R. J. Godunko.

**Diagnosis and relationships.** The availability of short lateral projections of abdominal segments parallel to body axis, of divergent apical sclerites of penis lobes in imago, of typical marking on the lateral part of abdominal terga and the lack of long and dense setae on the distal part of





Figures 16–20. *Ecdyonurus rizuni* sp. nov., egg. (16) general outline of the egg, scale bar = 100  $\mu$ m; (17) egg pole with small KCTs attachment structures, scale bar = 50  $\mu$ m; (18) chorionic surface with KCTs attachment structures, tubercles and small granules: (a) general view, scale bar = 10  $\mu$ m; (b) detail-lateral view, scale bar = 5  $\mu$ m, (19) cone-shaped tubercles and small granules at high magnification (smooth chorionic surface visible), scale bar = 2  $\mu$ m, (20) micropyle, scale bar = 10  $\mu$ m.

the superlinguae of the hypopharynx indicate *E. rizuni* sp. nov. belongs to the *E. helveticus*-group (Bogoescu and Tabacaru 1962, Hefti et al. 1989, 1991).

Male imago of *E. rizuni* sp. nov. by some details of the penis lobe structure is similar to *E. subalpinus*, but can be easily differentiated from the latter by the following characteristics: (1) size of body; (2) coloration of body and wings; (3) penis lobes more stretched laterally; (4) shape of lateral and basal sclerites of penis lobes. Male subimago of *E. rizuni* sp. nov. differ from *E. subalpinus* by the characters of color of body and wings.

Larvae of *E. rizuni* sp. nov. differ from all other known species of the *E. helveticus* species-group by the following characteristics: (1) correlation of the number of setae and bristles on the first segment of maxillary palps, on the dorsal part of the outer fore-corner of galea-lacinia and a single row of setae on the ventral side of the labrum; (2) shape of the pronotum expansion; (3) broad femora with length/width ratio of metafemora mean 2.34; (4) shape of tergo-abdominal spines; (5) wide and strong asymmetric gills 4 with length/width ratio mean 1.61; (6) tarsal claw without teeth; the lack of teeth on the tarsal claw are the autapomorphies of *E. rizuni* sp. nov. (7) coloration of abdominal terga and femora (see above). Additional distinctive characters include the structure of egg chorion. Eggs of *E. rizuni* have no concentrations of KCTs attachment structure

at the egg poles but have characteristic cone-shaped tubercles on the chorionic surface. They are easily distinguishable from other species of the *E. helveticus* species-group: *E. alpinus*, *E. austriacus*, *E. helveticus*, *E. parahelveticus* Hefti, Tomka et Zurwerra, *E. zelleri*, *E. picteti* (Hefti et Tomka 1986; Hefti et al. 1986, 1987), *E. carpathicus* and *E. subalpinus*.

**Distribution and biology.** Hitherto *E. rizuni* sp. nov. has been found in a single stream: in the environs of the town of Rakhiv (Rakhiv's'ki Mts.) and in the Zakarpat'ska Region, in the southern slope of the Chornohora mountain-range. Larvae have been caught in the altitude between 850–1350 m a.s.l., in a small and very small brook, 0.2–2 m wide and 0.05–0.2 m deep, with cold water (in summer mean 10°C) and current velocity about 0.1–0.4 m/s. Those brooks are almost completely shaded by a sub-alpine forest; the substrate was predominately cobbles and pebbles. In the brooks on Rakhiv's'ki Mts. and Menchul Mt., *E. rizuni* is the only species from the Heptageniidae family. From among Ephemeroptera, only *Baetis rhodani* (Pictet, 1843) lives together with *E. rizuni*; numerous *Gammarus* spp., *Dugesia* sp. Oligochaeta, *Bythinella austriaca*, Leuctridae, Nemouridae and Elmidae are also present. In the tributary of the Brebeneskul stream the new species occurs together with *B. alpinus* (Pictet, 1843), *Rhithrogena iridina* (Kolenati, 1839) and *Ecdyonurus* spp. (*helveticus*-group). *E. rizuni* is a univoltine winter spe-

cies (Clifford 1982) with a flight period from July to the beginning of September.

**Etymology.** The new species is named after our friend Dr. Volodymyr Bohdanovych Rizun, who collected some specimens of this species in the town of Rakhiv.

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