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On the interstitial cladocera of the River Ter (Catalonia, NE Spain), with a description of the male of *Alona Phreatica*

Francesc Sabater
Departament d'Ecologia, Facultat de Biologia, Universitat de Barcelona, Diagonal 645, 08028 Barcelona, Spain

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Abstract

This paper deals with the interstitial Cladocera fauna of the Ter river (NE Spain) and offers the first description of the male of *Alona phreatica* Dumont.

Eight Chydorid species (*Alona phreatica, A. guttata, A. quadrangularis, A. rectangula, A. rustica, Pleuroxus denticulatus, P. aduncus, Chydorus sphaericus*) were widely distributed over the Ter basin. In one site, a large number of individuals of many cladocera species, as well as other crustacean species (Harpacticoida, Amphipoda, Cyclopoida and Ostracoda) were found. This confirms the importance of chydorids in hyporheic habitats, ignored by many previous studies on this subject.

Introduction

Few previous works have dealt with the Chydoridae inhabiting interstitial water. However, there is a great deal of research yet to be undertaken in this subject. Dumont (1983) stresses the existence of phreatic Cladocera and suggests that they have been overlooked in many previous studies. Several species of interstitial Cladocera were found by him, by digging holes in bank sediments in a river in Auvergne (France).

The actual number of Cladocera species found in the hyporheic zone is low when compared with other crustaceans such as Cyclopoida and Harpacticoida. In fact, where Cladocera were mentioned from hyporheic zones, they were usually rare and always without males.

I here present new reports of interstitial Chydoridae, in a hyporheic habitat along the Ter River (Catalonia, NE Spain), and a first description of the male of *Alona phreatica*. When species was first described by Dumont (1983), no males were available.

This study also aims to add to the knowledge of the hyporheic fauna in Spain, which is poorly known. To this end, as analysis of a population of *Alona phreatica* over a one year period is presented.

Sampling sites and methods

Eighteen sampling points were chosen from the hyporheic zone along the catchment area of the Ter River (NE Spain). Species of Cladocera were present in only seven sampling sites. The location of the sites is shown in Fig. 1.

The source of the Ter is in the Pyrenees mountains at 2400 m (a.s.l.). The river is 208 km long and has a drainage area covering 3010 km^2. The average discharge is 25 m^3/s at the mouth. It presents a Mediterranean regime and undergoes strong variations in flow over the year. In the catchment area there are towns with both important industry and agricultural nuclei which are important sources of local pollution. There are three reservoirs in the middle of its course, situated close to each other and which divide the river in two strongly differentiated segments. (Sabater & Armengol, 1986).

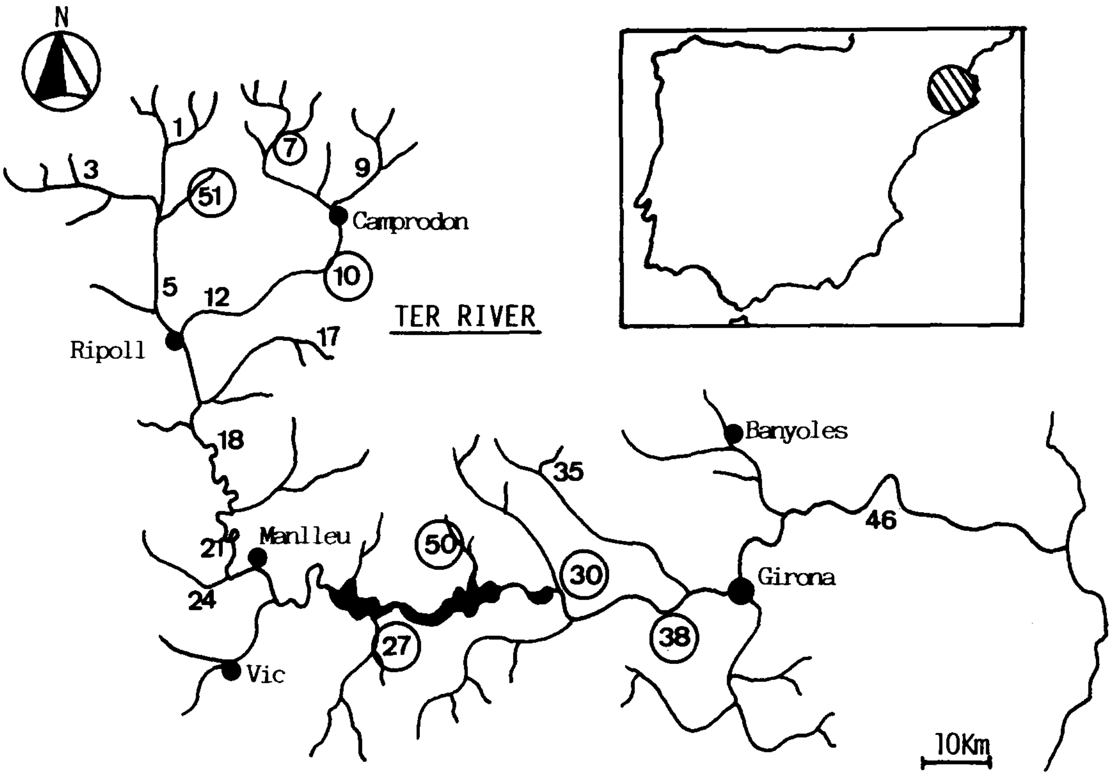

Fig. 1. The location of the eighteen hyporheic sampling sites along the catchment area of the Ter river. The circled stations indicate points where Cladocera species were found. The main towns are also indicated.

One of the sampling sites (T27) has been sampled monthly for a one year period, from February 1983 to February 1984, as it proved to be rich both qualitatively and quantitatively in Cladocera species. The others have been sampled only once, in September 1983. These sites also present a varied fauna of Crustacea (Harpacticoida, Cyclopoida, Ostracoda and Amphipoda) although not a large number of species.

The sampling sites in which specimens of cladocera were found are listed below with information on their physico-chemical features:

Site T7: This station is located upstream in the headwater of the Ter at 1400 m (a.s.l.). Its geological substratum is made up of slates and granitic rocks. The sediment bank is formed by a great amount of gravel and sand together with coarse gravel, pebbles and stones. It is very permeable and its interstitial water is quite oxygenated (8.8 mg O_2/l). The specific conductance was 55 μS/cm, the pH was 7.5 and the calcium content is low (19.6 mg Ca/l). Little detritus was found.

Site T10: This point is located further downstream at 925 m (a.s.l.), about 2 km from Camprodon. There were no signs of chemical reducing conditions and little detritus was found. (The conductivity was 140 μS/cm, the pH was 7.7 and there were 7.4 mg O_2/l of dissolved oxygen). This site lies on a siliceous-substratum and presents large boulders and a gravel bank. The sediment compaction is very low.

Site T27: This station is at 470 m (a.s.l.) on a tributary of the Ter (Riera Major) which also drains over an area of siliceous substratum. This tributary has high quality water. The sediment bank is mostly made up of gravel and sand. Its interstitial water was very clear and quite oxygenated (5.2–9.8 mg O_2/l). The water mineralization had ranged from 90 to 255 μS/cm according to season and a moderate amount of detritus was found.

Sites T30 and T38: Two stations situated a few kilometres downstream from the reservoirs, at 160 m (a.s.l.) and 98 m (a.s.l.). Both sites present a moderate amount of fine detritus and many algae on the stones. The sediments, made up of gravel and sand beds with large boulders, are not at all compacted. No signs of pollution were observed. The conductivity was between 522 and 430 μS/cm, the dissolved oxygen was 4.6–6.2 mg O_2/l and the average annual chloride content was 25.5 mg Cl/l.

Site T50: This point is located on a tributary (Riera de Rupit) of the Ter at 840 m (a.s.l.). It is a small chalk stream. The conductivity was 429 μS/cm, the pH was 7.7, the alkalinity was 4.7 meq/l, the sulphate content was 0.3 mg of ionic SO4/l, that of calcium was 238 mg/l and magnesium, 23.4 mg/l. According to the amount of sandy sediments and fine gravels extracted, the hyporheic porosity was fairly low and its interstitial water proved to be little oxygenated (3.9 mg O_2/l). The fine detritus is plentiful.

Site T51: This station is situated at 1200 m (a.s.l.) on a small tributary of the headwater of the Freser river. It is, in turn, the main tributary of the Ter. This small tributary drains a calcareous substratum. The sediment bank is made up of gravel and sands. No signs of reducing chemical conditions were observed (The conductivity was 260 μS/cm, the dissolved oxygen was 5.8 mg/l, the pH was 7.4 and calcium content 70.7 mg/l.

The interstitial fauna was sampled using the method of Bou & Rouch (1967), by pumping the groundwater at depths of 10 to 50 cm below the gravel beds. The samples were always taken at riffle points. The volume of pumped waters was 50 *l*. It was filtered through a 100 μm mesh plankton net. The samples were fixed in 4% formaldehyde and taken to the laboratory. There they were stained for 24 hours with a selective stain, rose bengal, in order to improve the selection of organisms under a stereo-microscope.

Results

The following Chydoridae were identified: 5 species of *Alona* (*phreatica, guttata, quadrangularis, rectangula, rustica*), 2 species of *Pleuroxus* (*aduncus* and *denticulatus*) and *Chydorus sphaericus*. Except for *A. phreatica*, the species present the typical morphology of the epigean populations as described by several authors (Flössner, 1967; Smirnov, 1971; Negrea, 1983; Alonso, 1985...).

Pleuroxus denticulatus *(Scourfield, 1907)*

This species was found in the two sampling sites (T50 and T27), where *Alona quadrangularis* was also found. The former species is quite abundant in site T50 whereas not in T27 where it appears in autumn to winter and is most frequent in December. The first mature females appear in January and ephippia were not found. The maximum body length found was 0.49 mm.

P. denticulatus is rare in Spain, and it has only been located before in the Ter basin, from March to May in a small pond close the river (Alonso, 1985). It seems that at present, this species is confined to the Ter basin. This also seems to be the first time that this species is recorded in the interstitial habitat. However, Alonso (1985) comments the possibility of finding it in the bank sediments of running waters.

Pleuroxus aduncus *(Jurine, 1920)*

This species has only been found in samples from site T27. It was never dominant and appears from August to February with a maximum in December, as in *Pleuroxus denticulatus*. The maximum body length was 0.54 mm and females with ephippium were not observed.

Its presence in the hyporheic habitat has not been established before. However, Margalef (1953) remarks on its adaptation to clear running waters with abundant macrophytes.

Chydorus sphaericus *(O.F. Muller, 1785)*

This species occurred mainly in T27. Its presence is fairly occasional throughout the year, and there were never more than 30 individuals in 50 litres of water. It was observed in samples from February 1983 and June of the same year, and from December to February 1984. It always made up less than 10% of the total number of species. It has also been found in samples from site T51, a small chalk stream, tributary of the Ter river at 1200 m (a.s.l.). However, it was previously found by digging holes in bank sediments at the rivermouth of the Ter (Sabater, 1986). The identified specimens present the typical morphology of the epigean species found throughout the small water bodies of Spain

(Alonso, 1985). The maximum body length was 0.35 mm).

Alona guttata *(Sars, 1862)*

This species has been found at the sampling sites after the reservoirs (T30, T38), at site T10 and mainly at site T27. Until now, this species has always been observed together with *A. phreatica*. Both are the most widely distributed over the Ter basin. *A. guttata* is always dominant at sampling sites below the reservoirs, but not so at T10, whereas at site T27 it is very abundant, but never dominant. At this site, this species appears almost throughout the year but is only abundant in winter. The maximum body length found was 0.38 mm, and mature females appear during summer and winter. Ephippia were not found.

In the Ter samples, *Alona phreatica* was found with *Alona guttata*. It is interesting that Dumont (1983) has found in France *A. phreatica* associated to another species, *Alona bessei*, which seems extremely similar to *A. guttata*. Nevertheless, further studies on *A. guttata* are necessary to define this species, and to establish its relationships with other close species.

In Spain, this species was previously unrecorded in the hyporheic habitat. However, it was observed in the litoral of lakes and reservoirs (Armengol, 1978). It is distributed over small water bodies of the humid area (Alonso, 1985).

Alona quadrangularis *(O.F. Muller, 1785)*

This species occurred in two localities: 'Riera Major' (T27) and 'Riera de Rupit' (T50). At site T50 this species is present in small numbers, and was found together with *P. denticulatus*. At site T27, maximum development is reached in winter. The maximum body length found was 0.82 mm and the smallest egg-carrying females were 0.45 mm long. They appear after the period of the major flow. Ephippia were not found.

A. quadrangularis was previously unrecorded in the interstitial habitat of running waters. However it has been found by Margaritora *et al.* (1975) in small ponds near a river. It has an affinity for sandy bed substrates (Flössner, 1972).

It is widespread in Spain, colonizing lakes, reservoirs (Armengol, 1978) and small water bodies (Alonso, 1985). The latter author never found the species in real abundant numbers in a more than 500 small water bodies all across Spain.

Alona rustica *(Scott, 1895)*

This species has only been found in site T7, where it is quite abundant: 40 specimens per 50 litres of water. The maximum body length was 0.51 mm. It is a new record for the Iberian Peninsula, although the site coincides ecologically with other similar acidic water sites where it was found previously in the Pyrenees at an altitude of 2100 m (a.s.l.) (Alonso, personal communication). This species prefers acidic waters (pH = 4–7.5) with a low calcium content (2.4–8.6 mg Ca l^{-1}, is confined to high mountains and is generally found in association with aquatic mosses (Flössner, 1967).

A. rustica has been recorded previously in the interstitial habitat of running waters by Dumont (1983). Negrea (1983) found it in hyporheic samples from a peat zone at 1080 m (a.s.l.) in Rumania.

Alona rectangula *(Sars, 1862)*

This species only occurred in samples from site T27 from December to February, just after the period of overflow. Although never dominant, the species was fairly abundant and a maximum number of individuals was found in December (89 indiv./50 l.) while during the following months, there were between 30 and 40 specimens per 50 litres filtered. Generally it made up between 5 and 10% of the total number of specimens. The maximum body length was 0.38 mm; females with ephippium were not found.

The identified specimens have the typical morphology of epigean specimens found fairly widespread in small water bodies in Spain (Alonso, 1985). However, a great number of the specimens found in samples from January to February show some variation in the postabdomen (Fig. 2). The basal spine is shorter and less sharp than is typical, and the general shape of the postabdomen does not coincide with those described as subspecies by Smirnov (1971).

This species has rarely been mentioned in groundwater habitats. However, its occurrence in the hyporheic area is fairly certain, since it has been found in a river bank (at Pisuerga River, Spain; De

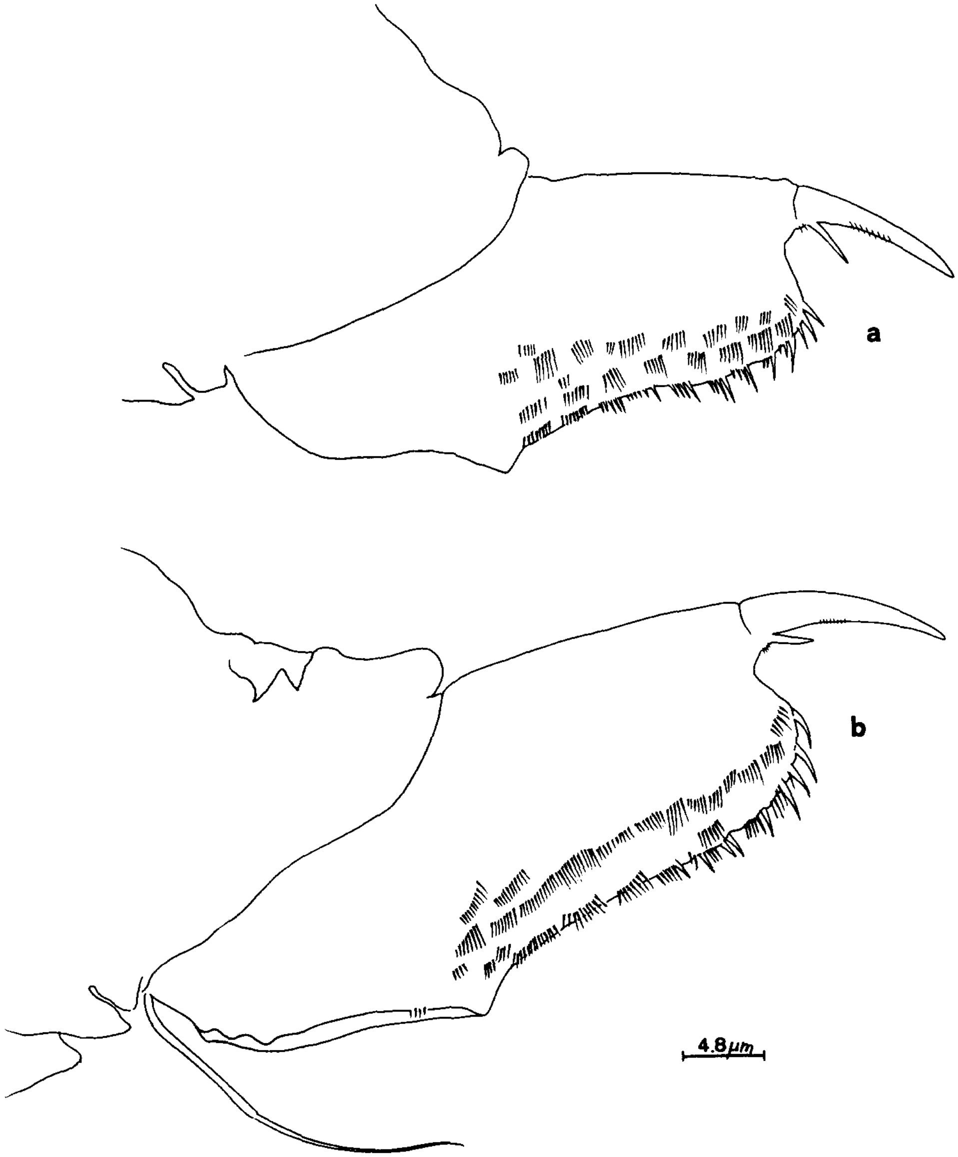

Fig. 2. a/ Postabdomen of *Alona rectangula* which coincides with the typical morphology. b/ Postabdomen of *Alona* cf. *rectangula* (see explanation in text).

Manuel, personal communication). Some moults were found in rivermouth sediments of the Ter (Sabater, 1986) too.

Alona phreatica *(Dumont, 1983)*

This species is fairly widespread in the Ter basin. It was found in sites below the reservoirs (T30, T38), in T10 and in site T27. At this point, it is very abundant, while in the other sites it was quite scarce. Moreover in the latter site, the first specimens appear from March and their maximum development is reached in June, but specimens are occasionally present in samples from December. In all these samples males were found in small numbers.

The only report of this species is its description by Dumont (1983) from interstitial waters in the hyporheic zone of a river in Auvergne (France). He considers *Alona phreatica* to be an obligate phreatobiont, because its swimming abilities are reduced, i.e., it crawls around and between organic debris and mineral particles, feeding on small colloid and particulate material. Dumont recognizes morphological resemblances between this species, *Alona protzi* and *Alona smirnovi*. Until the present, both have been observed as inhabitants of places connected to the groundwater systems (Petkovski & Flössner, 1972). The absence of an eye in *Alona smirnovi* suggests an adaptation to the groundwater systems. The evident sign of reduction of the eye in *Alona phreatica* should indicate a fairly recent invasion of groundwater (Dumont, 1983).

Description of the male

Only parthenogenetic females were found by Dumont (1983). The male is similar to the female in general morphology but there are differences which can be summarized as follows:

Size

Total mean length in the adult male is 334 μm (n=18) ranging from 302–369 μm and the total mean height is 201 μm between 190 and 220 μm. In comparison with other species the size difference between males and females is minimum.

Diagnosis

Shape. The male is more rectangular than the female (Fig. 3). The posterior height and the maximum height are similar in the male, whereas in females the ratio between these two dimensions is 1:3.

Head. The rostrum in the male is more flattened than in the female. The three main connected headpores and the lateral headpores are very similar to those of the female (Fig. 3). The antennule differs chiefly in the presence of 11 terminal olfactory setae instead of the 12 present commonly in the males of the chydorids. The median long non segmented aesthetes and the lateral sensitive seta (non-pore external seta) are attached almost subdistally (Fig. 4). The antennules do not reach the tip of the rostrum but the sensory setae extend well beyond it. The ocellus and eye have little pigment, as in the female. The eye is as large as the ocellus. The labrum is triangular with a curved frontal ridge (Fig. 4). The antennae are as in the female (Fig. 4). Its antennal formula is 0(1) 0(0) 3(1)/1(0) 1(0) 3(1).

Shell(valves). The shell of the male is slightly less arched in front than that of the female. The setation on the ventral margin gives way to rows of fine spines at the posterior margin. However, in some males the setation does not quite reach the posterior corner (Fig. 4). In males, as in females, the valves are striated with approximately 14 striae that are clearly visible in the posterior ventral sector of the valves. The striation is slightly obliquous.

Trunk limbs. The first trunk is modified (Fig. 4). The outer distal lobe of endite has a well developed copulatory hook. The ascending part of the hook tapers gradually to a point where there are two ridges, and it is 1/3 longer than the descending part (Fig. 3).

Postabdomen. The male postabdomen (Fig. 4) is rectangular in such a way that the dorsal and ventral margins are parallel in the postanal section. The preanal corner is only slightly marked. The distal corner is rounded and with a cleft at the base where the claw inserts. The opening of the sperm duct is ventral to the base of the terminal claw. In the dorsal margin, the small teeth of the female are replaced by bundles of fine setae in the male. The fascicles on the lateral surface consist of clusters of fine setae of similar length and which almost reach the dorsal margin. The terminal claw is slightly bent and relatively shorter than the claw of the female. The total length of the postabdomen is 4–5 times larger than that of the claw. The basal spine is S-shaped and its length measures from 0.4 to 0.5 the length of the claw.

Relationships with other species

Dumont (1983) considers this species to be closely related to *Alona protzi*, but he had no males. I can now confirm that the *A. phreatica* male resembles *A. protzi*, in the shape of its postabdomen and headshield, and the rounded rostrum. The size dimorphism is the same in both species. Although body shape in the two species is similar, *A. protzi* has 2 teeth in the ventro-posterior corner of the valves, while *A. phreatica* has none.

With *Alona smirnovi*, another species that is

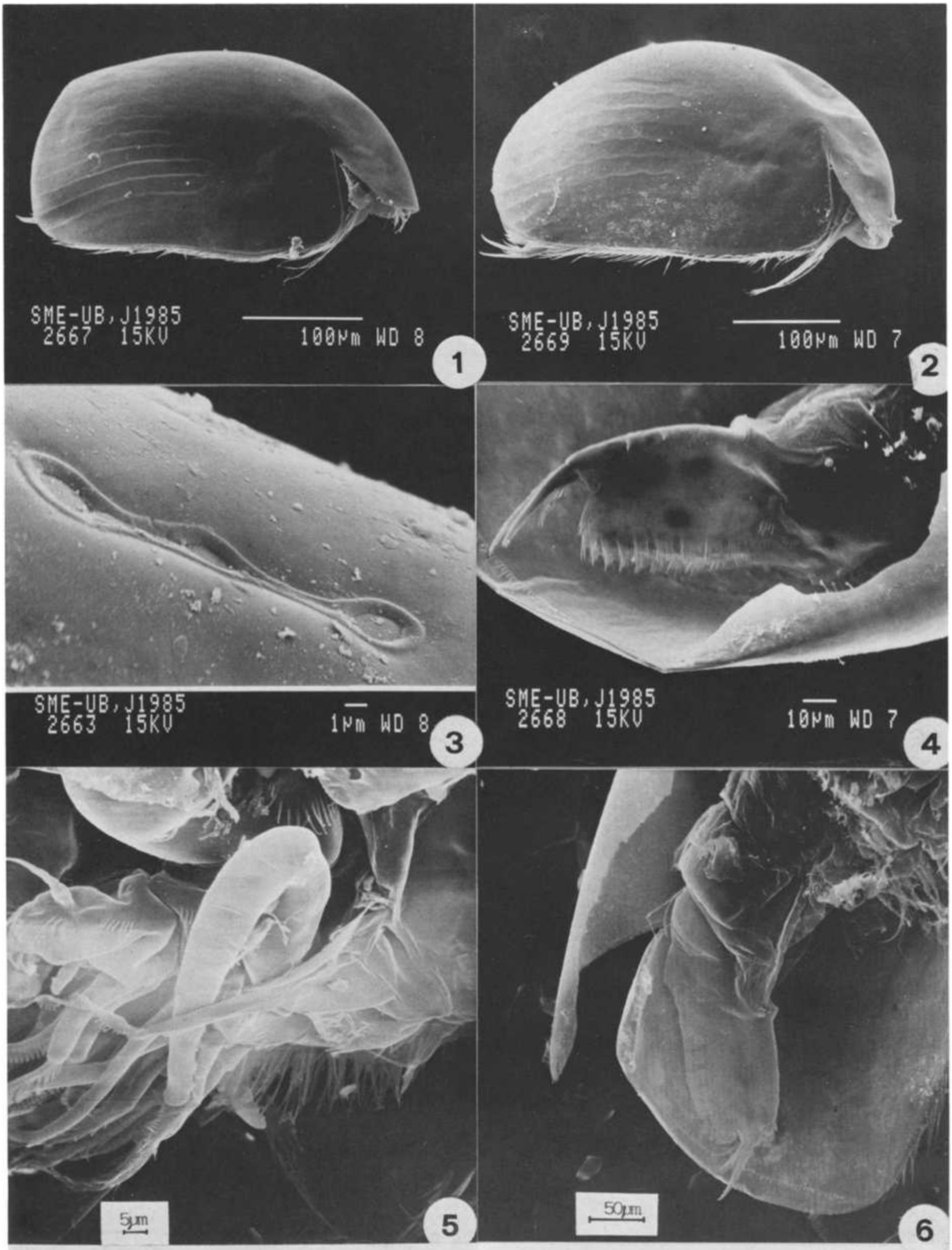

Fig. 3. Alona phreatica (T27, Ter river on 9 June 1983): 1: ♂; 2: ♀; 3: Head pores; 4: Postabdomen of female; 5: Copulatory hook; 6: Postabdomen of male, showing the setation of the posterior zone of valve.

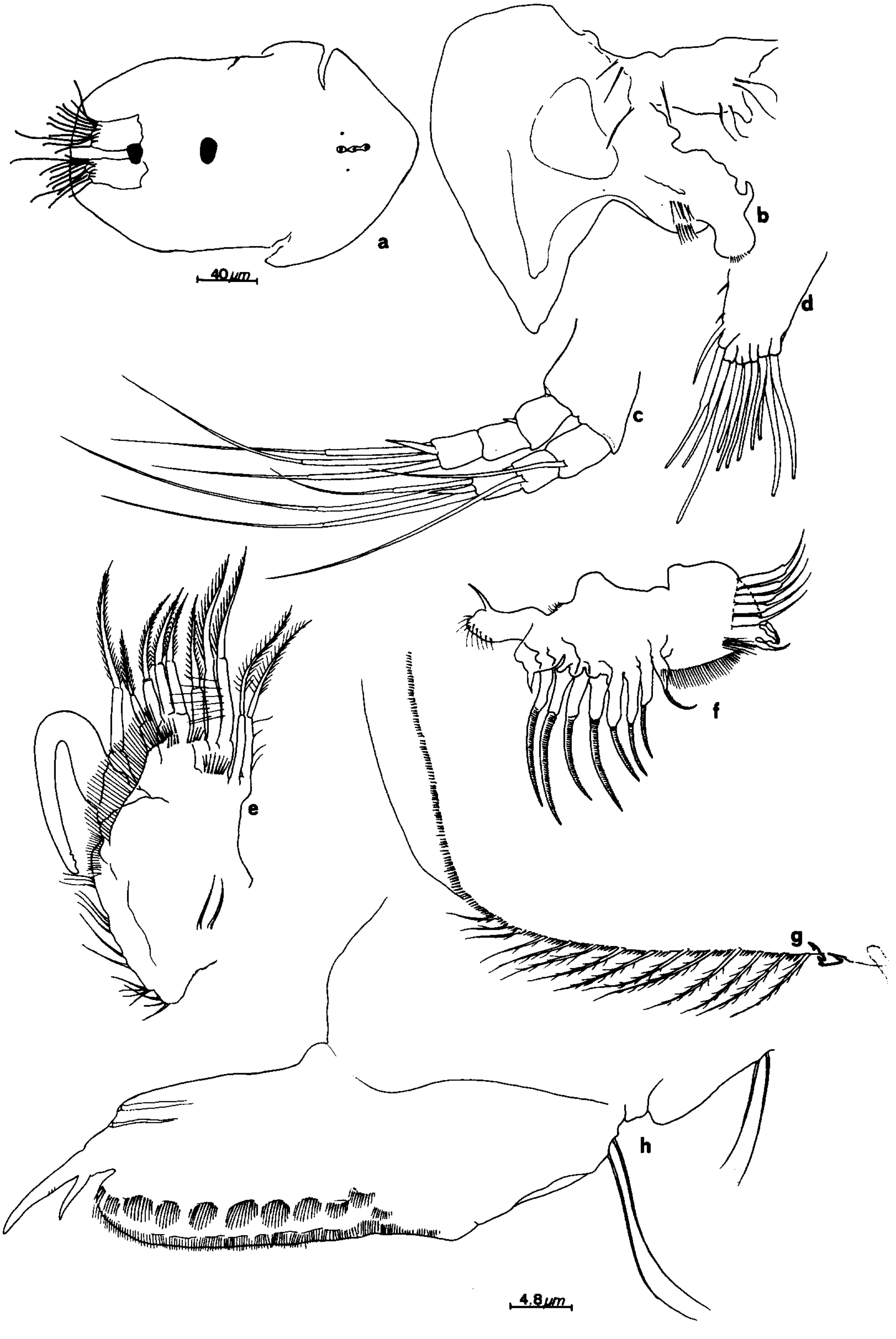

Fig. 4. Alona phreatica ♂: a: Headshield. Tip of the rostrum is flattened. b: Triangular labrum. c: Second antenna. d: First antenna with 11 olfactory setae. e: First trunk limb. f: Second trunk limb. g: Posterior zone of valve. h: Postabdomen.

morphologically close to *A. phreatica*, many differences are found: absence of the eye, the bundles of fine setae which do not reach the margin of the anal region and the basal spine which is not S-shaped.

The annual distribution of the chydorid community and the analysis of the *Alona phreatica* population in T27

This sampling station provided a large number of representatives of many crustacean groups (Harpacticoida, Amphipoda, Chydoridae, Cyclopoida and Ostracoda), as well as water mites, insect larvae (Plecoptera, Ephemeroptera and Chironomidae), Oligochaeta, Nematoda, Tardigrada and Rotatoria (Table 1).

The Chironomid larvae and the Cyclopoids were always the most abundant groups. Sometimes Oligochaets and Chydorids were also numerous. The Cyclopoids generally represented between 30 and 60% and Chironomids between 15 and 50% of the total number of specimens. In some of the samples from December 1983, January 1984 and February 1984, Chydorids made up between 34 and 41%. Tardigrads usually make up less than 5% of the total fauna but in samples from February 1983, they represented 20%. In contrast, the Harpacticoids, Ostracods and Amphipods were always numerically less important.

Comparing the number of species of Cladocera found in the samples, it is interesting to note the large number of species found at point T27. Except for one species (*A. rustica*), almost all species identified in this work, can be observed at T27.

Figure 5 shows the abundance of the different Chydorid species which were found at this point. There is a big difference in the amount of specimens and in their temporal distribution throughout the year. With the exception of *Alona phreatica*, the abundance of each species increased markedly in the samples taken the months following the period of major flow (in November 1983), and the highest number of species occurred from December to February. However, *A. phreatica* occurred mainly between March and September and its highest number was found in a June sample (800 specimens in 50 litres of water pumped) while lower numbers were recorded in August. This species and *Alona*

Table 1. The abundance of the different animal groups in 50 litres of water pumped at 27, from February 1983 to February 1984.

	Feb.	Mar.	May	June	July	Aug.	Sep.	Oct.	Dec.	Jan.	Feb.
Alona phreatica	–	339	68	799	419	6	325	2	8	–	–
Alona guttata	–	107	6	37	56	–	40	–	514	183	13
Alona rectangula	–	–	–	–	–	–	–	–	89	36	32
Alona quadrangularis	–	–	–	2	21	–	10	–	227	27	493
Pleuroxus denticulatus	–	–	–	–	–	–	15	28	182	31	42
Pleuroxus aduncus	–	–	–	–	–	4	20	4	279	58	45
Chydorus sphaericus	15	–	–	34	–	–	1	–	24	1	13
Total CLADOCERA	15	446	74	872	496	10	411	34	1323	336	638
HARPACTICOIDA	12	6	10	8	13	–	35	8	40	18	19
OSTRACODA	5	27	30	14	9	8	12	19	70	8	9
CYCLOPOIDA	203	438	1452	2169	3550	101	23	234	1250	323	267
AMPHIPODA	1	–	1	–	–	–	–	2	–	1	–
ISOPODA	–	–	–	–	–	–	–	–	–	1	–
ROTATORIA	20	–	2	14	14	4	–	4	20	–	15
TARDIGRADA	198	42	132	8	17	12	–	–	61	36	19
NEMATODA	12	4	78	35	74	5	121	5	12	27	13
OLIGOCHAETA	34	9	414	353	441	21	52	2	48	54	64
EPHEMEROPTERA larvae	2	3	36	8	7	3	–	6	50	27	137
PLECOPTERA larvae	4	1	24	31	8	20	3	3	71	9	348
CHIRONOMIDAE larvae	78	48	2688	2013	705	51	47	23	243	125	576
Other Insects larvae	2	–	–	–	28	2	–	–	–	–	6
HYDRACARINA	–	12	552	201	178	24	52	59	81	18	7

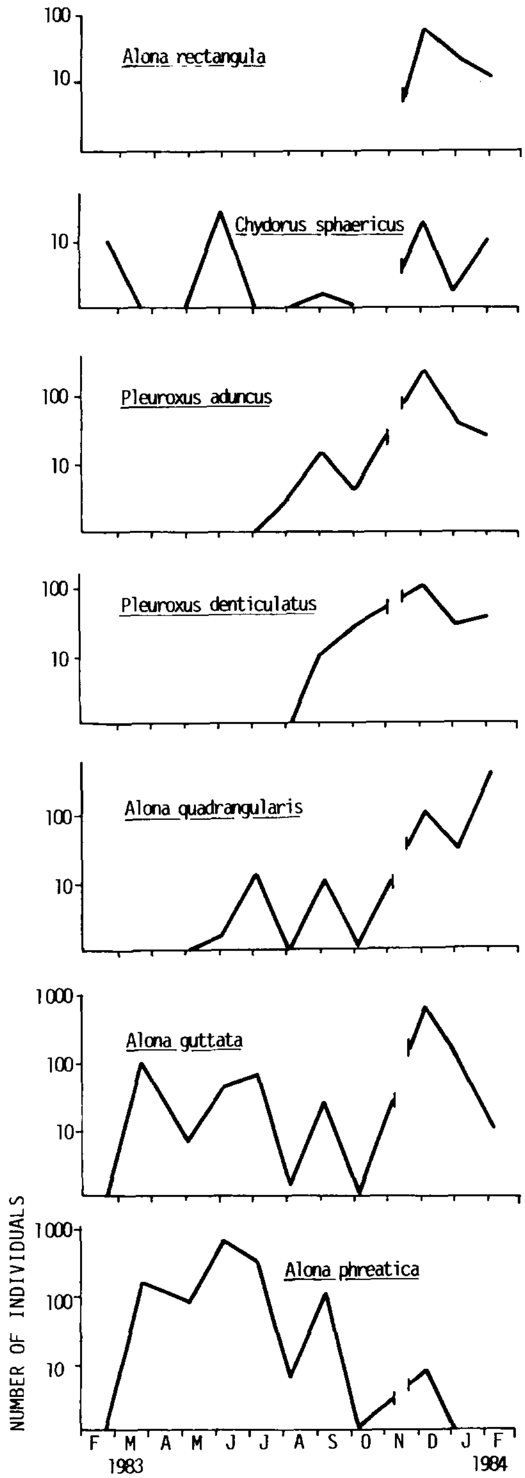

Fig. 5. The quantitative distribution throughout the year of the Chydorid species in T27. It was impossible sample in Novembre 1983 because the flow increased markedly.

guttata are the most abundant, despite the fact that the latter was rarer when both appeared together, and became more abundant after *A. phreatica* had disappeared. *A. guttata* was present in great numbers during December and January, when it made up between 40 and 50% of the total.

The first specimens of *Alona quadrangularis* appeared together with the above species in summer but it never reached more than 1%. After the major flow, it increased markedly, becoming numerically dominant in February 1984, when it reached about 80%. Similarly, *Pleuroxus denticulatus* and *Pleuroxus aduncus*, which always appear together, presented a maximum in December. Nevertheless, they were never dominant, usually made up between 6 and 20% of the total in samples where they were numerically important.

The species *Alona rectangula* and *Chydorus sphaericus* were the least abundant at this station. The latter appeared occasionally throughout the year (never more than 35 individuals per 50 litres). *Alona rectangula* occurred only from December to February (in samples collected after the month of over flow), and makes up less than 10%, despite its large numbers in December (89 individuals/50l.).

Finally, a size-frequency analysis of the *A. phreatica* population in this station was carried out because it is the only species which had males, and females with ephippium. The diagram in Fig. 6 gives an idea of the size of the different instars and general life history. The reproductive instars are marked.

The number of specimens varies considerably from month to month and peaks in June (c. 800 individuals per 50 litres of pumped water). In all, six instars could be distinguished (Fig. 6): two immature, and from the third one onwards, reproductive instars begin to appear. The smallest size at which females were carrying eggs is 335 μm.

In the June sample the first males and females with ephippium were found. The males measure 330–340μm, exceptionally up to 365 μ. They are approximately the same size as the adult females.

The distribution of instars was practically identical on all sampling occasions (Fig. 6). The calculated range of length of each instar is shown in Table 2. In the sample from March, when the first individuals began to appear, only immature instars were observed and the first instar was lacking. There were no males and only two instars of fe-

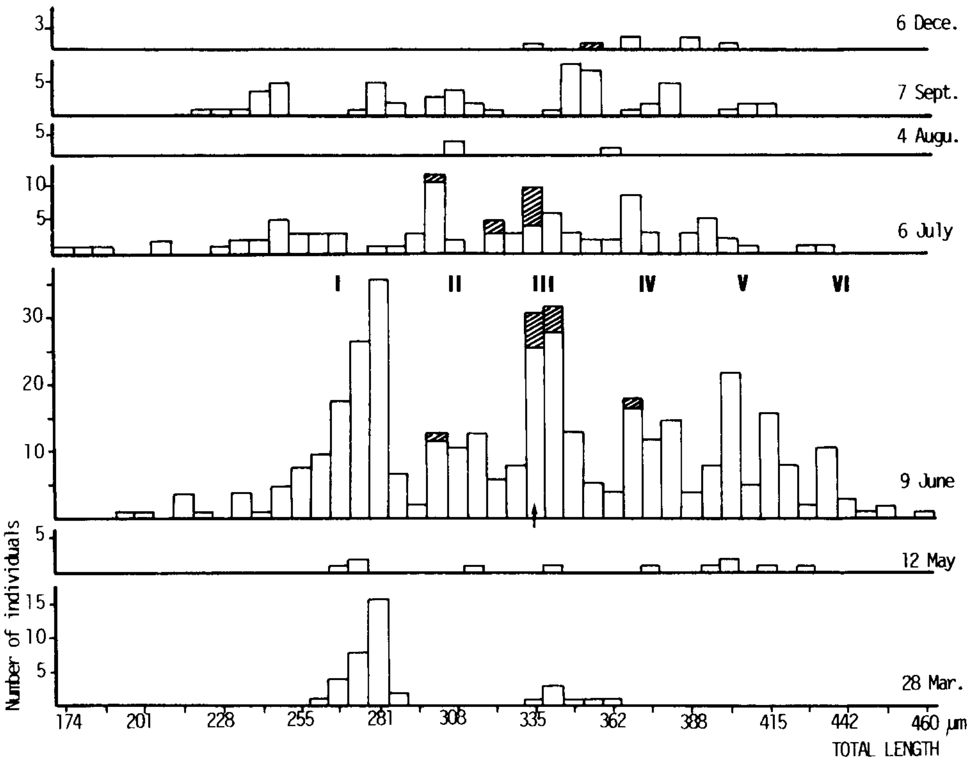

Fig. 6. Histograms showing the size structure of the population, reflecting the different instars, of *Alona phreatica* collected at T27 throughout the year 1983. The shaded portion indicates the abundance of males. The arrow shows the first reproductive instar.

Table 2. The total length of each instar of *Alona phreatica,* calculated from Fig. 6.

Instar	Range of total length in µm
I	200 – 281
II	282 – 321
III	322 – 355
IV	356 – 389
V	390 – 422
VI	423 – 455

males. In contrast, in the sample from December, only mature instars were found, and the specimens began to disappear. In this period, few female specimens and a male (350 µm) have been found. The smallest was 335 µm and the largest, 400 µm. On the other hand, in the sample from September no males were found, and the females were slightly smaller than the corresponding instars measured in other months.

Discussion

The present study shows the importance of the Cladocera species in hyporheic habitats. Until recently (Frey, 1980; Dumont, 1983) the occupation of the subterranean waters by cladocera had been ignored.

Except for *Alona phreatica*, which has only been found in interstitial waters, the rest of the species identified were previously known from surface waters. Usually these species are never abundant in surface waters. Some of them (*Alona quadrangularis, Alona rustica, Alona rectangula, Pleuroxus denticulatus*) have been observed before by (Margaritora *et al.*, 1975; Amoros, 1980; Negrea, 1983; Alonso, 1985) especially on the bank sediments in ponds very near to the rivers.

In general, almost all the species identified have been mentioned before in clear and permanent waters with moderate mineralization, and some of them show an affinity for sandy substrates. Here, all of these have been found in unpolluted sites with sandy substrate, oxygenated waters with a low organic matter content.

The large number of species and the larger numbers of individuals of each one of them have been found in a particular a sampling point (T27).

It is not known at present whether all those Cladocera follow the same life-history pattern as those of surface water. It has been postulated that they might lead a dual way of life, partly in the groundwater and partly in surface water, like many Cyclopoids and Harpacticoids (Dumont, 1983). It is not known whether these species produce smaller numbers of offspring and few ephippia and which are the circumstances of the production of ephippia, in relation with those of surface species.

In site T27 the abundance of each species in interstitial water (except *A: phreatica*) increases markedly after the period of flow (Fig. 5). A tentative explanation of the existence of this species in interstitial waters might be that it is a way to resist the drift. In agreement with this hypothesis, the chydorids appear only in the open waters during periods of low current.

Only in *Alona phreatica* was the presence of females with ephippium and of males observed. This might be because the above species came from other sites, especially from riverine standing waters. It also seems that they are not obligatory hyporheic inhabitants like *A. phreatica*, and their presence in interstitial waters may be explained simply as a protection against the drift.

Finally, of the eight chydoridae species identified, *Alona rustica* and *Alona phreatica* had not been recorded previously on the Iberian Peninsula and, likewise, this is the first description of the male of *A. phreatica*.

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