

**Metazoan parasite fauna of conger eel
Conger conger L. from
Sardinian waters (Italy)**

*Parassitofauna in grongo, Conger conger L.,
delle acque della Sardegna*

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SUMMARY - Between March and May 2006, 26 specimens of conger eel *Conger conger* L (Osteichthyes, Congridae) caught from waters near to Sardinian coast, were examined for metazoan parasites. Twenty taxa, thirteen of which identified morphologically to the species level, were recorded. The checklist compiled after this preliminary study includes 2 ectoparasites species, the copepod *Hatschekia* sp. and the polychaeta *Ichthyotomus sanguinarius*, and 18 endoparasites species comprising 8 digeneans, 3 cestodes, 6 nematodes and 1 acanthocephala. Most of this parasite species have been previously reported in conger eel from Mediterranean Sea except for *Hatschekia* sp., *Proctoeces maculatus*, *Scolex pleuronectis* and *Cucullanus bioccai*, new records for this host in the Mediterranean basin.

RIASSUNTO – Da Marzo a Maggio 2006 sono stati esaminati parassitologicamente 26 esemplari di grongo *Conger conger* L. (Osteichthyes, Congridae), pescati nelle acque circostanti le coste della Sardegna. Sono stati individuati 20 taxa, 13 dei quali identificati morfologicamente a livello di specie. L'elenco stilato dopo questo studio preliminare include 2 specie ectoparassite, il copepode *Hatschekia* sp. e il polichete *Ichthyotomus sanguinarius*, e 18 endoparassiti comprendenti 8 digenei, 3 cestodi, 6 nematodi e 1 acantocefalo. Gran parte di queste specie è stata precedentemente segnalata in gronghi del Mar Mediterraneo, eccetto *Hatschekia* sp., *Proctoeces maculatus*, *Scolex pleuronectis* e *Cucullanus bioccai*, nuove segnalazioni in questo ospite nel bacino Mediterraneo.

Key words: Conger eel, *Conger conger*, Parasites, Mediterranean basin, Sardinian Sea.

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INTRODUCTION

The conger eel, *Conger conger* L. (Osteichthyes, Congridae) is a benthic species living in rocky and sandy bottoms between 10 and 1000 m. It is widely distributed in the Eastern Atlantic, in the Western Black Sea and it is very common in all the Mediterranean Sea (Relini *et al.*, 1999). Its diet is mainly based on Osteichthyes, Crustaceans, Molluscs and Polychaeta, with feeding pattern varying in relation to living depth and to its reproductive cycle (Cau & Manconi, 1984). Previous studies on its parasitic fauna, with particular attention to Digenea, in different areas of the Mediterranean basin have been done.

From the Adriatic Sea, records of parasites of conger eel were reported by Orecchia *et al.* (1985; 1988) and Radujković *et al.* (1989); from the Tyrrhenian and Ligurian Sea by Orecchia & Paggi (1978), Paggi *et al.* (1998); from the western Mediterranean by Bartoli *et al.* (2005), but, to date, there are no detailed reports on parasite communities in specimens fished in Sardinian waters. The aim of this first study was to characterize the parasitic fauna of conger eel stock from these waters moreover contributing to the knowledge of its metazoan parasites in Mediterranean Sea.

MATERIALS AND METHODS

Between March and May 2006, 26 specimens of conger eel, ranging from 39 to 106 cm total length, fished at different depths in the Gulf of Palmas (600 m), Gulf of Cagliari (400 m) and Gulf of Arbatax (40 m) have been examined for parasitic infections. The specimens were transported to the laboratory, measured and weighed, then dissected by using standard parasitological techniques. The viscera and the gills were removed and observed together with body surface and cavities. All the parasites were removed, identified according to morphological criteria, counted and then preserved in 70% ethanol or in AFA (Alcohol, Formalin and Acetic Acid). Life stages of parasites and their sites of infections are reported in Table 1. Parasite prevalence and its 95% confidence intervals, mean intensity and abundance, listed in Table 1, were calculated according to Bush *et al.* (1997).

RESULTS

Twenty parasite taxa, thirteen of which identified to the species level, were recorded. Their list and the site of infection in the hosts are reported in Table 1. All the examined fishes were infected by at least one parasite species, reaching 100% of total prevalence of infection.

The ectoparasites were represented by two species: *Hatschekia* sp. Poche, 1902 (Copepoda) (Fig. 1, 2, 3) and *Ichthyotomus sanguinarius* Eisig, 1906 (Polychaeta) (Fig. 4, 5). The copepod specimens collected from the gills of 8 (P% = 30.8) conger eels have been morphologically ascribed to genus *Hatschekia*. The mean intensity of infection was 4.1, ranging from 1 to 12 parasites per host. The polychaete *I. sanguinarius*, the only species of the family Ichthyotomidae, has been found attached on fins and on skin of 11.5% of conger eels examined, with mean intensity of 17.3 but with a wide intensity range, being one *C. conger* heavily infected by 50 of these ectoparasites.

Endoparasites collected included 8 species of Digenea, 6 of Nematoda, 1 of Acanthocephala and 1 species of Cestoda with several larval stages belonging to Tetracanthida and Trypanorhyncha.

<i>Conger conger</i> (26)	Site(s)	P%(CI)	MI±SE	A±SE
Infected		100 (87.5-100)	62.2 ± 21.6	62.2 ± 21.6
Infected by:				
Digenea				
<i>Lecithochirium rufoviride</i>	S	69.2 (48.6-85.4)	6.3 ± 2.1	4.4 ± 1.5
<i>Lecithochirium fusiforme</i>	S	42.3 (23.8-62.6)	6.8 ± 3.5	2.9 ± 1.6
Hemiuridae sp.	S	26.9 (11.7-47.4)	3.0 ± 1.1	0.8 ± 0.4
<i>Prosorhynchus crucibulum</i>	I	30.8 (14.6-51.4)	3.7 ± 1.1	1.3 ± 0.5
<i>Prosorhynchus aculeatus</i>	I	26.9 (11.7-47.4)	59.0 ± 23.5	15.9 ± 7.9
<i>Dolichoenterum longissimum</i>	S	3.8 (0.0-19.4)	1.0	0.04 ± 0.04
<i>Helicometra fasciata</i>	I	3.8 (0.0-19.4)	2.0	0.1 ± 0.1
<i>Proctoeces maculatus</i>	I	3.8 (0.0-19.4)	13.0	0.5 ± 0.5
Cestoda				
Tetraphyllidea sp. *	I	38.5 (20.6-58.9)	56.0 ± 35.3	21.5 ± 14.2
<i>Scolex pleuronectis</i> *	I	34.6 (17.6-55.2)	16.5 ± 4.9	5.1 ± 2.1
Trypanorhyncha spp. *	I - GB	7.7 (0.0-24.9)	5.5 ± 0.5	0.4 ± 0.3
Nematoda				
<i>Hysterothylacium</i> sp. *	VC	61.5 (41.0-79.4)	3.3 ± 0.6	2.0 ± 0.5
<i>Cucullanus bioccai</i>	S - I	46.2 (27.0-66.2)	6.3 ± 2.4	2.9 ± 1.3
Nematoda sp. *	I - VC	23.1 (9.0-43.3)	1.8 ± 0.4	0.4 ± 0.2
<i>Anisakis simplex</i> type I *	S - I	11.5 (1.69-29.9)	1.0 ± 0.0	0.1 ± 0.1
<i>Cristitectus congeri</i> *	I	7.7 (0.0-24.9)	1.5 ± 0.5	0.1 ± 0.1
<i>Anisakis simplex</i> type II *	I	3.8 (0.0-19.4)	1.0	0.04 ± 0.04
Acanthocephala				
Acanthocephala sp.	I	3.8 (0.0-19.4)	1.0	0.04 ± 0.04
Polychaeta				
<i>Ichthyotomus sanguinarius</i>	F	11.5 (1.69-29.9)	17.3 ± 16.3	2.0 ± 1.9
Copepoda				
<i>Hatschekia</i> sp.	G	30.8 (14.6-51.4)	4.1 ± 1.4	1.2 ± 0.5

Legenda: * = larvae; G = gills; F = fins; S = stomach; I = intestine; GB = gall bladder; VC = ventral cavity.
 (* = larva; G = branchie; F = pinne; S = stomaco; I = intestino; GB = vescica natatoria; VC = cavità ventrale).

Table 1 - Parasite species of *Conger conger* from Sardinian waters.
 Tabella 1 - Specie parassite di *Conger conger* delle acque della Sardegna.

Adults of Digenea belonging to 8 species included in 4 families were identified by morphological analysis. Among these families, Hemiuridae, represented by *Lecithochirium rufoviride* (Rudolphi, 1819) Lühe, 1901 (Fig. 7), *Lecithochirium fusiforme* Lühe, 1901, and an unidentified species, showed the higher prevalence of infection (80.8%). All the specimens were collected from the hosts' stomach.

Bucephalidae of the species *Prosorhynchus crucibulum* (Rudolphi, 1819) Odhner, 1905, *Prosorhynchus aculeatus* Odhner, 1905 (Fig. 6), both in intestine, and *Dolichoenterum longissimum* Ozaki, 1924, in stomach, infected 12 conger eels (P% = 33.3).

Helicometra fasciata (Rudolphi, 1819) Odhner, 1902 (Opecoelidae) and *Proctoeces maculatus* (Looss, 1901) Odhner, 1911 (Fellodistomidae) (Fig. 8) showed prevalence of 3.8%, being both detected in the intestine of one host.

Larval stages of Cestoda occurred in 38.4% of conger eels. Identification to species level was possible only for *Scolex pleuronectis* Muller, 1788 (Fig. 9), while morphology of Tetraphyllidea and Trypanorhyncha larvae (Fig. 10) didn't allow further identification. All the specimens were found in the intestine, except for one infection by Trypanorhyncha, observed also in gall bladder.

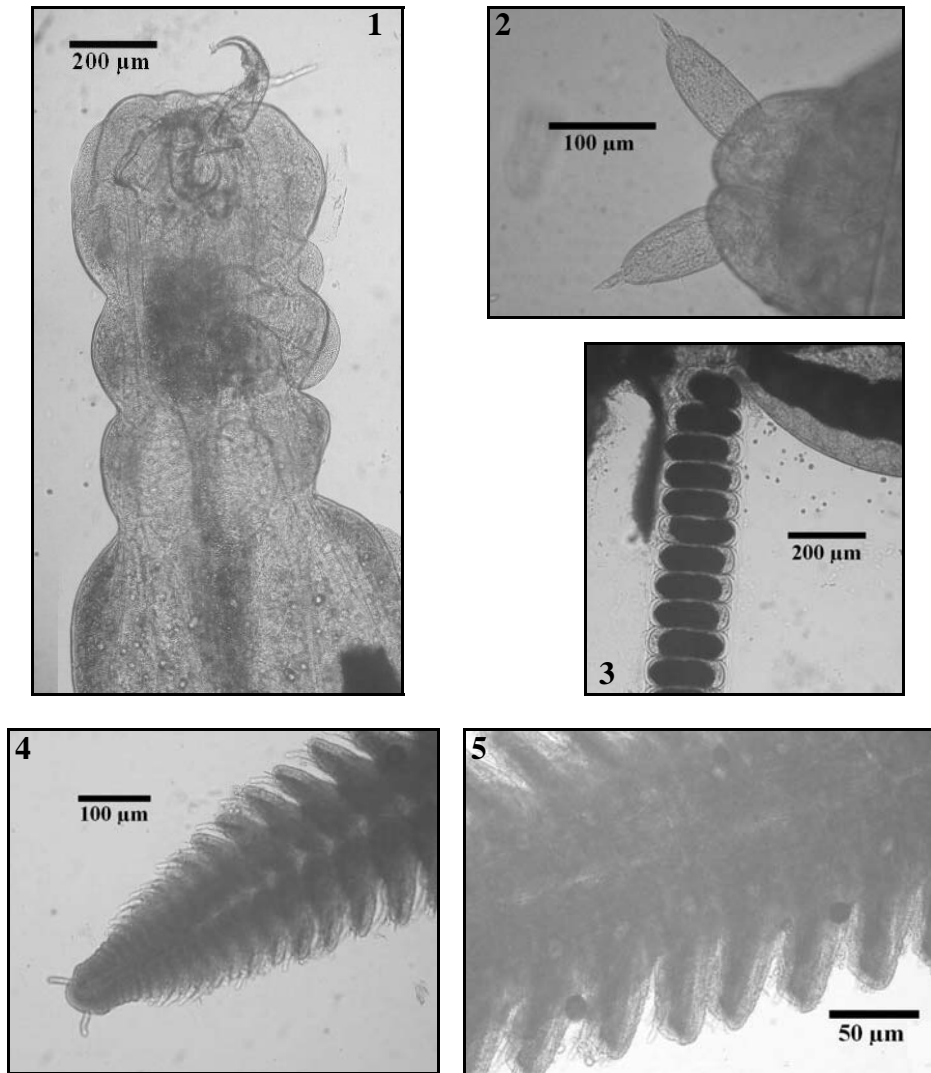


Plate 1 – Figure 1 – *Hatschekia* sp., cephalothorax. Figure 2 – *Hatschekia* sp., uropods. Figure 3 – *Hatschekia* sp., portion of an egg sac. Figure 4 – *Ichthyotomus sanguinarius*, hindbody. Figure 5 – *Ichthyotomus sanguinarius*, eggs between pseudopods.

Tavola 1 – Figura 1 – *Hatschekia* sp., cefalotorace. Figura 2 – *Hatschekia* sp., uropodi. Figura 3 – *Hatschekia* sp., porzione di sacca ovigera. Figura 4 – *Ichthyotomus sanguinarius*, estremità posteriore. Figura 5 – *Ichthyotomus sanguinarius*, uova.

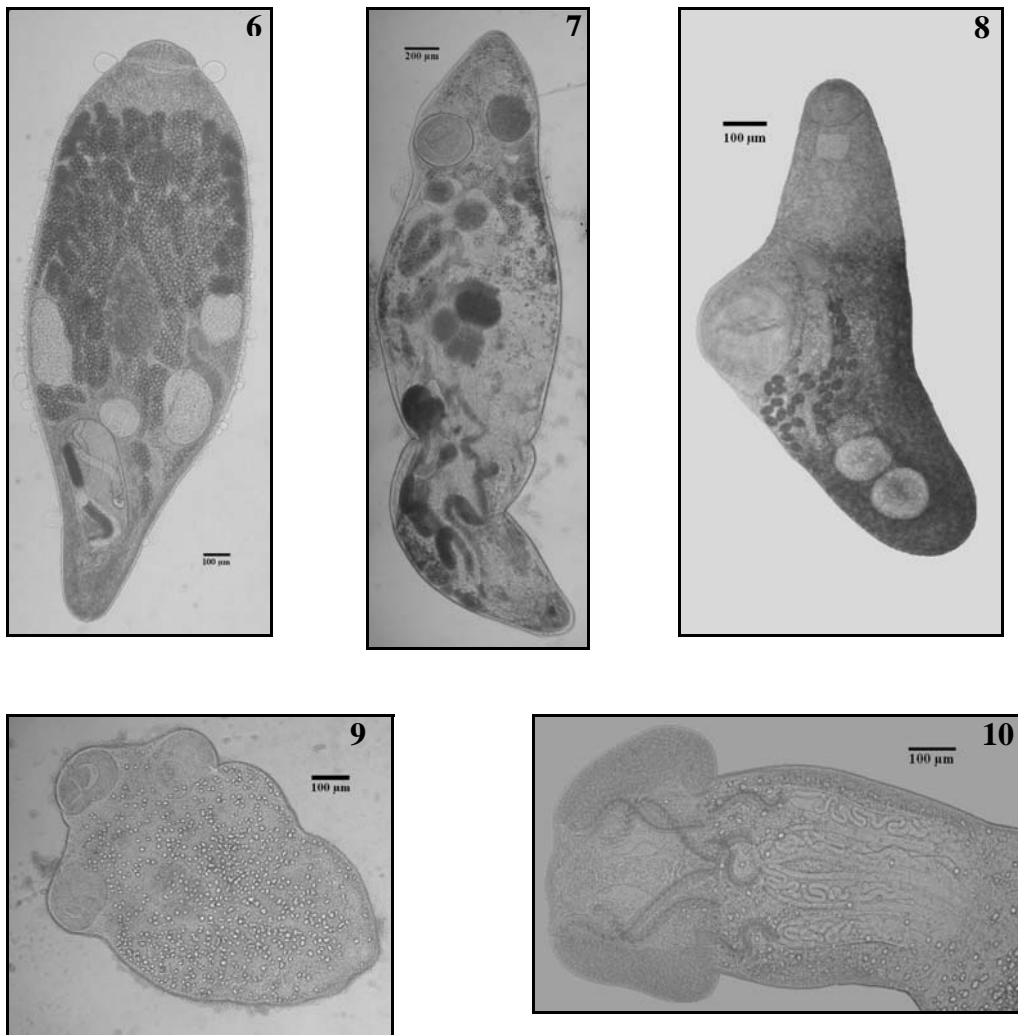


Plate 2 – Figure 6 – *Prosorhynchus aculeatus*, adult. Figure 7 – *Lecithochirium rufoviride*, adult. Figure 8 – *Proctoeces maculatus*, adult. Figure 9 – *Scolex pleuronectis*. Figure 10 – *Trypanorhyncha* sp., larva.

Tavola 2 – Figura 6 – *Prosorhynchus aculeatus*, adulto. Figura 7 – *Lecithochirium rufoviride*, adulto. Figura 8 – *Proctoeces maculatus*, adulto. Figura 9 – *Scolex pleuronectis*. Figura 10 – *Trypanorhyncha* sp., larva.

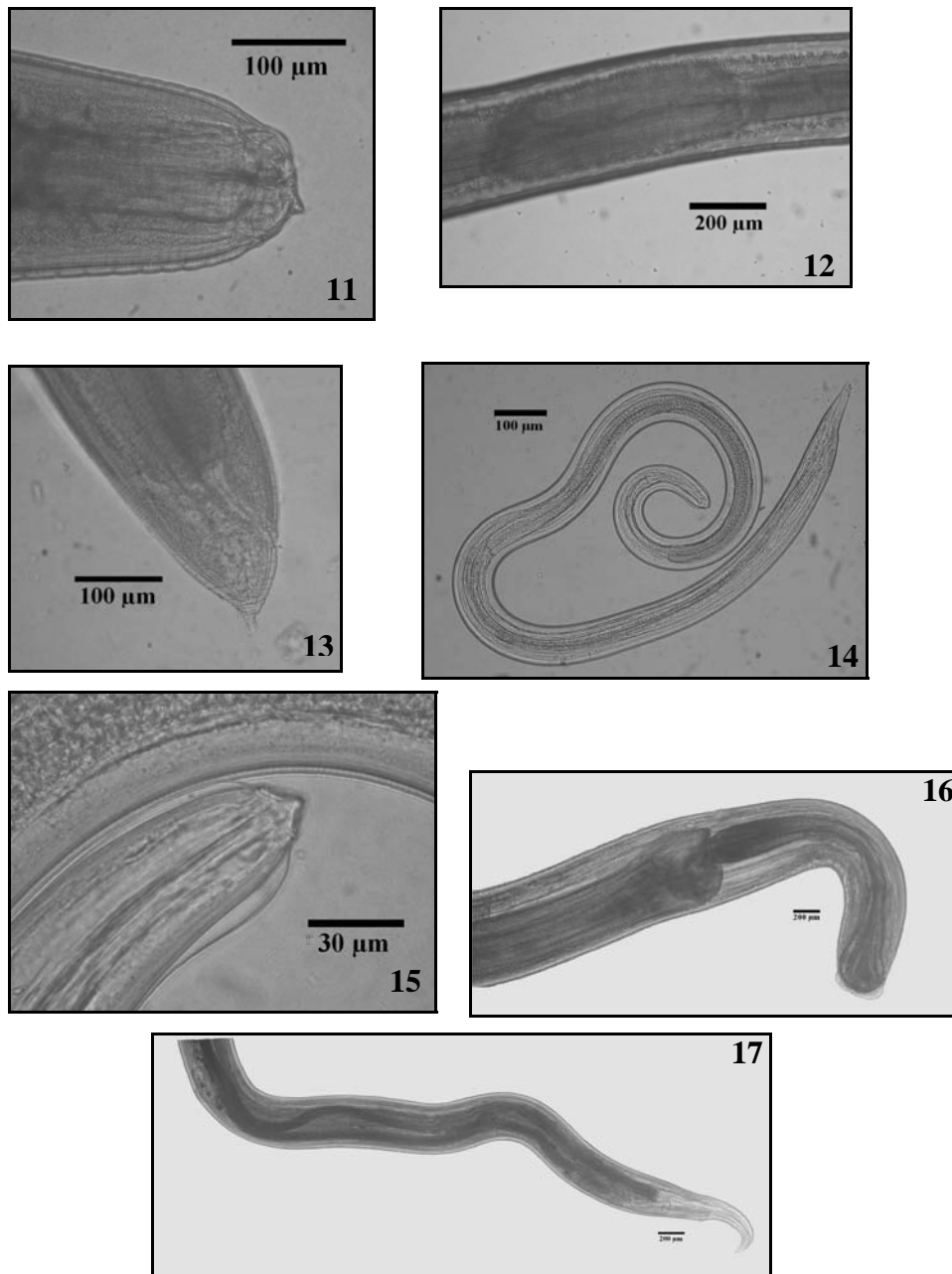


Plate 3 – Figure 11 – *Anisakis simplex* Type I, head. Figure 12 – *Anisakis simplex* Type I, ventriculum. Figure 13 – *Anisakis simplex* Type I, caudal portion. Figure 14 – *Cristitectus congeri*, adult. Figure 15 – *Cristitectus congeri*, anterior portion. Figure 16 – *Cucullanus bioccai* adult female, anterior portion. Figure 17 – *Cucullanus bioccai* adult female, caudal portion.

Tavola 3 – Figura 11 – *Anisakis simplex* Tipo I, estremità anteriore. Figura 12 – *Anisakis simplex* tipo I, ventricolo. Figura 13 – *Anisakis simplex* Tipo I, estremità caudale. Figura 14 – *Cristitectus congeri*, adulto. Figura 15 – *Cristitectus congeri*, adulto, estremità anteriore. Figura 16 – *Cucullanus bioccai* femmina adulta, estremità anteriore. Figura 17 – *Cucullanus bioccai* femmina adulta, estremità posteriore.

Six taxa of Nematoda were detected: *Anisakis simplex* Type I (Fig. 11, 12, 13) and Type II larvae (*sensu* Berland 1961), *Cristitectus congeri* Petter, 1970 (Cystidicolidae) (Fig. 14, 15), both found in intestine, *Cucullanus bioccai* Orecchia & Paggi, 1987 (Fig. 16, 17) found both in intestine and stomach and *Hysterothylacium* sp. larvae Ward & Magath, 1917 encysted on the connective tissues in the visceral cavity. Almost all of these worms were not viable so that it was difficult to determine their species. Larvae belonging to an undetermined species, encysted in intestine and ventral cavity of 6 conger eels (P% = 23.1) were also observed. Altogether, Nematoda infections occurred in 84.6% of the sample.

Only one Acanthocephala sp. in the posterior intestine of one specimen of *C. conger* was found (P% = 3.8). The morphological features of this specimen didn't allow to have a further classification.

DISCUSSION AND CONCLUSION

Results obtained in this study indicate that all the parasite species recognized in conger eel from Sardinian waters were already reported in specimens from different areas of Mediterranean Sea, except for *Hatschekia* sp., *P. maculatus*, *S. pleuronectis*, *C. bioccai* and *C. congeri*, new records for Mediterranean conger eel populations.

The occurrence of the Copepoda *Hatschekia* sp. is a new finding in *C. conger* both from Mediterranean and Eastern Atlantic areas. Belonging to the same family, *Congericola pallidus* was already reported by Paggi *et al.* (1998) in specimens from central and southern Tyrrhenian sea.

The presence of *I. sanguinarius* was already mentioned by Stoch (2003) in Gulf of Naples. This parasite, as reported by Martin & Britayev (1998), is specific for Congridae. Normally the infection is due to a couple of worms (male and female) that lives attached to the fins. Otherwise, in this study a very heavy infection by 25 couples of worms, attached also to the skin, was observed.

Among Digenea, the most abundant group in terms of number of species, the Hemiuridae *L. rufoviride* and *L. fusiforme* were reported in Mediterranean areas. *L. rufoviride* by Orecchia & Paggi, (1978) and by Paggi *et al.* (1998), both by Bartoli *et al.*, (2005). Their infections, each with a prevalence of more than 80%, were detected and noticed as most common in the Eastern Atlantic (Vilas & Paniagua, 2004).

The Hemiuridae sp. observed in this study may be *L. musculus*, yet reported in *C. conger* from Mediterranean Sea (cited by Radujković *et al.*, 1989), but its morphological features didn't allow an accurate identification. A proper diagnosis should be obtained by molecular analysis as done by Vilas *et al.* (2003) for specimens collected in Eastern Atlantic.

The Bucephalidae *P. crucibulum* and *D. longissimum* were already detected in different Mediterranean areas (Orecchia *et al.*, 1988; Radujković *et al.*, 1989; Paggi *et al.*, 1998). *P. crucibulum* and *P. aculeatus* were recently detected by Bartoli *et al.* (2005) in specimens from the Scandola Nature Reserve off Corsica, both with prevalences higher than those recorded in this investigation.

The infection prevalences of *H. fasciata* and *P. maculatus* were very low. *H. fasciata* has already been detected in conger eels from Mediterranean areas, as cited by Radujković *et al.* (1989) and observed by Bartoli *et al.* (2005), while *P. maculatus* is, in this study, firstly reported in this host. Several species of Teleosts harbour the adults of this Fellodistomidae, while larval stages usually occur in mussels. Sporocysts and cercariae, infecting *Mytilus galloprovincialis* from St. Gilla lagoon (Gulf of Cagliari) have been recently found (unpublished data).

Digenea is the most well represented taxa within the whole parasite community of *C. conger*. Among this group the species *L. rufoviride* has the greatest prevalence of infection (P% = 69.2), and *P. aculeatus* shows the greatest mean intensity and abundance, respectively of 59.0 and 15.9.

In spite of this the Cestoda reached the higher number of specimens. Larvae of Trypanorhyncha spp. and Tetrphyllidea spp. were previously detected in this host by Orecchia & Paggi (1978) and Paggi *et al.* (1998), while *S. pleuronectis* was observed in Eastern Atlantic conger eels by Sanmartin *et al.* (2000), with prevalence (24.32 %), mean intensity (4.17) and mean abundance (1.01) lower than those estimated in this study.

Six species of Nematoda have been detected, all at larval stage except for *C. bioccai* which has previously reported by Orecchia & Paggi (1987) in *Mugil cephalus* caught in Lake Sabaudia. The most represented Nematoda was *Hysterothylacium* sp., larvae found in 61.5% of conger eels, with a low mean intensity of 3.3. Different species of this genera, *H. aduncum* (Orecchia & Paggi, 1978; Orecchia *et al.*, 1985) and *H. fabri* (Hristovsky & Jardas, 1991) were observed in Mediterranean. Larvae of *C. congeri* showed a value of prevalence similar to that recorded by Quintero *et al.* (1989) from Eastern Atlantic, respectively of 7.7% and 8.2%. Larvae of Anisakis Type I and Type II, identified by morphological analysis *sensu* Berland 1961, were found with different prevalences, respectively of 11.5% and 3.8%. Paggi *et al.* (1998) reported adults of *A. pegreffii* in specimens from Tyrrhenian sea. Diagnostic enzymatic analysis would be useful to determine the correct identification of the larvae collected.

The results of this study indicate that the parasite fauna of conger eel may be different in the three fishing areas, but the low number and the dishomogeneity of the samples from each of these suggest the advisability of widening this research in order to give a correlation between parasite communities, geographical areas, living depth and age of hosts. Additional data may allow to indicate the use of parasite species as biological tags for *C. conger* stocks discrimination.

Furthermore, considering the whole sample and comparing the results of this study with those carried out in Atlantic conger eel populations it appears that the parasite fauna of conger eels in the Mediterranean basin is more varied since the number of species detected results higher than those reported in Eastern Atlantic by previous authors (Quinteiro *et al.*, 1989; Sanmartin *et al.*, 2000; Santos & Gibson, 2002; Vilas *et al.*, 2003; Vilas & Paniagua, 2004).

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