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The Oligoneuriidae (Ephemeroptera) of the Duero Basin (Central North of Spain)

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With 4 figures and 1 table in the text

Abstract

Three species of Oligoneuriidae have been found in the Duero basin (Central North of Spain): *Oligoneuriella rhenana* Imhoff, *Oligoneuriella duerensis* sp. n. and *Oligoneuriopsis skhounate* Dakki & Giudicelli. The description of the imago male, imago female and nymph of *Oligoneuriella duerensis* sp. n. are given in this paper. The genus *Oligoneuriopsis* is first cited in Europe.

Introduction

The family Oligoneuriidae has hitherto comprised two genera in Europe (Puthz, 1978): The genus *Oligoneuriella*, with the species *O. rhenana* Imhoff widely distributed over the Palearctic region and a group of others, some of them recently described (Sowa, 1961, 1973; Ali, 1971; Sowa & Zosidze, 1973; Soldán & Landa, 1977; Koch, 1980; Alba & Sowa, in press), and the genus *Oligoneurisca* with the species *O. borysthenica* Tshernova cited from Central and Eastern European Lowlands.

During a study carried out in the Duero basin (Central North of Spain) we have collected many specimens belonging to this family, founding the genus *Oligoneuriella* with two different species, *O. rhenana* Imhoff and *O. duerensis* sp. n., whose description is given in this paper, and the genus *Oligoneuriopsis* with the species *O. skhounate* recently described from North Africa by Dakki & Giudicelli (1980).

Area of study

76 localities were studied in the Duero basin along 22 streams of different characteristics. The distribution of these localities was decided taking into account the representativity of zones, having been represented in Fig. 1. The principal physico-chemical characteristics of some of them have been resumed in Table 1.

Methods

Four samples were taken at each locality corresponding to the four seasons of the year 1981. Handy nets were used collecting aquatic larvae in lotic and lentic parts of the

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Table 1. Principal physico-chemical characteristics of some localities studied in the Duero basin, where species of Oligoneuriidae exist.

Locality	Distance to the source (km)	Width (m)	Altitude (m)	Type of Sub-stratum	Hardness mg/l CO_3Ca	Mean summer Water temp. °C
R. Duero:						
Garray	78	25	1.010	Gravel	44	18.5
Andaluz	200	31	900	Gravel	82	19.5
S. E. de Gormaz	285	30	860	Gravel	110	19.5
Roa	384	53	750	Gravel	182	22.0
Q. de Onésimo	450	37	720	Gravel	215	23.0
Puente Duero	503	36	690	Gravel	225	22.5
La Fregeneda	875	100	190	Stony	150	19.5
R. Ucero:						
Burgo de Osma	78	10	890	Stony	225	19.5
R. Pisuerga:						
Cordovilla	216	30	770	Gravel	190	21.5
S. de Cerrato	244	46	740	Gravel	260	22.0
Cabezón	311	48	700	Gravel	257	22.5
R. Arlanza:						
Torrepadre	160	30	790	Stony	147	21.0
R. Arlanzón:						
S. M. de Juarros	48	12	920	Stony	87	18.0
R. Carrión:						
Villoldo	170	18	790	Stony	72	20.0
R. Esla:						
Gradefes	76	32	870	Stony	102	19.0
S. C. de Carabias	153	45	730	Gravel	130	21.5
R. Valderaduey:						
Sahagún	54	7	810	Stony	90	26.0
Benegiles	188	10	650	Gravel	192	25.0
R. Cea:						
Almanza	42	10	900	Stony	135	18.0
R. Porma:						
V. del Condado	50	32	870	Stony	97	13.0
R. Orbigo:						
Carrizo	70	41	880	Stony	80	16.0
Requejo	112	30	780	Gravel	92	22.0
R. Tera:						
Trefacio	30	14	900	Stony	10	18.0
Mozar	130	45	690	Gravel	12	24.0
R. Duratón:						
Duruelo	13	6	1.000	Stony	73	23.0
L. de Contreras	72	15	800	Gravel	210	19.0
R. Cega:						
Rebollo	22	9	900	Gravel	50	23.0
R. Adaja:						
Muñotello	10	7	1.100	Gravel	20	19.0
Blascosancho	72	10	860	Sandy	115	20.0
Valdestillas	170	23	690	Sandy	150	27.0
R. Eresma:						
Bernardos	60	10	800	Sandy	130	22.0
R. Tormes:						
Angostura	22	16	1.180	Stony	10	20.0
Ejeme	102	27	850	Gravel	10	21.
R. Huebra:						
Cerralbo	96	13	610	Stony	45	26.0
R. Agueda:						
El Payo	13	15	810	Stony	5	24.0
C. de M. Viejo	84	16	570	Stony	50	27.0

studied rivers, by removing stones and vegetation of the substrata. The imagos were caught with handy nets as well and light-traps disposed near the respective localities of the rivers.

Results

Among the samples collected in the Duero basin we have identified three species of Oligoneuriidae: *Oligoneuriella rhenana* Imhoff, *Oligoneuriella duerensis* n. sp. and *Oligoneuriopsis skhounate* Dakki & Giudicelli, distributed on the studied area as it is shown in Fig. 1.

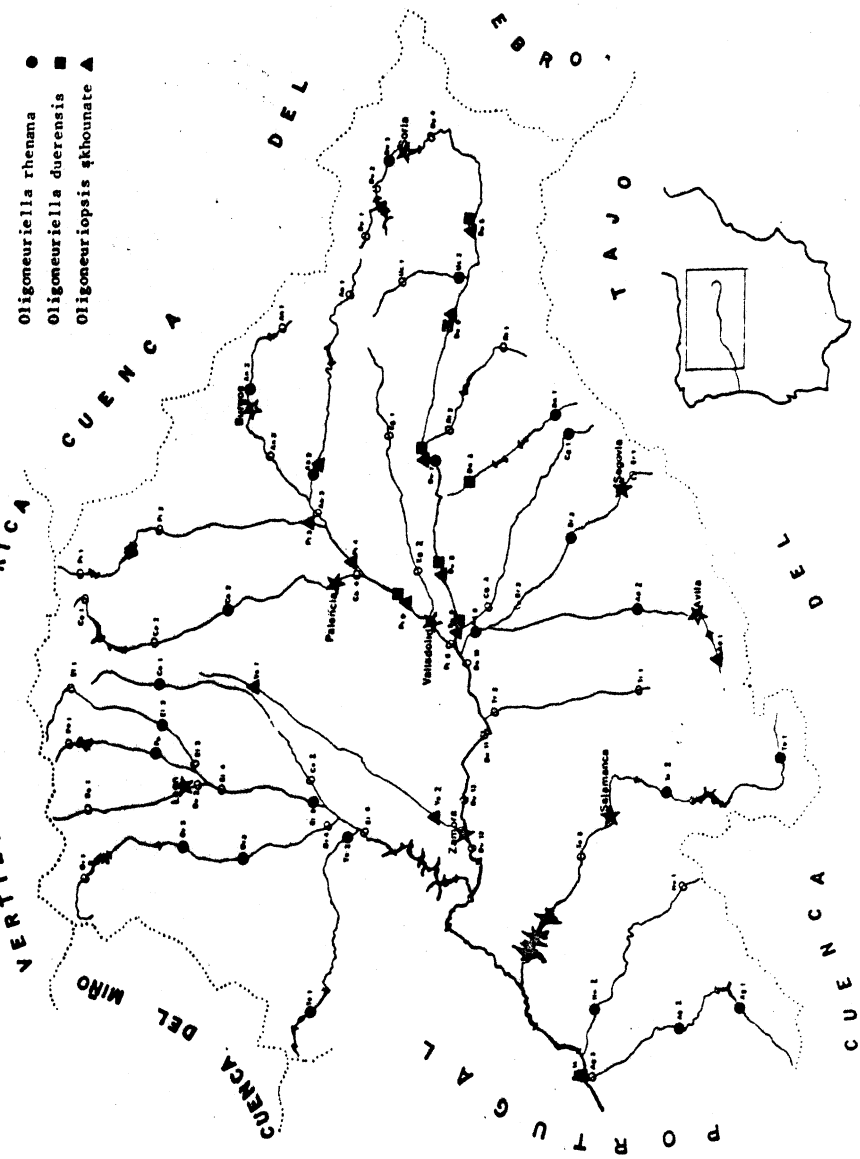

Fig. 1 Distribution of *Oligoneuriella rhenana*, *Oligoneuriella duerensis* and *Oligoneuriopsis skhounate* in the studied localities of the Duero basin.

The genus *Oligoneuriella* appears from June and is present to August in many tributaries of the Duero basin and in the Duero river itself. *Oligoneuriella rhenana* is the most widely spread on the studied area and the period in which this species is more abundant corresponds to the months of June and July, being present in August as stade of larvae only in the coldest places. Larvae of this species have been collected at the following localities:

River Duero: Garray (26.6.81) 7L; Roa (17.6.81) 1L; River Ucero: Burgo de Osma (26.6.81) 8L; River Arlanza: Torrepadre (18.6.81) 9L; River Arlanzón: San Millán de Juarros (25.6.81) 6L; (23.8.81) 3L; River Carrión: Villoldo (19.6.81) 1L; (28.8.81) 3L; River Esla: Gradefes (19.6.81) 52L; Sta. Colomba de las Carabias (23.6.81) 2L; River Porma: Vega del Condado (20.8.81) 17L; River Cea: Almanza (19.6.81) 10L; River Orbigo: Carrizo de la Rivera (21.6.81) 1L; Requejo (22.6.81) 8L; (18.8.81) 5L; River Tera: Trefacio (22.6.81) 64L; (17.8.81) 29L; Mozar (23.6.81) 5L; River Duratón: Duruelo (6.7.81) 184L; River Cega: Rebollo (17.6.81) 18L; River Eresma: Bernardos (12.6.81) 9L; River Adaja: Blascosancho (6.6.81) 4L; Valdestillas (13.6.81) 2L; River Tormes: Angostura (10.6.81) 32L; (12.8.81) 10L; Ejeme (6.6.81) 3L; (12.8.81) 1L; River Huebra: Cerralbo (8.6.81) 10L; River Agueda: El Payo (9.6.81) 4L; Castillejo de Martín Viejo (9.6.81) 3L.

Apart from the specimens identified as *Oligoneuriella rhenana* we have distinguished some others which differ in some features from the other European *Oligoneuriella* described until now and which we have considered belonging to a new species whose description is given here:

Oligoneuriella duerensis sp. n.

Description of the nymph

Dimensions (lengths): Body of mature nymph: 10—12 mm. Cerci: 5 mm.

Coloration: Light yellowish brown, without any distinctive pattern on the body.

Head: Without special features. Compound eyes black, in dorsal view not exceeding the lateral margin of head in females (Fig. 2 b) and reaching it in males (Fig. 2 c).

Thorax: Same coloration as the rest of the body, whith no special characteristics. Appendices: Fore femora approximately two times long as broad, with some spines on the dorsal surface and along the posterior margin; fore tibia with a dorsal longitudinal row of long spines near the base of filtrating setae (Fig. 3 a). Mid and hind femora longer, approximately three times long as broad; in the mid femur there are only few long setae and some long spines just at the base of the posterior margin, and shorter spines along it (Fig. 3 b); the hind femur has short spines along the posterior margin and some longer ones at base but not long natatorial setae (Fig. 3 c); mid and hind tibia with a group of 4—5 long dark spines at apex.

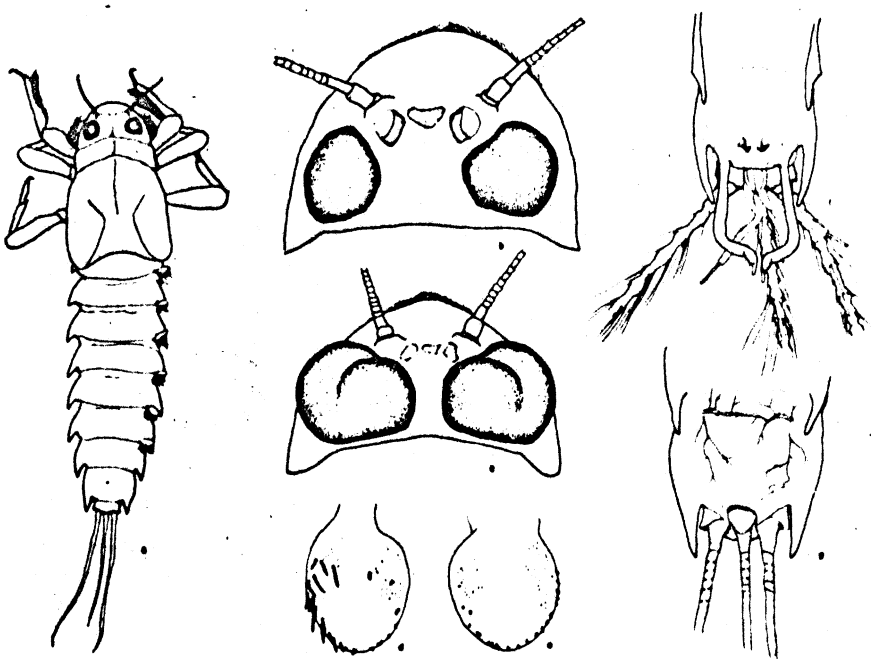

Fig. 2. *Oligoneuriella duerensis* sp. n.: a) Nymph; b) dorsal view of female nymph head; c) id. male nymph head; d) lamella of first gill; e) lamella of third gill; f) ventral view of imago male last abdominal segments; g) id. of imago female.

Abdomen: Surface of terguites with short blunt spinelike setae regularly distributed. Posterolateral spines of abdominal segments well developed, conspicous from the segment 3 and with the outer margins straight, slightly diverging from the axis of the abdomen (Fig. 2 a). First gill oval, of similar size or slightly larger than the others, with some long spines along the outer margin and shorter ones at the apex (Fig. 2 d); other gills almost circular, with short spines distributed along the outer and apical margins (Fig. 2 e); bunch of filaments slightly longer than the lamella. Cerci with same coloration as the rest of the body, with long lateral setae along their inner margin.

Holotype and paratypes nymphs: River Duero in San Esteban de Gormaz (Soria, Spain) 2. VII. 82. Coll. González del Tánago.

Description of the imago male

Dimensions (lengths): Body: 14 mm. Fore wing: 11.5 mm. Hind wing: 5.5 mm.

Coloration: General color whitish except the region of the thorax which has a light cinnamon brown color.

Head: Compound eyes black, very protruded representing nearly all the volume of head. In dorsal view, they are separated by a distance less than half the width of one of them (Fig. 3 d).

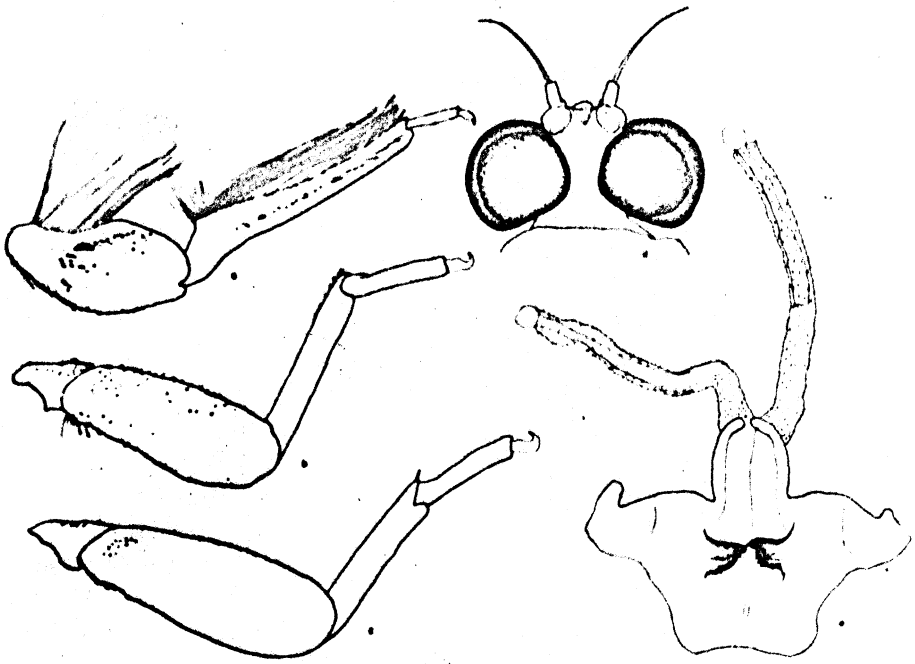

Fig. 3. *Oligoneuriella duerensis* sp. n.: a) dorsal view of nymph fore leg; b) id. of mid leg; c) id. of hind leg; d) dorsal view of imago male head; e) penial sclerite and edeago of imago male.

Thorax: Light cinnamon brown color, contrasting with the rest of the body. Fore wing with the anterior veins reddish brown and the membranous surface light grey. Hind wing completely whitish. Fore legs with two longitudinal dark band on femora and with the tibia darker than the rest. Mid and hind legs whitish, with a small dark spot at the apex of femora.

Abdomen: Abdominal segments white alternated with intersegmental regions completely translucid. Cerci whitish, with long setae along the posterior margin of articles (Fig. 2 f).

Genitalia: Outer process of penial sclerite slender, regularly curved towards the centre. Inner sclerified process well developed, with irregular denticles in the low margins and with a strong triangular protuberance at the superior central extreme. Penis long and slender, membranous, with rounded lobes at apex (Fig. 3 e).

Holotype and paratype imago male: River Duero in San Esteban de Gormaz (Soria, Spain) 2. VII. 82. Coll. González del Tánago.

Description of the imago female

Same dimensions and color as the imago male. Compound eyes much smaller, being separated, in dorsal view, by a distance larger than the width of

one of them Legs completely white, not well developed. Sternite 9 with two lateral processes and posterior margin with two pointed medial projections (Fig. 2g). Cerci white with only several long setae along their margins.

Holotype and paratype imago female: River Duero in San Esteban de Gormaz (Soria, Spain) 2. VII. 82. Coll. González del Tánago.

Affinities: The species *Oligoneuriella duerensis* seems to be similar to *Oligoneuriella zanga* Soldán & Landa, known from the Caucasus. The nymph of *O. duerensis* differs from the nymph of *O. zanga* in some characteristics of femora and gills: the first species has short spines along all the posterior margin of mid femur and only a few (3—4) long setae at base, having only spines along the posterior margin of hind femur. Soldán & Landa (1977) have described and drawn "spines on the hind margin of femur of middle leg only near the base of femur together with setae" but not mentioned the existence of long natatorial setae on hind femur although this character has been considered as present by Koch (1980). In the other hand, the imago male of *O. duerensis* has not the spine on the inner side of the outer lobes of penis described for *O. zanga* by the respective authors.

Considering the key to the European nymphs of Sowa (1973) the species *O. duerensis* should be considered as "nymph claire, gris jaunatre" but without "un dessin net des taches brunes sur la face dorsal du corps" and with "bord posterior-proximal des fémurs intermediaires et postérieurs dépourvu de soies natatoires". These characters together with the size of the first gill which is of similar size or slightly larger than the other gills can be considered as good features identifying *O. duerensis* from the other European species of the genus included by Sowa in the mentioned key.

Oligoneuriella duerensis is restricted to the central region of the Duero basin, being present in the middle and low zones of river Duero and low zones of rivers Pisuerga and Duratón, where it is very abundant. This species has the larval development period in late spring and early summer and flys as adult from the first days of July. It has been found at the following localities:

River Duero: Andaluz (25.6.81) 13L; San Esteban de Gormaz (27.6.81) 150L; (25.8.81) 24L; (2.7.82) 115L, ♂♂ + ♀♀; Roa (17.6.81) 188L; Quintanilla de Onésimo (13.6.81) 235L; Puente Duero (13.6.81) 18L; Muelle de la Fregeneda (8.6.81) 1L; River Pisuerga: Cabezón (14.6.81) 1L; River Duratón: Laguna de Contreras (27.6.81) 3L.

The genus *Oligoneuriopsis* is represented in the Duero basin by the species *O. skhounate* Dakki & Giudicelli which is the latest Oligoneuriidae appearing in the studied area, having been collected as larvae during the months of summer (August) and autumn (October). Its distribution in Spain so far known is restricted to the middle and low zones of the rivers Duero and Pisuerga where it can be considered as abundant. The species is also present in

Valderaduey stream and rivers Adaja and Arlanza but sporadically. It has been found at the following localities:

River Duero: Andaluz (24.8.81) 1L; (3.10.81) 1L; San Esteban de Gormaz (25.8.81) 1L; (2.10.81) 1L; Roa (2.8.81) 38L; Quintanilla de Onésimo (26.8.81) 75L; (8.11.81) 3L; Puente Duero (9.11.81) 1L.

River Pisuerga: Cordovilla la Real (28.8.81) 3L; Soto de Cerrato (29.8.81) 5L; (12.10.81) 3L; Cabezón de Pisuerga (27.8.81) 26L.

River Arlanza: Torrepadre (29.8.81) 1L. River Adaja: Muñotello (12.8.81) 1L.

River Valderaduey: Sahagún (28.8.81) 17L; Benegiles (2.11.81) 4L.

Discussion

Three species of Oligoneuriidae have been found in the Duero basin, nearly always related with water eutrophication conditions more or less marked, being considered as potamic species. In some cases where they habit higher zones of rivers it is possible to find some causes which change or modify the natural zonation of rivers, like natural lakes [Sanabria lake above Trefacio (river Tera) where *O. rhenana* exists], artificial reservoirs (which is the case of Garray, river Duero) or, in the other hand, discharges of raw sewage effluents of little villages which produce a nutrient enrichment of waters (the case of Almanza, in river Cea or Angostura in river Tormes, etc).

Oligoneuriella rhenana seems to be the species that habits in higher altitudes, as it is has been mentioned before (Sowa, 1973), being the most frequent in the Duero basin and relatively abundant in some localities where no other species of the family exist. Its larval development is carried out in spring and summer. *Oligoneuriella duerensis* habits at lower altitudes and is much less frequent than the precedent species but very abundant where it exists, having the larval development in spring and early summer (from June to August).

Oligoneuriopsis skhounate is restricted to the central region of the Duero basin being present at the same localities where other species of Oligoneuriidae exist (Fig. 1) but having its larval development a bit later than them. This species is relatively abundant in late summer although it exists as larvae in autumn as well.

In Central and Southern Africa, *Oligoneuriopsis skhounate* nymphs have been found at high altitudes, being cool-adapted (Agnew, 1980). In the North, this species habits in a wide range of altitude (1.420—190 m) (Dakki & Giudicelli, 1980). In Spain, it has been collected in localities where altitude varies between 1.110 m and 650 m, having its more numerous populations in the middle zone of some rivers where potamic conditions exist and mean summer temperatures of water exceed 20 °C (at 700—750 m altitude).

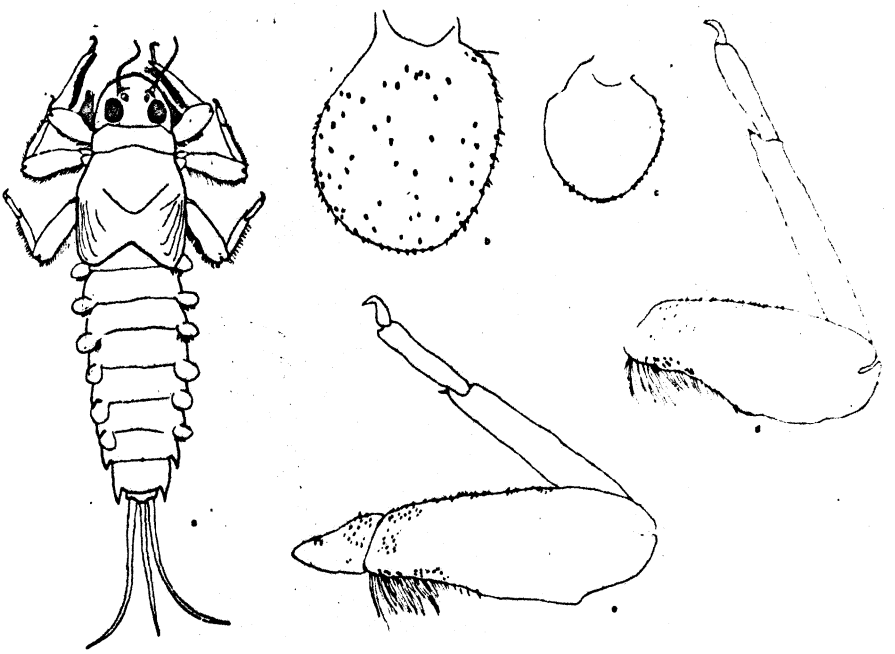

Fig. 4. a) *Oligoneuriopsis skhounate*: dorsal view of nymph. b) *Oligoneuriella rhenana*: lamella of first gill; c) id. of third gill; d) id. dorsal view of mid leg; e) id. of hind leg.

The presence of the genus *Oligoneuriopsis* in the Iberian peninsula changes the idea of endemism of this genus to the Afrotropical region (AGNEW, 1980) and extends its distribution area to the Mediterranean European zones. Iberian peninsula has, nevertheless, a certain similarity with the North of Africa as it has been mentioned in several works (GANGWERE & MORALES, 1970; ALMAÇA, 1976) having been together geographically some time ago and being exposed to many commun factors affecting their flora and fauna simultaneously.

Some characteristics have been mentioned distinguishing the larvae of *Oligoneuriopsis* and *Oligoneuriella* (AGNEW, 1980; DAKKI & GIUDICELLI, 1980). In order to identify the Iberian Oligoneuriidae larvae we propose the following key:

1. Lateroabdominal spines of the abdomen exceeding the posterior margin of terguites on segments 2—6 (Fig. 2 a). Lamella of gills smaller in length than the half length of terguite ..... *Oligoneuriella* ... 2
   Lateroabdominal spines of abdomen shorter, not exceeding the posterior margin of terguites on segments 2—6 (Fig. 4 a). Lamella of gills large, reaching or exceeding the half length of terguites ..... *Oligoneuriopsis skhounate* DAKKI & GIUDICELLI
2. Basal part of posterior margin of mid and hind femora with long natatorial setae (Fig. 4 d, 4 e). First lamella much larger than the others (Fig. 4 b). Nymph dark brown ..... *Oligoneuriella rhenana* IMHOFF

Basal part of posterior margin of mid and hind femora without long natatorial setae (Fig. 3 b, 3 c). First lamella similar or slightly larger than the others (Fig. 2 d, 2 e). Nymph pale, yellowish brown ..... *Oligoneuriella duerensis* sp. n.

Acknowledgements

We are very grateful to Dr. DAKKI who kindly regarded our specimens of *Oligoneuriopsis skhounate* and confirmed their identification.

Résumé

Trois espèces de la famille Oligoneuriidae étaient recoltés dans le bassin de la rivière Duero: *Oligoneuriella rhenana* IMHOFF, *Oligoneuriella duerensis* sp. n. et *Oligoneuriopsis skhounate* DAKKI & GIUDICELLI. L'imago mâle, femâle et la larva d'*Oligoneuriella duerensis* sp. n. sont décrites. Le genus *Oligoneuriopsis* est cité en Europe pour la première fois.

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