

**Lectotype fixation and redescription of *Ecdyonurus subalpinus* (Ephemeroptera: Heptageniidae) with notes on its biology and distribution**

**Stanovení lektotypu a redeskripce druhu *Ecdyonurus subalpinus* (Ephemeroptera: Heptageniidae) s poznámkami k jeho biologii a rozšíření**

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**Taxonomy, Ephemeroptera, Heptageniidae, *Ecdyonurus subalpinus*, lectotype, redescription, adult, larva, egg, biology, distribution, Europe**

**Abstract.** Lectotype and paralectotype of *Ecdyonurus subalpinus* Klapálek, 1907 have been fixed and illustrated on the basis of the only two till preserved adult male specimens of original syntype series deposited in the State Museum of Natural History, National Academy of Sciences of Ukraine, L'viv and the National Museum, Praha, respectively. Data on proper identification of the type locality are discussed and this is defined, as follows: Ukraine, Ivano-Frankivs'k Region, Gorgany mountain range, Yablonyts'kyi mountain pass, 13.5 km NE Yasinia village, 930 m a.s.l., 48°18'16" N, 24°26'50" E. Remaining life cycle stages, namely mature larva, male and female subimago, and female imago are redescribed according to material collected in the Czech Republic, Slovakia, Poland, and Ukraine, critical distinguishing characters are illustrated. Although differing in some morphological characters, the populations from all over the area do not exceed intraspecific variability range. Egg chorionic structures are described and illustrated in detail for the first time. Data on *E. subalpinus* biology (preferred habitats and biotopes, larval growth rates, life cycle type) and distribution are summarised and discussed.

## INTRODUCTION

*Ecdyonurus subalpinus* was originally described by Klapálek (1907: 33) (as *Ecdyurus subalpinus*) from the Eastern Carpathians according to adult males collected by J. Dziędzielewicz at three localities situated at the present territory of Ukraine. Simultaneously, Dziędzielewicz (1907), on the basis of his collections in the Gorgany Mountain range in 1905 and 1906, found this species at several further localities. Later on, he completed the original description of adults according to the material collected near Vorokhta [Worochta, in Dziędzielewicz (1919)], Kremenets' [Tatarów or Tartarów], Mykulychyn [Mikuliczyn], and Yablunytysa [Jablonica] villages at elevations of 800-1,000 m in July and September (Dziędzielewicz 1919).

Komárek (1919) published a record on distribution of *E. subalpinus* in Central Bohemia and mentioned some larval characters for the first time illustrating larval habitus and tracheal gills 1, 4 and 7 (Komárek 1919: 61, figs. 1-4). Although short additional description is presented and male external genitalia in ventral view as well as larval gills are figured by Šámal (1931: 57,

**Ukraine:** Blotek [Blotek] stream, Chomiak [Khomiak] Mt., 10.vii.1905, 1 female; ditto, 16.vii.1905, 1 male; Blotek stream, Kremenets' village, 18.vii.1905, 1 female; Vorokhtyans'kyi brook, Vorokhta village, 22.vi.1907, 1 male subimago; ditto, 30.vi.1907, 1 female subimago; Żnec [Zhnets'] brook, Khomiak Mt., 5.xi.1909, 1 male; Zhnets' brook, Mikulyczyn village, 23.vi.1907, 1 male, all material J. Dziędzielewicz leg., det. et coll.; Ivano-Frankivs'k region, Dzhurdzhi brook, Nature Reserve "Gorgany", 20.vi.1999, 1 female, 4 male subimagoes, 10 larvae, 4 larval exuviae; Dovzhynets' brook, Nature Reserve "Gorgany", 30.vii.1999, 23 mature larvae, all material R. J. Godunko leg., det. et coll. (NASU).

All specimens were preserved in 80 % alcohol. The material from the Czech Republic and Slovakia is deposited in collection of the Institute of Entomology, Academy of Sciences of the Czech Republic, Česká Budějovice. The specimens from Poland and Ukraine are deposited in the Department of Hydrobiology, Institute of Environmental Sciences, Jagiellonian University, Kraków (IESJU), Poland and in the State Museum of Natural History, National Academy of Sciences of Ukraine, L'viv (NASU). Permanent slides were prepared to transfer the objects directly into Liquid de Faure, the eggs dissected from mature females were dried by the critical point method, gold coated and electronmicrograms were taken by the JEOL JSM 6300 at 25 kV.

## SYNTYPE SERIES AND TYPE LOCALITY

The type series of *E. subalpinus* apparently consisted of 4 male adults (according to the original description) labelled "Jasień, granica, 27./VII. 1905 (1 ♂), Chomiak, Weredyk, 8./VIII. 1906 (2 ♂♂) a pot. Barani 7./VII. 1905 (1 ♂), vše leg. Józef Dziędzielewicz." (Klapálek 1907). Unfortunately, the author did not properly state the place of deposition of the specimens and type. Consequently, this material represents syntypes according to the ICZN Article 73.2. However, the only damaged specimen (here designated as paralectotype, see below) is at present deposited in the collection of the National Museum in Praha, Czech Republic and the other labelled "Jasień. (granica) 27.-7.-1905. Dz."; "Ec. subalpinus Klap." is found in the State Museum of Natural History, National Academy of Sciences of Ukraine in L'viv, Ukraine.

The fate of two remaining specimens of the type series (1 male imago collected 8.viii.1906 and 1 male imago collected 7.vii.1905) is unknown although there are empty pins with original labels described in detail by Goduňko (1999). However, these labels evidently do not concern the syntype series mentioned by Klapálek (1907) and any other syntypes have been found neither in the National Museum in Praha nor in the State Museum of Natural History in L'viv.

Taking into account the same original localization of these two specimens (the letter "ň" in Czech is equivalent to "ń" in Polish), as well as the same collector and collection time, we can consider the specimen deposited in L'viv (here designated as lectotype) a part of syntype series. Moreover, there is further specimen with original Dziędzielewicz's label similar to Klapálek's (1907): "Chomiak (Weredyk) 8.-8.-1906." and two labels: "Ecdyurus.", "81.". However, since this location is a little different, we do not include this specimen into syntype series. Apparently, some exchange of material was carried out between František Klapálek and Józef Dziędzielewicz in the beginning of the past century. Although we are not able to trace it, we can suppose that some syntypes were probably returned to L'viv after they had been described in Praha.

To define the type locality (ICZN, Article 74.1, Recommendation 74.6, 74.7), the expression "granica" (= a border) on the original labels seems well defined. The "border" in question clearly means the Gorgonian inner range dividing the Tisza and Dniestre/Prut basins in the geographical point of view. Indeed, at that time the administrative border dividing Galicja (since 1918 under the Polish administration) and the Hungarian Kingdom (up to 1918 under the Austrian-Hungarian administration) fully followed this natural geographic border. The analysis

fig. b) and Mikulski (1936: 90, fig. 49) (specimens from Bohemia and Poland, respectively) the proper differential diagnosis is presented as late as more than 30 years ago by Landa (1969). He first mentioned the subimaginal stage and completed both larval and imaginal descriptions by figures of critical distinguishing characters like sclerites of penis lobes in dorsal and ventral views, shape of larval pronotum and tracheal gills 1 and 3, labrum, and variability of spines on dorsal surface of femora (Landa 1969: 202-203, figs. 2SA, 5SA, 6SA, 9SA). He also summarized all data so far known on biology and distribution of this species. Based on Central European material, Hefti et al. (1989: figs. 3b, 5a, 10e) completed diagnosis of *E. subalpinus* with SEM photographs of penis lobes, spines on dorsal surface of larval femora and lateral part of pronotum.

However, Klapálek (1907) did not designate the holotype specimen and his original description was very short containing nearly no information on critical morphological details of male imago. Moreover, some questions may concern the type locality is concerned. Hence, subsequent taxonomical treatment of this species seemed to be only tentative (however mostly correct) since the type material had never been revised. Recently, one of us (Goduňko 1999) studied the original material from Dziędzielewicz's collection (housed in the State Museum of Natural History in L'viv) and, based on analysis of original labels, showed one specimen to belong to the type series of *E. subalpinus* deposited in the National Museum in Prague.

The objective of this paper is, first of all, to re-define *E. subalpinus* as one of the key-species of the whole *E. helveticus* Eaton, 1883 species-group to enable subsequent detailed revision of all the respective species described later, their possible synonymies, clinal variability and proper taxonomic status. Specific aims are as follows: (1) to fix, describe and illustrate the lectotype and paralectotype of *E. subalpinus* and define its type locality, (2) complete diagnosis of females including egg structures, subimagoes and mature larvae, and define critical distinguishing characters of adult male and larvae with respect to other representatives of the *E. helveticus* species-group, (3) to analyse intraspecific variability of this species within the whole distribution area and summarise substantial data on biology.

## MATERIAL AND METHODS

Besides the syntype series specimens (see below), the following material of *E. subalpinus* was examined in detail:

**Czech Republic:** Zlatý brook, Davle-Libřice (coordinates according to the uniform grid system 6052), 1.v.1945, 4 males (two with subimaginal exuviae), 3 females, 6 larval exuviae; ditto, 26.iv.1946, 5 males, 6 females, 3 larval exuviae; ditto, 1.v.1948, 1 male, 9 females; ibid, 3.vi.1954, 1 male; ditto, 6.vi.1954, 5 males, 4 females; Mlýnecký brook, Valeč (5845), 6.vii.1956, 3 males; ditto, 6.vi.1957, 1 male; brook, Prackovice (5450), 25.vi.1957, 4 male and 2 female subimagoes; Telnický brook, Adolfov (5249), 25.vi.1957, 1 male, all material V. Landa leg. et det.; brook, Lánská obora (5849), 1.v.1972, 27 mature larvae; Trnovský brook, Dobříš (6251), 12.vi.1974, 10 mature larvae, 8 larval exuviae; Babský brook, Řevnice (6051), 15.iii.1977, 8 larvae (on slides); Padrt'ský brook, Padrt' (6348), 12 larvae, all material T. Soldán leg. et det.; Klučná, Branov (6049), 6.iv.1995, 15 mature larvae, M. Putz leg. et det.

**Slovakia:** Kolačkovianka stream, Nová Ľubovňa (6789), 15.vi.1975, 1 male subimago, 10 mature larvae; Kvačianka stream, Kvačany (6883), 17.vi.1975, 5 mature larvae; brook, Krajná Polana (6696), 5.vi.1985, 2 females, 2 males and 1 female subimago; Okna stream, Remetské Hámre (7199), 3.vii.1975, 23 mature larvae; Drieňovec brook, Remetské Hámre (7199), 3.vii.1975, 2 male subimagoes, 28 mature larvae, all material T. Soldán leg. et det.

**Poland:** Roztoka, Beskid Sądecki, 6.xi.1985, 3 mature larvae; ditto, 25.vii.1985, 4 mature larvae, M. Kłownowska-Olejnik leg., det. et coll. (IESJU).

Abdominal segments III-X, genitalia, cerci, mesothoracic legs and one metathoracic leg is missing.

REDESCRIPTION OF FEMALE IMAGO, MALE AND FEMALE SUBIMAGO,  
MATURE LARVA AND EGG DESCRIPTION

**Female imago:** Length of body 10-14 mm, length of mesothoracic wing 12-17 mm, length of cerci 15-23 mm. General coloration of body yellowish-brown to brown-castaneous with light grayish smudges. Head yellowish-brown to brown. Antennae brown, eyes grayish-black, ocelli yellowish on the apex with wide dark bands at basis. Thorax darker, unicolorous brown to brown-castaneous with grayish smudges, sometimes contrasting with a little paler abdominal segments. Legs yellowish-brown, prothoracic legs darker. Mesothoracic wings translucent,

of both published data and material by J. Dziędzielewicz from museums in L'viv, Kraków and Praha showed that he had never collected in the Zakarpats'ka region (i. e. in the Tisza basin). Taking into account this fact, the locality in question should be situated in the north side of the respective divide. Consequently, we define, according to the Recommendation 74.6 of ICZN, the type locality of *Ecdyonurus subalpinus* Klapálek, 1907, as follows: Ukraine, Ivano-Frankivs'k Region, Gorgany mountain range, Yablonyts'kyi mountain pass, 13.5 km NE Yasinia village, 930 m a.s.l., 48°18'16" N, 24°26'50" E.

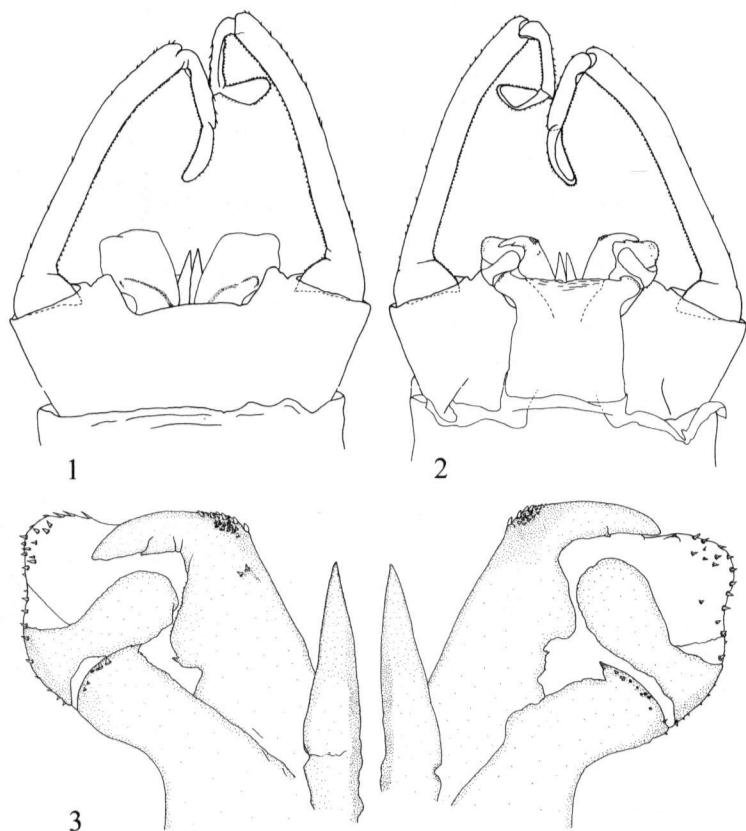
FIXATION OF LECTOTYPE AND PARALECTOTYPE

**Lectotype:** male imago, in 80% alcohol (parts on slides), originally labelled "Jasień. (granica) 27.-7.-1905. Dz.", "Ec. subalpinus Klap." and designated as such by R. J. Godunko and T. Soldán in September, 2000 is deposited in the collection of the State Museum of Natural History, National Academy of Sciences of Ukraine, L'viv, Ukraine, under the No. E1.07.17.11/01.

**Description:** Length of body 12.1 mm, length of mesothoracic wing 13.4 mm, cerci damaged (broken). Head generally brown. Antennae light brown, eyes black, ocelli brown on the apex. General coloration of thorax dark brownish with light brown bands. Thorax paler apparently contrasting to coloration of abdominal segments. Prothoracic legs generally of the same colour as thorax only slightly paler. Meso- and metathoracic legs yellowish-brown with light diffused, markings on the outer surface of femora, coxae and trochanters darker. Mesothoracic wings hyaline, translucent, unicolorous with the exception of yellowish costal and subcostal fields and yellowish translucent pterostigma. Venation generally yellowish-brown. Metathoracic wings hyaline, unicolorous. General coloration of abdominal terga brownish with paler, small spots on surface. Hardly visible, small reddish-brown spots on lateral part of terga around typical pattern of the *Ecdyonurus helveticus* species-group. Sterna yellowish-brown with well visible and darker nerve ganglia. Styliger and forceps segments 1 and 2 brown, segment 3 slightly paler. Forceps base with a pair of conspicuous lateral projections (Figs 1, 2). Penis lobes paler, slightly divergent, only moderately laterally extended in dorsal view (Fig. 2). Anterolateral portion of penis lobes strongly rounded with well visible rounded protuberances approximately at distal half portion of its length. Apical sclerites pointed with conspicuous and strong external denticulation and isolated inner teeth in the middle of lobe apparent in dorsal view (Fig. 3). Lateral approximately club-shaped apparently narrowing in their basal third. Basal sclerites massive with teeth and some small spines submarginal to their anterolateral margins. Spines present also on anterolateral portions part of penis lobe and forceps. Titilators brownish, elongated and roughly triangular, slightly asymmetrical and sharply pointed at apex (Fig. 3).

**Paralectotype:** male imago (strongly damaged dried pinned specimen), originally labelled "Chomiak (Weredyk) 8.-8.-1906.", "Ecdyurus.", "81." and designated as such by R. J. Godunko and T. Soldán (September, 2000) is deposited in the collection of the National Museum (Department of Entomology) in Praha, Czech Republic, under the No. 50.003.

**Description:** Length of head, thorax and abdominal segments I-II 5.2 mm; length of mesothoracic wings 12.7 mm. Coloration of head, thorax, preserved abdominal segments, prothoracic legs and wings similar to lectotype. Wing coloration is identical with the lectotype.



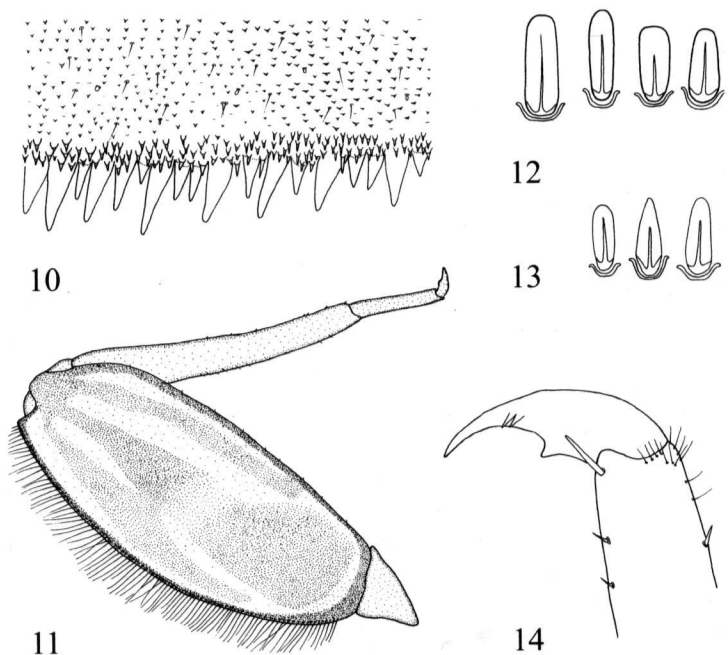
Figs 1-3: External male genitalia of lectotype of *Ecdyonurus subalpinus* (Klapálek): 1 – penis, styliger and forceps, ventral view; 2 – penis, styliger and forceps, dorsal view; 3 – details of penis lobes sclerites and titilators, dorsal view.

Obr. 1-3: Vnější genitálie lektotypu *Ecdyonurus subalpinus* (Klapálek): 1 – penis, styliger a gonostyly, ventrální pohled; 2 – penis, styliger a gonostyly, dorsální pohled; 3 – detaily skleritů penisu a titilátorů, dorsální pohled.

yellowish-brown to brown-castaneous, contrasting to abdominal segments. Meso- and metathoracic legs unicolorous, yellowish-brown. Prothoracic legs darker, tarsi, coxae and trochanters darker than femora. Wings translucent with yellowish-brown venation. Mesothoracic wings either unicolorous, grayish or greenish-brown or sometimes (more rarely) with darker, greenish-brown large triangular patterns, that are typically present e.g. in *Ecdyonurus torrentis* Kimmins, 1942. Mesothoracic wings translucent. Terga yellowish-brown sometimes slightly castaneous with paler and darker spots on surface. Posterior margins of terga sometimes with dark band. Coloration of lateral part of terga similar to female imago, but usually darker. Sterna yellowish-brown to brown with paler spots. Nerve ganglia hardly distinguishable. Styli, forceps and cerci generally darker than abdominal segments. Penis pale. Penis lobes rounded with prominent well visible pointed apical sclerites, in ventral view.

**Female subimago:** Length of body 10-11 mm, length of mesothoracic wing 12-13 mm, length of cerci 13-14 mm. General body colour, including that of wings, similar to male subimago.

**Mature larva:** Length of body 11-13 mm, length of caudal filaments 7-9 mm. General coloration of body yellowish-brown to dark brown. Head yellowish-brown to dark brown, antennae distinctly paler. Labrum small and wide with nearly straight lateral lobes and very slightly

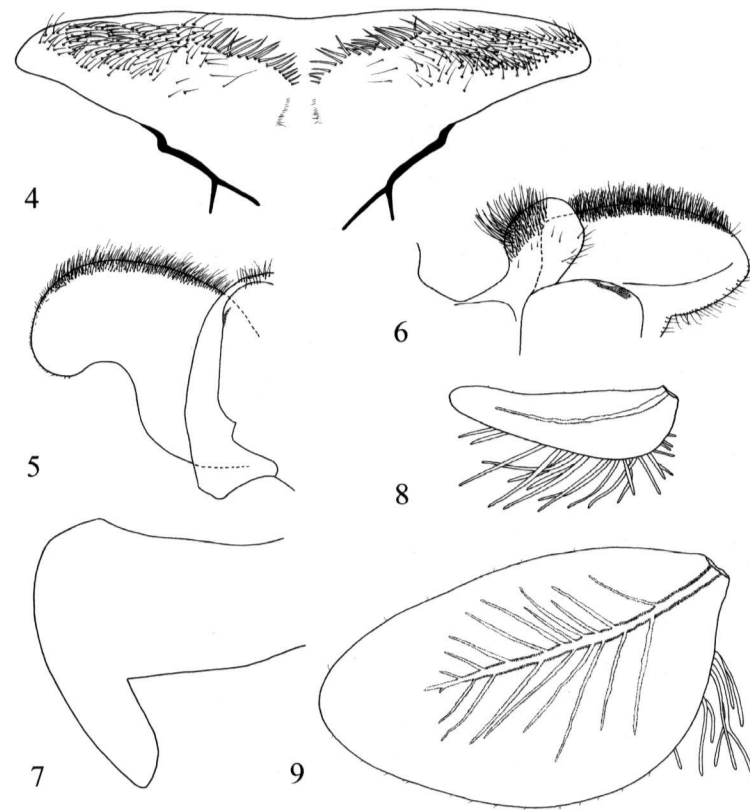


Figs 10-14: Critical morphological characters of mature larva of *Ecdyonurus subalpinus* (Klapálek): 10 – posterior margin of fourth abdominal tergum, dorsal view; 11 – metathoracic leg; dorsal view; 12 – scales of dorsal surface of profemur; 13 – scales of dorsal surface of prothorax; 14 – tarsal claw, ventral view.

Obr. 10-14: Kritické rozlišovací morfologické znaky dospělé larvy *Ecdyonurus subalpinus* (Klapálek): 10 – zadní okraj čtvrtého abdominálního terga, dorsální pohled; 11 – zadní noha, dorsální pohled; 12 – tyčinky na vnějším povrchu předních stehen; 13 – tyčinky na vnějším povrchu předního trochanteru; 14 – drápek chodidla, ventrální pohled.

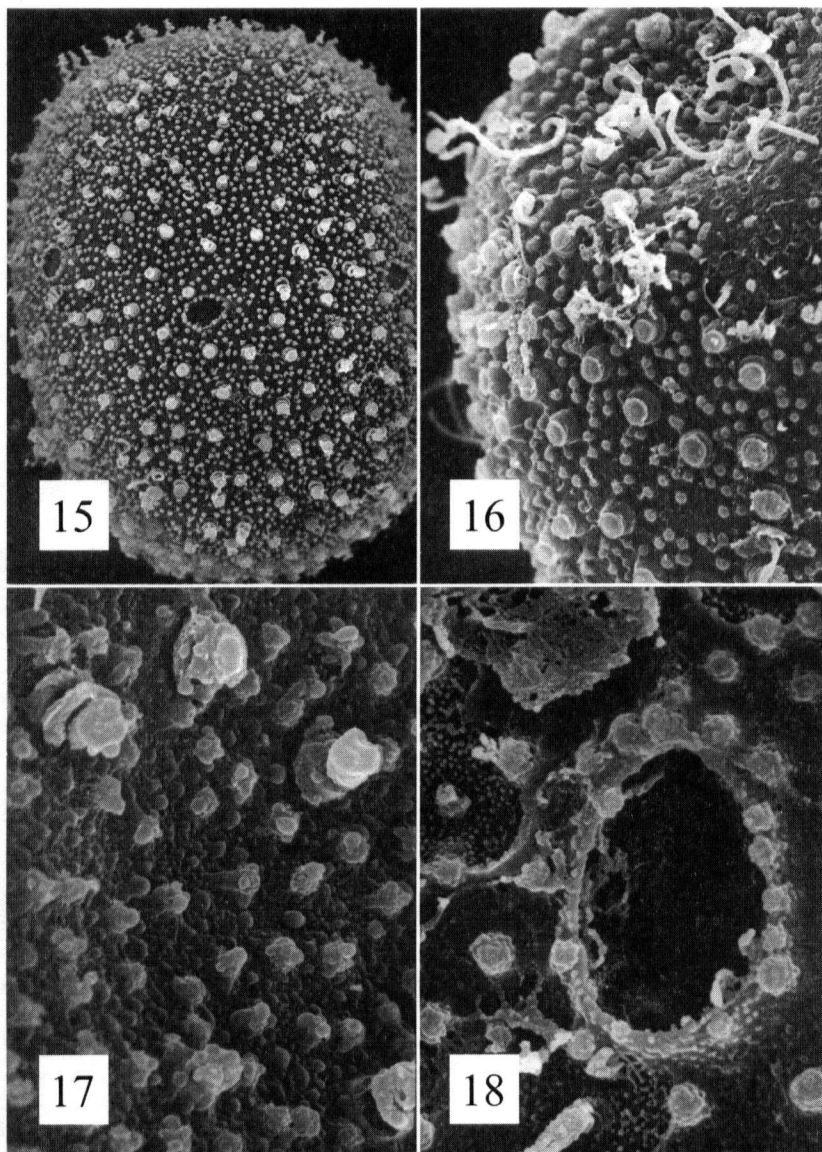
unicolorous, sometimes slightly translucent, yellowish to yellowish-gray with brownish venation. Pterostigma yellowish-brown, translucent. Metathoracic wings similar to mesothoracic ones in coloration. Abdominal terga yellowish to yellowish-brown. Lateral part of terga with typical pattern of the *Ecdyonurus helveticus* species-group and brownish spots around, sterna paler. Nerve ganglia sometimes conspicuously darker, usually discernible. Subgenital plate large, posterior margin slightly rounded. Apical portion of subanal plate slightly pointed. Cerci yellowish-brown to brown.

**Male subimago:** Length of body 8-12 mm, length of mesothoracic wing 11-13 mm, length of cerci 12-15 mm. General coloration of body lighter than in imago, yellowish-brown to brownish, or brown-castaneous. Head yellowish-brown, facial keel with small darker spots. Antennae brown, eyes grayish-black. Ocelli yellowish dorsally, basal portion with dark band. Thorax



Figs 4-9: Critical distinguishing morphological characters of mature larva of *Ecdyonurus subalpinus* (Klapálek): 4 – labrum, ventral view; 5 – hypopharynx, dorsal view; 6 – glossa and paraglossa, ventral view; 7 – shape of posterolateral pronotal projection; 8 – tracheal gill 1, dorsal view; 9 – tracheal gill 4, dorsal view.

Obr. 4-9: Kritické rozlišovací morfologické znaky dospělé larvy *Ecdyonurus subalpinus* (Klapálek): 4 – labrum, ventrální pohled; 5 – hypopharynx, dorsální pohled; 6 – glosy a paraglosy, ventrální pohled; 7 – tvar posterolaterálního pronotálního výběžku; 8 – žaberní plátek 1, dorsální pohled; 9 – žaberní plátek 4, dorsální pohled.



**Figs 15-18:** Morphological characters of egg chorion of *Ecdyonurus subalpinus* (Klapálek): 15 – the egg, general view; 16 – egg pole with KTC (knob-terminated coiled threads) attachment structures; 16 – chorionic surface of egg with three types of microgranules and KTC attachment structures; 18 – detail of micropyle and micropylar rim.

**Obř. 15-18:** Morfologické znaky chorionu vajíčka *Ecdyonurus subalpinus* (Klapálek): 15 – vajíčko, celkový pohled; 16 – vaječný pól s knoflíkovitými stočenými vláknitými fixačními strukturami (KTC); 16 – povrch chorionu vajíčka se třemi typy mikrogranul a fixačními strukturami (KTC); 18 – detail micropyle a micropylárního valu.

incurved anterior bmargin (Fig. 4). Six to nine relatively massive bluntly pointed bristles on ventral side of labrum arranged in a single row. Maxilla: more than 10 long fine setae on the distal margin of the first maxillary palpomere; 35-50 long bristles on the outer margin and more than 20 long bristles on dorsal part of the outer fore corner of galea-lacinia. Hypopharynx (Fig. 5) with hairs and setae pattern typical for other species of the *E. helveticus* species-group, superlinguae moderately bent backwards. Glossa and paraglossa with several rows of longer setae, paraglossa symmetrical (Fig. 6). Posterolateral extensions of pronotum (Fig. 7) bluntly pointed at the apex and apparently strongly asymmetrical, inner margin of expansion straight or slightly convex. Their axes form evidently sharp angle to the body axis. Thorax yellowish-brown to dark brown with darker patterns formed by diffused bands and smudges. Legs yellowish-brown to dark brown, femora with darker longitudinal bands on their dorsal surface as in Fig. 11. Femoral scales rounded at the apex most of them with parallel lateral margins (Fig. 12). Different scales present on trochanters. Most of them show slightly convergent lateral margins, some of them pointed at apex (Fig. 13). Tarsal claws (Fig. 14) only moderately bent, generally with two (sometimes with three) strong teeth. Abdominal terga yellowish-brown to dark brown. Their posterolateral spines small, parallel to the body axis. Uniform markings with diffused paler spots and smudges similar on terga of all abdominal segments, lateral part of terga with a pair of brownish spots. Posterior margins of abdominal terga (Fig. 10) with row of pointed spines and numerous much smaller subapical ones arranged into several irregular rows. Small pointed scales and long fine setae present also on surface of terga. Tracheal gills milky or whitish-gray but often grayish-brown or reddish-brown in the middle portion. Plate of gill 1 (Fig. 8) relatively short, slightly bent, tapered toward the apex. Plate of gill 4 strongly asymmetrical, always less than twice longer than wide (Fig. 9). Sterna yellowish-brown to brown with distinctly darker nerve ganglia. Cerci brown, darker at base. Paracercus lighter, yellowish-brown.

**Egg:** Dimension: 129-134  $\mu\text{m}$  (130.7  $\mu\text{m}$  in average, 24 eggs measured) in length and 93-116  $\mu\text{m}$  (103.1  $\mu\text{m}$ ) in width. Eggs generally oval, only slightly longer than wide (Fig. 15). Surface of exochorion regularly covered with large knob-terminated coiled thread (KTC) attachment structures all over its surface, uncoiled threads about 5-10  $\mu\text{m}$  in length (Fig. 16). The KTC more densely concentrated at one of the poles. Among them, three morphological types of microgranules are irregularly but densely scattered (Fig. 16). There are two types of simple oval or spherical tubercles measuring about 0.5 and 1.0  $\mu\text{m}$ , respectively. Third microgranular type about 2-3 times larger and elongated, funnel or mushroom-shaped and apparently composed of 2 or more subunits (Fig. 17). Some (usually 3-5) micropyles (Figs. 15, 18) situated in the equatorial and subequatorial areas, measuring 5.0-8.1  $\mu\text{m}$  (6.3  $\mu\text{m}$  in average) in length and 2.9-5.4  $\mu\text{m}$  (4.3  $\mu\text{m}$ ) in width. Micropyle roughly oval but apparently bluntly pointed at one side, sperm guide not distinguishable. Micropylar rim narrow but well apparent, with some granules on its margins (Fig. 18).

#### NOTES ON BIOLOGY AND DISTRIBUTION

Larvae of *Ecdyonurus subalpinus* mostly prefer smaller streams and brooks of epi- and metarhithral zone however they occur in the latter rather exceptionally like in crenal habitats. They generally live on stony habitats; preferring places with moderate current, streamline

paralectotype are missing, only first two abdominal segments are present) and seem to be very characteristic for this species. Typical arrangement of penis lobe tooth was observed in all populations from both Ukraine and the Czech Republic studied showing nearly no intraspecific variability.

On the other hand, some differences between lectotype and the additional material studied were found as far as body coloration is concerned. Lectotype specimen seems to be lighter or paler than in most specimens of the Ukrainian and Czech populations. However, this can be attributed to current intraspecific variability, body coloration vary considerably, we have observed both yellowish brown and dark brown specimens of males as well as females within the same population. In his original description, Klapálek (1907: 33) mentioned both light and dark brown specimens, Landa (1969) mentioned both specimens with reddish brown or pitch brown abdomen as well. Some apparent morphological differences of lectotype and adult populations from Ukraine and the Czech Republic evidently represent a result of desiccation of (and/or long-term effects of light on) pinned specimen. This concerns not undistinguishable dark brown facial keel well apparent in alcohol fixed material and blackish brown band at the base of compound eyes, which are, moreover, deformed to flat shape in the lectotype.

Wings of the lectotype specimen are completely translucent except for costal and subcostal fields, which show olive brown shading. However, most specimens studied possess basal half of wings light grayish coloured. This is apparently caused by intraspecific variability. We have a possibility to study three males collected by J. Dziędzielewicz in the Chornogora and Gorgany region very close to the type locality. All of them possess apparently coloured basal part of wings.

Oblique pale lateral colour patterns of abdominal segments are usually well distinguishable and characteristic in fresh material but hardly visible in the lectotype. As indicated above, this was caused by original deposition of these specimens. On the other hand, diffused dark brown spots on sterna indicating nerve ganglia seems to be better discernible in the lectotype than in fresh or alcohol fixed material which is generally darker in coloration. Cerci are generally yellowish brown or light brown, darker at the base, not ringed.

To conclude, the present study of original syntypes showed *E. subalpinus* to be well-defined species. However, most of earlier larval descriptions of *E. subalpinus* are usually based on the comparison to rather remote species of the genus (mostly *E. venosus* (Fabricius, 1775) species-group) as far as differential diagnosis is concerned. The *E. helveticus* species-group was weakly defined (see Kimmins 1958) for a long time and numerous species were still unnamed, true critical diagnostic characters remained unknown.

The question of different wing colour patterns in subimagos is still open. Within the populations from the Czech Republic, colored wings (zig-zag dark triangular patterns) are being currently observed in the first generation while unicolorous grayish wings prevail in the second one. On the contrary, no such relationships have been observed in the populations from the East Carpathians. Both colour patterns occur in subimagos emerging from spring to autumn.

There is probably no chance to distinguish females of individual species of the *E. helveticus* species-group and *E. subalpinus* is not an exception. However, ootaxonomy provides us with a lot of valuable data. At this moment, *E. subalpinus* is the only species of which relevant data are at disposal and similar studies are urgently needed.

places are settled only exceptionally. However, within some brooks short of stones, they were found also in organic debris and submerged branches, although never occurring on sand and submerged plants. They colonize mostly shadowed places with relatively warm water. Larvae were found in both lowland and coline zones evidently preferring the latter. Lowland localities are colonized rather exceptionally provided that the biotopes show respective slope, stony bottom and current speed. Adults fly usually at dusk, those of the second generation in the late afternoon.

As far as the elevation range is concerned, larvae were found at the altitudes of 182-480 m in the Czech Republic and at those of 400-1,200 m in the Eastern Carpathians, respectively.

*E. subalpinus* together with *E. helveticus* Eaton, 1883 are the only known bivoltine species within the Central European representatives of the genus *Ecdyonurus* Eaton, 1868. Larvae of the first generation of *E. subalpinus* hatching in late September and October overwinter, and stay in lower larval instars till March, main growth of this overwintering generation occur in April and May after apparent increase of water temperature in early spring. Larvae of the second generation develop quickly during summer months being always by approximately a third smaller in body size than overwintering ones and giving rise to smaller adults. Developmental range of both generations does not substantially differ at different altitudes in the populations of the Czech Republic (Landa 1969) and Germany (Geissen 1995). However, univoltine winter life cycle seems to be observed in the Eastern Carpathians, in Poland and Ukraine (Sowa 1975, Godun'ko 2001). Young larvae overwinter here, adults were collected flying from late May to early October. There is a possibility of different development rate of larvae originating from the same egg cohort. Consequently, the flight period lasts from late May to early October, regardless the proper type of life cycle is determined. On the contrary, *E. helveticus*, the species usually inhabiting higher elevations (e.g. up to 2,400 m in the Alps), shows a typical seasonal monovoltine life cycle except for the populations rarely living at lower altitudes. In this case, bivoltine life cycle identical to *E. subalpinus* usually occurs (Breitenmoser-Würsten & Sartori 1995).

Besides the original material from Ukraine (Klapálek 1907, Dziędzielewicz 1919), *E. subalpinus* has been found (only first records presented here, see e.g. Landa & Soldán (1989) for detailed list of localities in the Czech Republic and Slovakia) in the Czech Republic (Bohemia) (Komárek 1919), southern Poland (Mikulski 1936), Slovakia (Landa 1969), Germany (Jacob 1974), Austria (Bauernfeind 1990) and Rumania (Bogoescu 1958). There are also some findings from Croatia (Šámal 1935), Macedonia (Puthz 1980), Hungary and Bulgaria (Uzunov et al. 1981).

## DISCUSSION

Adult males of *Ecdyonurus subalpinus* can be easily distinguished by the following combination of critical characters: 1) penis lobes apparently rounded, spherically shaped, not tapered laterally at all as in all remaining related species, 2) apical sclerites of penis lobe with bluntly pointed terminal part and a simple straight inner projection directed to the centre of the lobe, 3) basal sclerites of penis lobe with only a single well distinguished pointed tooth. Spherically shaped penis lobes single *E. subalpinus* out of all remaining species of the *E. helveticus* species-group except for *E. carpathicus* Sowa, 1973. However, this species can be easily distinguished by quite different shape of basal sclerites and of its teeth. Naturally, these characters are well apparent in the lectotype specimen from Ukraine (genitalia of the

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## SOUHRN

Druh *Ecdyonurus subalpinus* (Klapálek, 1907) byl pod jménem *Ecdyonurus subalpinus* popsán na základě materiálu sbíraného J. Dziędzielewiczem ve východních Karpatech. Původní Klapálekův popis se zmiňuje o 4 exemplářích samců, avšak typový materiál nebyl označen a od té doby se jej nepodařilo lokalizovat. Následující redeskripcie byly proto většinou spíše orientační a některé i nepřesné, přinášející pochybnost o identitě tohoto místy hojného středoevropského druhu. Situace byla navíc komplikována také tím, že nebyla přesně stanovena typová lokalita. Na základě studia původního popisu a sbírkového materiálu v Praze a ve Lvově se podařilo lokalizovat syntypovou sérii, z nichž se však zachovaly pouze dva exempláře; z nich jeden je navíc silně poškozen a nekompletní. V této práci je fixován lektotyp v jedinci uloženém ve Státním přírodovědeckém muzeu Ukrajinské akademie věd ve Lvově (No. E1.07.17.11/01) a paralektotyp v poškozeném jedinci uloženém v Entomologickém

With respect to other representatives of *E. helveticus* species-group the larva of *E. subalpinus* can be distinguished by the combination of all three characters, as follows: 1) posterior margin of abdominal terga with pointed spines only (Fig. 10); 2) pronotal expansions bluntly pointed at the apex and strongly asymmetrical; 3) surface of femur with scales rounded at the apex only. Lateral sides of scales mostly slightly divergent. The character (1) distinguishes *E. subalpinus* from *E. alpinus* Hefti, Tomka et Zurwerra, 1987, *E. austriacus* Kimmins, 1958, *E. parahelveticus* Hefti, Tomka et Zurwerra, 1986 (posterior tergal margin with small pointed and large rounded spines), the characters (2) and (3) distinguish *E. subalpinus* from all other species described so far, i.e. *E. carpathicus* Sowa, 1973, *E. epeorides* Demoulin, 1955, *E. helveticus* (Eaton, 1885), *E. krueperi* (Stein, 1863), *E. picteti* (Meyer-Dür, 1864), *E. siveci* Jacob et Braasch, 1984, *E. vitoshensis* Jacob et Braasch, 1984 and *E. zelleri* (Eaton, 1885).

Concerning the distributional area of *E. subalpinus*, the situation seems to be unclear. In the North and West Europe, its area is undoubtedly restricted by the Alps and Hercynian mountains in Central Europe (cf. Hefti et al. 1989, Haybach 1998). We are not sure about its distribution in the Balkan although some authors (Šámal 1935, Puthz 1980) report this species from this area. Some of these data might actually concern other species of the *E. helveticus* species-group and respective material would have to be re-examined with respect to recent taxonomic knowledge. Anyway, the area of *E. subalpinus* is relatively large, if not largest, in comparison to other species of the *E. helveticus* species-group. This might be a source of controversial data on its life cycle since individual subareas (e.g. Central Bohemia and the Ukrainian Carpathians) provide quite different environmental factors.

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oddělení Národního muzea v Praze (No. 50.003). Analýza původních etiket umožnila s přihlédnutím k okolnosti, kde J. Dziędzielewicz skutečně sbíral, definovat typovou lokalitu takto: Ukrajina, Ivano-Frankivská oblast, pohoří Gorgany, Jablonitský průsmyk, 13,5 km severovýchodně od obce Jasiňa, 930 m, 48°18'16" severní šířky, 24°26'50" východní délky. Lektotyp je podrobně popsán a vyobrazen, redeskripce se týká také ostatních stádií druhu *E. subalpinus* (dospělec samice, subimago samce a samice, dospělá larva), kdy bylo použito materiálu z České republiky, Slovenska, Polska a Ukrajiny. Struktury vaječného chorionu jsou poprvé popsány v této práci na základě elektronmikrogramů z rastrovacího mikroskopu. Hlavními diferenciativními diagnostickými znaky *E. subalpinus* jsou: 1) laterálně neprotážené a sféricky zaoblené laloky penisu, 2) apikální sklerit penisu s tupě zašpičatělou terminální částí a jednoduchým přímým vnitřním výběžkem, 3) basální sklerit penisu s jediným, dobře patrným zašpičatělým zubem, 4) posterolaterální pronotální výběžky u larev silně asymetrické, s tupě zašpičatělou apikální částí, 5) vnější povrch stehien výhradně se zaoblenými šupinkami, 6) zadní okraj abdominálních segmentů výhradně se zašpičatělými trny. Vnitrodruhová variabilita spočívá hlavně ve zbarvení křídel subimag. Larvy preferují kamenitý substrát ritronu kolinného výškového stupně. Druh má pravidelně 2 generace do roka, výjimečně ve vyšších polohách jedinou. Areál je severovýchodně ohraničen východními Karpaty na Ukrajině, západně Alpami a Hercynským systémem v Německu a Rakousku, data o výskytu na Balkáně jsou nejistá.