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**ON *DAPHNIA* (*CTENODAPHNIA*) *SIMILIS* CLAUS, 1876
AND OTHER INTERESTING ANOMOPODS (CRUSTACEA,
BRANCHIOPODA) FROM APULIA (SOUTHERN ITALY)**

SUMMARY

This paper refers about the anomopods collected in the frame of a faunistic survey carried out in Apulia by the “Laboratorio di Zoogeografia e Faunistica” of the University of Salento. Some interesting *taxa* were found. Among these, *Daphnia* (*Ctenodaphnia*) *similis* (Daphniidae) was recorded for the first time in Italy, and *Pleuroxus letourneuxi* (Chydoridae) in Peninsular Italy. The presence of uncommon *taxa* with an unclear taxonomical status as *Daphnia* (*Ctenodaphnia*) *bolivari*, *Macrothrix groenlandica*, and *Ceriodaphnia quadrangula* var. *hamata* is briefly discussed. On the basis of samples studied, Salentine Peninsula and Gargano Promontory show a high anomopod species richness and appear to be worth of further, more punctual, studies.

RIASSUNTO

Nella presente nota sono riportati i risultati dello studio dei campioni di anomopodi (Branchiopoda) raccolti nell'ambito di indagini faunistiche condotte dal Laboratorio di Zoogeografia e Faunistica dell'Università di Lecce. Sono stati rinvenuti alcuni *taxa* di interesse da un punto vista tassonomico e faunistico: il rinvenimento di *Daphnia* (*Ctenodaphnia*) *similis* costituisce il primo reperto di questo dafnide in Italia; *Pleuroxus letourneuxi*, già conosciuto per la Sicilia e la Sardegna, è stato rinvenuto per la prima volta in Italia peninsulare. Viene brevemente discusso il rinvenimento di alcuni *taxa* poco comuni e dall'incerta posizione sistematica: *Daphnia* (*Ctenodaphnia*) *bolivari*, *Macrothrix groenlandica* e *Ceriodaphnia quadrangula* var. *hamata*.

Sulla base dei campioni studiati la Penisola Salentina ed il promontorio del Gargano sembrano ospitare una ricca fauna ad anomopodi che merita di essere studiata più estesamente.

INTRODUCTION

As often stressed, the distribution ranges of some less charismatic animal species reflects the distribution and research activity of their specialists rather than that of the species themselves (e.g. DUMONT *et al.*, 1995; MURA, 2001). The scarcity of information available on certain regions affects the understanding of distributional and ecological patterns of certain taxa and implies the impossibility of carrying on sound chorological and biogeographical studies.

Southern Peninsular Italy has been subjected only to occasional sample collections directed towards the census of its branchiopod fauna. In this scenario, a few data are available on Apulian Cladocera: out of the 102 species, and about 10 subspecies, currently known for Italian inland waters (MARGARITORA, 2005), only 6 anomopod species are to date reported for Apulia: *Daphnia curvirostris*, *Ceriodaphnia reticulata*, *Simocephalus vetulus*, *Pleuroxus truncates*, *Chydorus sphaericus* and *Tretocephala ambigua*.

These data highlight an important cognitive gap which should be fulfilled. Furthermore, Apulia represents a distinct biogeographic province within the Italian territory, and its fauna deserves more than occasional sampling.

The sampling surveys carried out in Apulia by the “Laboratorio di Zoogeografia e Faunistica” of the University of Salento led to the collection of several cladoceran species which allows the realization of a first preliminary census of the anomopods of the region.

MATERIAL AND METHODS

Sample collections were carried out in January, February and April 2005 in temporary and permanent water bodies located from sea level to 785 m a.s.l. (Tab. 1). Sixteen sites lie on the Salentine Peninsula, two on the Gargano Promontory (Fig. 1).

Samples were collected in open water by mean of a 200 µm towing net and fixed *in situ* with 1,6 % buffered formaldehyde. No samples were collected near the bottom of the water bodies or among vegetation, this way benthic crustaceans have been not exhaustively sampled.

Identification of collected animals was carried out according to SMIRNOV (1992) and KOTOV (1999) for the genus *Macrothrix*, to ORLOVA-BIENKOWSKAJA (2001) for the genus *Simocephalus*, and to BENZIE (2005) for *Daphnia* species. The species belonging to other genera were identified according to MARGARITORA (1985) and ALONSO (1996).

Tab. 1 - Sampled sites. Ti : *Triturus italicus* ; Gh : *Gambusia holbrooki* ; Cc : *Cyprinus carpio* ; Ca : *Carassius auratus*; Tt : *Tinca tinca* ; Aa : *Anguilla anguilla* ; Ms: *Mugil* sp.

SITE	NAME	Geographical Coordinates	Altitude (m a.s.l.)	Hydroperiod	Occurring vertebrates
01	Sandonaci 1	40° 26' 10,9" N 17° 55' 07,3" E	38	Temporary	-
02	Sandonaci 2	40° 26' 13,1" N 17° 55' 12,8" E	39	Temporary	-
03	Sandonaci 3	40° 26' 13,1" N 17° 55' 12,8" E	39	Temporary	-
04	Sandonaci 4	40° 26' 24,5" N 17° 55' 05,1" E	37	Temporary	-
05	Francavilla Fontana 1 (Stagno di C.da Capitolo)	40° 32' 11,3" N 17° 32' 55,5" E	140	Permanent	Ti
06	Francavilla Fontana 2	40° 32' 11,3" N 17° 32' 55,5" E	140	Temporary	Ti
07	Francavilla Fontana 3	40° 31' 48,9" N 17° 33' 29,8" E	139	Temporary	-
08	San Pancrazio Salentino	40° 24' 27,4" N 17° 50' 31,2" E	61	Temporary	-
09	Bosco Lucci - Mesagne	40° 34' 25,5" N 17° 51' 42,5" E	51	Temporary	Ti
10	Bosco Mangiato - Martina Franca	40° 44' 27,1" N 17° 14' 42,5" E	432	Temporary	Ti
11	Veglie 1	40° 20' 19,9" N 17° 59' 52,2" E	43	Temporary	-
12	Veglie 2	40° 20' 16,8" N 17° 59' 47,1" E	44	Temporary	-
13	Veglie - incrocio	40° 20' 23,0" N 17° 58' 48,7" E	51	Temporary	-
14	Bosco di Cerano - Tramazzone	40° 32' 42,2" N 18° 00' 47,7" N	12	Temporary	Ti
15	Rauccio - Torre Chianca	40° 27' 49,7" N 18° 08' 41,4" E	3	Permanent	Gh
16	Alimini Piccolo - Fontanelle	40° 10' 50,0" N 18° 26' 45,0" E	0	Permanent	Gh, Cc, Ca, Tt, Aa, Ms
17	Cutino d'Otri - Gargano	41° 47' 46,6" N 16° 01' 43,4" E	785	Temporary	Ti
18	Cutino Revitali - Gargano	41° 51' 51,9" N 16° 03' 42,9" E	270	Temporary	Ti

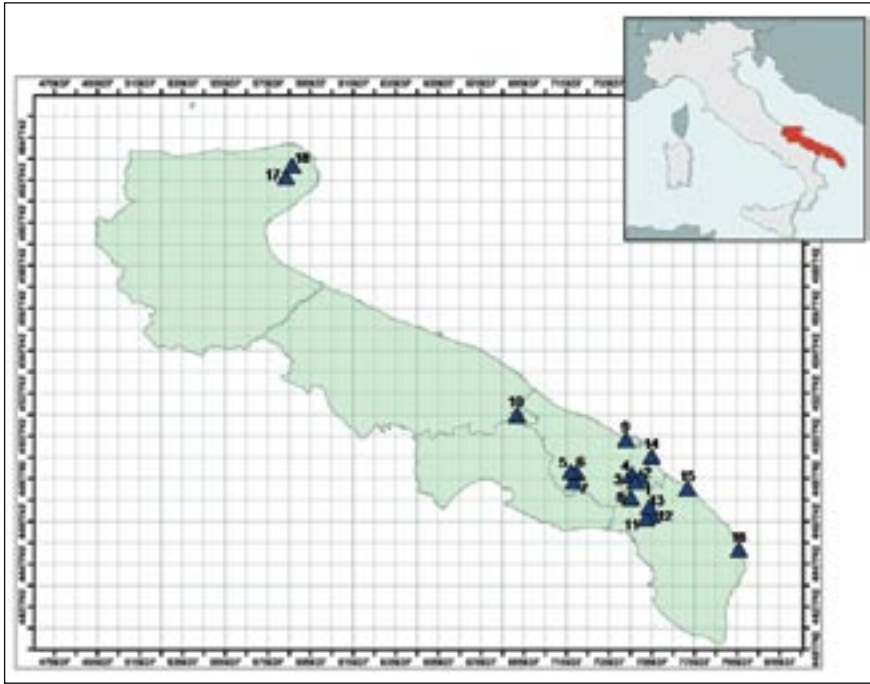


Fig. 1 - Location of the sites where Anomopoda were collected.

RESULTS

In the studied samples 17 anomopod *taxa* were found (Tab. 2). The predominance of *taxa* typical of open waters (11 species belonging to the families Daphniidae, Moinidae and Bosminidae) on the species belonging to primarily benthic families (Chydoridae and Macrothricidae, represented by 6 *taxa* only) is possibly due to the sampling technique adopted.

The only vertebrate predators present in some of the sampled sites are the newt *Triturus italicus* (Salamandridae) and the fish *Gambusia holbrooki* (Poeciliidae), *Cyprinus carpio*, *Tinca tinca* (Cyprinidae) and *Anguilla anguilla* (Anguillidae). The newts have been observed both in temporary and permanent water bodies, fish only in the permanent ones.

Among the 17 anomopod *taxa* found, *D. (C.) similis* and *P. letourneuxi* constitute the first record for Italy and Peninsular Italy, respectively. Other *taxa* are noteworthy for their uncertain taxonomical status or for being quite uncommon.

Tab. 2 - Recorded *taxa*. Chorological categories according to VIGNA TAGLIANTI *et al.* (1992). HOL, Holarctic; MED, Circum-Mediterranean; PAL, Palaearctic; PAL + ETI, Palaearctic and Ethiopic; PCO, Paracosmopolitan (*sensu* NASELLI-FLORES *et al.*, 1998); WPA, West-Palaearctic.

TAXA	Occurrence sites	Chorology
Familia Daphniidae		
<i>Daphnia (Daphnia) hyalina</i> Leydig, 1860	16	PAL
<i>Daphnia (Daphnia) obtusa</i> Kurz, 1874 emend. Scourfield, 1942	10, 17	PCO
<i>Daphnia (Daphnia) pulex</i> Leydig, 1860	09	PCO
<i>Daphnia (Ctenodaphnia) bolivari</i> Richard, 1888	01, 02, 11, 13	PAL + ETI
<i>Daphnia (Ctenodaphnia) chevreauxi</i> Richard, 1896	01, 02, 03, 04, 07, 08, 09, 11, 12, 14	MED
<i>Daphnia (Ctenodaphnia) similis</i> Claus, 1876	18	PCO
<i>Ceriodaphnia quadrangula</i> Müller, 1785	03, 04, 08, 11, 13, 18	HOL
<i>Ceriodaphnia quadrangula</i> var. <i>hamata</i> G. O. Sars, 1890	16	HOL
<i>Simocephalus vetulus</i> (Müller, 1776)	05	WPA
Familia Moinidae		
<i>Moina brachiata</i> (Jurine, 1820)	03, 04, 12, 13	PAL + ETI
Familia Bosminidae		
<i>Bosmina (Bosmina) longirostris</i> (Müller, 1776)	16	PAL
Familia Chydoridae		
Subfamilia Chydorinae		
<i>Pleuroxus letourneuxi</i> (Richard, 1888)	04, 05, 06, 13, 18	MED
<i>Chydorus sphaericus</i> (Müller, 1776)	05, 06, 15	PCO
Subfamilia Aloninae		
<i>Alona rectangularis</i> G. O. Sars, 1862	15	PAL
<i>Oxyurella tenuicaudis</i> (G. O. Sars, 1862)	15	HOL
Familia Macrothricidae		
<i>Macrothrix groenlandica</i> Lilljeborg, 1900	07, 13	PAL
<i>Macrothrix hirsuticornis</i> Norman & Brady, 1867	05	PAL

Notes on selected species

DAPHNIIDAE

Daphnia (Ctenodaphnia) bolivari Richard, 1888

Mat.: Sandonaci 1 (08/I/2005); Sandonaci 2 (08/I/2005); Veglie 1 (08/I/2005); Veglie-incrocio (07/IV/2005).

D. (C.) bolivari is a daphnid *taxon* closely related with *Daphnia (Ctenodaph-*

nia atkinsoni Baird, 1859, with which it has often been synonymized. It has a controversial taxonomical status: BUROLLET (1954) and MARGARITORA (1967, 1985) consider *D. bolivari* as an environmentally-induced form of *D. atkinsoni*, ALONSO (1996) treats it as a good species. BENZIE (2005), in his monograph on genus *Daphnia*, maintains *D. (C.) atkinsoni* and *D. (C.) bolivari* as separate species, but stresses the opportunity of further studies directed towards clarifying the taxonomical status of these *taxa*. In the present work, we followed BENZIE (2005) and, waiting for a revision of the group, treated this *taxon* as a valid species.

Daphnia (Ctenodaphnia) similis Claus, 1876

Mat.: Cutino Revitali (12/IV/2005).

D. (C.) similis is a widespread *Ctenodaphnia* known from North and South America, Eurasia and Africa. Its relationships with the closely related *taxa* *D. similoides* and *D. carinata* deserve further analysis. Furthermore, as pointed out by BENZIE (2005), it is verisimilar that under this binomem itself several cryptic *taxa* are included. In the Mediterranean area there are specific records of this *taxon* from Morocco, Tunisia (MOUELHI *et al.*, 2000), Spain (ALONSO, 1996), Turkey (USTAOĞLU, 2004) S-E Europe (FLÖSSNER, 2000) and Israel (EITAM *et al.*, 2004).

In the frame of the present study, *D. similis* (Fig. 2) was collected on April 12th, 2005 in the “Cutino Revitali”. This is a temporary pond in a pasture landscape on carbonatic substratum at 270 m a.s.l. on the Gargano Promontory. Its ponding phase lasts from November to July, fish are absent from the pond, but it is a breeding site for *Triturus italicus* and *Bufo* sp. At the sampling date, at 9.00 a.m., water was turbid due to suspended clay, water temperature was 14.4°C, electric conductivity 150 $\mu\text{S cm}^{-1}$ and pH 7.9. *D. similis* coexisted with *Ceriodaphnia quadrangula*, *Pleuroxus letourneuxi*, cyclopoid and calanoid copepods, and ostracods. The features of the collection site are in good accordance with those described by ALONSO (1996) as typical for the species.

Female: length 1,7-2,0 mm. Tail spine length 0,6-0,8 mm. Body oval, head rounded (Fig. 2A). Swimming hairs do not reach the posterior margin of carapace. Rostrum pointed, very short with little spines on the margin of the tip; antenna I presents a thin hair and aesthetes that reach and exceed the tip of the rostrum (Fig. 2B). Ventral margin of carapace with two lines of spine, one is composed by short and strong spines very close one to each other, the other one by longer and thinner spines more widely spaced (Fig. 2C). Postabdomen (Fig. 2D): three dorsal processes, length of the second intermediate between the first, the longest, and the third one, the shortest. 11 anal teeth, short and strong, equally sized. Three combs of little spines on the postabdominal claw: the first comb presents few, long spines, the third comb presents the smallest spines.

Male: only three males were found in the sample. One specimen was 1,45 mm, the others 1,5 mm in length. Head is rounded, body oval with spines on margin of carapace until on ventral margin (Fig. 2F). Antenna I long, with a short flagellum, a distal sensory seta and few short aesthetes (Fig. 2G). 6 or 7 anal spines of similar

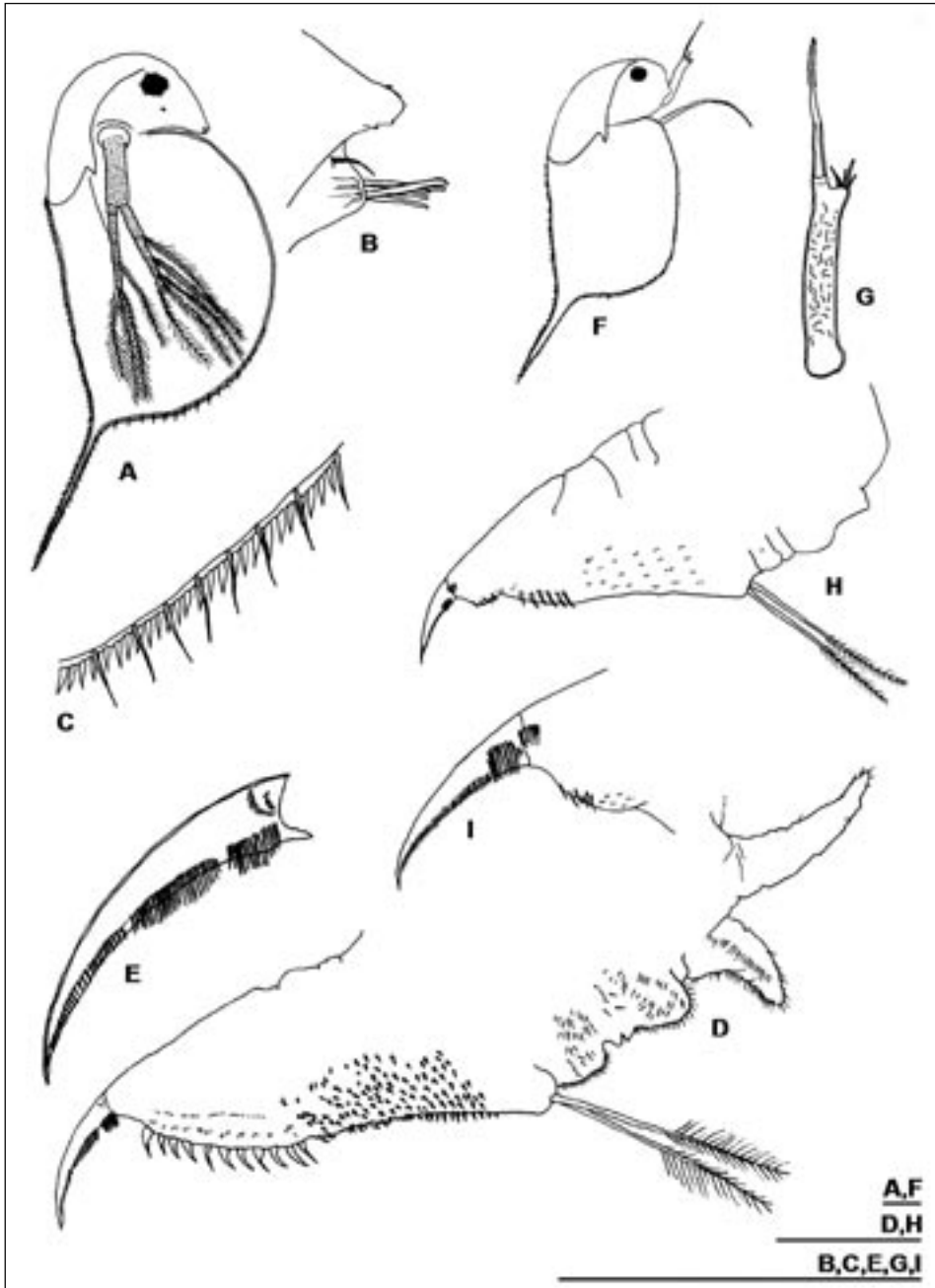


Fig. 2 - *Daphnia (Ctenodaphnia) similis*. Female: (A) habitus; (B) rostrum and antenna I; (C) detail of ventral margin of carapace; (D) postabdomen; (E) postabdominal claw. Male: (F) habitus; (G) antenna I; (H) postabdomen; (I) postabdominal claw. Scale bar: 0,2 mm.

length, and a separate group of shorter spines on ventral margin of postabdomen, near the postabdominal claw (Fig. 2H). Another group of few spines is placed near the basis of the postabdominal claw (Fig. 2I).

Ceriodaphnia quadrangula var. *hamata* G.O. Sars, 1890

Mat.: Alimini Piccolo (01/IV/2005).

Ceriodaphnia quadrangula var. *hamata* is an uncommon variety of *Ceriodaphnia quadrangula* Müller, 1758, currently known to occur in about twenty sites in North and Central Italy (MARGARITORA, *personal communication*). It differs from *C. quadrangula* s.s. in the morphology of the fornix but this feature seems to lack of taxonomic value.

CHYDORIDAE

Pleuroxus letourneuxi (Richard, 1888)

Mat.: Sandonaci 4 (08/I/2005); Francavilla Fontana 1 (07/01/2005); Francavilla Fontana 2 (07/I/2005); Veglie 1 (08/I/2005; 07/IV/2005); Veglie 2 (07/IV/2005); Veglie-incrocio (07/IV/2005); Cutino Revitali (12/IV/2005).

Pleuroxus letourneuxi is a chydorid species typical of temporary water bodies in the arid areas of circum-Mediterranean countries: it is known to occur in Spain, Turkey, Northern Africa, Malta, Israel, Sardinia and Sicily (COTTARELLI *et al.*, 1995; ALONSO, 1996; LANFRANCO, 2001; EITAM *et al.*, 2004). Its finding in Apulia constitutes the first record of this species in Peninsular Italy.

MACROTHRICIDAE

Macrothrix groenlandica Lilljeborg, 1900

Mat.: Francavilla Fontana 3 (13/II/2005); Veglie-incrocio (07/IV/2005).

The monograph on world Macrothricidae by SMIRNOV (1992) and the key to Euro-Asian *Macrothrix* by KOTOV (1999) treat *Macrothrix groenlandica* as a valid species. Conversely, MUNRO FOX (1962), USAI and MARGARITORA (1987) and ALONSO (1996) consider "*M. groenlandica*" as a "form" with no taxonomical value of *M. hirsuticornis*, which should be a species characterized by an high morphological plasticity. This opinion is reinforced by the finding of intermediate forms (MUNRO FOX, 1962; USAI and MARGARITORA, 1987). *M. groenlandica* has been found to occur syntopically and synchronically with *M. hirsuticornis* s.s. in Turkey (USTAOĞLU *et al.*, 2003), and syntopically but not synchronically in Sicily (MARRONE *et al.*, 2006).

In Apulia *M. groenlandica* was collected in 2 sites (Tab. 2), one of which close to a site hosting *M. hirsuticornis* s.s.

CONCLUDING REMARKS

In spite of the ratio 1:5 between permanent and temporary sampled sites, the

number of species recorded in both habitat typologies is comparable: 7 species were found only in permanent water bodies, 8 in temporary pools and 2 species were present in both habitat typologies. This datum, suggesting that in the studied area cladoceran species richness is likely linked to the length of the hydroperiod of the water bodies, is in good accordance with the study carried out in Israel by EITAM *et al.* (2004); nevertheless, in Apulia a bigger dataset is needed to test this hypothesis.

In contrast to what observed by BLAUSTEIN *et al.* (1996), in Apulia the coexistence of salamandrid larvae with large sized cladocerans like *Daphnia* (*Ctenodaphnia*) *chevreuxi*, *Daphnia* (*Ctenodaphnia*) *similis* and *Simocephalus vetulus* has been recorded. Moreover, in accordance to what reported in literature (e.g. MARGARITORA *et al.* 2001), fish proved to exclude large cladocerans from the sites where they occur, favouring small bodied *taxa*.

On the basis of currently available data, Apulia anomopod fauna does not show the geographically expected strong eastern or southern influences. Only 2 *taxa* (i.e. *D. chevreuxi* and *P. letourneuxi*) among the 17 collected are typical Mediterranean species, while most of them show a Palaearctic or even wider distribution. The occurrence in Peninsular Italy of *D. (C.) similis* and *P. letourneuxi* was probable and, for *D. similis*, even expected (MARGARITORA, 1985). Conversely, the finding of some populations of anomopods belonging to uncommon or controversial species is of interest for the realization of future studies and comparisons.

The present note confirms that the actual knowledge on micro-crustaceans distribution in Italy is widely incomplete and shows the need for further studies. In order to fulfil this gap several sampling campaigns have been recently carried out (e.g. MURA *et al.*, 1999; SCIROCCO *et al.*, 2002; LICCHELLI *et al.*, 2003; MARRONE, 2003a, 2003b; MURA and BELMONTE, 2004; MARRONE and NASELLI-FLORES, 2004, 2005; MARRONE and MURA, 2006; MARRONE *et al.*, 2006; MURA *et al.*, 2006; SCANABISSI *et al.*, 2006) leading to the collection of several entities new to Italian fauna or to the studied areas and confirming the richness of the still poorly-known entomostracan fauna of southern Italy. Nevertheless, much work remains undone.

In Apulia, the Gargano Promontory is at present poorly known as far as freshwater crustaceans are concerned and this territory seems to be worth of further, more punctual, samplings aimed at the study of its micro-crustacean fauna.

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