

Rhithrogena grischuna nov. sp., a new mayfly species from eastern Switzerland related to *Rh. hercynia* Landa, 1969 (Ephemeroptera ; Heptageniidae)

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Keywords : Ephemeroptera, new species, *Rhithrogena*, Heptageniidae, Switzerland.

A new species, *Rhithrogena grischuna* nov. sp., is described at all stages (imagines, subimagines, nymphs and eggs) from material collected in eastern Switzerland. This species belongs to the *hybrida* group, and is related to *Rh. hercynia* and allied species, for which we propose a new group, the *hercynia* group, characterized by the presence of dark spots on the upper face of the femora, both in imaginal and larval stages.

Some ecological and biocoenotic data on *Rh. grischuna* are also given.

Rhithrogena grischuna nov. sp., une nouvelle espèce d'éphémère de Suisse orientale apparentée à *Rh. hercynia* Landa, 1969 (Ephemeroptera, Heptageniidae)

Mots clés : Ephemeroptera, espèce nouvelle, *Rhithrogena*, Heptageniidae, Suisse.

Une nouvelle espèce, *Rhithrogena grischuna* nov. sp., est décrite à tous les stades (imagos, subimagos, larves et œufs) à partir de matériel récolté en Suisse orientale. Cette espèce appartient au groupe *hybrida*, et est étroitement apparentée à *Rh. hercynia* et autres espèces affines, pour lesquelles nous proposons un nouveau groupe, le groupe *hercynia*, caractérisé par la présence de taches foncées sur la face supérieure des fémurs, tant aux stades larvaire qu'imaginal.

Quelques données écologiques et biocénétiques sur *Rh. grischuna* sont également présentées.

1. Introduction

In Europe, the genus *Rhithrogena* is probably the most diversified among the Ephemeroptera. Until now, more than fifty species have been described.

In a synthetical work devoted to that genus, Sowa (1984) proposed some species groups on the basis of larval and imaginal characters. The new species described here belongs to the so-called *hybrida* group. The most important patterns of these species are :

- In male imagines : forewings often colored ; penis lobes spread out and cylindrical with the outer tooth generally not visible in ventral view ; inner tooth smaller and also conspicuous in ventral view too.
- In nymphs : lateral sclerites of the first sternite quadratic with their anterior margin perpendicular to the body axis ; all gills crenulated.

This group includes today somewhat less than twenty species. Recently Belfiore (1987) proposed a new group for two species, *Rh. nuragica* Belfiore and *Rh. insularis* Esben-Petersen, the latter one previously considered in the *hybrida* group. In so far as the dividing of species into groups reflects more their morphological affinities rather than some phylogenetic relationships, we propose a new group, called *hercynia* group, with the following features :

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— Species previously belonging to the *hybrida* group that possess a dark spot on the upper face of the femora, both in nymphs and adults.

The *hybrida* group would be therefore restricted to the species in which the upper face of the femora are without such a dark spot.

Table I itemizes the known species belonging to these groups.

During field work led by the junior author in the eastern part of Switzerland (Canton of Graubünden), important populations of a species related to the *hercynia* group were found. The rearing of specimens allowed us to establish that they did not belong to an already described species.

Table 1. Systematic position of the species related to the *Rh. hybrida* group.

hybrida group
<i>Rh. nivata</i> (Eaton, 1871)
<i>Rh. hybrida</i> Eaton, 1885
<i>Rh. degrangei</i> Sowa, 1969
<i>Rh. strenua</i> Thomas, 1982
<i>Rh. puthzi</i> Sowa, 1984
<i>Rh. reatina</i> Sowa & Belfiore, 1984
<i>Rh. endenensis</i> Metzler et al., 1985
<i>Rh. sibillina</i> Metzler et al., 1985
<i>Rh. circumtatica</i> Sowa & Soldán, 1986
<i>Rh. diensis</i> Sowa & Degrange, 1987
<i>Rh. fonticola</i> Sowa & Degrange, 1987
<i>Rh. mariaedominicae</i> Sowa & Degrange, 1987
insularis group
<i>Rh. insularis</i> Esben-Petersen, 1913
<i>Rh. nuragica</i> Belfiore, 1987
hercynia group
<i>Rh. fiorii</i> Grandi, 1953
<i>Rh. hercynia</i> Landa, 1969
<i>Rh. gratianopolitana</i> Sowa et al., 1986
<i>Rh. corcontica</i> Sowa & Soldán, 1986
<i>Rh. podhalensis</i> Sowa & Soldán, 1986
<i>Rh. grischuna</i> nov. sp.

2. Description of *Rhithrogena grischuna* nov. sp.

MALE IMAGO

Body length : 10.2-11.0 mm ; forewing : 11.7-12.1 mm ; cerci : 27-30 mm.

Face of the head olivaceous grey, antennae middle brown. Basis of ocelli dark brown. Eyes large, beige grey dorsally, basal portion silver grey.

Thoracical sclerites dark brown to black brown. Forewing intensively colored brown in the basal half. Veins dark brown, except the Sc and M1 light brown, and the big transversal whitish. Pterostigmatic area milky, with 13-15 transversal veins. Forelegs with femora and tibiae medium brown, tarsi greyish brown. Middle and hind legs olivaceous brown. Femora with a distinct elongated violet spot in the middle of the upper face.

Abdominal terga uniformly medium brown, segment borders sometimes paler. Sterna light brown ; in the anterior part, two small elongated spots, darker and directed downwards. Nerve ganglia hardly visible, without any kind of coloration.

Cerci dark brown in proximal part, gradually lighter.

Genitalia.

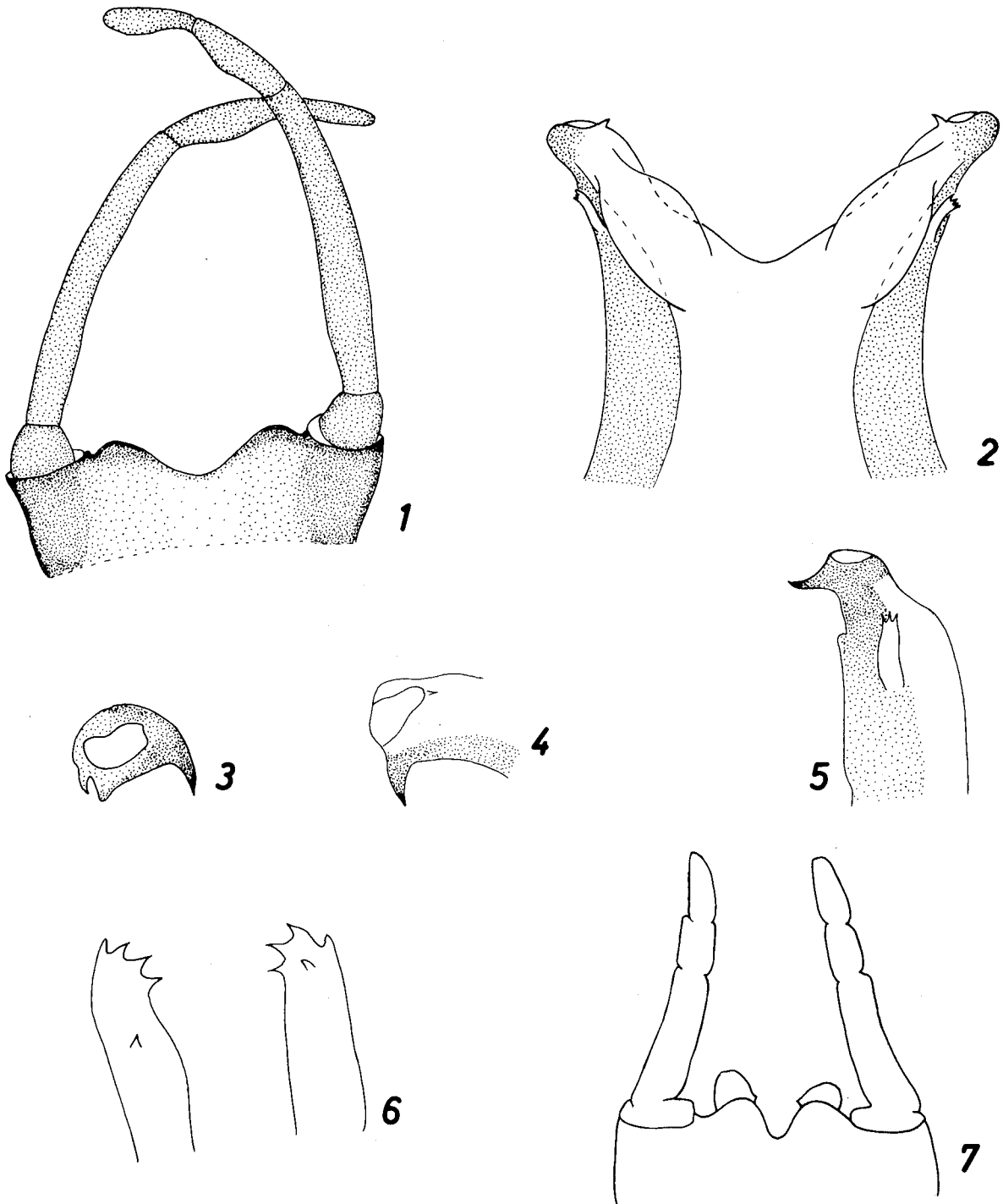
Styliger laterally dark brown, medium brown in the central portion. Posterior margin moderately incurved (Fig. 1).

Penis, in ventral view (Fig. 2), with membranous part at the base of lobes. Inner margin of penis lobes clearly convex in the distal part, and covered with membranous folds in the middle. Inner tooth quite visible. In apical view (Fig. 3), penis lobe semi-quadratic with genital pore well developed. In parallel median view, see in Fig. 4. In lateral view (Fig. 5), external tooth and apical margin of penis lobe with slightly concave contour. Titillators (Fig. 6) with subparallel margins, bearing 3-5 teeth. Generally, one supplementary tooth visible on their surface.

FEMALE IMAGO

Body length ; 11.5-12.5 mm ; forewing : 12.8-15.0 mm ; cerci : 18-22 mm.

Face of the head olivaceous grey, antennae brown.



Figs 1-7; *Rh. grischuna* nov. sp. 1-6 : male imago ; 7 : male subimago.

Fig. 1 : styliger plate and gonostyles in ventral view ; Fig. 2 : penis in ventral view ; Fig. 3 : penis lobe (left) in caudal view ; Fig. 4 : penis lobe (right) in parallel median view ; Fig. 5 : penis in lateral view ; Fig. 6 : titillators ; Fig. 7 : genitalia in ventral view.

Thoracical sclerites medium brown. Forewings colorless, veins dark brown. Pterostigmatic area milky as for the male. Forelegs olivaceous brown, middle and hindlegs yellowish brown. Femora of all legs with an elongated spot.

Abdominal terga brown, each of them with two small light spots. Sterna paler, with the same spots as for the male.

Subgenital plate with posterior margin slightly convex, rather subrectilinear, without incision.

Cerci light to middle brown, darker in basal portion.

MALE SUBIMAGO

Body length: 9.2-10.0 mm; forewing: 11.5-12.0 mm; cerci: 12-13 mm.

General color dark brown, except the thorax medium brown.

Wings brownish grey in basal part, dark grey in the distal one; veins brownish. All legs with elongated spots on femora.

Sterna lighter than terga. Genitalia as in Fig. 7. Styliger plate deeply incised.

NYMPH

Body length: 11.5-12.5 mm; cerci: 7.3-7.8 mm.

Body dark brown. Femora of all legs with a distinct large violet spot in the middle of the light central area (Fig. 8).

Head dark brown, thorax middle brown. Abdominal terga I-IV light brown, gradually darker. Terga V-VI dark brown, VII with inconspicuous lighter lateral areas. Terga VIII-IX with big light spots separated by dark elongated central band. Tergum X dark brown. Sterna lighter than terga, middle brown, without any maculation on nerve ganglia. Same spots as in the imago also visible. Cerci light brown, darker on the proximal part.

Labrum slightly incurved in the middle of the anterior margin. Middle combs of distal part of the maxilla with 10-13 teeth (Fig. 9). Spines on the upper face of hind femora with distinct divergent margins and truncate apex (Fig. 10). Claws generally with 2 teeth.

All gills moderately crenulated. Lamella of the first gill with well developed semilunar plica

(Fig. 11). Second gill with large lamella and central sclerite rather narrow (Fig. 12). Sixth and seventh pairs of gills as in figs 13 and 14. Central portion of the posterior margin of abdominal tergum V (Fig. 15) with long and pointed teeth, slightly rounded. Submarginal microdenticles numerous.

EGGS

Length: ca. 160 μm ; width: ca. 100 μm .

General size ovoid (Fig. 16). Polar cap at one of the poles (Fig. 17), with numerous adhesive elements. Exochorionic surface also with some adhesive elements and with macrogranules very irregularly arranged. Micropyle with well developed margin (Fig. 18).

In comparison, the eggs of *Rh. gratianopolitana* are bigger (Fig. 19), the polar cap is more extended (Fig. 20), the macrogranules on the exochorionic surface are less numerous, and the margin of the micropyle is less developed (Fig. 21).

Material examined

Switzerland, Canton of Graubünden; 1 σ holotype, 1 \varnothing allotype, 3 $\sigma\sigma$, 2 $\varnothing\varnothing$, 2 s.i. $\sigma\sigma$ (all with nymphal exuviae), as well as 37 nymphs paratypes: Rein Anterior River (Vorderrhein), Disentis/Muster, 1,050 m a.s.l., 2-5.VI.1988.

Other material: 6 larvae (L), 4.V.1988, 8 L, 20.V.1988, same locality; 3 L, same river, Zignau, 850 m, 4.V.1988; 1 L, same river, Castrisch, 720 m, 4.V.1988; 1 L, Calanca Valley, Calancasca stream, Auglio, 1,035 m, 19.VI.1984; 2L, same locality, 18.V.1985; 2L, same stream, Valbella, 1,300 m, 18.V.1985.

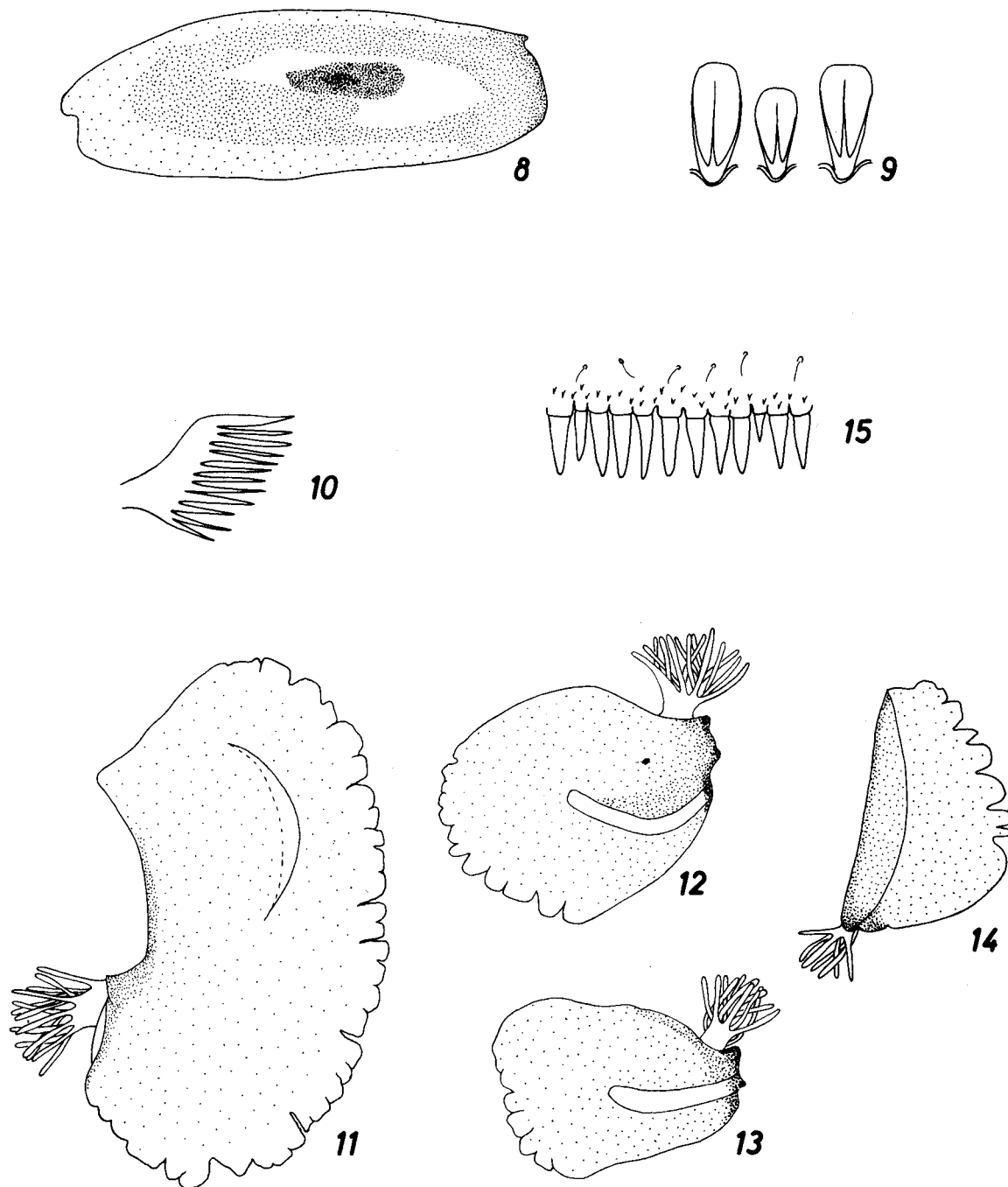
Holotype, allotype and paratypes deposited in the Musée zoologique Lausanne, except 1 σ , 1 \varnothing , 3N paratypes in the Zoologisches Museum Zürich.

Etymology.

Named after the district where this species has been found (Canton of Graubünden) called Grischuna in rhaeto-romanian language.

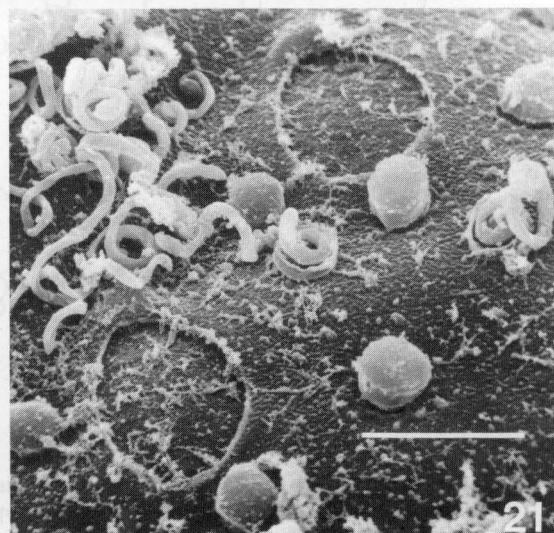
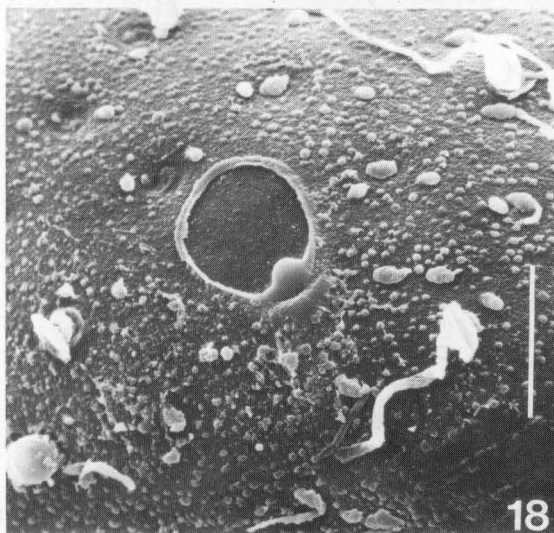
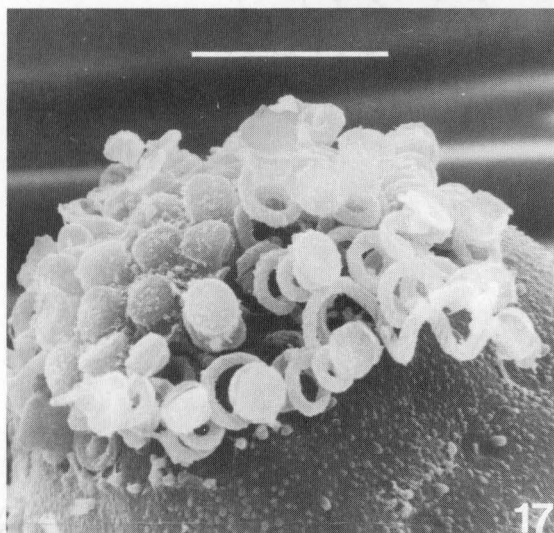
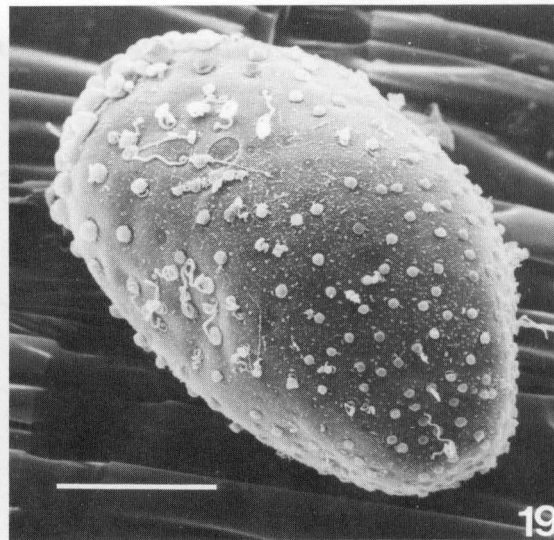
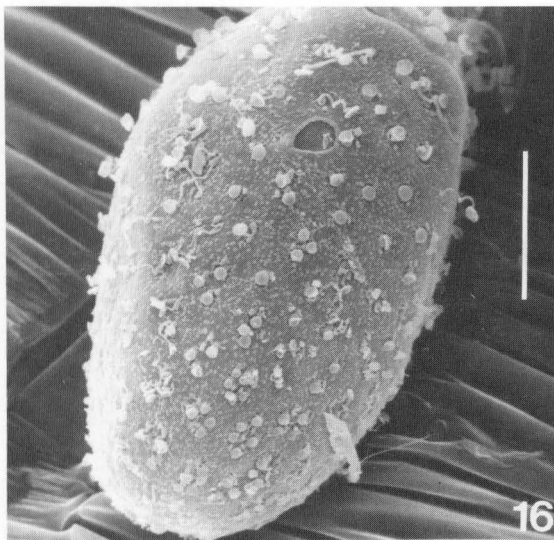
Affinities

Rh. grischuna nov. sp. is closely related to *Rh. corcontica* Sowa & Soldán, 1986. It differs from the latter in imaginal stage in that the posterior margin of the styliger is less incurved, the membrane folds of the penis are less extended, and the distal part of the penis lobes are less rounded. At larval stage, *Rh. grischuna* presents the same abdominal patterns than those of *Rh. corcontica*. Nevertheless, it can be distinguished by its darker coloration, by



Figs 8-15 : *Rh. grischuna* nov. sp. : nymph.

Fig. 8 : upper face of hind femora ; Fig. 9 : spines on the upper face of hind femora ; Fig. 10 : comb of the distal part of the maxilla ; Fig. 11 : first gill ; Fig. 12 : second gill ; Fig. 13 : sixth gill ; Fig. 14 : seventh gill ; Fig. 15 : posterior margin of the fifth abdominal tergum.



Figs 16-18 : *Rh. grischuna* nov. sp. : egg

Fig. 16 : general view (scale : 40 μ m) ; Fig. 17 : polar cap (scale : 20 μ m) ; Fig. 18 : micropyle and macrogranules (scale : 10 μ m) ; Figs 19-21 : *Rh. grisanopolitana* Sowa, Degrange & Sartori, 1986 : egg ; Fig. 19 : general view (scale : 40 μ m) ; Fig. 20 : polar cap with unrolled adhesive elements (scale : 30 μ m) ; Fig. 21 : micropyles and macrogranules (scale : 10 μ m).

Table 2. Physical and chemical compounds of the type locality

PHYSICAL COMPOUNDS					GEOCHEMICAL COMPOUNDS				
JULY 1987-1988	mean	min.	max.	N	ditto [MMOL/M3]	mean	min.	max.	N
pH	7.8	7.5	8.3	144	calcium	314	393	214	12
conductivity (μS/cm)	77	67	85	144	potassium	48.5	41.5	57.5	12
temperature (°C)	9.3	6.8	13	144	magnesium	47.5	38	77	12
water-level (m)	0.4	0.39	0.4	144	sodium	60	52	82.5	12
discharge (m3/s)	1.2	1.1	1.4	12	sulphate	88.5	76	104	12
pressure (mb)	893	890	895	144	chloride	35	22.5	65	12
porosity	0.2	0.16	0.2	12	alkaline earths	361	316	470	12
CHEMICAL COMPOUNDS									
ditto [MMOL/M3]	mean	min.	max.	N	ditto [MMOL/M3]	mean	min.	max.	N
total carbon	778	678	873	12	total nitrogen	37	29	56	12
total inorg. c.	676	589	794	12	particulate n.	5.5	2.5	8.5	12
carbon dioxide	17	14	22	12	dissolved n.	31.5	26	48.5	12
bicarbonate	656	573	772	12	diss. org. bound n.	3	1.5	5	12
total org. c.	102	79	157	12	nitrate	27.5	22.5	45	12
particulate o.c.	40	28	92	12	nitrite	0.1	0.1	0.1	12
dissolved o.c.	63	49	104	12	ammonia	1.2	0.4	1.9	12
total phosphate	0.5	0.4	1.7	12	oxygen theoret.	317	289	336	12
particulate ph.	0.2	0.1	0.3	12	oxygen concent.	347	312	369	12
dissolved ph.	0.5	0.2	1.5	12	o. saturation	29	23	33	12
ortho-phosphate	0.5	0.2	1.5	12	o. over sat (%)	9	8	10	12

the size of the spot on the upper face of femora (smaller in *Rh. corcontica*), by the presence of numerous submarginal microdenticles on the posterior margin of the terga, and finally, by the shape of the spines on the upper face of hind femora (rounded in *Rh. corcontica*).

Rh. grischuna is easily recognizable from *Rh. hercynia*, *Rh. podhalensis* and *Rh. gratianopolitana* mainly by the shape of the penis lobe (especially in caudal view), by the shape of the combs of the lacinia and by the patterns of abdominal terga of the nymphs.

The eggs of *Rh. grischuna*, as previously seen, differ from those of *Rh. gratianopolitana*, and can also be distinguished from those of *Rh. corcontica* and *Rh. hercynia*, especially by the shape of macrogranules on the exochorion, and from those of *Rh. podhalensis* by the size of the polar cap (see Figs 32-34 in Sowa & Soldán 1986).

3. Distribution and biology

Rh. grischuna has been collected in big streams or small rivers, mainly between 800 and 1300 m above sea level, and seems to belong to metarhithral associations. The physical and chemical compounds of the type locality are summarized in table 2. This species flies from the end of May to the middle of June in the type locality. It has been found together with *Rh. degrangei* Sowa and *Rh. puthzi* Sowa that possess the same flying period, although *Rh. degrangei* is a little earlier. These three species are replaced later by *Rh. alpestris* Eaton and *Rh. loyolaea* Navàs that fly in August-September. The global mayfly composition is given in table 3.

The young larvae of *Rh. grischuna* are present in the river from the end of summer (September), and, as in the case for all the species of the *Rh. hercynia* group, belong to the monovoltine winter species group (Uws) (Clifford 1982).

Table 3. Mayfly composition of the type locality

EPHEMEROPTERA	
Baetidae	
	Baetis alpinus (Pictet)
	Baetis rhodani (Pictet)
Heptageniidae	
	Epeorus alpicola Eaton
	Ecdyonurus picteti Meyer-Dür
	Ecdyonurus venosus (Fab.)
	Rhithrogena alpestris Eaton
	Rhithrogena degrangei Sowa
	Rhithrogena loyolaea Navàs
	Rhithrogena puthzi Sowa
	Rhithrogena semicolorata group
	Rhithrogena grischuna nov. sp.

In Switzerland, *Rh. grischuna* seems to be vicariant with *Rh. gratianopolitana*. The latter colonized rather bigger rivers at lower altitudes (200-900 m) (Sowa et al. 1986), and can be considered as a meta-to hyporhithral inhabitant (occasionally epipotamal) (Degrange & Sowa 1987). Until now, *Rh. gratianopolitana* has been found only in the western and central part of Switzerland.

The records of *Rh. hercynia* in Switzerland (Zurwerra & Tomka 1984) as well as the re-description of this species on the basis of Swiss material (Metzler et al. 1985) are probably erroneous. The specimens re-described by Sowa & Soldán (1986) from the type locality are rather different in imaginal, nymphal as well as egg stages. *Rh. hercynia* sensu Metzler et al. is probably synonym with *Rh. gratianopolitana*.

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