Mesopot. J. Mar. Sci., 2012, 27 (2): 140 - 156

Occurrence of five nematode species from some Red Sea fishes, Yemen

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(Received: 13 February 2012 - Accepted: 1 April 2012)

Abstract - Between September 2010 and May 2011, a total of 228 specimens belonging to 11 different species of marine fishes were collected from Al-Mehwat fish market at Hodeidah city, Yemen, to be investigated for nematode infections. Five species of nematodes, belonging to three families, were detected. These were the adult form of *Cucullanus bourdini* Petter and Le Bel, 1992 and the third larval stages of *Anisakis simplex* (Rudolphi, 1809), *Terranova* sp., *Hysterothylacium* sp. and *Echinocephalus overstreeti* Deardorff & Ko, 1983. *C. bourdini* was recorded from three fish species, *A. simplex* from all the eleven examined fish species, *Hysterothylacium* sp. from eight fish species, while both *Terranova* sp. and *E. overstreeti* were recorded from one fish species only. Adult nematodes were detected from fish intestine, while the larval parasites were detected from fish body cavity, mesenteries, stomach, intestine, liver, spleen, gonads and kidneys. For each parasite species, the prevalence, mean intensity and abundance were calculated for each infected host species. *C. bourdini*, *Terranova* sp. and *Hysterothylacium* sp. are recorded here for the first time from the Red Sea fishes of Yemen, while *A. simplex* and *E. overstreeti* were previously reported from some Red Sea fishes of Yemen. Among these five parasites, both *A. simplex* and *Hysterothylacium* sp. are known to have zoonotic importance.

Key words: Parasites, Nematodes, Fishes, Red Sea, Yemen, Zoogeography.

Introduction

The marine nematodes are grouped in 10 orders, 78 families, 708 genera and 5872 species in addition to 168 species which are placed in Nematoda incertae sedis (WoRMS, 2012). Although nematodes have been collected from many tissues and organs within fishes, adult nematodes are moderately site specific within the fishes. Adult cucullanid, gnathostomatid and anisakid nematodes are typically found in the digestive tract (Olsen, 1974; Moravec and Nagasawa, 2000).

Generally, nematode life cycles have five growth stages separated by four molts. The first four stages are larval and designated L_1, L_2, L_3, and L_4 while the fifth stage is the sexually mature adult (Olsen, 1974). The larva, hatching from the egg, is assumed to L_2 that is sheathed in the cuticle of the L_1. When L_2 stage is ingested by a crustacean, it molts to the L_3 which is infective for the final host. Furthermore, L_3 are encapsulated in the viscera of teleosts. Larval size appears important. Larvae developing in an invertebrate host smaller than 3 mm will encapsulate in a fish as L_3 stage, but those bigger than 3 mm remain in the fish gut, grow and molt twice until the adult stage in final host (Berland, 1998).

Some nematodes are responsible for human infections caused by the consumption of raw, undercooked, and not adequately salted, pickled, or smoked seafood (Adams *et al.*, 1997). Some genera of Anisakidae, important for public health, include *Anisakis*, *Pseudoterranova*, *Gnathostoma*, *Eustrongylides*, *Contracaecum*, *Phocascaris* and *Hysterothylacium* (Berland, 2006). The nematodes are one of the most important agents for financial losses in the marketing value of fish (Shih *et al*., 2010). They can cause the death of or disease in teleosts (Dick and Choudhury, 1995). Therefore, these infections should be taken into serious consideration for wild and cultured marine fish.

Only two works were done on the nematodes of marine fishes of Yemen. Al-Zubaidy (2010) reported the third larval stages of *A. simplex* from five fish species: *Lethrinus lentjan* (Lacepède, 1802), *Lethrinus nebulosus* (Forsskål, 1775), *Carangoides bajad* (Forsskål, 1775), *Rastrelleger kanagurta* (Cuvier, 1816) and *Variola louti* (Forsskål, 1775) taken from Al-Mehwat fish market, Al-Hodeidah city. Al-Zubaidy (2011) reported the larval forms of *E. overstreeti* from *Abalistes stellaris* (Bloch and Schneider, 1801) from Al-Hodeidah and Luhaya fish markets. Hence, the present investigation was aimed to gain more information on nematodes infecting other Red Sea fishes with emphasis on those of human health concern.

Materials and Methods

A total of 228 fish specimens from 11 different species of marine fishes were bought from Al-Mahwat fish market, Hodeidah city during the period from September 2010 to May 2011. Originally, all these specimens were fished from the Red Sea. These fishes included two species of the family Serranidae; *Epinephelus guttatus* (Linnaeus, 1758) and *Epinephelus tauvina* (Forsskål, 1775), two species of the family Sphyraenidae; *Sphyraena barracuda* (Edwards, 1771) and *Sphyraena jello* Cuvier, 1829, four species of the family Lutjanidae; *Lutjanus fulviflamma* (Forsskål, 1775), *Lutjanus gibbus* (Forsskål, 1775), *Lutjanus kasmira* (Forsskål, 1775) and *Pristipomoides filamentosus* (Valenciennes, 1830), one species of the family Balistidae; *Abalistes stellaris* and two species of the family Carangidae; *Carangoides fulvoguttatus* (Forsskål, 1775) and *C. bajad*. Fish scientific names are in accordance with Froese and Pauly (2012).

Fishes were maintained in isothermal boxes with ice and carried to the laboratory of Marine Biology and Fisheries Department, Hodeidah University. In the laboratory, they were measured to the nearest cm total length, and were dissected immediately by using a dissection microscope. Fishes were thoroughly examined for helminth parasites in the stomach, intestine, body cavity, liver, spleen, gonads and kidneys. The parasites were isolated, fixed, stained and mounted according to Amlacher (1970). Figures were drawn with the aid of a camera lucida and photographs were taken with Panasonic type camera model DMC.TZ2, Japan.

Parasite measurements were taken to the nearest millimeters. Parasitological indices such as prevalence (P), mean intensity (I) and mean abundance (A) were calculated in accordance with Bush *et al.* (1997). Identification of the nematodes was done according to the contributions of Anderson (2000), Timi *et al*. (2001) and Bicudo *et al*. (2005).

Results and Discussion

Out of the 228 marine fish specimens examined, 98 fishes were infected with nematodes. The following is a systematic account of such nematodes based on the World Register of Marine Species (WoRMS, 2012).

Phylum Nematoda
Class Secernentea
Order Ascaridida
Family Cucullanidae
Subfamily Cucullaninae
Cucullanus bourdini Petter and Le Bel, 1992
Family Anisakidae
Subfamily Anisakinae
Anisakis simplex (Rudolphi, 1809)
Terranova sp.
Subfamily Raphidascaridinae
Hysterothylacium sp.
Order Spirurida
Family Gnathostomatidae
Subfamily Gnathostomatinae
Echinocephalus overstreeti Deardorff and Ko, 1983

The parameters of infection (prevalence, intensity and abundance) of the studied fishes with these nematodes are demonstrated in Table (1).

1- *Cucullanus bourdini* Petter and Le Bel, 1992 (Fig. 1):

Description (based on 4 males and 6 females): Medium sized nematodes, body whitish, elongated, with slightly transversely striated cuticle, usually somewhat narrowed at region of middle part of esophagus. Esophagus muscular, somewhat expanded at the anterior end to form a rather large, elongate pseudobuccal capsule (esophastome); posterior part of esophagus also expanded, as wide as pseudobuccal capsule or slightly broader or narrower, opening into intestine through a valve. Excretory pore far posterior to level of deirids.

Female (Fig. 1 A, B): Body long and slender, measures 15.5-19.0 (17.5) long x 0.37-0.45 (0.40) wide. Dorsoventral elongated stoma. Esophagus 1.35-1.50 (1.40). The distance from cephalic extremity of nerve ring is 0.40-0.48 (0.45). Vulva not salient, posterior to the middle of the worm body; ovejector short directed anteriorly; uteri opposed, containing immature eggs. Eggs oval, thin walled, 0.65-0.80 (0.75) long x 0.30-0.49 (0.45) wide. Anterior ovary extends almost beyond the junction of esophagus and intestine, posterior ovary almost reaches the anus. A pair of phasmids situated midway between anus and posterior end; phasmids measured 0.14 from tip of tail. The tail is conical, 0.370-0.410 (0.390) long.

Male (Fig. 1C): Length of body 12.9-16.0 (13.5), width 0.27-0.35 (0.30). Esophagus narrow, measures 1.20-1.28 (1.25) in length. The distance from cephalic extremity of nerve ring is 0.35-0.44 (0.39). Length of spicules 0.57-69 (0.65). Precloacal sucker present; cloaca prominent with non sclerotized wall. Papillae, 3 pairs, the anterior - most just in front of the sucker; four

pairs of ad-cloacal papillae, three sub-ventral and one lateral pair; four pairs of post- cloacals, 2 pairs sub-ventral, one lateral situated on the level or just in front of the anterior pair of sub-ventrals. Phasmids situated anterior to the other pairs of post-cloacal papillae. Tail smooth, conical, 0.21-0.25 (0.23) long.

Parameters of Infection: A total of 12 adult *C. bourdini* were picked up from the intestine of five *P. filamentosus*, one *L. fulviflamma* and two *L. gibbus*. Details of the prevalence, intensity and abundance of infection of these host species are demonstrated in Table (1).

The genus *Cucullanus* Müller, 1777 includes 29 species parasitizing various marine fishes around the world (WoRMS, 2012) as well as a large number of species parasitizing various freshwater and brackishwater fishes around the world (Moravec *et al.*, 2005). Among these species is *C. bourdini* which was originally described from *Aprion virescens* Valenciennes, 1830, *Pristipomoides flavipinnis* Shinohara, 1963 and *P. filamentosus* from New Caledonia, Australia by Petter and Le Bel (1992). Since then, it has been reported only twice. Morand and Rigby (1998) recorded it from *Balistapus undulatus* (Park, 1797), *Lutjanus gibbus* and *Myripristis kuntee* Valenciennes, 1831 from French Polynesia. Moravec and Justine (2011) reported this worm from *Pristipomoides auricilla* (Jordan, Evermann and Tanaka, 1927) and *P. filamentosus* off New Caledonia. Therefore, the present report considerably extends the geographic range of *C. bourdini* to the Red Sea, reports *L. fulviflamma, L. gibbus* and *P. filamentosus* as hosts for this parasite for the first time in the Red Sea coastal waters of Yemen (Table 1), adds *L. fulviflamma* as a new host record in the world and extends the number of hosts of *C. bourdini* in the world to eight hosts.

2- Larva of *Anisakis simplex* (Rudolphi, 1809) (Fig. 2):

Parameters of Infection: A total of 317 third stage larvae of *A. simplex* were picked up from the body cavity, stomach, mesenteries, intestine, liver, spleen, gonads and kidneys of the 11 inspected fish host species (Table 1). Among these hosts, the prevalence ranged from 5-50 %, while the intensity ranged from 3-11.7 and the abundance from 0.2-3.4. Details of the parameters of infection of each host species are demonstrated in Table (1).

The present larvae of *A. simplex* are identical with those reported by Al-Zubaidy (2010) from five fish species (*L. lentjan, L. nebulosus, C. bajad, R. kanagurta* and *V. louti*) from Al-Mehwat fish market, Al-Hodeidah city, including *C. bajad* of the present study. So, *C. bajad* is recorded here as a host for this parasite for the second time in the Red Sea and the remaining ten hosts of the present study (Table 1) are now considered as new hosts in the Red Sea.

The genus *Anisakis* includes ten distinct species (WoRMS, 2012). Among these species, three species are the most important from a public health point of view. These have been described within the *A. simplex* complex: *A. simplex* (sensu stricto) found in the North Atlantic and North Pacific, *A. simplex* C found in the North Pacific and South Atlantic and *A. pegreffii* found in the Mediterranean Sea and the South Atlantic Ocean (Mattiucci *et al.*, 1997).

Table 1. Prevalence (P), mean intensity (I) and mean abundance (A) of nematodes of some fish species from Red Sea, Yemeni coastal water.

Parasite species	Fish species	No. of Examined fishes	No. of Infected fishes	P (%)	Total no. of parasites	I	A
Cucullanus bourdini	*L. fulviflamma*	20	1	5.0	1	1.0	0.1
	L. gibbus	20	2	10.0	3	1.5	0.2
	P. filamentosus	30	5	16.7	8	1.6	0.3
Anisakis simplex	*E. guttatus*	20	5	25.0	34	6.8	1.7
	E. tauvina	20	1	5.0	3	3.0	0.2
	S. barracuda	15	1	6.7	8	8.0	0.5
	S. jello	15	4	26.7	21	5.3	1.4
	L. fulviflamma	20	10	50.0	67	6.7	3.4
	L. gibbus	20	6	30.0	44	7.3	2.2
	L. kasmira	20	3	15.0	17	5.7	0.9
	P. filamentosus	30	7	23.3	28	4.0	0.9
	A. stellaris	28	3	10.7	35	11.7	1.3
	C. bajad	20	5	25.0	48	9.6	2.4
	C. fulvoguttatus	20	3	15.0	12	4.0	0.6
Terranova sp.	*A. stellaris*	28	3	10.7	4	1.3	0.1
Hysterothylacium sp.	*E. guttatus*	20	9	45.0	18	2.0	0.9
	E. tauvina	20	2	10.0	6	3.0	0.3
	S. barracuda	15	3	20.0	14	4.7	0.9
	S. jello	15	4	26.7	26	6.5	1.7
	L. gibbus	20	6	30.0	41	6.8	2.1
	P. filamentosus	30	3	10.0	17	5.7	0.6
	A. stellaris	28	3	10.7	22	7.3	0.8
	C. bajad	20	4	20.0	18	4.5	0.9
Echinocephalus overstreeti	*A. stellaris*	28	5	17.9	7	1.4	0.3
Totals		228	98	42.9	502	5.1	2.2

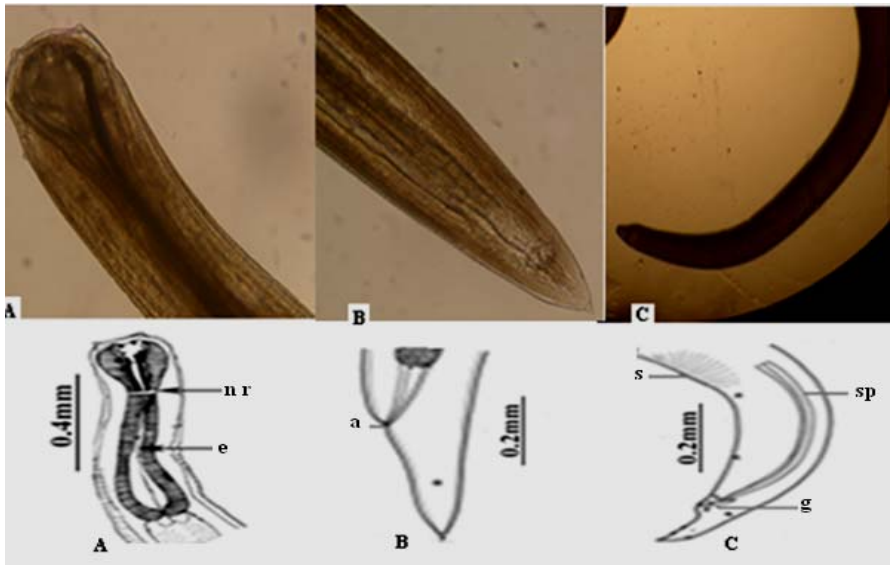

Figure 1. Adult form of *C. bourdini*. A- anterior end of female, B- posterior end of female, C- posterior end of male.
a= anus, e= esophagus, g= gubernaculum, n r= nerve ring, s= sucker, sp= spicules.

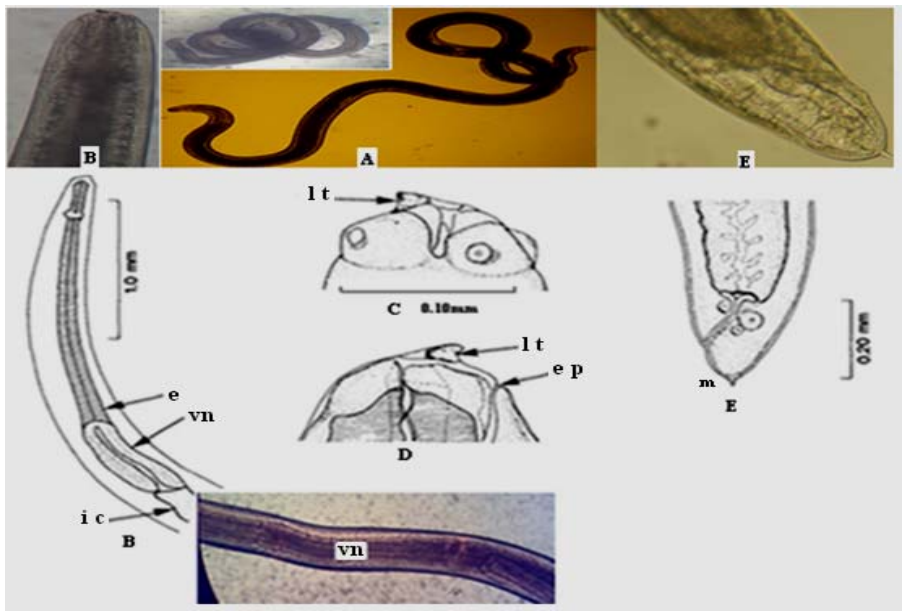

Figure 2. Third larval stage of *A. simplex*. A-Whole mount, B-Anterior portion, C-Head viewed from the lateral side, D-Head from the sagittal, E-Posterior end with mucron. e=esophagus, e p= excretory pore, i c= intestinal caecum, l t= lateral tooth, m= mucron, vn= ventriculus.

The zoogeography of *Anisakis* spp. depends on the distribution of final host, host specificity in final and intermediate hosts, migration patterns of second and paratenic hosts and the characteristic life cycle. These factors enable *Anisakis* siblings to explore different marine environments, such as the shallow seas, the open ocean, or the deeper waters (Klimpel *et al.*, 2008). Since anisakids are not host specific at the larval stage, this may result in a higher probability of transmission (Mattiucci *et al.*, 1997). *A. simplex* larvae were recorded from fishes in Canadian marine waters (McDonald and Margolis, 1995), Japanese waters (Oshima, 1972), New Zealand marine waters (Hewitt and Hine, 1972), German coastal waters (Palm *et al.*, 1999), off United States Pacific Coast (Myers, 1979), Hawaiian Islands (Smith and Wootten, 1984), the Southwestern Mediterranean Sea (Costa *et al.*, 2004), the Adriatic Sea (Petter and Radujkovic, 1989) and the Red Sea (Al-Zubaidy, 2010).

A. simplex is one of the most significant foodborne parasites in human infections (Dorny *et al.*, 2009). *A. simplex* larvae are commonly found in the viscera and musculature of fishes (Costa *et al.*, 2003). Humans can become accidental hosts by consuming raw or undercooked fish or seafood that contains the third-stage larvae. Humans might subsequently suffer by two distinct clinical entities, namely gastrointestinal anisakiasis and allergic anisakiasis (Shih *et al.*, 2010). Although the record of *A. simplex* from all the 11 hosts in the present study was from the body cavity, mesenteries and viscera, the indication of the importance of *A. simplex* from the zoonotical point of view is clear as such larvae are found also in fish musculature (Costa *et al.*, 2003). The high prevalence of this nematode in economically important fish species indicates that damage to the fishing industry could occur by considerably reducing the quality of fish, leading to a loss in marketing values (Dorny *et al.*, 2009; Shih *et al.*, 2010).

3- Larva of *Terranova* sp. (Fig. 3):

Description (based on three third-stage larvae): Small whitish nematodes; body length measures 4.50-7.00 (6.0) long x 0.14-0.19 (0.18) wide. Cuticle with thin transversal striation more evident in the posterior extremity of the body. Anterior extremity with a dorsal and two poorly developed ventro-lateral lips. Six cephalic papillae, one pair in the dorsal lip and a pair in each ventro-lateral lip. Boring tooth below the oral aperture, between the two ventro-lateral lips. Nerve ring 0.20-0.25 (0.23) from anterior body end. Esophagus slender 0.82-1.15 (0.95) long x 0.38-0.44 (0.42) wide. Excretory pore opening beneath the boring tooth. Deirids inconspicuous. Ventriculus elongate, 0.27-0.35 (0.30) length. Ventricular appendix absent. Intestinal caecum length 0.37-0.39 (0.38). Two nearly spherical rectal glands. Tail conical, 0.22-0.26 (0.25). The mucron absent.

Parameters of Infection: Only four specimens of *Terranova* sp. were picked up from three *A. stellaris*. So, the prevalence of infection was 10.7 %, the mean intensity was 1.3 and the abundance was 1 (Table 1).

The genus *Terranova* was erected by Leiper and Atkinson in 1914 (WoRMS, 2012). *Terranova* was later considered as a synonym of *Phocanema* and *Pseudoterranova* (Hartwich, 1974). This state of taxonomic confusion was solved by Gibson and Colin (1982) and Gibson

(1983) and *Terranova* is currently considered as a valid genus. The genus *Terranova* includes four marine species (WoRMS, 2012) out of 19 species found in different fishes and reptiles of the world (Villegas and González-Solís, 2009).

Most species of the genus *Terranova* parasitize aquatic hosts but they can also be found in terrestrial and semi aquatic reptiles (Medina-Rios, 2009). Several reports on *Terranova* sp. larvae parasitic in teleost fishes from the world were known (Tavares *et al.*, 2007). In the Red Sea, Egypt coastal waters, Abdou (2005) listed seven marine fish species parasitized by *Terranova* sp. Tavares and Luque (2006) listed 24 species of marine fishes from the coastal zone of the State of Rio de Janeiro parasitized by these larvae. Rückert (2006) reported *Terranova* sp. from *Epinephelus coioides* (Hamilton, 1822) and *Epinephelus fuscoguttatus* (Forsskål, 1775) from Indonesia. Medina-Rios (2009) reported one *Terranova* sp. from *E. guttatus* from Puerto Rico.

The morphology and measurements of specimens of the present materials correspond, more or less, to those described by Felizardo *et al.* (2009) from *Paralichthys isosceles* Jordan, 1891 in Brazil. However, they differ in the following ratios: length of ventriculus: esophagus (0.3-0.33 *Vs* 0.14-0.19), length of esophagus: body (0.16-0.18 *Vs* 0.14-0.15) and length of ventriculus: body (0.05-0.06 *Vs* 0.02-0.3). Abdou (2005) described larvae of *Terranova* sp. from the Red Sea fishes in Egypt, but the species was poorly defined and incompletely described. In the present study, the description and the first occurrence of larvae of *Terranova* sp. from *A. stellaris* is documented in Red Sea, Yemen coastal waters.

4- Larva of *Hysterothylacium* sp. (Fig. 4):

Description (based on 15 third-stage larvae): Body 4.5-10.9 (9.2) long x 0.09-0.20 (0.14) wide. Cuticle with fine lateral alae along all length of the body. Esophagus 0.35-0.85 (0.69) long. Excretory pore opening below the nerve ring. Ventriculus appendage 0.33-0.75 (0.52) long x 0.06-0.12 (0.09) wide. Intestinal caecum anteriorly projected, 0.06-0.20 (0.17) long x 0.02-0.04 (0.03) wide. Tail conical, 0.10-0.22 (0.13) long, tipped with a single minute thorn (mucron). Four oblong rectal glands present.

Parameters of Infection: A total of 162 specimens of *Hysterothylacium* sp. were picked up from 34 fish specimens belonging to eight species (*E. guttatus*, *E. tauvina*, *S. barracuda*, *S. jello*, *L. gibbus*, *P. filamentosus*, *A. stellaris* and *C. bajad*). Among these hosts, the prevalence ranged from 10-45 %, the intensity from 2-7.3 and the abundance from 0.3-2.1. Details of prevalence, intensity and abundance of infection of these eight fish species are shown in Table (1).

The genus *Hysterothylacium* includes 24 marine species (WoRMS, 2012). Nematodes of this genus use fishes as both intermediate and definitive hosts (Costa *et al.*, 2004). The morphology of *Hysterothylacium* larvae found in the above-named eight fish host species of the present study are similar with those of *Hysterothylacium* KB found in *Mene maculata* (Bloch and Schneider, 1801), *Mulloidichthys auriflamma* (Forsskål, 1775) [synonym of *Parupeneus forsskali* (Fourmanoir and Guézé, 1976)], *Otolithes argenteus* (Bloch and Schneider, 1801), *Pseudorhombus arsius*

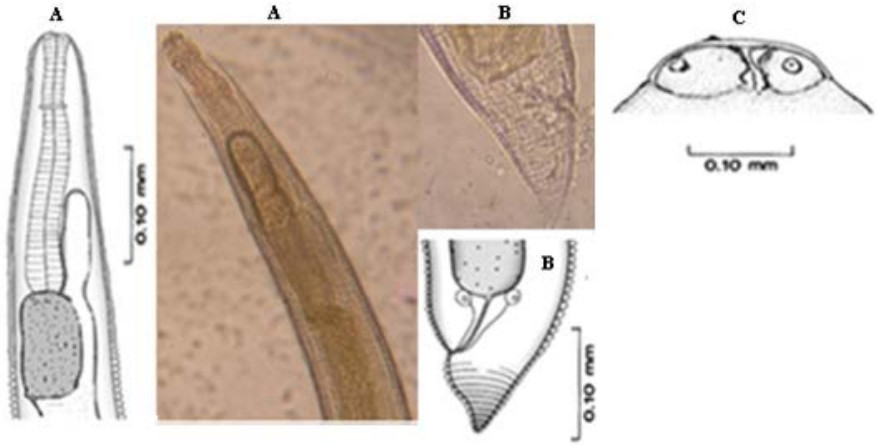

Figure 3. Third larval stage of *Terranova* sp. A-Anterior portion, B-Posterior end, C-Head viewed from lateral.

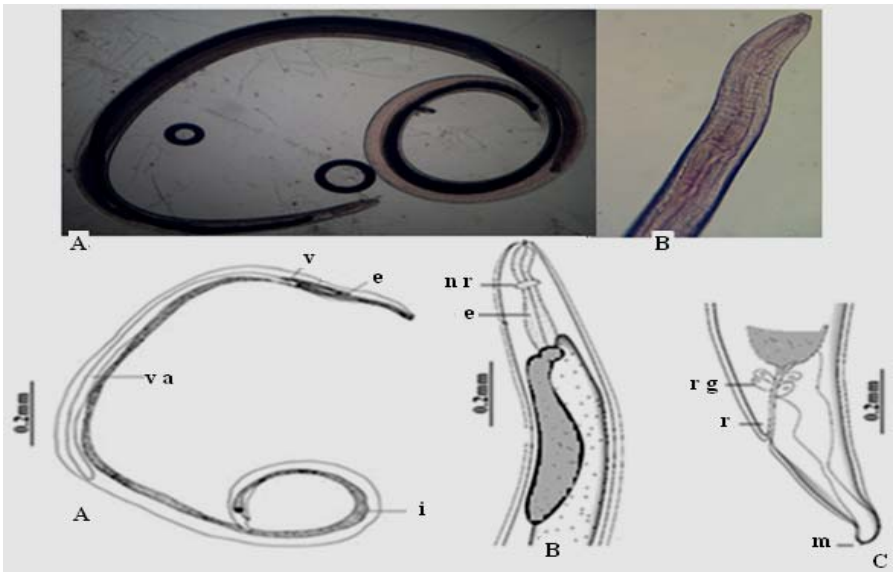

Figure 4. Third larval stage of *Hysterothylacium* sp. A-Whole mount, B-Anterior portion, C-Posterior portion.
e= esophagus, i= intestine, m= mucron, n r= nerve ring, r= rectum, r g= rectal glands, v= ventriculus, v a= ventricular appendix.

(Hamilton, 1822), *Sphyraena obtusata* Cuvier, 1829, *S. jello*, and *Upeneus sulphureus* Cuvier, 1829 from Arabian Gulf, Kuwait by Petter and Sey (1997), *Hysterothylacium* MD in *Micropogonias furnieri* (Desmarest, 1823) by Pereira *et al.* (2004) in Brazil and *Hysterothylacium* sp. from *Paralichthys isosceles* by Felizardo *et al.* (2009) in Brazil. Table (2) shows such similarity especially in measurements of total body length, length of

Table 2. Range and mean (in parenthesis) of some comparative measurements of four *Hysterothylacium* spp. larvae.

Structures	*Hysterothylacium* sp.	*Hysterothylacium* KB	*Hysterothylacium* MD	*Hysterothylacium* sp.
Total length	4.5-10.9 (9.2)	3.4-9.8 -	1.65-4.05 (2.83)	3.62 -16.7 (10.1)
Larger width	(0.14) 0.09-0.20	-	0.05-0.1 (0.07)	0.11-0.40 (0.25)
Esophagus length	0.35-0.85 (0.69)	- 0.31-0.8	0.17-0.36 (0.26)	0.23-1.16 (0.69)
Ventricular appendage length	0.33-0.75 (0.52)	0.35-0.78 -	0.19-0.42 (0.30)	- -
Ventricular appendage width	0.06-0.12 (0.09)	- -	0.01-0.06 (0.04)	0.05-0.15 (0.10)
Intestinal caecum length	0.06-0.20 (0.17)	0.03-0.22 -	0.05-0.07 (0.06)	0.05-0.32 (0.18)
Intestinal caecum width	0.02-0.04 (0.03)	- -	0.01-0.03 (0.02)	- -
Tail length	0.10- 0.22 (0.13)	0.10-0.24 -	0.07-0.17 (0.10)	0.10-0.32 (0.20)
Reference	This study	Petter & Sey (1997)	Pereira *et al.* (2004)	Felizardo *et al.* (2009)
Locality	Yemen	Kuwait	Brazil	Brazil

ventricular appendage, intestinal caecum and tail. Peculiar features of larvae can disappear in the L3, L4 and adult stages (Pereira *et al*., 2004). However, it is evident that the use of the single minute thorn in the tail apex is an inadequate specific taxonomic character in this genus, despite its use by Petter and Sey (1997) and Pereira *et al*. (2004).

Hysterothylacium, one of the anisakid nematodes which may cause anisakidosis, includes 59 species (Moravec and Nagasawa, 2000). They were reported from several parts of the world such as Gulf of Mexico (Deardorff and Overstreet, 1981), Argentina (Sardella *et al.*, 1998), Chile (Torres *et al*., 1998), Australia (Bruce, 1990), Europe (Moravec, 1994), New Zealand (Bruce *et al.*, 1994), Japan (Moravec and Nagasawa, 2000), Taiwan (Shih and Jeng, 2002), Portugal (Costa and Biscoito, 2003), Northeastern Atlantic and the Seas North of Europe (Køie, 1993), the Mediterranean Sea (Petter and Maillard, 1987), the Adriatic Sea (Petter and Radujkovic, 1989), the Pacific and Atlantic waters of North America (Marcogliese, 1996), the Bohai Sea, China (Ma *et al*., 1997) and the Black Sea (Ismen and Bingel, 1999). So, the present work documented, for the first time, the occurrence of the larval stages of *Hysterothylacium* sp. in eight marine fish species (Table 1) of the Red Sea, Yemeni coastal waters.

5- Larva of *Echinocephalus overstreeti* Deardorff and Ko, 1983 (Fig. 5):

Parameters of Infection: Seven larvae of *E. overstreeti* were detected from the intestine of five *A. stellaris*, so, its prevalence was 17.9 %, mean intensity was 1.4 larvae per infected fish and the abundance was 0.3 (Table 1).

The present larvae of *E. overstreeti* were identical with those reported by Al-Zubaidy (2011) from *A. stellatus* from Al-Mehwat fish market, Al-Hodeidah city. So, the present work is the second report of *E. overstreeti* from this fish from the Red Sea of Yemeni coastal waters.

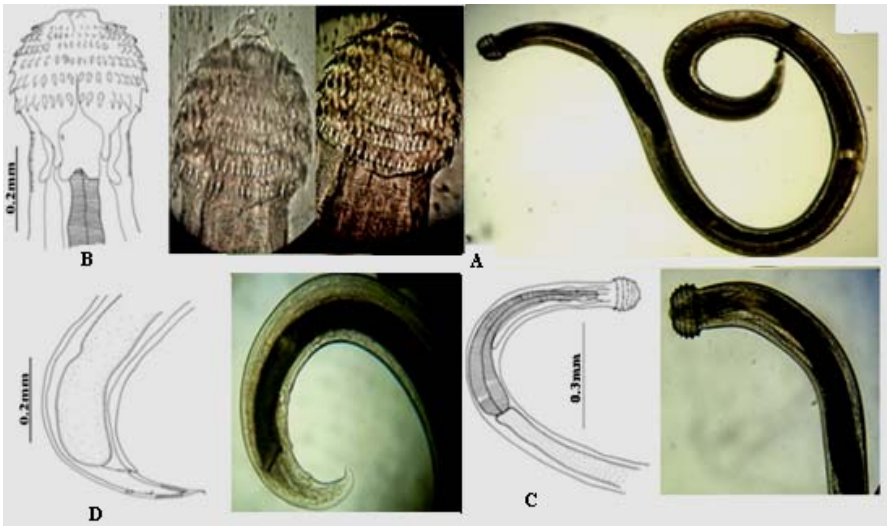

Figure 5. Larval stage of *E. overstreeti*. A-Whole mount, B-Cephalic extremity, lateral view, C-Esophageal region, lateral view, D-Posterior extremity.

E. overstreeti Larvae were originally described from the ray *Taeniura melanospilos* Bleeker, 1853 (synonym of *Taeniura meyeni* Müller and Henle, 1841) from off the Marquesas Islands, Australian waters (Deardorff and Ko, 1983). Later, adult specimens were recovered from *Pastinachus sephen* (Forsskål, 1775), *Myliobatis australis* Macleay, 1881, *Urogymnus asperrimus* (Bloch and Schneider, 1801), *Taeniura meyeni* and *Heterodontus portusjacksoni* (Meyer, 1793) from different parts of the world (Beveridge, 1987; Brooks and Deardorff, 1988; Moravec and Justine, 2006). In the Red Sea, Al-Zubaidy (2011) reported this parasite for the first time from *A. stellatus*.

Acknowledgements

Thanks are due to Prof. Dr. Frantisek Moravec of the Institute of Parasitology, Biology Centre of the Academy of Sciences of the Czech Republic and Prof. Dr. Luiz Eduardo Roland Tavares, Departamento de Parasitologia Animal, Universidade Federal Rural do Rio de Janeiro, Brazil for their help in parasite identification.

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ظهور خمسة أنواع من الديدان الخيطية من بعض أسماك البحر الأحمر، اليمن

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المستخلص - تم ما بين أيلول (سبتمبر) 2010 ومايس (مارس) 2011 جمع 228 نموذجا من الأسماك البحرية العائدة إلى 11 نوعا من سوق أسماك المحوات، مدينة الحديدة، اليمن للتحري عن الإصابات بالديدان الخيطية. تم العثور على خمسة أنواع من الديدان العائدة لثلاث عوائل. شملت هذه الطور البالغ للدودة *Cucullanus bourdini* Petter & Le Bel, 1992 والمرحلة

اليرقية الثالثة لكل من النوع (Rudolphi, 1809) *Anisakis simplex* والنوع *Terranova* sp. والنوع *Hysterothylacium* sp. والنوع *Echinocephalus overstreeti* Deardorff and Ko, 1983. سجل النوع *C. bourdini* من ثلاثة مضيفات وسجل النوع *A. simplex* من جميع المضيفات الأحد عشر المفحوصة، أما النوع *Hysterothylacium* sp. فقد سجل من ثمانية مضيفات، بينما سجل كل من النوع *Terranova* sp. والنوع *E. overstreeti* من مضيف واحد فقط. عثر على الديدان البالغة في أمعاء الأسماك بينما وجدت الأطوار اليرقية في الجوف الجسمي، المساريق، المعدة، الأمعاء، الكبد، الطحال، المنسلين والكليتين. إحتسبت نسبة إصابة، شدة إصابة ووفرة إصابة كل نوع من المضيفات المصابة. وفي هذه الدراسة تم تسجيل كل من النوع *C. bourdini* والنوع *Terranova sp.* والنوع *Hysterothylacium* sp. لأول مرة من أسماك البحر الأحمر في اليمن، في حين كان كل من النوع *A. simplex* والنوع *E. overstreeti* قد سجلا سابقا من بعض أسماك البحر الأحمر في اليمن. من بين هذه الطفيليات الخمسة، فأن لكل من النوع *A. simplex* والنوع *Hysterothylacium* sp. أهمية في إنتقال الإصابة من الأسماك إلى الإنسان.