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Ecdyonurus parahelveticus n. sp., a new species belonging to the *Ecdyonurus helveticus*-group (Ephemeroptera, Heptageniidae)[1]

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Three populations from the Swiss (Valais, Fribourg) and French (Savoy) Alps were identified to be a new species belonging to the *Ecdyonurus helveticus*-group. The morphological description and the ecology of that new species is presented. In addition a differential diagnosis with all other species belonging to the *E. helveticus*-group is presented, excluding *E. epeorides* and *E. siveci* because of the lack of the material.

The members of the *Ecdyonurus helveticus*-group belong to the family Heptageniidae. All species of the family are widely distributed through Europe and represent an important part of the benthic fauna of rivers and streams.

In the literature which is older than 50 years, we find five still valid taxa of the *Ecdyonurus helveticus*-group: *E. krueperi* (STEIN, 1863), *E. picteti* (MEYER-DÜR, 1864), *E. helveticus* (EATON, 1885), *E. zelleri* (EATON, 1885) and *E. subalpinus* (KLAPALEK, 1907). Additional contributions to the group appeared in more recent literature:

- DEMOULIN (1955) described *E. epeorides* on the basis of only one damaged imago and one damaged nymph.
- KIMMINS (1958) discussed three species belonging to the group *(E. austriacus, E. helveticus* and *E. zelleri)* and set *E. epeorides* synonym to *E. zelleri.*
- BOGOESCU & TABACARU (1962) defined differences between the *E. helveticus-*, the *E. venosus-* and the *E. "lateralis"*-group.
- THOMAS (1968) claimed the synonymy of *E. bollenganus* (NAVÁS, 1933) with *E. helveticus.*
- SOWA (1973) described a new species from the Polish Carpathians *(E. carpathicus).*
- PUTHZ (1975) considered *E. austriacus* as a synonym of *E. picteti.*

So a total of 6 species belonging to the *E. helveticus*-group appeared in the Limnofauna Europaea (ILLIES, 1978). Later PUTHZ (1980) described the subspecies *E. krueperi albanicus* and finally JACOB & BRAASCH (1984) published a revision of the group with keys for the determination. They described one new species *(E. siveci),* one new subspecies *(E. carpathicus vitoshensis)* and rejected the synonymy established by KIMMINS (1958) for *E. epeorides* and *E. zelleri,* considering then the existence of eight species and two subspecies.

Despite these recent papers, the taxonomy of the group remains obscure and the identification of most species is difficult. One reason for this is due to the

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fact that the authors did not always possess large series of material from locotypical populations. So it was not always possible to take into account the phenotypical variability of the species discussed here. With the present work, we start a series of papers on the taxonomy of the *Ecdyonurus helveticus*-group. Until now, we have investigated more than 50 populations from Europe, which represent the following species: *E. carpathicus, E. helveticus, E. krueperi, E. picteti, E. subalpinus* and *E. zelleri.*

During our recent expeditions, we have identified three populations which belong to the *E. helveticus*-complex. A morphological study of the imagines and the nymphs shows distinct characters which motivate us to consider them to belong to a new species. In addition, the analysis of the relative electric mobility of 16 enzymes confirm the specificity of the three populations. These enzymes are: adenylate kinase (AK), aldolase (ALD), arginine phosphokinase (APK), glutamate-oxaloacetate transaminase 1 and 2 (GOT-1, GOT-2), glycerophosphate dehydrogenase (α GPDH), Hexokinase 1 and 2 (HK-1, HK-2), Indophenol oxydase 1 and 2 (IPO-1, IPO-2), leucine amino peptidase (LAP), malate dehydrogenase 1 and 2 (MDH-1, MDH-2), mannose phosphate isomerase (MPI), phosphoglucomutase (PGM) and retinol dehydrogenase (RDH). In the *E. helveticus*-group we found the highest correlation (I = 0,93) of the relative mobility of the investigated enzymes between the new species and *E. helveticus.*

Because the ecology and the geographical distribution of this new species is not yet thoroughly investigated, we take into consideration its relatively close phylogenetic relationship to *E. helveticus* and propose the name *E. parahelveticus.*

DESCRIPTION

Imago, male

Length of the body (without cerci): 10–13 mm
Length of the anterior wings: 12–13 mm

Head: fuscous in the ocelli area and on the vertex, the facial keel generally more clear. Eyes light grey, more dark at their outer base. *Thorax:* The thoracic segments are fuscous to brown in contrast to the shade of the abdomen, which is more yellowish. All coxae are whitish, bordered with slight brown lines. The forelegs, more dark than the others, have the same coloration as the thorax. The middle and the hind legs are more whitish, but all present some clean dark spots on the tarsal area and very often at the level of the tibio-femoral articulations. Tarsal claws twofold and asymmetrical. The fore wings present a hyaline surface with the exception of the costal and subcostal area which is opaque. Pterostigmatic area slightly brownish with a few transverse branched veins. Hind wings hyaline with whitish veins at the level of the costal projection. *Abdomen:* General colour yellowish to light brown. Tergites with a lot of tracheal branches and presenting laterally the typical pattern of the *E. helveticus*-group (Fig. 4). Sternites yellowish with white lateral margins. Visible ganglionar chain which is underlined with grey spots (Fig. 5). Lateral margin of the last abdominal segment bordered with a fuscous line. *Cerci:* Dark brown, same colour as the forceps. *Genitalia:* In dorsal view (Fig. 2) the outlines of the penis lobes are rounded and slightly streched laterally. The apical sclerite, very prominent, generally supports a twofold pointed tooth directed towards the centre of the lobe. The very large lateral sclerite occupies a large proportion of the penis lobe. The apical margin of the lateral sclerite pre-

sents a pronounced sinuous outline. The basal sclerite usually supports a little notch or denticule but never bears any projecting teeth directed to the middle of the lobe. Forceps and forceps base fuscous, clearly darker than the ventral face of the last abdominal segment. The lateral protuberances of the forceps base are small or non existent (Fig. 3). No clear incision between the first and the second basal article of the forceps.

Imago, female

Length of the body (without cerci): 13–14 mm
Length of the anterior wings: 12–13 mm

In comparison with the male, the general colour of the body seems to be more clear and more homogeneous, the thorax and the abdomen being not so contrasted. Near to the lateral tergites the abdomen presents a reddish shade. The coloration of the forelegs is not, or only slightly darker than in the other legs.

Subimago, male and female

General colour of the body brownish to yellowish, little contrasted. The head of the male subimago presents a clean black surface at the front and the ocellar region, which can sometimes prolong itself until the facial keel. The opaque wings show a banding pattern but its intensity is not so accentuated as in *E. picteti* and is brownish. The male genitalia exhibit the very prominent apical sclerite (Fig. 7).

Eggs

The eggs were directly extracted from the imaginal abdomen. They were first included in a drop of chloralphenol and then preserved in a medium after HEINZE (1952). The eggs of *E. parahelveticus* are oval, yellowish with a net macrogranulation inside (Fig. 1). All around the egg surface appear filaments which are more concentrated at the two poles of the egg.

Nymph

General colour of the body brownish to yellowish. The lateral extensions of the abdomen are short and oriented in a parallel direction with the longitudinal axis of the body (Fig. 8). Two types of spines appear on the tergo-abdominal margin of the nymph: the spines of the first type are short and less densely distributed in constrast to the other species of the *E. helveticus*-group investigated by us. The spines of the second type are rounded at the apex and give the impression of a scale (Fig. 9 and 10). Femoral teeth rounded at the apex in the form of a spatula (Fig. 12). The tarsal claws present seldom teeth (Tab. 1). Fourth gill asymmetrical, its breadth longer than half its lenght (Fig. 11).

Nb. of teeth	0	1	2	3
n	104	2	3	3

Tab. 1. Number of teeth observed on the tarsal claw. n = number of legs.

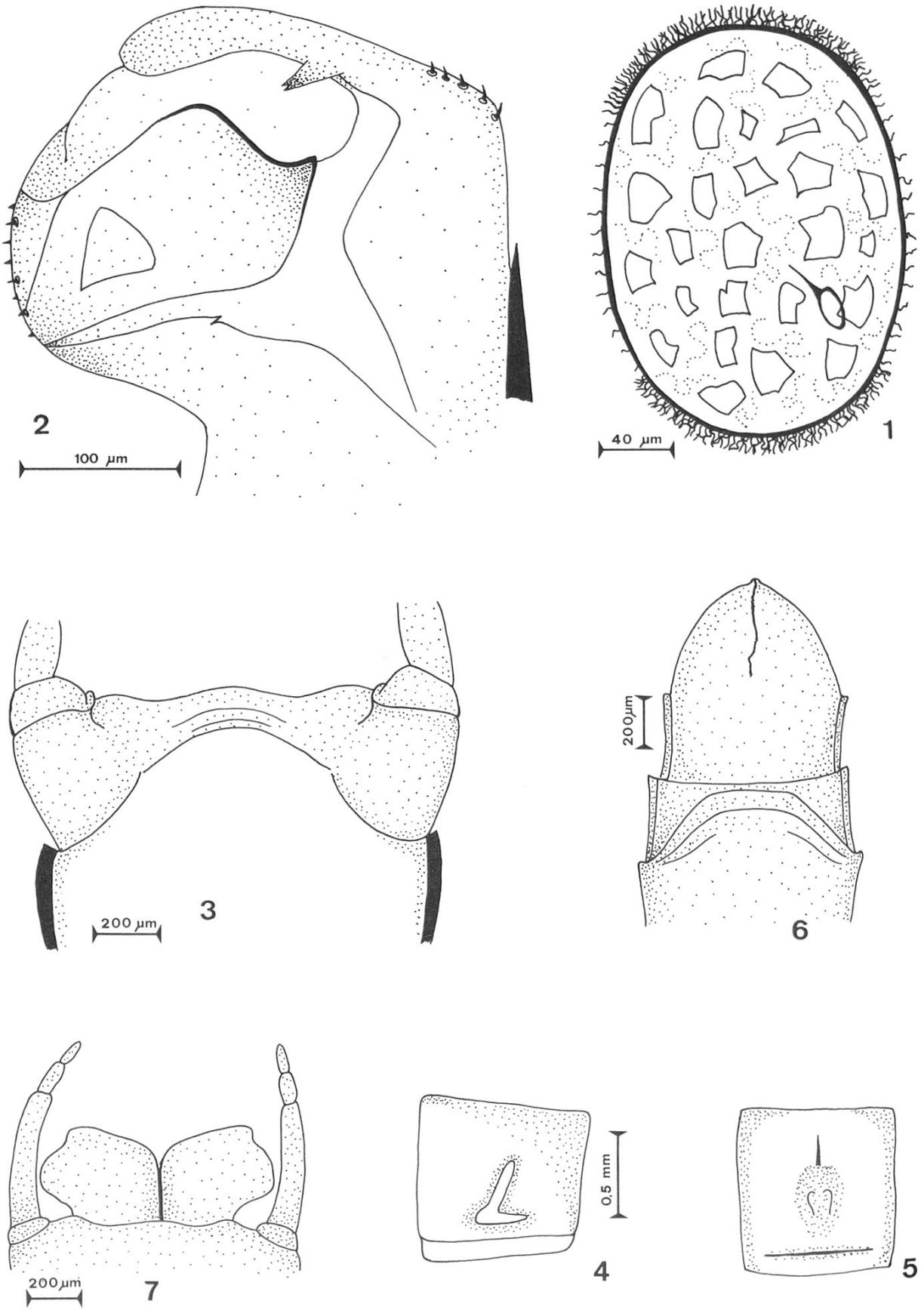

Fig. 1–7. Morphological characteristics of *E. parahelveticus*. 1 egg; 2–5 adult male: 2 = penis, dorsal view, 3 = forceps base, 4 = fourth lateral abdominal tergite, 5 = fourth abdominal sternite; 6 adult female: pygidium and genital plate; 7 subimago: genital structure of male.

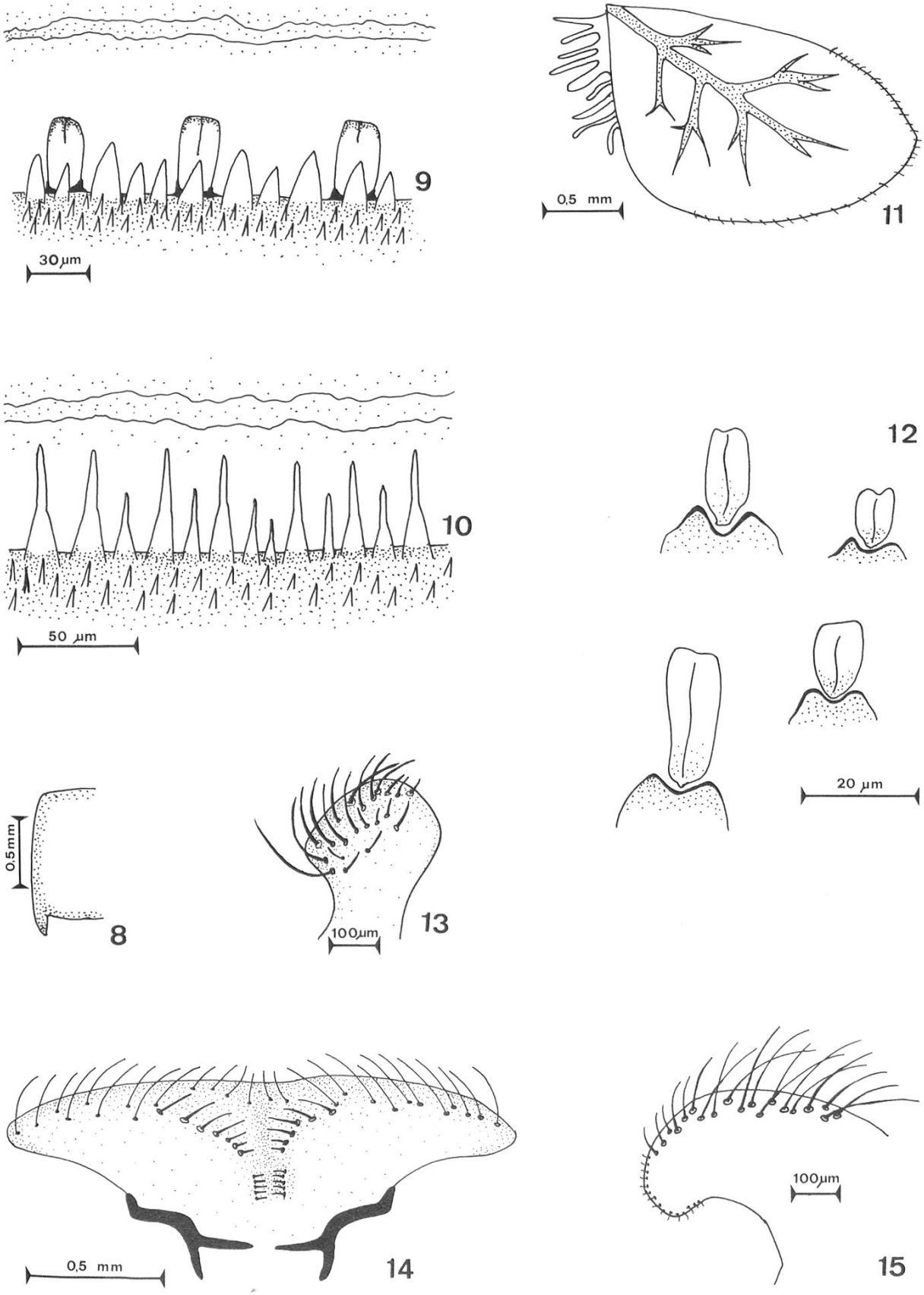

Fig. 8–15. Morphological characteristic of *E. parahelveticus*. 8 abdominal tergite (left side); 9–10 comparison of tergo-abdominal spines: 9 = *E. parahelveticus*, 10 = other members of *E. helveticus*-group; 11 fourth gill; 12 femoral teeth; 13–15 some mouthparts: 13 = glossa, 14 = labrum, 15 = hypopharynx.

MATERIAL

All the collected material comes from a few stations on the Vièze de Morgins, from one on the Drance de la Manche and from one in a tributary of the Geissalpbach (Fig. 16). It consists of imagines directly catched in the air and nymphs reared in the laboratory until the imaginal stage.

Tributary of the Geissalpbach: 4 ♂ imagines and 4 nymphal skins.
- Gantrischli, Fribourg, CH (593.450/169.150), 1270 m, 6.7.83 (leg. Hefti).

Drance de la Manche: 6 ♂ imagines, 4 ♀ imagines, 2 subimagines, 10 nymphs and nymphal skins.
- Chardonnières, Haute Savoie, F. (548.500/110.050), 1300 m, 27.7.84 (leg. Metzler, Zurwerra).

Vièze de Morgins: 13 ♂ imagines (1 ♂ I holotype no 269 + 12 ♂ I paratypes), 11 ♀ imagines, 13 subimagines, 50 nymphs and nymphal skins.
- Morgins, Valais, CH (554.230/120.310), 1340 m, 7.9.80 (leg. Tomka, Zurwerra). 17.6.83 (leg. Hefti).
- En Tey, Valais, CH (553.450/119.020), 1430 m, 17.6.83 (leg. Hefti), 15.9.83 (leg. Hefti).
- Sassex, Valais, CH (552.350/117.800), 1540 m, 22.8.82 (leg. Zurwerra), 17.6.83 (leg. Hefti).
- Lac de Chésery, Valais, CH (552.050/117.520), 1610 m, 7.9.80 (leg. Tomka, Zurwerra), 17.6.83 (leg. Hefti).

The types are deposited in the Entomological Department, Institute of Zoology, University Fribourg, Pérolles, 1700 Fribourg, Switzerland.

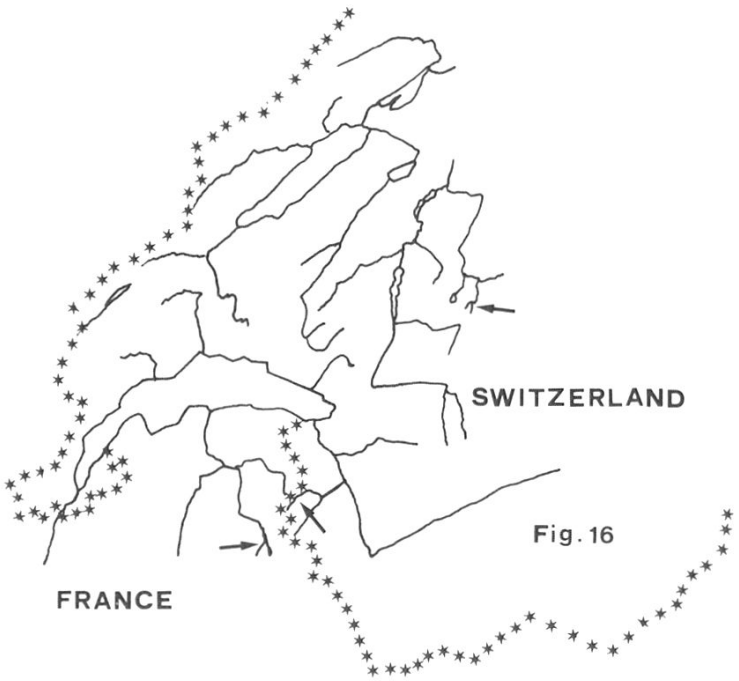

Fig. 16. Geographical situation of the investigated stations.

ECOLOGY

All the investigated stations belong to the epi-metarhithral stage (ILLIES & BOTOSANEANU, 1963) and are composed of cold mountain streams with a calcareous character (Tab. 2). *E. parahelveticus* is an alpine species: the larvae grow dur-

ing the winter in the middle of the stream where the current velocity is generally higher than 1 m/s. The nymphs migrate then to the edge where the emergence takes place. The flight of the adults is during August until the middle of September. In the valley of the Vièze de Morgins we found *E. helveticus* (ZURWERRA & TOMKA, 1984) and *E. picteti* (both in a small number) together with *E. parahelveticus*. In this same valley, it was not possible to find adult larvae of the new species at an altitude lower than 1300 m and this may perhaps be due to the heavy pollution of the river below that point. Further investigations will be necessary to define whether the biogeographical distribution of the new species corresponds to that of the other species belonging to the *E. helveticus*-group (HEFTI *et al., 1985).*

Tab. 2. Ecological data: Arithmetic means from n samples for the electrical conductivity (E. C. $_{20°}$) in μS/cm, for the alcalinity (ALC) in mVal/l, for the total hardness (TH) in mmole/m^3, for the non-carbonate hardness (NCH) in mVal/l and for the temperature (T) in °Celsius. n = number of measures.

	E.C.$_{20°}$	pH	ALC	TH	NCH	T
Tributary of the Geissalpbach (n=1)	-	-	2,57	-	-	6,3
Chardonnière (n=1)	300	8,11	2,50	1,40	0,30	12,4
Vièze de Morgins (n=6)	259	8,34	2,33	1,51	0,69	5,6

DIFFERENTIAL DIAGNOSIS

Imago, male: The characteristic drawing on the lateral tergite and the existence of a prominent apical sclerite on the penis structure proves that *E. parahelveticus* belongs to the *E. helveticus*-group. The distinction from all the other members of the group is possible because of the ratio of length to width of the lateral sclerite (which is smaller than 2 in the case of *E. parahelveticus),* its position (in the middle of the lobe) and the strongly curved form of its anterior outline. In addition, the rounded lobes of the penis are truncated laterally and permit the distinction from *E. helveticus, E. picteti,* and *E. zelleri.* The forceps base presents slight or no protuberances.

Tab. 3. Differential enzymes permitting the biochemical separation between *E. parahelveticus* and the other members of the *E. helveticus*-group.

E. parahelveticus - E. helveticus : GOT-1
E. parahelveticus - E. zelleri : AK, GOT-2
E. parahelveticus - E. krueperi : ALD, GOT-2, IPO-1, LAP, MDH-1
E. parahelveticus - E. picteti : GOT-2, HK-1, HK-2, LAP, PGM
E. parahelveticus - E. subalpinus : GOT-2, IPO-1, IPO-2, LAP, RDH
E. parahelveticus - E. carpathicus : ALD, COT-2, IPO-1, IPO-2, MPI, PGM

Nymph: In contrast to the elongated and densely distributed spines of all the other investigated members of the *E. helveticus*-group, the spines of *E. parahelveticus* are short, some of them being rounded at the apex and look like scales.

Enzyme electrophoresis: The new species can be separated from the other species of the *E. helveticus*-group by the different mobilities of the enzymes listed in Tab. 3.

DISCUSSION

The characters mentioned in the differential diagnosis permit the distinction between *E. parahelveticus* and all the other species we have investigated (cf. introduction). Specimens of *E. siveci* and *E. epeorides* were for us not available but the morphological features and the ecological data for these two species are given in the papers of DEMOULIN (1955) and JACOB & BRAASCH (1984). They clearly demonstrate the differences with *E. parahelveticus*. In addition Dr. Jacob confirmed us (personal communication) the very strong deep outline of the lateral sclerite for the species *E. siveci*, like it appears on Fig. 9 (JACOB & BRAASCH, 1984). The description of *E. siveci* is based on two male imagines from Scavnica by Maribor (YU) and on larval material from Luce by Celje (YU). We investigated this type locality at Luce at the same season when Dr. Sivec mentionned the larvae but we only found the species *E. picteti*.

To the status of *E. epeorides*, KIMMINS (1958) already wrote: "In view of the poor condition and limited material it might have been better to have left the specimen nameless." Since that time, Dr. Malicky found only one male imago and two larvae.

Considering the very small quantity of material at disposition and the very broad variability of the characters in the well known species, we can only attribute a dubious status to the species *E. epeorides*.

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RESUME

Trois populations des Alpes helvétiques (Valais, Fribourg) et françaises (Savoie) furent identifiées comme appartenant à une nouvelle espèce d'*Ecdyonurus* du groupe *helveticus*. La description morphologique des imagines, des subimagines, des nymphes et des œufs est présentée ainsi que les caractéristiques écologiques principales de cette nouvelle espèce. Un diagnostic différentiel est ensuite proposé, englobant l'ensemble des représentants du groupe *helveticus*, à l'exception toutefois d'*E. epeorides* et d'*E. siveci*.

BIBLIOGRAPHY

BOGOESCU, C. & TABACARU, I. 1962. *Beiträge zur Kenntnis der Untersuchungsmerkmale zwischen den Gattungen Ecdyonurus und Heptagenia (Ephemeroptera).* Beitr. Entomol. *12:* 273–291.

DEMOULIN, G. 1955. *Mission E. Janssens et R. Tollet en Grèce (juillet–août 1953). 4^e note. Ephemeroptera.* Bull. Ann. Soc. Roy. Ent. Belg. *91:* 38–44.

HEFTI, D., TOMKA, I. & ZURWERRA, A. 1985. *Recherche autoécologique sur les Heptageniidae (Ephemeroptera, Insecta).* Bull. Soc. Entomol. Suisse *58:* 87–111.

HEINZE, K. 1952. *Polyvinyl-Lactophenol-Gemisch als Einbettungsmittel für Blattläuse.* Naturwissenschaften *39:* 285–286.

ILLIES, J. & BOTOSANEANU, L. 1963. *Problèmes et méthodes de la classification et de la zonation écologique des eaux courantes, considérées surtout du point de vue faunistique.* Mitt. Internat. Ver. theor. Limnol. *12:* 1–57.

ILLIES, J. 1978. *Limnofauna Europaea.* Gustav Fischer Verlag.

JACOB, U. & BRAASCH, D. 1984. *Neue und statusrevidierte Taxa der Ecdyonurus helveticus-Grossgruppe (Ephemeroptera, Heptageniidae).* Entomol. Abh. Staatl. Mus. Tierkunde Dresden *48* (6): 53–61.

KIMMINS, D. E. 1958. *The Ecdyonurus* (EATON) *Complex (Ephemeroptera).* Ann. Naturhist. Mus. Wien. *62:* 225–232.

PUTHZ, V. 1975. *Über einige europäische Heptageniiden (Insecta, Ephemeroptera).* Rev. Suisse Zool. *82:* 321–333.

PUTHZ, V. 1980. *Ergebnisse der Albanien-Expedition 1961 des Deutschen Entomologischen Institutes.* Beitr. Entomol. Berlin *30* (2): 343–355.

SOWA, R. 1973. *Taxonomie et écologie d'Ecdyonurus carpathicus sp. n. des Carpates polonaises (Ephemeroptera, Heptageniidae).* Bull. Acad. Pol. Scie. Cl. II *21:* 285–289.

THOMAS, A. 1968. *Quelques Ecdyonurus et Rhithrogena européens de la collection Navas (Ephemeroptera).* Ann. Limnol. *4:* 209–218.

ZURWERRA, A. & TOMKA, I. 1984. *Beitrag zur Kenntnis der Eintagsfliegenfauna der Schweiz (Insecta, Ephemeroptera).* Bull. Soc. Frib. Sc. Nat. *73* (1/2): 132–146.

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