# 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 (*Parastenocaris* sp. and *Robertgurneya* 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-DEBOUTEVILLE (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 zoological 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 kwnowledge of this fauna allows to set the conection between marine and hipogean fauna, because, although this conection seemed evident, it had not been proved.

The only works on intestitial fauna of the Catalan littoral have been carried out by ANGELIER (1950) and DELAMARE-DEBOUTEVILLE, 1953, 1954). This paper aims at increasing the kwnowledge 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 100 μ. 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

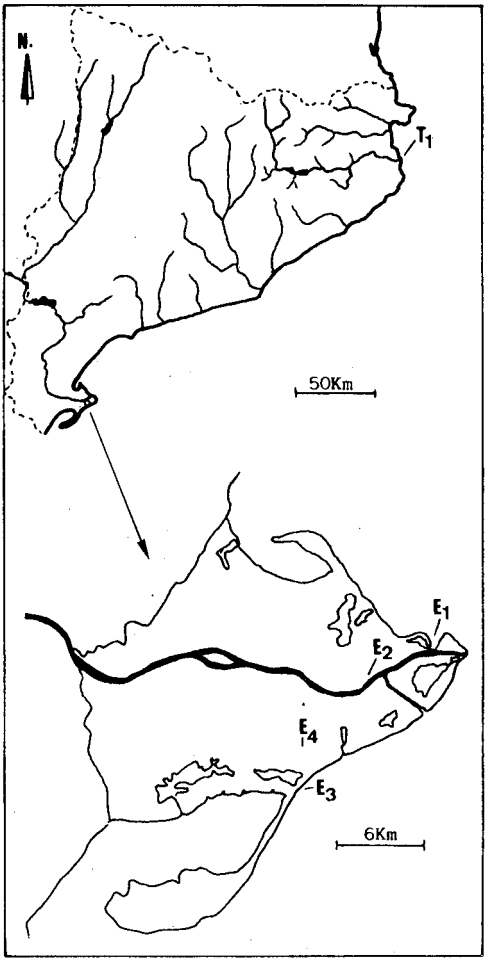


Fig. 1. Sampling sites in the Ter rivermouth ($T_1$) and the Ebre Delta ($E_1$...$E_4$).

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

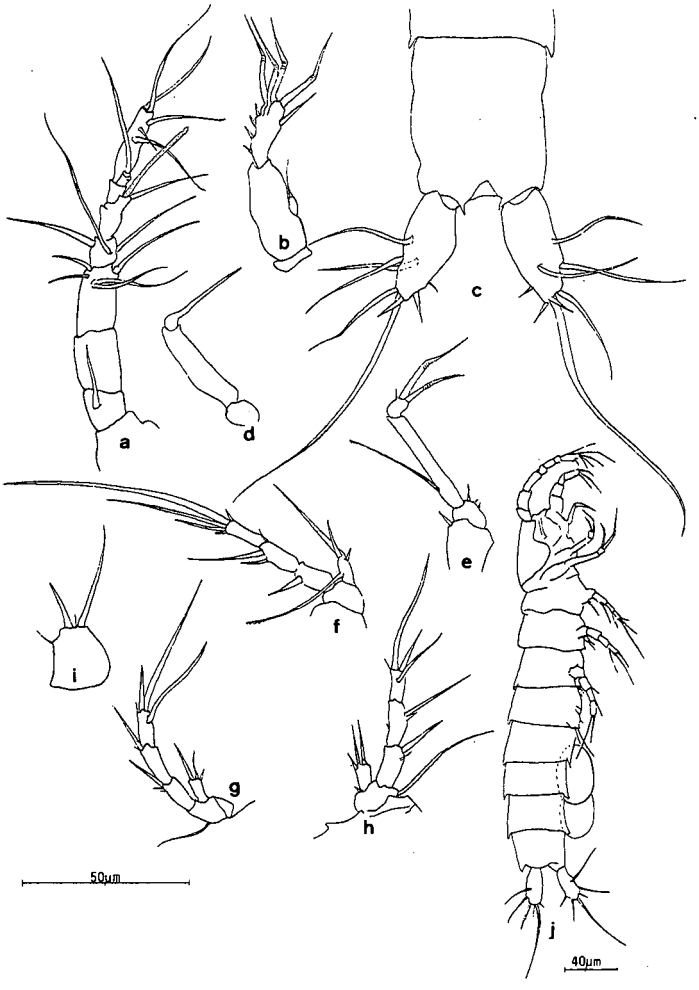


*Fig. 2. Parastenocaris* sp. ♀: a. First antenna; b. Second antenna; c. Furcal rami; d. Mxp.; e. $P_1$; f. $P_2$; g. $P_3$; h. $P_4$; i. $P_5$; j. Adult female (0.35 mm).

Parastenocaris *sp. ♀: a. Primera antena; b. Segunda antena; c. Furca; d. Mxp; e.* $P_1$; *f.* $P_2$; *g.*$P_3$; *h.* $P_4$; *i.* $P_5$; *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 $E_4$ site. *Harpacticus littoralis* has only been found in Ebre rivermouth ($E_1$). This especies 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 $T_1$. It is one of the many species of Parastenocaridae, 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 afinity. *Nitocra spinipes* has also been found in the Ter rivermouth. This species prefers brackish water and is eurithermic (LANG, 1948).

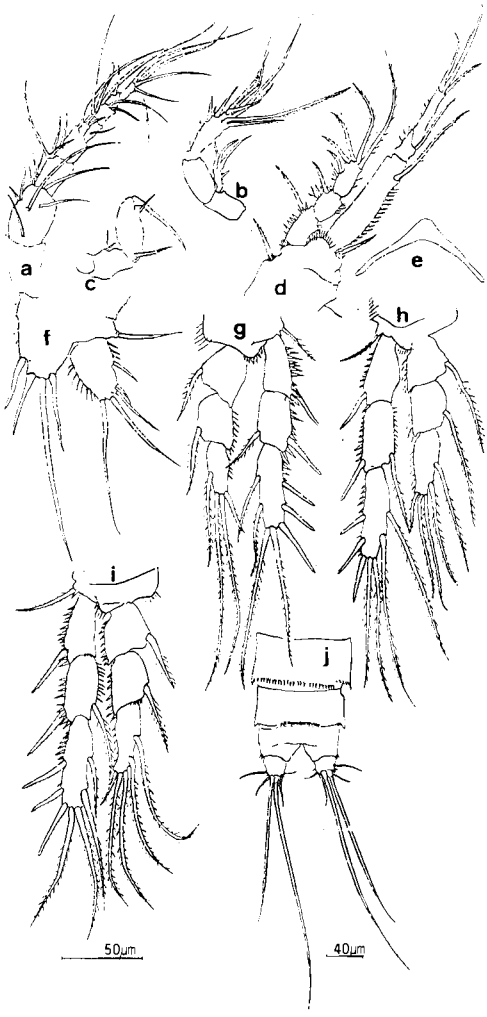


Fig. 3. *Robertgurneya* sp. ♀: a. First antenna; b. Second antenna; c. Mxp; d. $P_1$; e. Rostrum; f. $P_5$; g. $P_2$; h. $P_4$; i. $P_3$; j. Furcal rami.

Robertgurneya *sp. ♀: a. Primera antena; b. Segunda antena; c. Mxp; d. $P_1$; e. Rostrum; f. $P_5$; g. $P_2$; h. $P_4$; i. $P_3$; 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 *Acanhocyclops 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-DEBOUTEVILLE (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 Peninsule. *Paraleptastacus spinicauda* is a new mention for Spain and was found in Portugal by GALHANO (1970). Other species *Robertgurneya* cf. *ecaudata* 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 desenbocaduras 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 (*Psamastacus confluens, Parastenhelia spinosa, Nitocra spinipes*) son nuevas para la Península Ibérica. *Parastenocaris* sp. y *Robertguneya* sp. son probablemente dos nuevas especies.

REFERENCES

ANGELIER, E., 1950. Recherches sur la faune des sables littoraux méditerranéens. *Vie et Milieu,* 1(2): 185-190.
- 1953. Le peuplement des sables submergés d'eau douce. *Ann. biol.,* 29(11-12): 467-486.

CHAPPUIS, P. A., 1942. Eine neue Methode zur Untersuchung der Grundwasser-fauna. *Acta. Sci. Math. Nat. Kolozsvar.,* 6: 3-7.
- 1946. Un nouveau biotope de la faune souterraine aquatique. Bull. Sect. Sci. Acad. Roumanie, 29: 1-8.
- 1953. Nouveaux crustacés troglobies de l'Italie du Nord. *Mem. Mus. civ. Stor. nat. Verona,* 4: 1-12.

CHEVREUX, E. & FAGE, L., 1925. *Amphipodes.* Faune de France, 9. Ed. Lechevalier. Paris.

CHINCHILLA, M. & COMÍN, F. A., 1977. Contribució al coneixement dels crustacis del Delta de l'Ebre. *Tre. Inst. Cat. Hist. Nat.,* 8: 119-144.

DELAMARE-DEBOUTEVILLE, C., 1953. La faune des eaux souterraines littorales en Algérie. *Vie et Milieu,* 4(2): 470-503.
- 1954. Premières recherches sur la faune souterraine littorale en Espagne. *P. Inst. Biol. Ap.* 27: 119-129.
- 1957. Lignées marines ayant pénetre dans les eaux souterrains continentales. Un problème de biogeographie actuelle. *C.R. Somm. Soc. Biogeogr.* 1: 53-67.

DUSSART, B., 1967. *Les copépodes des eaux continentales d'Europe occidentale.* Tome I. Ed. Boubée. Paris.
- 1969. *Les copépodes des eaux continentales d'Europe occidentale.* Tome II. Ed. Boubée. Paris.

FORES, E., MENÉNDEZ, M., PRETUS, J.L. & COMÍN,

F.A., (in press). Contribución al conocimiento de crustáceos y rotíferos del Delta del Ebro. *Misc. Zool.*, 10.

GALHANO, M.H., 1970. Contribuiçâo para o conhecimiento da fauna intersticial em Portugal. *Inst. Zool. Dr. Augusto Nobre,* 110: 1-206.

HERTZOG, L., 1936. Crustacés des biotopes hypogés de la vallée du Rhin, d'Alsace. *Bull. Soc. Zoo. France,* 61: 350-372.

KARAMAN, S.., 1935. Die Fauna unterirdischen Gewässer Iugoslawiens. *Verh. Int. Ver. Limnol.,* 7: 46-73.

LANG, K., 1948. *Monographie der Harpacticiden* Vol. 2 Lund. Otto Koeltz Science Publishers.

LÖFFLER, H. 1961. Grundwasser und Brunnenostracoden aus südwestdeutchland und den vogesen. *Beitr. Naturk. Forsch. SW. Deutschlands,* 20: 31-42.

MARGALEF, R., 1953. *Los crustáceos de las aguas continentales ibéricas.* Ed. Dir. Gen. Mont. Minist. Agric. Madrid.

– 1983. *Limnología.* Ed. Omega. Barcelona.

MOTAS, C., 1958. Freatobiologia o nova ramura a limnologiei. *Natura,* 10: 95-105.

PESCE, G.L., 1979. Cyclopides des eaux souterraines phréatiches de la region des Marche, Italie Central. *Acta Mus. Mac. Sci. Nat.,* 15(8): 167-192.

– 1980. Ricerche faunistiche in acque freatiche delle Marche e stato attualle delle conoscenze sulla fauna interstiziale italiana. *Riv. Idrobiol.,* 19(3): 547-590.

PESCE, G.L. & MAGGI, D., 1981. Cyclopides et Calanoides des eaux phréatiques de la Grèce Meridionale et insulaire (Crustacea, Copepoda). *Zool. Mediterranea,* 7(1): 163-182.

RUFFO, S., 1961. Problemi relativi allo studio della fauna interstiziale iporreica. *Bull. Zool.,* 28: 73-319.

– 1982. *The Amphipoda of the Mediterranean.* Part 1. Ed. Mem. Inst. Ocean. Monaco (13). Mónaco.

SASSUCHIN, D.N., KAVANOF, N.M. & NEISWESTNW-SHADINA, K., 1927. Über die mikroskopische Pflanzen und Tierwelt der Sandfläche der Okaufer Murrow. *Russ. Hydrobiol. Z. Satow*, 6: 59-83.