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Notes on two mayfly species belonging to the *Ecdyonurus helveticus*-group (Ephemeroptera, Heptageniidae)¹

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This paper presents the morphological descriptions of two species belonging to the *Ecdyonurus helveticus*-group. On the basis of these descriptions we consider *E. austriacus* KIMMINS, 1958 as a distinct species and we reject the synonymy with *E. picteti* (MEYER-DÜR, 1864) established by PUTHZ (1975).

In 1958 KIMMINS, examining some material from Dr. PLESKOT, described a new species belonging to the *E. helveticus*-group, which he named *E. austriacus*. All the specimens came from a few stations near Lunz (Austria). Some years later, PUTHZ (1975) concluded by comparing the light dark striation pattern on the subimaginal wings that the KIMMINS specimens are identical with *E. picteti*. So he put *E. austriacus* in synonymy with *E. picteti*.

The holotype of *E. austriacus* is a male imago (in the collection of the British Museum). The holotype of *E. picteti* either was never designed by MEYER-DÜR or was lost. PUTHZ (1975) supported the first possibility by drawing attention to the fact that both the description of MEYER-DÜR and his material in Geneva (Natural History Museum) is restricted to the subimaginal stage. PUTHZ designated a female subimago from Grisons as the lectotype of *E. picteti*. On four occasions we collected material belonging to the *E. helveticus*-group in Grisons. By breeding larvae from different stations, we could obtain subimaginal and imaginal stages with the light dark striation pattern of the subimaginal wings. Because our extended investigations in Grisons revealed no other taxa of the *E. helveticus*-group with this light dark striation pattern, we identified these insects with the subimagines from the MEYER-DÜR collection (although our experience with the members of the *E. helveticus*-group shows that colour pattern does not always represent a good differential diagnostic character). The material from Grisons, identified this way with MEYER-DÜR's description of *E. picteti*, was used to redescribe the species.

During the summer 1985, we had the opportunity to investigate the *E. austriacus* locotypical localities near Lunz. We found both species (*E. picteti* and *E. austriacus*) at the same station, but not at the same time. A morphological study clearly demonstrated that they are two distinct species. In addition, biochemical investigations by starch gel electrophoresis confirmed the distinct character of *E. austriacus* and *E. picteti*. These biochemical results will be published later. In this paper, we present a new morphological redescription of *E. austriacus* and a complete description of *E. picteti*.

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DESCRIPTIONS

Ecdyonurus austriacus species propria KIMMINS, 1958 (Figs. 1–6)

Imago, male

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

Length of the fore wings: 12–13 mm

Head. Fuscous to dark in the ocellar area. The facial keel yellower and reticulated with grey spots. Scapus and pedicellus brownish grey. The eyes are grey with reddish reflections and are bordered with a sub-marginal brownish clear and yellow band.

Thorax. Dorsal part castaneous to dark, ventrally fuscous with the exception of the lateral sclerites around the coxae which are more pale. The fore legs have the same coloration as the thorax. Middle and hind legs paler with brownish tarsi and some dark spots at the tibio-femoral articulations. Fore wings hyaline with the exception of the costal, the subcostal, and the brownish opaque pterostigmatic zone. Hind wings hyaline.

Abdomen. General colour brown yellowish with reddish tinge. Lateral tergite exhibiting the typical pattern of the *E. helveticus*-group (Fig. 13). Posterior margin of the lateral tergite clearly whiter. Sternites yellowish with reddish brown reflections. Cerci fuscous. *Genitalia.* In dorsal view (Fig. 2): the inner part of the distal border of the penis lobe forms with the elongation of the penis axis of symmetry an angle of not more than 60 degrees, the most distal point of the lobe being situated in the external half of its length. The apical sclerite generally presents a very strong inner denticulation pattern directed towards the middle of the lobe. The lateral sclerite is large and does not present any deep narrowing in the external part. The basal sclerite bears a slender tooth directed perpendicularly to the penis axis of symmetry. A little hump is often present at the outer base of the penis stem. The forceps base has two strong lateral protuberances (Fig. 3), the forceps becoming clearly paler at the apex.

Imago female

Length of the body (without cerci): 11–14 mm

Length of the fore wings: 14–15 mm

General colour of the body homogeneously brownish red with a darker head. The thorax does not contrast with the abdomen. The fore legs are browner than the other ones which are more yellowish. Fore wings hyaline with the exception of the costal vein and the pterostigmatic area. A yellow stain appears at the base of the wing and prolongs itself along the costal vein until the pterostigmatic area. Hind wings hyaline and yellowish at the level of the costal projection.

Eggs

The eggs of *E. austriacus* are oval, yellowish, with a dense macrogranulation inside. All around the surface appears a thin granulated sculpture, which seems to be more important at the two poles of the eggs (Fig. 1).

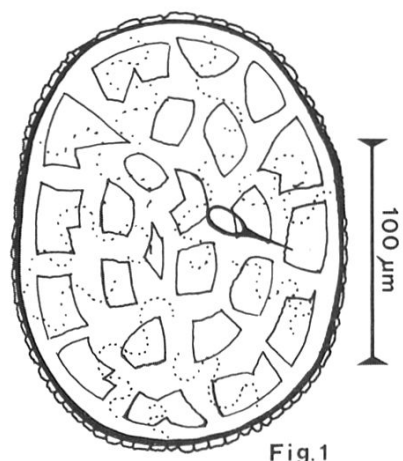


Fig. 1

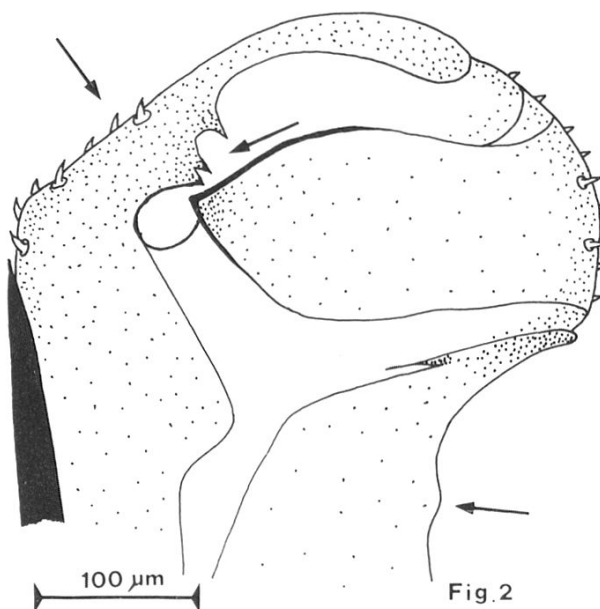


Fig. 2

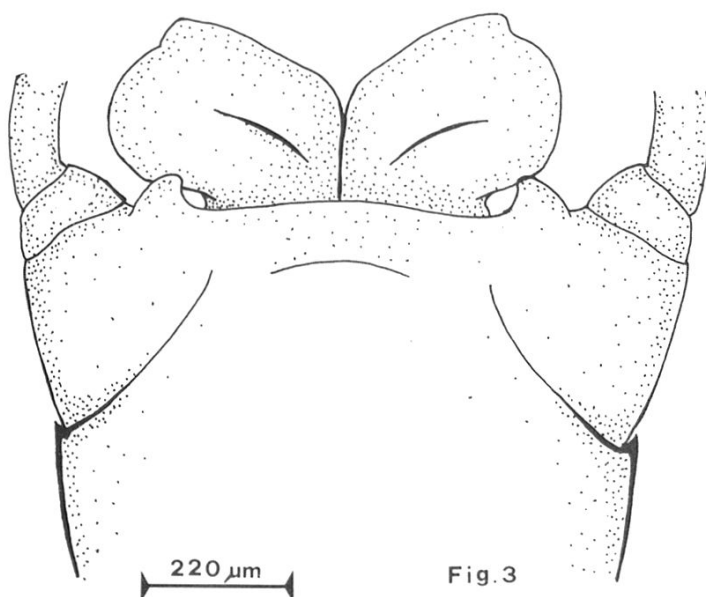


Fig. 3

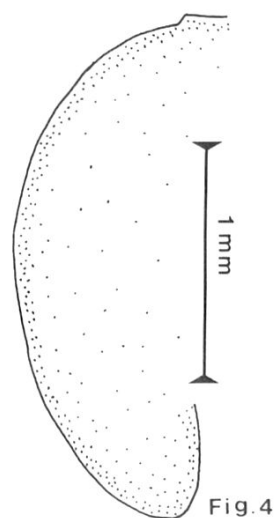


Fig. 4

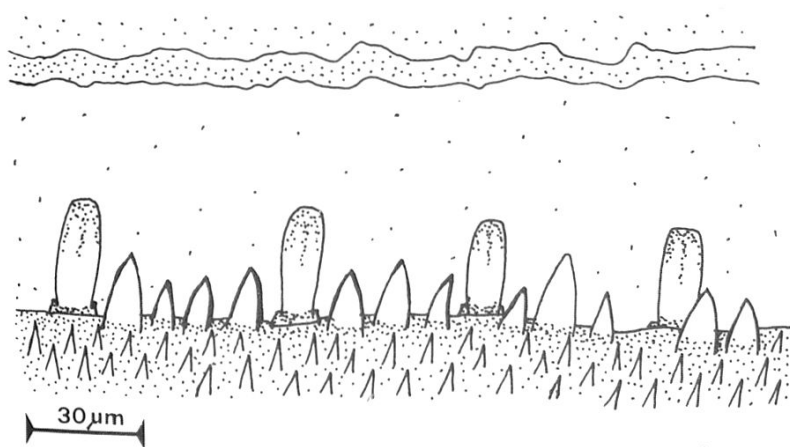


Fig. 5

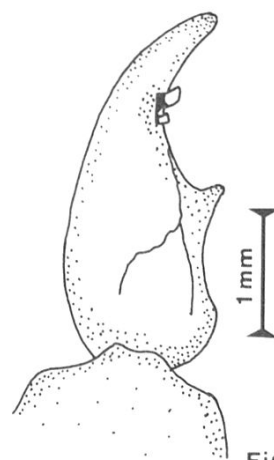


Fig. 6

Figs. 1–6. Morphological characteristics of adults and nymphs of *Ecdyonurus austriacus*. 1: Egg. 2: Imago, penis lobe (dorsal view). 3: Imago, penis and forceps base (ventral view). 4: Nymph, lateral pronotum expansion. 5: Nymph, tergo-abdominal spines. 6: Nymph, tarsal claw of the first leg.

Subimago

General colour of the body clearer, homogeneously yellowish brown. Head dark with white ocelli. Eyes grey. The opaque wings present the typical grey banding pattern already described by KIMMINS (1958).

Nymph

General colour of the body brown clear to yellowish. The lateral extensions of the abdomen are short, and the pilosity of the hypopharynx is typical for the *E. helveticus*-group (Fig. 12). The tergo-abdominal margins of *E. austriacus* are clearly composed of small and rounded spines (Fig. 5). External outline of the pronotum expansion regularly curved, its apex slightly directed towards the body (Fig. 4). Femoral teeth in the form of a spatula. A twofold tarsal denticulation is generally present, the first tooth being clearly stronger than the second one (Fig. 6). Fourth gill asymmetrical, clearly broader than half the length (Fig. 14).

Ecdyonurus picteti (MEYER-DÜR, 1864) (Figs. 7–12)

Imago, male

Length of the body (without cerci): 13–15 mm

Length of the fore wings: 14–15 mm

Head. Fuscous in the ocelli area, a brownish clear coloration with black reticulated spots on the facial keel. Antennae brown clear at their base, becoming paler at their distal end. Eyes grey clear, slightly darker at the base.

Thorax. Dorsally and ventrally fuscous to dark with some yellowish tinges, whitish around the coxae. Fore legs fuscous, clearly darker than the others, which are pale yellowish with clear brown spots on the tarsi and on the tibio-femoral articulations. Fore wings hyaline with the exception of the costal and subcostal veins, which are clearer than the other ones. Hind wings hyaline.

Abdomen. The lateral sclerite with the typical pattern characterizing the *E. helveticus*-group seems to be more visible than in *E. austriacus*. The abdomen is more yellowish brown without any reddish tinge. Lateral margins of the sternites white; the ganglionar chain is visible. *Genitalia.* Dorsal view (Fig. 7): the penis lobes are laterally stretched. The distal borders of the lobes present a more or less flat outline in contrast to *E. austriacus*. The basal sclerite always bears at least one very prominent tooth (often more than one) directed obliquely to the axis of symmetry of the penis. Forceps base fuscous, with two strong lateral protuberances as in *E. austriacus* (cf. Figs. 3 and 10), becoming progressively paler at the apices.

Imago, female

Length of the body (without cerci): 14–15 mm

Length of the fore wings: 14–16 mm

Colour yellowish with reddish tinges at the abdominal lateral tergites. The homogeneously colorated thorax is not contrasting with the abdomen. Fore legs darker than the others. Fore wings hyaline with costal and subcostal veins slightly clearer than the others. Pterostigmatic area opaque.

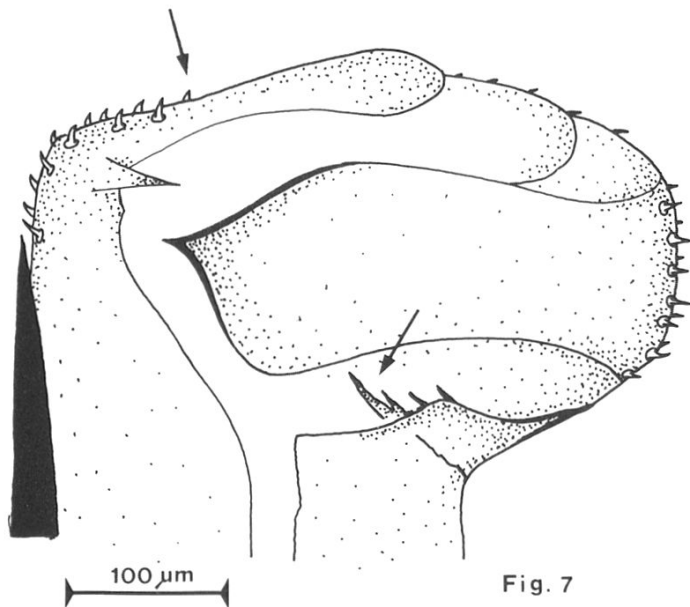


Fig. 7

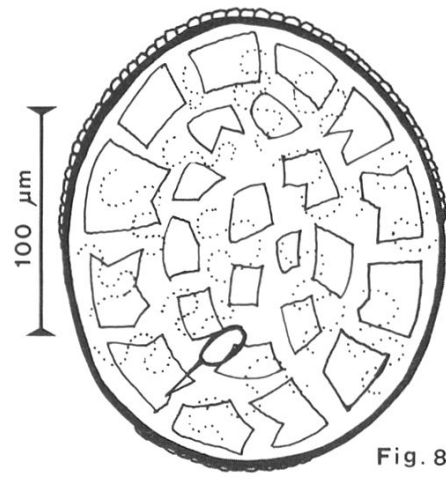


Fig. 8

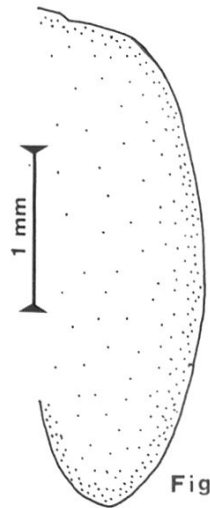


Fig. 9

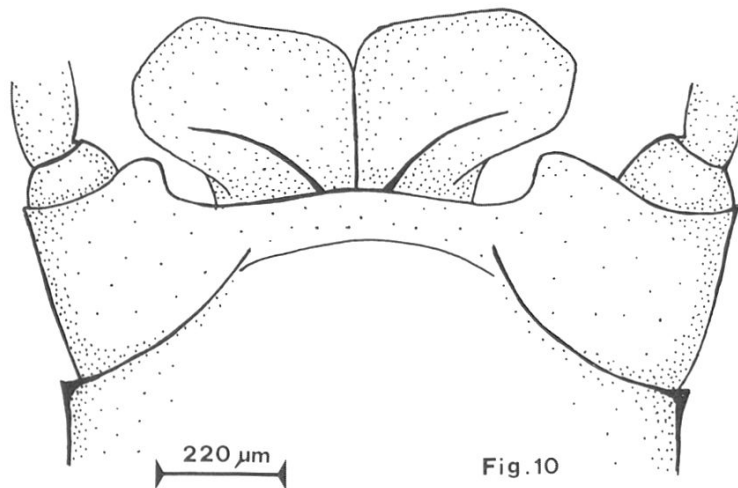


Fig. 10

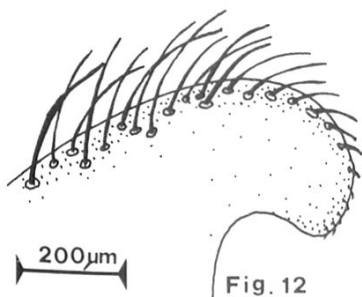


Fig. 12

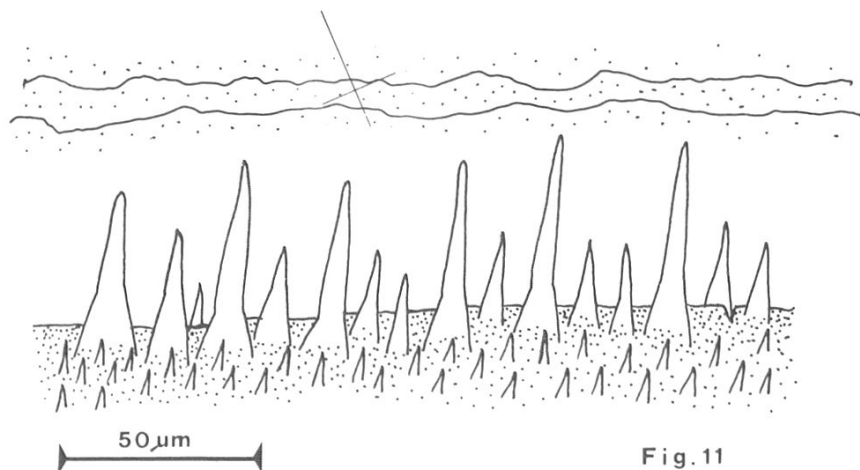


Fig. 11

Figs. 7–12. Morphological characteristics of adults and nymphs of *Ecdyonurus picteti*. 7: Imago, penis lobe (dorsal view). 8: Egg. 9: Nymph lateral pronotum expansion. 10: Imago, penis and forceps base (ventral view). 11: Nymph, tergo-abdominal spines. 12: Nymph, hypopharynx.

Eggs

The eggs of *E. picteti* are yellowish, oval, with a dense macrogranulation inside. In contrast to *E. austriacus*, the outer granulated sculpture at the surface is coarse and limited to only one pole of the egg (Fig. 8).

Subimago

General body colour clear brown with grey eyes. The wings show the same banding pattern as in *E. austriacus* but in addition present slightly brownish reflections.

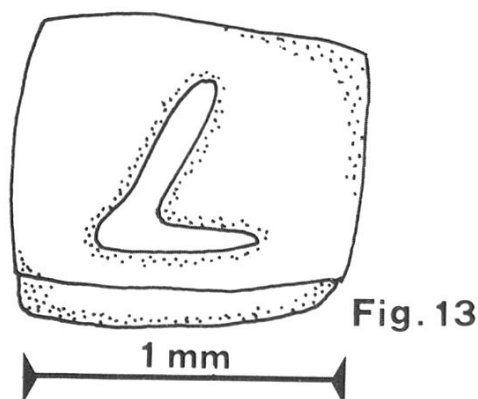
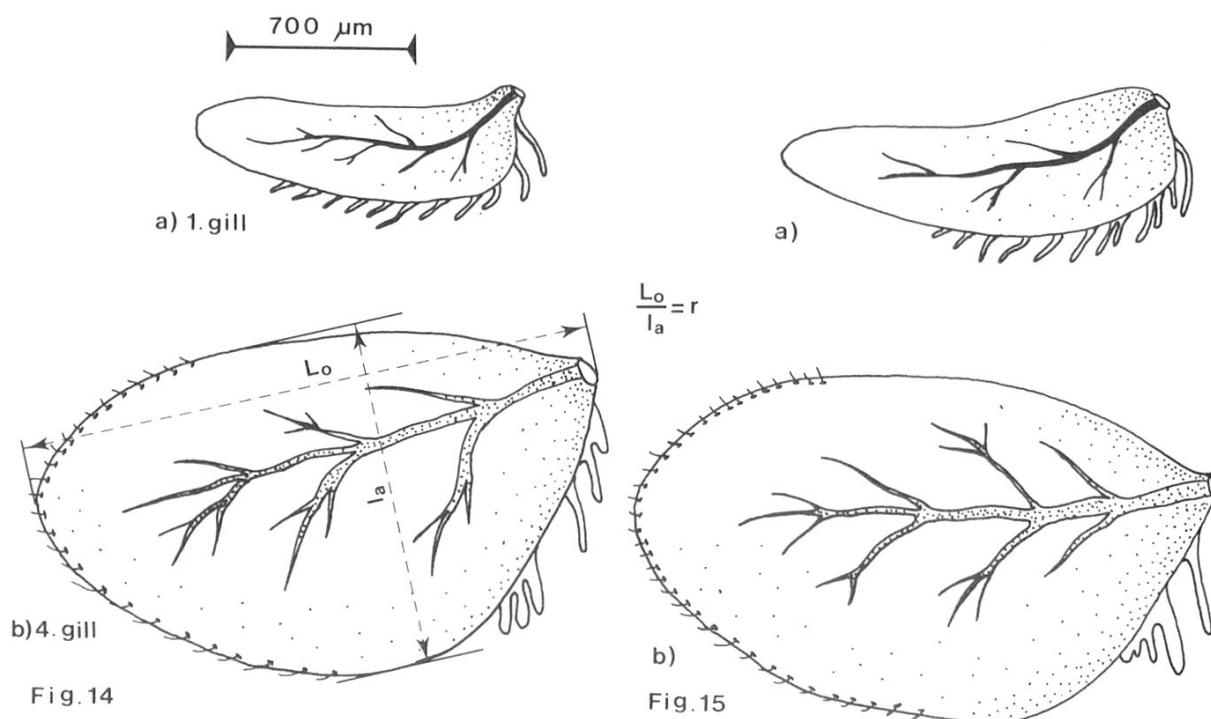


Fig. 13. Typical drawing on the lateral abdominal sclerite, characterizing the members of the *Ecdyonurus helveticus*-group.



Figs. 14–15. Fig. 14. First (a) and fourth (b) gill of the nymph of *Ecdyonurus austriacus*: $\bar{M}_r = 1.72$; $\sigma = 0.06$; $n = 10$. Fig. 15. First (a) and fourth (b) gill of the nymph of *Ecdyonurus picteti*: $\bar{M}_r = 1.75$; $\sigma = 0.05$; $n = 10$. L_o : length, l_a : breadth.

Nymph

Generally bigger than in *E. austriacus*. General colour of the body brownish clear. The lateral extensions of the abdomen are short and directed parallel to the axis of the body. Hypopharynx typical for the *E. helveticus*-group (Fig. 12). The long and regularly distributed tergo-abdominal spines of *E. picteti* permit an easy distinction from *E. austriacus* (cf. Fig. 11 and Fig. 5). Pronotum expansion rounded at the apex, its extern outline not regularly curved but almost parallel to the axis of the body (Fig. 9). Fourth gill asymmetrical, its general shape almost identical as in *E. austriacus* (Fig. 15). Other characters like tarsal denticulation, morphology of the labrum, etc. present a broad range of variability.

MATERIAL AND ECOLOGICAL DATA

E. austriacus

All the collected material comes from the locotypical stations near Lunz, where Dr. PLESKOT herself made investigations (see MACAN, 1974 p. 152 ff). In addition, the comparison of our specimens with the *E. austriacus* holotype (Brodingbach) specimen deposited in the British Museum) confirm us the identity of our material.

- Schreyerbach, Lunz (Austria), 6.8.85, 800 m. 11 ♂ imagines, 9 ♀ imagines, 7 subimagines, as well as the nymphal skins of all, and 5 nymphs.
- Seebach, Lunz (Austria), 1.8.85, 620 m. 1 ♂ imago with its nymphal skin.

E. picteti

Our material comes from populations in Europe and represents a total of more than 300 specimens. A complete list of all investigated stations in Switzerland is given in ZURWERRA & TOMKA (1984). Listed below are the stations outside of Switzerland:

- Eau de Bérard, Le Couterey (France), 12.6.83, 1400 m.
- Barberine, Vallorcine (France), 18.6.83, 1140 m.
- Doubs (source), Mouthe (France), 30.6.83, 650 m.
- Radowna, Krnica (Yougoslavia), 16.8.83, 650 m.
- Seebach, Lunz (Austria), 1.6.85, 620 m.

Ecological data

The table 1 presents a synoptic view of the ecological characteristics of the two species.

Tab. 1. Ecological characteristics of *E. picteti* and *E. austriacus*. Altitude (Alt.) in meters; temperature (Temp.) in centigrades; pH; alcalinity (ALC.) in mVal/l; electrical conductivity (CE_{20°}) in μ S/cm for 20 °C. M = mean, σ = standard deviation, n = number of stations.

	Alt.			Temp.			pH			ALC.			CE _{20°}		
	M	σ	n	M	σ	n	M	σ	n	M	σ	n	M	σ	n
<i>E. picteti</i> *	1130	335	22	8,2	3,5	22	8,02	0,40	22	2,16	0,95	18	205	103	21
<i>E. austriacus</i>	710	90	2	5,5	0,3	2	7,64	0,22	2	1,90	0	2	178	17	2

*from Hefti et al. (1985).

Imago

The two species are easily separable because of the morphology of their genitalia. With the typical shape of its large lateral sclerite and with its basal teeth projected obliquely to the penis axis of symmetry (Fig. 7), *E. picteti* is easily extractable from all the other members of the *E. helveticus*-group. *E. austriacus* is recognizable by the strong curved inner border of its penis lobes, the shape of its lateral sclerite and the prominent inner margin of its apical sclerite (Fig. 2).

Nymph

The tergo-abdominal spines permit the distinction between *E. austriacus* and all the other members of the *E. helveticus*-group with the exception of *E. parahelveticus* HEFTI *et al.*, 1986; from the last mentioned species *E. austriacus* can be separated by the twofold denticulation of the tarsi. It is possible to distinguish *E. picteti* from *E. carpathicus* SOWA, 1973 and from *E. krueperi* (STEIN, 1863) because of the morphology of the glossa and the pronotum expansions. This last character permits furthermore the differentiation from *E. subalpinus* (KLAPALEK, 1907) (pronotum very pointed at the apex). In their key of determination, JACOB & BRAASCH (1984) stated that the shape of the fourth gill of *E. picteti* permits the differentiation from *E. helveticus* (EATON, 1885) and *E. zelleri* (EATON, 1885). We agree with this concerning the differentiation between *E. picteti* and *E. zelleri*, but not between *E. picteti* and *E. helveticus* within our locotypical populations. In most cases, only the morphology of the pronotum expansions, cited in the above mentioned paper, permits a separation between *E. picteti* and *E. helveticus*.

DISCUSSION

On the basis of the previous descriptions, it is clear that *E. picteti* and *E. austriacus* are two distinct species. In fact, it is possible to differentiate them in any case at the imaginal and at the nymphal stages. The factor which might be initially responsible for the confusion and for the synonymy of the two species was the wing pattern of the subimago. In the absence of a clear morphological description of *E. picteti*, this wing pattern was considered as the main differential characteristic for *E. picteti*. This character was overestimated by PUTHZ, who only considered some subimago females from the PICTET collection when he made the synonymy. KIMMINS (1958) himself created some confusion because he attributed the same name to different drawings on pages 226 and 227. Whereas the first drawing undoubtedly represents the holotype of *E. austriacus*, the one on page 227 corresponds to *E. picteti* (this drawing was made after a specimen from Pontresina, Grisons). A second problem is the fact that these two closely allied species live together at the same stations near Lunz. This co-occurrence may eventually be a supplementary source of error in the PUTHZ description.

As stated in the introduction, we investigated the biochemical features of the two species. The preliminary results showed a clear difference between *E. austriacus* and *E. picteti*. Enzymes like the phosphoglucose mutase (PGM) show a discriminative electromorph distribution permitting the identification of the two species. The complete biochemical survey will be published later with all the other members of the *E. helveticus*-group.

Therefore, we propose to reject the synonymy established by PUTHZ (1975) between *E. austriacus* and *E. picteti* and to attribute a distinct status of species for the KIMMINS specimen.

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RÉSUMÉ

La description morphologique de deux espèces d'*Ecdyonurus* appartenant au groupe *helveticus* est présentée. Sur la base de ces descriptions nous considérons *E. austriacus* comme espèce distincte d'*E. picteti* et nous rejetons par conséquent la mise en synonymie de ces deux espèces, effectuée par PUTHZ (1975).

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