Zeitschrift: Bulletin de la Société Vaudoise des Sciences Naturelles
Herausgeber: Société Vaudoise des Sciences Naturelles
Band: 80 (1990-1991)
Heft: 4

Artikel: A new Electrogena species from Switzerland (Ephemeroptera, Heptageniidae)
Autor: Landolt, Peter / Dethier, Michel / Malzacher, Peter
DOI: https://doi.org/10.5169/seals-279573

BULL. SOC. VAUD. SC. NAT. 80.4: 459-470.

A new *Electrogena* species from Switzerland (Ephemeroptera, Heptageniidae)

PAR

PETER LANDOLT[1], MICHEL DETHIER[2], PETER MALZACHER[3]
et MICHEL SARTORI[4*]

Abstract.–LANDOLT P., DETHIER M., MALZACHER P. and SARTORI M., 1991. A new *Electrogena* species from Switzerland (Ephemeroptera, Heptageniidae). *Bull. Soc. vaud. Sc. nat. 80.4*: 459-470.
A new species of *Electrogena* ZURWERRA & TOMKA 1985, *E. rivuscellana* SARTORI & LANDOLT nov. sp. is described at all stages and compared to its close relatives. This species occurs exclusively in very small and shallow brooksand the flighting period extents from middle of May to end of June. Finally, the authors propose a preliminary division of the European *Electrogena* species into three groups.

Résumé.–LANDOLT P., DETHIER M., MALZACHER P. et SARTORI M., 1991. Une nouvelle espèce de *Electrogena* de Suisse (Ephemeroptera, Heptageniidae). *Bull. Soc. vaud. Sc. nat. 80.4*: 459-470.
Une nouvelle espèce de *Electrogena* ZURWERRA & TOMKA 1985, *E. rivuscellana* SARTORI & LANDOLT nov. sp. est décrite à tous les stades et comparée aux autres espèces affines. Cette espèce se développe exclusivement dans de très petits cours d'eau et sa période de vol s'étend de mi-mai à fin juin. Les auteurs proposent enfin une subdivision préliminaire des *Electrogena* européennes en trois groupes.

[1]Institute of Zoology, Entomological Department, Pérolles, CH-1700 Fribourg.
[2]Service cantonal d'Ecotoxicologie, CP 78, CH-1211 Genève 8.
[3]Friedrich-Ebert-Straße 63, D-7140 Ludwigsburg.
[4]Musée de Zoologie, Palais de Rumine, Case postale 448, CH-1000 Lausanne 17.
* Adresse pour correspondance

ISSN 0037-9603
CODEN: BSVAA6

INTRODUCTION

Within the framework of a general survey of the mayfly fauna of Switzerland (STUDEMANN *et al.*, in prep.), fuller information was needed concerning a species belonging to the genus *Electrogena* ZURWERRA ET TOMKA (1985). This species was previously reported as *E. gridellii* (GRANDI 1953), but further comparison with *E. gridellii* from the type locality (Italy, Trieste area) showed the inconsistency of the previous determination. Our specimens proved to belong to a new species described in the present study.

DESCRIPTION

Electrogena rivuscellana SARTORI & LANDOLT nov. sp.
Ecdyonurus quadrilineatus MALZACHER 1981 pro parte nec LANDA 1970
Heptagenia gridellii ZURWERRA & TOMKA 1984 nec GRANDI 1953
Ecdyonurus gridellii SARTORI & DETHIER 1985
Electrogena gridellii SARTORI 1987
Electrogena sp.1 SARTORI *et al.* 1989

Male imago (from living specimens)

General coloration beige, dark brown.

Head greyish brown. Basis of the ocelli blackish, apical surface whitish. Basal segment of the antennae yellowish brown, flagellum yellowish. Compound eyes dark grey in the lower part, upper part greyish beige. In dorsal view, they are rather rounded and well separated (fig.1).

Pronotum greyish brown; meso- and metatergites dark brown, pleurites yellowish brown. Forelegs uniformly medium brown, except for the light brown tarsi. Mid- and hindlegs light brown, except for the medium brown tibio-tarsal joints. In the foreleg, the ratio of femora: tibiae: tarsi is about 1.0: 1.0: 1.4, and the ratio of the tarsal articles 1 to 5: 1.0: 2.0: 2.1: 1.5: 0.6. Wings translucent, except for the milky pterostigmatic area of the forewing. Longitudinal and transversal veins light brown.

Abdominal tergites medium brown. On each segment four dark spots are visible on the lateral border, two in anterior and two in posterior position (fig.3). Abdominal sternites light brown, with the nervous ganglia slightly tinted with medium brown. Cerci uniformly medium brown in the proximal part, light brown in the distal part.

Genitalia: styliger plate brown and rather narrow (fig. 18). Posterior margin with two lateral processes (fig. 4,18). Penis yellow to light brown, with a darker triangular pigmentation from the ejaculation opening, ending in a point halfway up the ventral side of the lobes. Apical margin of penis lobes slightly concave or straight (fig. 4, 5, 19, 20, 22). On the outer margin of the penis, the constriction of the lobes is marked by a notch (fig. 5, 21, 23). On the inner margin, the two lobes are separated by a "U"-shaped incision (fig. 5, 19, 20). Sickle-like titillators long and curved at the apex (fig. 5, 20).

Female imago (from living specimens)

General coloration reddish brown.

Head brown, ocelli as in the ♂; compound eyes black; antennae light brown. Thoracic tergites and sternites medium brown, pleurites whitish. Forelegs dark brown, mid- and hindlegs light brown with dark joints between femur and tibia. Wings translucent, pterostigmatic area milky. C and Sc veins medium brown, others dark brown. Abdominal tergites reddish-brown, with posterior margin darker. Abdominal drawings as in the ♂, but less contrasted. Subgenital plate rising over the posterior margin of the 9th sternite (fig.6). Subanal plate short, regularly rounded and dark brown (fig. 6). Cerci as in the ♂

Dimensions [mm]

	♂	♀
body length	10.8 (10-12)	10.4 (10-11.5)
forewing	10.5 (10-11)	11.3 (10-12)
cerci	22.3 (20-25)	18.4 (18-22)

Male subimago

General coloration of the abdomen more reddish brown than in the ♂ imago. Wings entirely greyish brown. Genitalia as in fig.24.

Female subimago

General coloration paler than in the female imago. Wings entirely greyish brown.

Note: for all winged stages freshly emerged specimens, as well as those kept in alcohol for a long time, present a lighter pigmentation.

Nymph

General coloration medium brown.

Head regularly rounded, with inconspicuous paler spot in front of the antennae. Labrum with well-developed lateral projections (fig.9). Hypopharynx with lateral lobes covered with long, thin setae on the outer margin; these setae are shorter, less numerous at the tip of the lobes and on the inner margin (fig.10). Apex of the galea-lacinia with 15-18 combs, the median ones with 18-28 teeth. Glossa and paraglossa of the labium as in fig. 11.

Thorax uniformly medium brown, except for the mesothorax with distinct darker spots. Upper face of femora covered with numerous spines. These are

slender, with subparallel margins and truncate or rounded apex (figs 12,26). The tarsal claws generally have 3 denticles, two well-developed and the third one smaller (fig. 13).

Abdominal tergites without any specific markings, except the drawings found in the winged stages that are already visible in the last instar larvae. Sternites paler, light brown. Nervous ganglia visible and tinted medium brown. Surface of the tergites only covered with scattered long setae, without sharp splinters. Hind margin with long and pointed teeth. All gills asymmetrical with well-developed reddish tracheation (fig. 14-17). Gill I somewhat rectangular (fig. 14); gills II-VI heart–shaped (fig. 15-16); gill VII slender with a long and narrow apex (fig.17). Proximal part of the cerci with long and pointed spines on the posterior margin of each segment, at least as long as the segment.

Sizes: for ♂ nymphs, body length up to 8.7 mm, cerci up to 8.3 mm; for ♀ nymphs 10.6 mm and 9.5 mm, respectively.

Eggs

General shape ovoid (240 µm/180 µm). The exochorion consists of a ground matrix covered with tubercles and knob-terminated coiled threads (KCT) (fig. 28). KCT are larger and at higher density at one pole (fig. 27). About 5 micropyles in the equatorial area.

Affinities

At the adult stage, *E. rivuscellana* is easily distinguishable from *E. lateralis* (CURTIS 1834) and related species such as *E. grandiae* (BELFIORE 1981) or *E. hellenica* ZURWERRA & TOMKA 1986. Through the shape of the penis lobes, *E. rivuscellana* presents affinities with *E. gridellii*, *E. quadrilineata* (LANDA 1970), *E. fascioculata* (SOWA 1974) and *E. ujhelyii* (SOWA 1981), but the following set of characters differentiates *E. rivuscellana*:

–"U"-shaped incision and notch on the lateral margin of the penis lobes (excluding all species except *E. gridellii*)

–narrowness of the styliger plate (excluding *E. gridellii* and *E. fascioculata*)

–general coloration of the abdomen (excluding all species except *E. ujhelyii*).

–shape of the subgenital and subanal plates (excluding *E. gridellii* and *E. ujhelyii*)

E. rivuscellana is situated morphologically between *E. gridellii* and *E. ujhelyii*. The latter can be separated from *E. rivuscellana* by the penis shape (fig. 7–8 vs fig. 4–5), as well as by the shape of the compound eyes (fig. 2 vs fig. 1). As mentioned above, *E. gridelli* can be differentiated by the styliger plate, the coloration of the abdomen and the ♀ genitalia.

When comparing closely related *Electrogena* species, caution has to be taken concerning the relative position of the penis lobes. Fig. 4–5 for *E. rivuscellana* and fig. 7–8 for *E. ujhelyii* show that in *Electrogena* species the

position of the lobes is subject to great variation, as are small details on the shape of the lobes. This is mainly due to the weak chitinisation of the apical sclerite.

In larval stages, *E. rivuscellana* shows few affinities with *E. lateralis* and differs from it especially with regard to the tarsal claws and the shape of the gills (BELFIORE 1982). *E. rivuscellana* can easily be separated from *E. gridellii* and *E. fascioculata* by the shape of the gills, the setae on the lateral lobes of the hypopharynx and the shape of the spines on the femora. *E. rivuscellana* shows greatest similarity to *E. quadrilineata*, from which it differs mainly by the absence of the four dark bands on the femora and the number of the spines on the cerci. *E. rivuscellana* can be separated from *E. ujhelyii* mainly by the absence of sharp splinters on the tergites, the general coloration of the abdomen, the shape of the gill VII, as well as the shape of the labrum.

The eggs of *E. rivuscellana* are closest to those of *E. ujhelyii* and *E. quadrilineata*, due to the structure elements of the chorion. They differ from those of *E. lateralis, E. grandiae* or *E. gridellii* by the number and distribution of KCT on the chorion (GAINO *et al.* 1987).

Material examined

1♂ imago holotype (with its nymphal skin): Switzerland, Geneva, commune of Cartigny, ruisseau de St-Victor, 415 m, 7-21.VI.1991, coll. P. Landolt, M. Dethier & M. Sartori. Paratypes: 4♂♂, 8♀♀, 3♂♂ subimagos, 2♀♀ subimagos, 9 nymphs, same data as the holotype; 1♂, 2♀♀, 11 nymphs, same locality, 28.V. - 3.VI.1985, coll. M. Dethier & M. Sartori. Holotype and paratypes kept in alcohol and deposited in the Museum of Zoology in Lausanne, except 2♂♂, 2♀♀ and 4 nymphs stored in the Entomological Department of the Institute of Zoology in Fribourg.

Other material examined (not type material): Switzerland, Fribourg, affluent of the Sarine river, St-Pierre, Treyvaux, 630 m, numerous ♂♂, ♀♀ and nymphs, 12.V.1980, 18.V.1980, 8.V.1985, coll. I. Tomka, D. Hefti, A. Zurwerra; Switzerland, Vaud, affluent of the Talent stream, Jorat, Froideville, 750 m, numerous larvae, coll. J. Aubert, as well as also from other rivulets of the same area (Jorat); Switzerland, Zurich, Stockwiesen, 21.IX.1987, 2 larvae, coll. V. Lubini; Germany, Baden-Württemberg, Schwabbach, Ohringen, 230 m, 4 nymphs, 6.V.1985, coll. P. Malzacher; same locality, numerous ♂♂, ♀♀ and nymphs, 27.V.1988, coll. P. Malzacher, P. Landolt, D. Studemann; Yugoslavia, Slovenia, Ribnica, Zimarice, numerous ♂♂, ♀♀ and nymphs, 29.V.1985, coll. I. Tomka, M. Metzler, A. Zurwerra.

Ecological data

The flying period of *E. rivuscellana* extends from about middle of May to end of June. Emergence generally takes place in the afternoon. In all the localities visited, *E. rivuscellana* colonizes very small brooks (up to 40 cm large) with a very low current speed and a water level generally up to 5 cm. The substrate is muddy and the borders of the rivulets are covered with dense vegetation.

The type locality (ruisseau de St-Victor) is a very short rivulet (less than 100 m long!) that supplies a small artificial fish-pond. *E. rivuscellana* was the only mayfly species found there. The other macroinvertebrates colonizing this biotope belong to Trichoptera (*Plectrocnemia cf. conspersa*, *Halesus* sp., *Sericostoma pedemontanum*), Heteroptera (*Velia caprai*), Diptera (Chironomidae Tanytarsini, Ceratopogonidae), Crustacea (*Gammarus pulex*) and Mollusca (*Lymnaea peregra, Pisidium* sp.).

In Switzerland *E. rivuscellana* seems to be distributed on the Plateau. This species is also present in southern Germany and in Slovenia.

Etymology of the name: *rivuscellana*, after the habitat of the larvae (*rivuscellus*, lat. = small brook).

DISCUSSION

Much confusion arose on the systematic status of several *Electrogena* species. Therefore, data available in the literature are not always easy to interprete, and possibly some of the following statements may have to be changed in the future. Several species of this genus are about to be described or redescribed. Nevertheless, when comparing currently known *Electrogena* species occurring in Europe, it seems possible to divide them into three groups.

The first group includes the following species: *E. lateralis, E. ozrensis* (TANASIJEVIC 1975), *E. malickyi* (BRAASCH 1983), *E. hellenica, E. vipavensis* ZURWERRA & TOMKA 1986. They are characterized by rounded penis lobes, nymphal tarsal claws with 1-2 denticles and a length/width ratio of the 7th gill between 2.0 and 2.2. The chorion of the eggs is covered with KCT regularly dispersed over the whole surface. With the exception of *E. lateralis* (PUTHZ 1978), the species of this group are distributed in the southern regions of Europe.

The second group takes in *E. quadrilineata, E. fascioculata, E. ujhelyii* and *E. rivuscellana*. The apical margin of the penis lobes is normally straight, but can be concave. The tarsal claws of the nymphs have 2-4 denticles and the length/width ratio of the 7th gill is between 2.4 and 2.7. The KCT structures on the egg chorion are more numerous and larger at one pole. The distribution of these species covers Central Europe (north of the Central European mountains).

The third group is composed of *E. fallax* (HAGEN 1864) and *E. gridellii*. These two species are rather close to those of the second group, but they differ by the absence of KCT elements on the egg chorion (GAINO *et al.* 1987). Both species are Mediterranean.

The division into three groups based on morphological characters, agrees well with the biochemical investigations (ZURWERRA *et al.* 1987). The two species *E. quadrilineata* and *E. rivuscellana* (second group) have a genetic identity value I = 0.87. They present a rather low I value of 0.65 and 0.57 with other species related to *E. lateralis* (first group) *E. fallax* (third group), respectively. On the basis of the morphological features as well as the

biochemical results (ZURWERRA *et al.*, 1987), *E. grandiae* is difficult to integrate in one of the three groups. The adult stages of *E. grandiae* are close to those of the species belonging to the first group, but the larval stages and the eggs are closer to the species of the second group. Biochemical data show that *E. grandiae* presents the closest degree of genetic similarity with the species of the third group. Further morphological and biochemical investigations will clarify the taxonomical and phylogenetical position of the *Electrogena* species.

ACKNOWLEDGMENTS

Our sincere thanks are due to the colleagues who provided us with material for this study: Drs V. LUBINI (Zurich), I. TOMKA, M. METZLER, D. HEFTI, A. ZURWERRA (Fribourg). We are grateful to the late Prof. R. SOWA (Cracow) for the gift of comparative material of *E. ujhelyii* and to Dr C. BELFIORE (Roma) for allowing us the comparison with *E. grandiae* and *E. gridellii*. We thank Prof. G. LAMPEL (Fribourg) for critical comments on the manuscript. We are indebted to Mrs D. STUDEMANN and Dr. A. ZURWERRA (Fribourg) for helpful discussions, Dr. M. MÜLLER (ETH, Zurich) for advice and making available the scanning electronic microscope and Mrs S. WERHONIG and Mr H. GACHOUD (Fribourg) for technical assistance.

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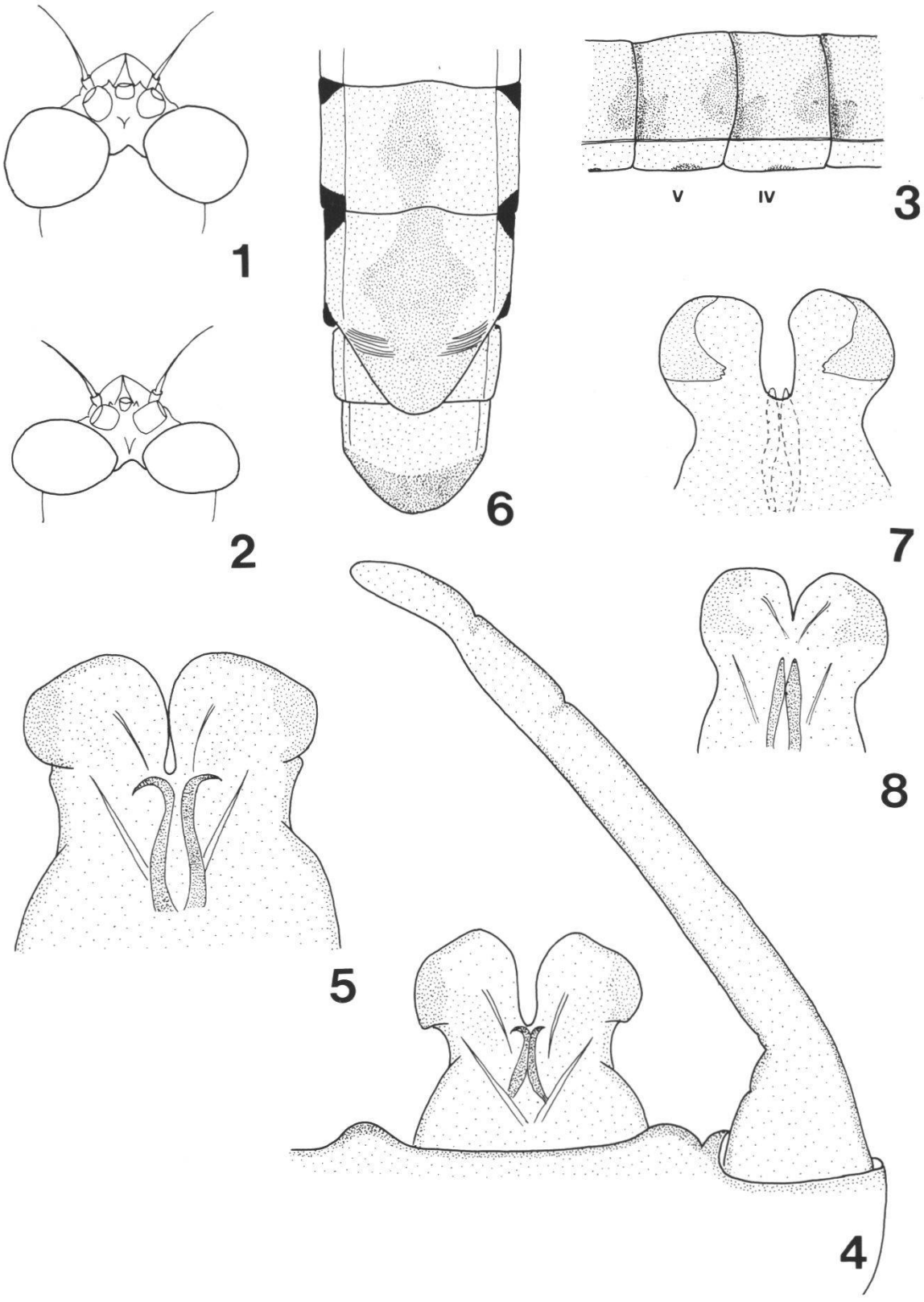
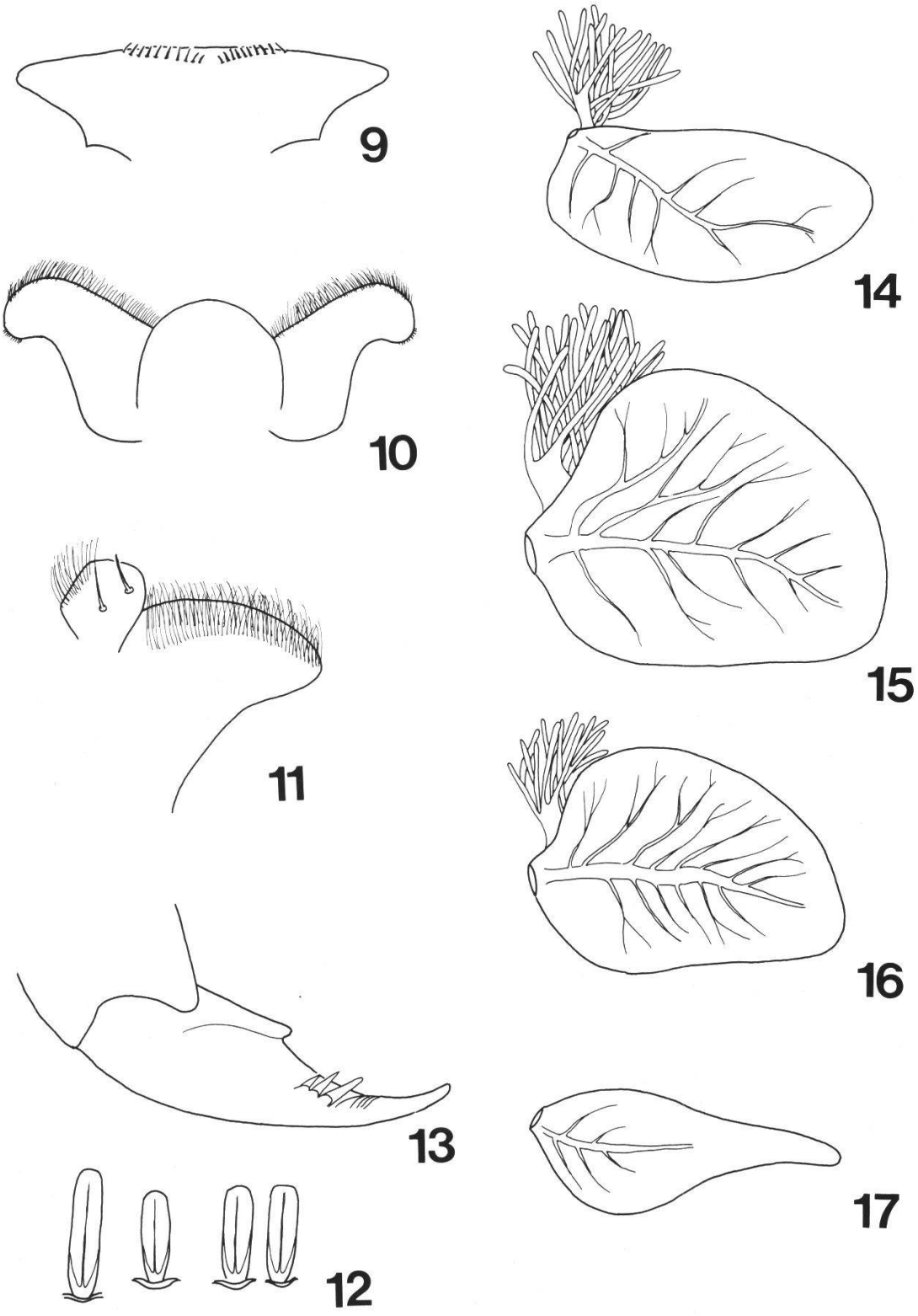
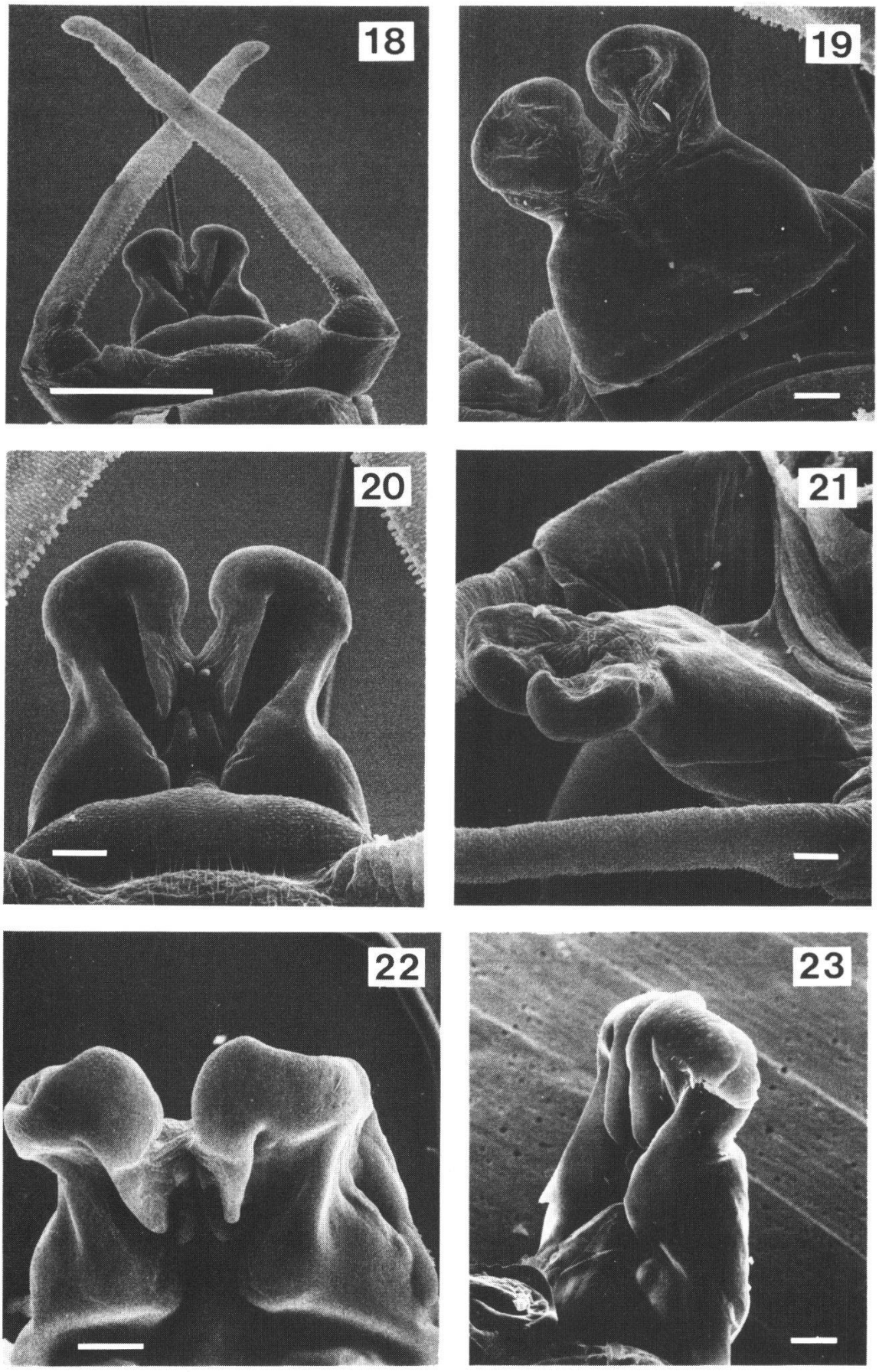
Manuscrit reçu le 1 octobre 1991



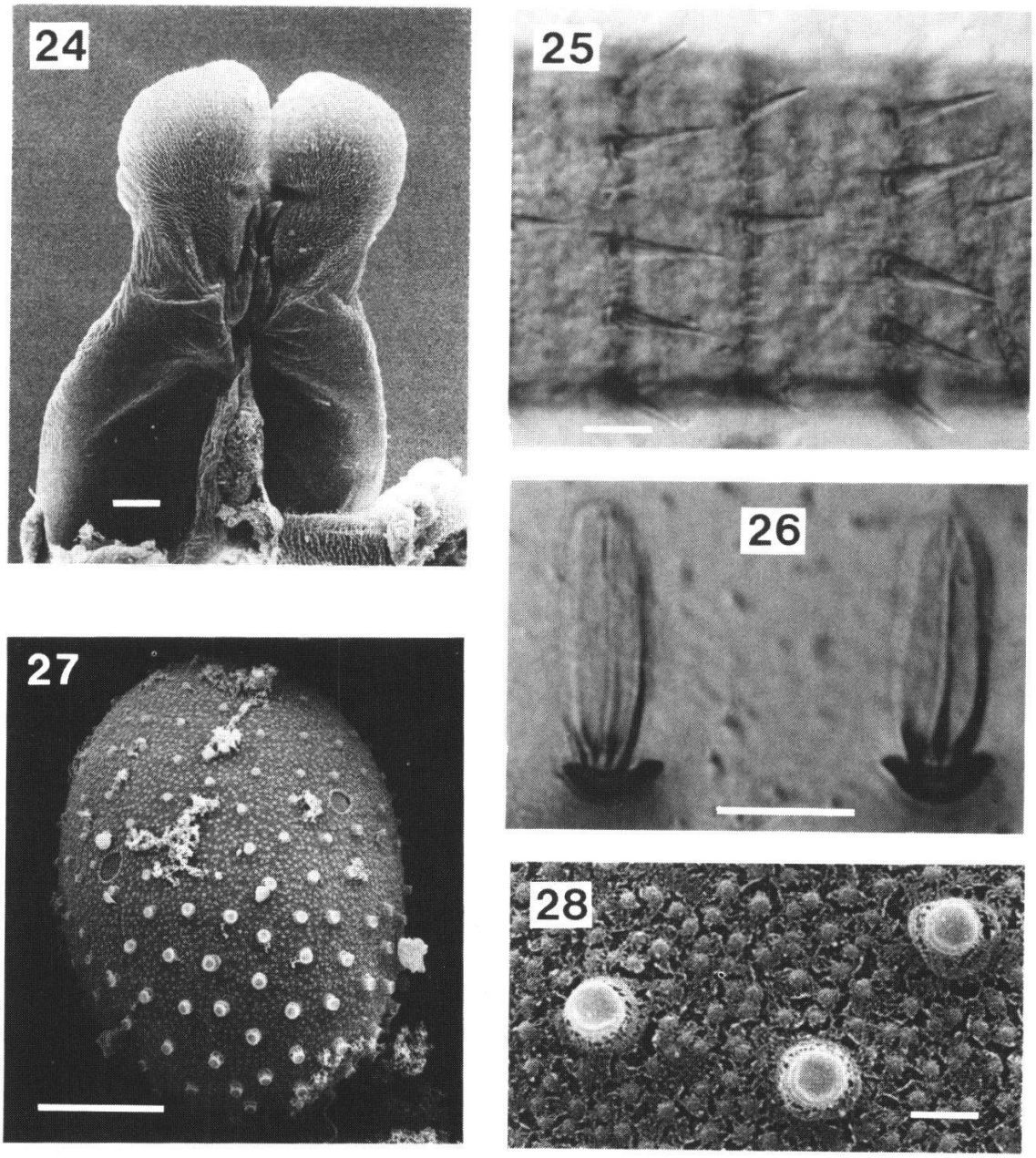
Figures 1-8.–*E. rivuscellana* nov. sp. (1,3,4,5,6) and *E. ujhelyii* (SOWA, 1981) (2,7,8). Male imago, except female imago fig.6.
1,2, Head, dorsal view. 3, abdominal segments IV-V, lateral view. 4, genitalia ventral view. 5,8, penis, ventral view. 6, genitalia, ventral view. 7, penis, dorsal view.



Figures 9-17.–*E. rivuscellana* nov. sp. Nymph.
9, labrum. 10, hypopharynx. 11, labium (left glossa and paraglossa). 12, spines, upper face, fore femora. 13, tarsal claw. 14, gill I. 15, gill III. 16, gill V. 17, gill VII.



Figures 18-23.–*E. rivuscellana* nov. sp. Male imago. Scale line: 50µm, except fig. 18, 500µm.
18, genitalia, ventral view. 19, penis, dorsal view. 20, penis, ventral view. 21, genitalia, latero-apical view. 22, penis, apical view. 23, penis, latero-ventral view.



Figures 24-28.–*E. rivuscellana* nov. sp. Male subimago (24), nymph (25,26), egg (27,28). Scale line: 24,25-27: 50μm, 28, 5μm.
24, penis, ventral view. 25, cerci, proximal segments. 26, spines, upper face, fore femora. 27, egg, general view. 28, exochorion, detail.