

SOME INTERSTITIAL SPECIES OF THE CRUSTACEAN COMMUNITIES OF THE TER AND EBRE RIVERMOUTHS (NE SPAIN)

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Some interstitial species of the crustacean communities of the Ter and Ebre rivermouths (NE Spain).— This paper deals with the interstitial fauna of five seashore sites: one is located in the Ter rivermouth and four in the Ebre rivermouth. Since the studies of Angelier (1950) and Delamare-Debouteville (1953, 1954) very few works have been carried out on this topic in the Catalan littoral. A number of interesting crustacea species (9 Harpacticoida, 5 Cyclopoida, 2 Cladocera and 2 Amphipoda) have been found. The majority of the identified Harpacticoida species (*Psammastacus confluens*, *Parastenhelia spinosa*, *Nitocra spinipes*) are new records for the Iberian Peninsula, and others (*Parastenocarid* sp. and *Roberigurneya* sp.) are likely to be new species.

Key words: Crustacea, Harpacticoida, Interstitial fauna, Rivermouth, Psammolittoral.

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INTRODUCTION

Littoral immersed beaches were thought to be a biologically poor habitat until the publication of the works of SASSUCHIN et al. (1927), KARAMAN (1935), HERTZOG (1936), CHAPPUIS (1942, 1946), ANGELIER (1950), DELAMARE-DEBOUDEVILLE (1957) and MOTAS (1958) among others on interstitial fauna in continental and marine waters. The interesting new habitat moved a lot of researchers to study it, and soon, the results showed a surprisingly high number of new species.

The interstitial habitat is inhabited by very varied species that are adapted to live in the capillary water between sand and gravel particles. These organisms show a considerable convergence in their adaptations. They are tiny, with long and flattened bodies, without pigments, with rudimentary vision or without eyes, with well developed sensorial setae and adherent organs and without natatory setae.

The most characteristic and abundant zoo-

logical groups are Ciliata, Tecameba, Tardigrada, Gastropoda, Oligochaeta, Nematoda, Polichaeta, Rotatoria, Crustacea (Cyclopoida, Harpacticoida, Cladocera, Ostracoda, Isopoda, Amphipoda, Syncarida, Mystacocarida), Hydracarina and Insect larvae.

The interstitial habitat has been a very important entry to groundwater colonization (MARGALEF, 1983). The knowledge of this fauna allows to set the connection between marine and hypogean fauna, because, although this connection seemed evident, it had not been proved.

The only works on interstitial fauna of the Catalan littoral have been carried out by ANGELIER (1950) and DELAMARE-DEBOUDEVILLE, 1953, 1954). This paper aims at increasing the knowledge of the psammolittoral fauna and presents new reports of interstitial crustacea of the Catalan littoral in the Ter and Ebre rivermouths. This study also shows the numerical importance of the crustacean species in a hyporheic habitat.

MATERIAL AND METHODS

Five samples were obtained, four from the Ebre rivermouth and one from the Ter rivermouth. The Ebre samples were taken in August 1984, in four different sites (fig. 1): E_1 in the mouth, E_2 in a site far away from the sea, on a river side without any littoral vegetation, E_3 near the sea in the "Eucaliptus beach", and E_4 in a sandy bank of a channel near the "Eucaliptus beach". The Ter sample was collected in May 1984 in riverine sediments, 30 m from the sea (fig. 1).

The method used to sample interstitial fauna is the same employed by Karaman and Chappuis (CHAPPUIS, 1964), that is digging a hole in the beach near the water and filtering the percolated water. The holes were 50 cm deep, the volume of filtered water was 20 liters each time, and the filter mesh diameter measured 100μ . The samples were then fixed with formalin 4% and taken to the laboratory where they were stained for 24 hours with a selective stain, rose bengal, in order to select organisms under a stereo-microscope easier.

SAMPLING SITES

River Ter

The T_1 site, at 30 m from the sea, presents a very fine sandy substrate. The hole was dug at 1 m from the river water and the percolated water was quite clear. The salinity was 6‰, the pH was 7.9 and there was 2.1 mg/l of dissolved oxygen. There was not much particulate organic material.

River Ebre

The mouth sampling site, E_1 , has brackish water. The substrate is formed by very fine and compact sand. It contains quite a lot of organic, little oxidized materials. The sediment is anoxic after the upper 15 cm. The percolated water below these 15 cm is absolutely dark.

In the E_2 sampling point (3 Km to the

mouth) the substrate is formed by fine and clear sand. Water infiltrations come from the river. Water is transparent and presents very little detritus. It usually was anoxic below the first 50 cm.

In the E_3 sampling site, in "Eucaliptus beach" the hole was dug in the sand. This point is therefore subject to wave action.

Finally, the E_4 site is near the "Eucaliptus beach", 30 m from the sea water. The hole

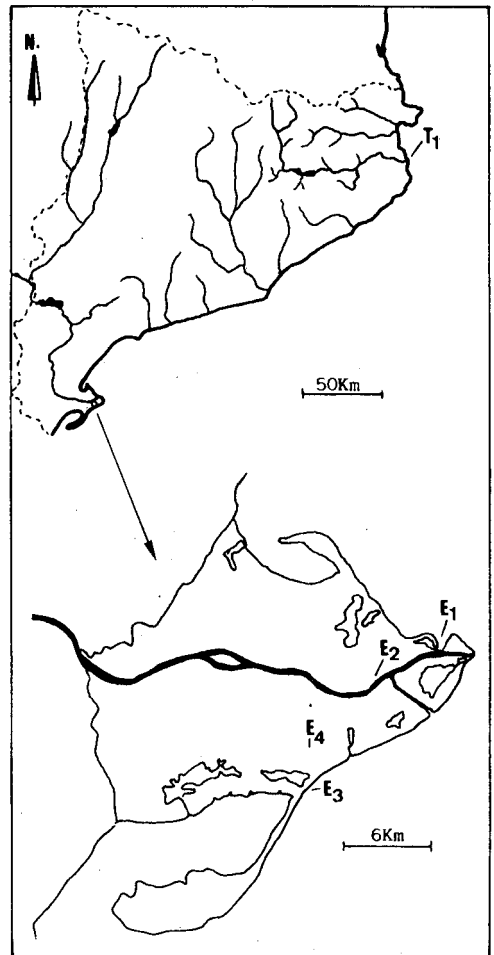


Fig. 1. Sampling sites in the Ter rivermouth (T_1) and the Ebre Delta (E_1 ... E_4).

Puntos de muestreo en la desembocadura del Río Ter (T_1) y del Delta del Ebro (E_1 ... E_4).

Table 1. Number of individuals of each group and species that have been found in five sampling points.
Número de individuos de cada especie hallados en cada uno de los cinco puntos de muestreo.

Species	Ter	Ebre ₁	Ebre ₂	Ebre ₃	Ebre ₄
TECAMEBA					
<i>Centropyxis</i> sp	+	.	.	.	.
NEMATODA	27	64	27	31	119
OLIGOCHAETA	125	2	48	40	38
POLICHAETA					
<i>Hediste diversicolor</i> (O.F. Müller, 1776)	.	6	.	.	.
ROTATORIA					
Bdelloidea	1	.	.	.	.
<i>Brachionus angularis</i> (Gosse, 1861)	.	.	.	1	4
<i>Brachionus calyciflorus</i> (Pallas, 1766)	.	.	.	.	10
<i>Brachionus quadridentatus</i> (Hermanns, 1783)	.	.	.	1	.
<i>Brachionus urceolaris</i> (O.F. Müller, 1773)	.	.	.	.	1
<i>Brachionus rubens</i> (Ehrenberg, 1838)	.	.	.	.	1
<i>Euchlanis</i> sp	4	.	.	1	.
<i>Lecane luna</i> (O.F. Müller, 1776)	.	.	.	.	2
<i>Lecane</i> sp	.	.	.	1	.
<i>Polyarthra</i> sp	.	.	.	.	2
<i>Hexarthra</i> sp	.	.	.	.	1
HARPACTICOIDA					
<i>Psammastacus confluens</i> (Nichols, 1935)	.	.	16	.	40
<i>Paraleptastacus spinicauda</i> (Scott, 1895)	2	.	.	.	.
<i>Parasthenelia spinosa</i> (Fischer, 1860)	.	1	.	.	.
<i>Robertigurneya</i> cf. <i>ecaudata</i> (Monard, 1936)	.	.	.	2	.
Copepodites of <i>Robertigurneya</i> sp	.	4	.	.	.
<i>Harpacticus littoralis</i> (Sars, 1910)	.	1	.	.	.
<i>Parastenocaris</i> sp	38	.	.	.	.
<i>Canthocamptus staphylinus</i> (Jurine, 1820)	1	.	.	.	.
<i>Nitocra spinipes</i> (Boeck, 1864)	2	.	.	.	.
<i>Bryocamptus</i> (B) <i>pigmaeus</i> (Sars, 1863)	1	.	.	.	.
CLADOCERA					
<i>Moina micrura</i> (Kurz, 1874)	.	.	.	3	2
<i>Chydorus sphaericus</i> (O.F. Müller, 1776)	8	.	.	.	.
Valves of <i>Alona rectangula</i> (Sars, 1861)	+	.	.	.	.
Valves of <i>Pleuroxus</i>	+	.	.	.	.
CYCLOPOIDA					
<i>Halicyclops rotundipes</i> (Kiefer, 1935)	.	5	.	.	.
<i>Paracyclops fimbriatus</i> (Fischer, 1853)					
Copepodites V	13	.	.	.	.
Copepodites IV	29	.	.	.	.
Nauplius	15	.	.	.	.
<i>Acanthocyclops vernalis</i> (Fischer, 1863)					
Nauplius	.	.	3	.	.
<i>Acanthocyclops robustus</i> (Sars, 1863)	.	.	.	.	1
<i>Acanthocyclops</i> sp. (copepodites IV)	.	.	.	12	6
Nauplius	.	.	.	52	8
OSTRACODA					
Valves of <i>Cyprideis</i> cf. <i>Litoralis</i>	.	+	.	.	.
Valves of <i>Heterocypris</i> sp	.	.	.	+	.
Valves of <i>Cypridopsis</i>	+	.	.	.	.
Valves of Candonidae	+	.	.	.	.
AMPHIPODA					
<i>Talitrus saltator</i> (Sars, 1890)	.	.	.	4	.
<i>Corophium orientale</i> (Schelleberg, 1928)	.	1	.	.	.
<i>Corophium</i> sp	.	1	.	.	.
TARDIGRADA					
	.	2	.	.	.
HYDRACARINA					
	1	1	.	1	.
COLEMBOLA					
	.	.	.	13	.
CHIRONOMIDAE larvae					
Orthocladiinae	.	.	.	2	.
COLEOPTERA larvae					
	.	.	.	1	.

was 40 cm deep in the side of a sandy, brackish water channel. The substrate is formed by fine sand and presents important amount of detritus.

RESULTS

Eighteen species of crustacea (9 Harpacticoida, 5 Cyclopoida, 2 Cladocera and 2 Amphipoda), 6 species of Rotatoria and 1 species of Polichaeta have been identified. Although Oligochaeta and Nematoda are very abun-

dant, they have not been identified.

Table 1 shows the abundance of the different numbers of organisms which have been found in each sampling points.

DISCUSSION

The determined species are eurihaline. Some of them are widely spread both in continental and littoral areas. It has been postulated that the simultaneous presence of the same species in distant areas allows to the affirmation

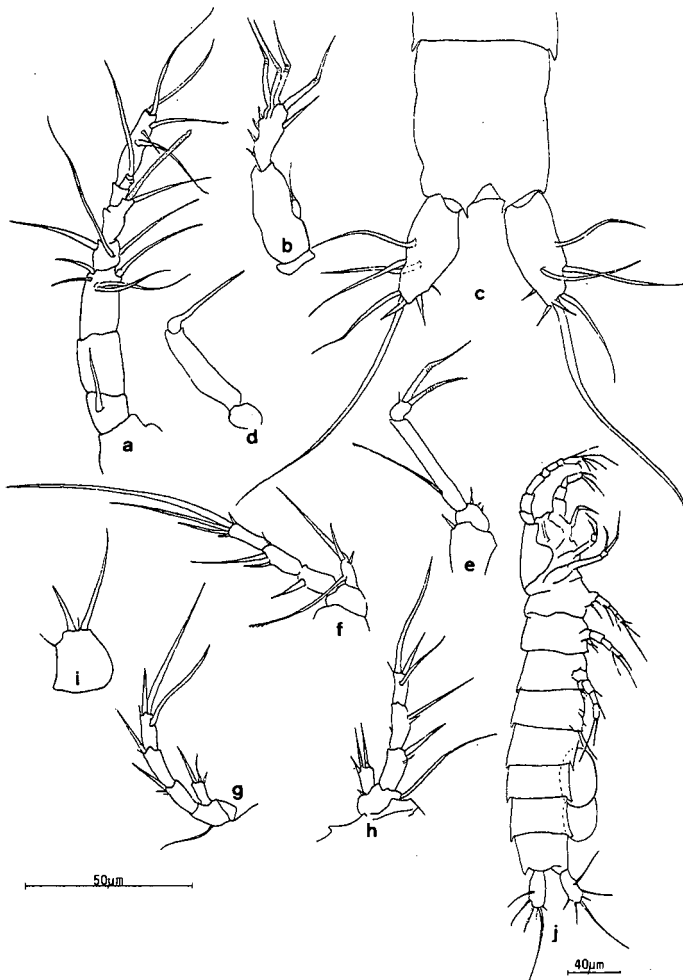


Fig. 2. *Parastenocaris* sp. ♀: a. First antenna; b. Second antenna; c. Furcal rami; d. Mxp.; e. P₁; f. P₂; g. P₃; h. P₄; i. P₅; j. Adult female (0.35 mm).

Parastenocaris sp. ♀: a. Primera antena; b. Segunda antena; c. Furca; d. Mxp.; e. P₁; f. P₂; g. P₃; h. P₄; i. P₅; j. Hembra adulta (0,35 mm).

of the existence of connection in underground world (ANGELIER, 1953). RUFO (1961) suggests that the interstitial habitat is a transition between the marine seaside and the underground environment.

In this work a high number of Harpacticoida has been found, some of them of *Parastenocaris* (fig. 2) and *Robertgurneya* (fig. 3) could be new species.

The majority of the identified Harpacticoida species are specifically psammon inhabitants, i.e., they live in sandy habitats. *Psammastacus confluens* and *Paraleptastacus spinicauda* are members of the same family. They characterized by flattened and thin bodies that allow them to live in interstitial water (LANG, 1948). Both are eurihaline species. They have been found in marine mesopsammon (GALHANO, 1970), and also in less brackish places.

The high density is also noteworthy of *Psammastacus confluens* in the E₄ site. *Harpacticus littoralis* has only been found in Ebre rivermouth (E₁). This species is adapted to live in brackish water habitats (DUSSART, 1967) and it does not seem to be usual to find it in interstitial water.

Parastenhelia spinosa and *Robertgurneya* cf. *ecaudata* belong to two different families, Parastenhelidae and Diosaccidae, that present similar ecological characteristics. Both are marine and adapted to live in mesopsammic habitats. Sometimes they are also found in psammic littorals (LANG, 1948).

Parastenocaris sp is very abundant in T₁. It is one of the many species of Parastenocariidae, many of which are endemic. These organisms are generally limited to live in psammon or hyporheic habitats in continental waters (DUSSART, 1967). The Ter rivermouth is the site where more Harpacticoida have been found. Some of them, as *Camptocamptus staphylinus* and *Bryocamptus pigmaeus*, are very common species in freshwater, but because of their euritope character, they can live in brackish water, with groundwater affinity. *Nitocra spinipes* has also been found in the Ter rivermouth. This species prefers brackish water and is eurithermic (LANG, 1948).

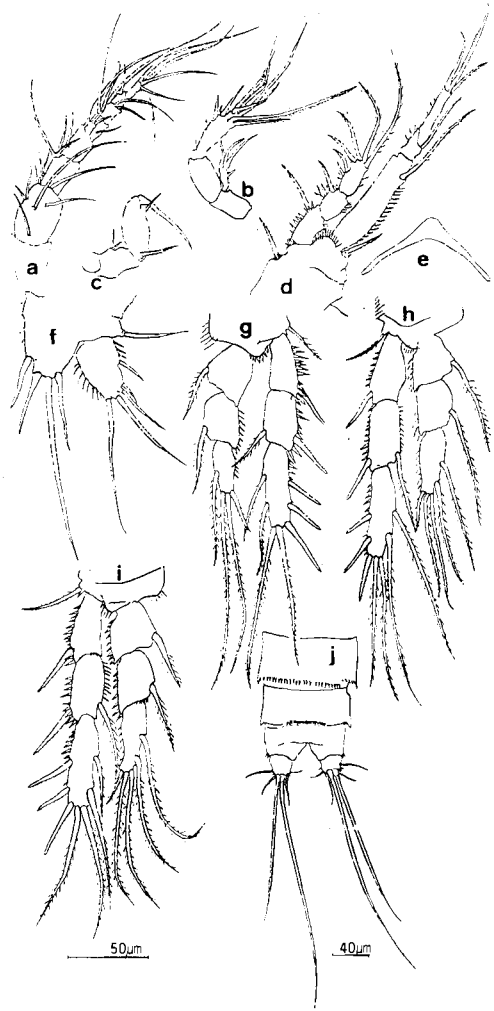


Fig. 3. *Robertgurneya* sp. ♀: a. First antenna; b. Second antenna; c. Mxp; d. P₁; e. Rostrum; f. P₃; g. P₂; h. P₄; i. P₃; j. Furcal rami.

Robertgurneya sp. ♀: a. Primera antena; b. Segunda antena; c. Mxp; d. P₁; e. Rostrum; f. P₃; g. P₂; h. P₄; i. P₃; j. Furcal rami.

The most interesting Cyclopoida species in these habitats is *Halicyclops rotundipes*. It lives in brackish water, up to 20 mS/cm (FORES et al, in press). It has been mentioned in estuarine and littoral ponds (DUSSART,

1969). The other Cyclopoida *Paracyclops fimbriatus*, *Acanthocyclops robustus* and *Acanthocyclops vernalis* are euritope species (MARGALEF, 1953; PESCE, 1979, 1980). *Paracyclops fimbriatus* and *Acanthocyclops vernalis* have been considered psammophile (ANGELIER, 1953) and troglophile (CHAPPUIS, 1953; PESCE & MAGI, 1981). LOFFLER (1961) states that *Paracyclops fimbriatus* resists 30% salinity.

The Cladocera *Chydorus sphaericus* has been found in the Ter rivermouth. It is exceptional to find it in brackish water. *Moina micrura*, which has been found in the Ebre Delta, was previously mentioned by CHINCHILLA & COMIN (1977).

Two species of Amphipoda have been found. One of them is usually considered as a psammic species, *Talitrus saltator*, because it is very common in sandy beaches of the seaside. It lives in the wave action zone. It makes galleries and holes and jumps easily (CHEVREUX, 1925). *Corophium orientale* is an infralittoral species of brackish water (RUFFO, 1982). It is suggested that this species was confused with *C. volutator* (RUFFO, 1982). This author states that the presence of *C. volutator* in the Mediterranean coasts needs much more information and study.

The interstitial population of these studied sites (Ter and Ebre rivermouths) is taxonomically interesting, especially in the case of Harpacticoida, because since the works of ANGELIER (1950) and DELAMARE-DEBOUDEVILLE (1954) there has not been any work on this subject in the Catalan littoral. There is a lot of research yet to be undertaken, as is shown by the fact that the Harpacticoida *Psammastacus confluens*, *Parastenhelia spinosa* and *Nitocra spinipes* are first mentioned here for the Iberian Peninsula. *Paraleptastacus spinicauda* is a new mention for Spain and was found in Portugal by GALHANO (1970). Other species *Robertgurneya* cf. *ecaadata* and *Parastenocaris* sp. need a revision and recollection of more material. Specially the genus *Parastenocaris* presents taxonomic problems because there are many endemic species with a very restricted biogeographic distribution.

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RESUMEN

Algunas especies intersticiales de las coimunidades de crustáceos de las desembocaduras de los Ríos Ter y Ebro.— La fauna intersticial de una estación de muestreo de la desembocadura del Río Ter, y de cuatro del Río Ebro es analizada. Entre las especies de crustáceos halladas destacan: 9 Harpacticoida, 5 Cyclopoida, 2 Cladocera y 2 Amphipoda. La mayoría de especies de Harpacticoida identificadas (*Psammastacus confluens*, *Parastenhelia spinosa*, *Nitocra spinipes*) son nuevas para la Península Ibérica. *Parastenocaris* sp. y *Robertgurneya* sp. son probablemente dos nuevas especies.

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