

## First record of *Derogenes varicus* and *Dinurus scombri* (Digenea: Hemiurata) from Red Sea fishes, Yemen

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**Abstract** - Two widely distributed and economically important food fish in the Red Sea were investigated. A total of 101 specimens of *Epinephelus tauvina* and 120 *Abalistes stellatus* were collected from Al-Mehwat local fish market, Hodeidah City, Yemen, between October 2009 and April 2010 and examined for their parasites. Two digenean species of the suborder Hemiurata, namely *Derogenes varicus* (Müller, 1784) and *Dinurus scombri* Yamaguti, 1934, were found in these fishes. The former parasite occurred in 15% of *A. stellatus* and 4% of *E. tauvina* and its mean intensity of infection was 4.2 and 3.5, respectively while the abundance was 15 and 4, respectively. The latter parasite occurred only in 1% of *E. tauvina*, with a mean intensity of 2 and an abundance of 0.02. The present study represents the first record of these two parasite species in Yemeni waters of the Red Sea. In addition, *E. tauvina* now represents a new host for *D. scombri*.

**Key words:** Parasites, Digenea, Hemiurata, Fishes, Red Sea, Yemen, Zoogeography.

### Introduction

Digenetic trematodes represent the largest group of all internal metazoan parasites as they comprise about 18,000 nominal species (Cribb *et al.*, 2001). The suborder Hemiurata is one of the most diverse groups of digeneans which usually occurs in the stomach and intestine of mainly marine teleost fishes (Gibson and Bray, 1979). This group has a wide geographical distribution, being found in the Great Barrier Reef of Australia, the Indian Ocean, and the Atlantic Ocean (Gibson and Bray, 1986). Life cycle of hemiuratids typically has marine gastropods as first intermediate hosts, crustaceans or some other invertebrates as second intermediate hosts and fishes as final hosts (Køie, 1979).

The literature on digeneans of Red Sea fishes is relatively limited. These included some papers on species from the Egyptian side of the Red Sea (Nagaty, 1948, 1954, 1956; Nagaty and Abdel-Aal, 1962a, b; Saoud and Ramadan, 1983; Ramadan, 1984; Hassanine, 2005; Hassanine and Gibson, 2005a, b; Abdou *et al.*, 2006), Jordan (El-Labadi *et al.*, 2005), Saudi Arabia (Al-Jahdali, 2010) and Yemen (Al-Zubaidy, 2010, 2011a-c). As both *E. tauvina* and *A. stellatus* are encountered as widely distributed food fish in the Red Sea and are comparatively cheap in prices, it was decided to study their digeneans as some of such parasites are known to be transmissible to

humans through the consumption of fishes, crustaceans or molluscs (Adams *et al.*, 1997). Information on their cestodes was recently investigated by Al-Zubaidy and Mhaisen (2011), while their nematodes and acanthocephalans will be dealt in forthcoming future reports.

## Materials and Methods

A total of 101 (45 males and 56 females) *Epinephelus tauvina* (Serranidae) and 120 (59 males and 61 females) *Abalistes stellatus* (Balastidae) were collected between 5 October 2009 and 20 April 2010 from Al-Mehwat local fish market, Hodeidah city, Yemen. Each fish specimen was measured to the nearest 1 mm. The fish were divided into five length classes.

Upon fish dissection, the digenetic trematodes were removed from the alimentary canal under a dissecting microscope and examined alive by a compound microscope. Worms were fixed in alcohol-formalin-acetic acid (AFA) under a slight cover slip pressure and preserved in 70% ethyl alcohol. Whole mounts were stained in alum carmine, cleared in lactophenol and mounted in Canada balsam. Drawings were done with a camera lucida and in a microscope. The specimens were deposited in the Department of Marine Biology and Fisheries, Faculty of Marine Science and Environment, Hodeidah University, Hodeidah, Yemen.

Parasite loads were calculated according to Margolis *et al.* (1982). These included prevalence of infection (percentage of infected host species with a particular parasite in a sample), mean intensity of infection (total number of a particular parasite species divided by number of hosts infected with that species) and mean abundance of infection (total number of a particular parasite species divided by the number of hosts examined for that species). T- test was used for the statistical analyses.

The digeneans were identified in accordance with Yamaguti (1971) and Jones *et al.* (2005). Parasite identification was confirmed by Dr. R.A. Bray, Department of Zoology, Natural History Museum, London.

## Results and Discussion

Two digenean species were recovered from the alimentary canal of the examined fishes. These species are arranged in the following systematic account of WoRMS (2011):

Class Trematoda

Subclass Digenea

Order Plagiorchiida

Suborder Hemiurata

Superfamily Hemiuroidea

Family Derogenidae

*Derogenes varicus* (Müller, 1784)

Family Hemiuridae

*Dinurus scombri* Yamaguti, 1934

***Derogenes varicus* (Müller, 1784) Looss, 1901 (Fig. 1)**

Description: Body fusiform, smooth, 0.980-2.850 (2.020) mm long x 0.450-0.820 (0.680) mm in its maximum width. Oral sucker 0.119-0.198 (0.168) x 0.122-0.196 (0.160) mm. Prepharynx absent. Pharynx elongated, 0.045-0.077 (0.061) x 0.044-0.081 (0.057) mm. Esophagus as long as or slightly longer than pharynx. Intestinal bifurcation at the pharynx level. Caeca terminate beyond vitelline. Genital atrium short, just posterior to oral sucker. The oval ventral sucker lies in the middle of the body. It is 0.340-0.360 (0.350) x 0.199-0.310 (0.289) mm. Two postacetabular testes smooth, oval and sub parallel. Anterior testis, 0.076-0.123 (0.119) x 0.051-0.101 (0.098) mm. Posterior testis, 0.135-0.138 (0.137) x 0.097-0.110 (0.104) mm. The smooth, almost spherical, ovary is situated beyond the testes. It is 0.065-0.199 (0.123) x 0.072-0.125 (0.102) mm. The two rounded compact masses of yolk or vitelline glands are situated beyond testes. Anterior vitelline 0.179-0.181 (0.180) x 0.075-0.088 (0.084) mm. Posterior vitelline 0.195-0.201 (0.199) x 0.115-0.126 (0.121) mm. Uterus extending from the end of intestine to the end of the pharynx. Many eggs spread throughout the parasite body. Eggs are thick-shelled, operculated, 0.035-0.047 (0.043) x 0.020-0.029 (0.027) mm.

Host: *Abalistes stellatus* and *Epinephelus tauvina*.

Site of infection: Stomach and intestine.

Locality: Red Sea, Yemeni coastal waters.

Prevalence of infection: 15% in *A. stellatus* and 4% in *E. tauvina*.

Range (and mean) intensity of infection: 1-8 (4.7) in *A. stellatus* and 2-5 (3.5) in *E. tauvina*.

Mean abundance of infection: 0.7 in *A. stellatus* and 0.14 in *E. tauvina*.

Geographical distribution: *D. varicus* was recorded from many areas in the world such as the North Sea and the adjacent waters (Nicoll, 1915; Rees, 1953; MacKenzie and Gibson 1970; Dunice, 1980), the English Channel (Nicoll, 1914), the east coast of North America (Manter, 1926), New Zealand (Manter, 1954), Bering Sea (Mamaev, 1965), Northeastern Pacific Ocean (Sekerak, 1975), Japan (Yamaguti, 1953), Mediterranean Sea (Renaud *et al.*, 1980; Bartoli *et al.*, 2005; Amel *et al.*, 2009) and Southeastern Alaska and British Columbia (Mortensen and Mothershead, 1988). So, the present study adds the Red Sea to the geographical distribution of *D. varicus*.

Infection parameters: The overall prevalence of infection of *A. stellatus* and *E. tauvina* with *D. varicus* were 15% and 4%, respectively (Table 1). The intensity ranged from 1-8 (4.7) in *A. stellatus* and 2-5 (3.5) in *E. tauvina*, while the abundance was 0.7 in *A. stellatus* and 0.14 in *E. tauvina*. Gibson (1972) reported higher prevalence of 30% and higher mean intensity of 12 individuals per fish for *D. varicus* in the flounder *Platichthys flesus* from a marine site, and much lower infection levels in two estuarine habitats (10-15% and 1-2,) at the east coast of Scotland. MacKenzie and Gibson (1970) reported an intensity of 1.06 for *D. varicus* from the flounder of the same Scottish sites. Schmidt (2003) reported a prevalence of 5.7% and an intensity of 1.9 with *D. varicus* in the flounder *P. flesus* from German Bight

of the North Sea. From coast of Oran, Algeria, Mediterranean Sea, Amel *et al.* (2009) reported a prevalence of 3% and a mean intensity of 1.3 for *D. varicus* from *Mullus surmuletus*. Dunice (1980) reported an intensity of 1-5 specimens of *D. varicus* in *Trigla gurnardus* from North Sea.

Parasite-host relationships: In the present investigation, the prevalence of *D. varicus* was significantly lower in *E. tauvina* in comparison with that in *A. stellatus* ( $P < 0.01$  and  $P < 0.05$ ).

The prevalence of infection of *A. stellatus* with *D. varicus* (Table 1) was positively correlated with host length ( $P \leq 0.01$ ). Such increase in the infection level with the increase in fish size is due to the accumulation of parasites (Rolbiecki, 2006). Perdiguero-Alonso *et al.* (2008) showed that *D. varicus* as well as two other parasites in the cod, *Gadus morhua*, has a long life-span which facilitates their accumulation. In connection with the food items of *E. tauvina*, Kathirvel and Selvaraj (1980) stated that their juveniles feed on crustaceans (60%), fish (30%) and polychaetes (10%). The adults feed primarily on fish but also prey on crabs, shrimps and cephalopods (Heemstra and Randall, 1993). *A. stellaris*, on the other hand, feeds on echinoderms, coral polyps, polychaetes and other invertebrates (Figueiredo and Menezes, 2000).

Table 1. Prevalence of infection with *D. varicus* in relation to sex and length classes in *E. tauvina* and *A. stellatus* from the Red Sea, Yemen.

Fish species	Fish sex	Fish length class (cm)					Totals by sex	Total
		≤ 20	21-25	26-30	31-35	≥ 36		
<i>E. tauvina</i>	♀	0.0	12.5	0.0	0.0	0.0	1.8	4.0
	♂	33.3	3.8	0.0	0.0	0.0	6.7	
<i>A. stellatus</i>	♀	0.0	0.0	8.3	22.2	27.3	9.8	15.0
	♂	0.0	7.1	12.5	40.0	45.4	20.3	
Total	♀	0.0	3.8	4.4	8.7	14.3	6.0	10.0
	♂	14.3	7.7	7.7	20.0	27.8	14.4	

In the present study, males of *A. stellatus* showed higher prevalence of infection with *D. varicus* than females. As no data are available on differences in food items of males and females of both *A. stellaris* and *E. tauvina*, the differences in parasite infection between both sexes can be explained as a consequence of differences in physiological status (Kennedy, 1975) or immune functions (Collazos *et al.*, 1994; Reimchen and Nosil, 2001; Kortet *et al.*, 2003). In some fishes, males are probably more susceptible to parasites and diseases in comparison with females due to immunosuppressive androgens (Ahmed *et al.*, 1985; Zuk, 1990) or different behavioral mating tactics, which may expose males to parasites (Reimchen and Nosil, 2001).

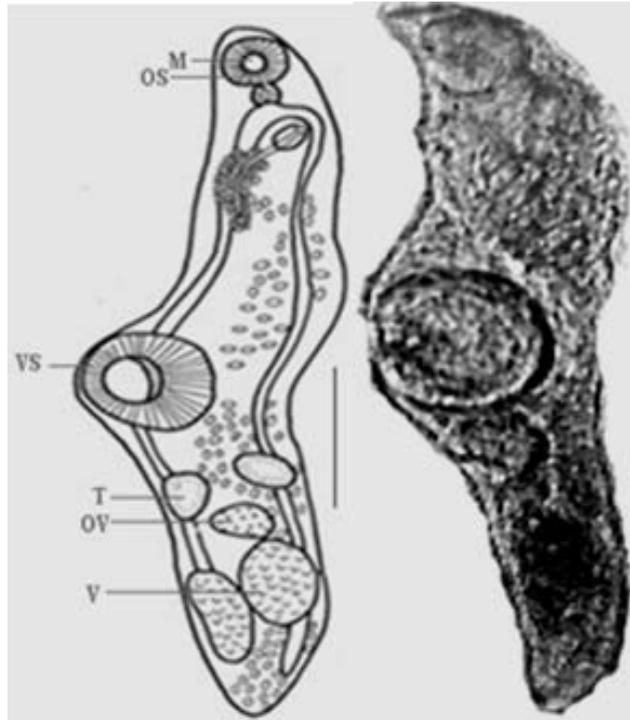


Figure 1. *Derogenes varicus* from Red Sea fishes. M: mouth, OS: oral sucker, VS: ventral sucker, T: testis, OV: ovary, V: vitelline gland. (Scale bar: 0.5 mm).

***Dinurus scombri* Yamaguti, 1934 (Fig. 2)**

Description: Body elongated, 1.8-2.95 (2.20) mm long x 0.38-0.70 (0.55) mm wide. Prosoma longer than ecsoma. Ecsoma well developed, 0.35-1.99 (0.99) mm long. Oral sucker terminal, measuring 0.18-0.39 (0.28) x 0.21-0.34 (0.27) mm. Preoral lobe present. Acetabulum located in the first third of body near the oral sucker, measuring 0.25-0.35 (0.30) x 0.24-0.33 (0.29) mm. Oral and ventral suckers are close together and approximately of the same size (sucker ratio 1: 1.05). Genital pore ventral to the anterior border of the pharynx. Testes, globular, contiguous in nature, oblique, in half postacetabular area. Seminal vesicle thin-walled with four lobes of unequal size, dorsal to the posterior margin of the acetabulum. Ovary bilobed, located in the middle third of the body. Vitellaria clumped in the form of seven tubules, not extending into the ecsoma. Excretory vesicle Y-shaped. Excretory pore terminal. No eggs were found in the present specimens.

Host: *Epinephelus tauvina*.

Site of infection: Stomach.

Locality: Red Sea, Yemeni coastal waters.

Prevalence of infection: 1%, as only one fish was infected out of 101 examined.

Mean intensity of infection: Two, as only two parasite specimens were detected from one infected fish.

Mean abundance of infection: 0.02, as only two parasite specimens were detected from all 101 examined fishes.

Geographic distribution: *D. scombri* has a worldwide distribution. It has been reported from Florida (Manter, 1947; Raptopoulou and Lambertsen, 1987), Pacific (Manter, 1940), New Zealand (Manter, 1954), Mexico (Regagnon *et al.*, 1997), Puerto Rico (Williams and Bunkley-Williams, 1996), Ghana (Fischthal, 1972), Senegal (Fischthal and Thomas, 1972), India (Rekha and John, 2003), Japan (Yamaguti, 1934), Brazil (Fernandes, 1971), Northwest of Azores (Guiart, 1938) and West Mediterranean Sea (Carbonell *et al.*, 1999). So, the present material represents the first record of this parasite in the Red Sea. The present study also adds *E. tauvina* as a new host record for *D. scombri*.

Infection parameters: The overall prevalence of infection of *E. tauvina* with *D. scombri* was 1%, while the intensity was 2 and the abundance was 0.02. With such lower level of infection, it is so difficult to contribute on the relationship between parasitic infection and both host length and sex.

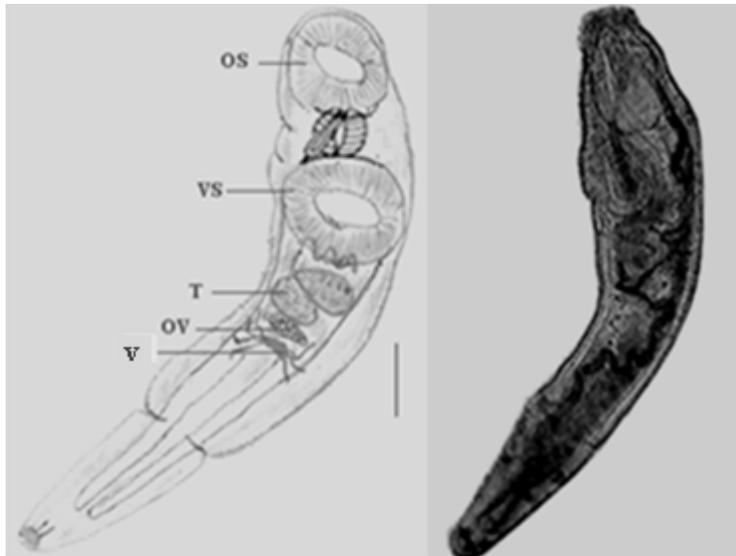


Figure 2. *Dinurus scombri* from the Red Sea fish *E. tauvina*. OS: Oral sucker, VS: Ventral sucker, T: Testis, OV: Ovary, V: Vitelline gland. (Scale bar: 0.5 mm).

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## أول تسجيل لنوعين من الديدان ثنائية المنشأ، رتبة نصفية الذنب الثانوية: *Derogenes varicus* و *Dinurus scomбри* من أسماك البحر الأحمر، اليمن

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**المستخلص** - تم تفحص نوعين من الأسماك الشائعة والهامة إقتصادياً من أسماك الغذاء في البحر الأحمر. جمعت 101 عينة من أسماك الهامور *Abalistes stellatus* من سوق أسماك المحوات في مدينة الحديدية، اليمن للفترة ما بين شهر تشرين الأول (أكتوبر) 2009 وشهر نيسان (أبريل) 2010 وفحصت بحثاً عن طفيلياتها. وجد نوعان من الديدان ثنائية المنشأ العائدة للرتبة الثانوية نصفية الذنب هما: (*Derogenes varicus* (Müller, 1784) و *Dinurus scomбри* Yamaguti, 1934). ظهر الطفيلي الأول في 15% من أسماك الحجم و4% من أسماك الهامور وبمعدل شدة إصابة قدرها 4.2 و 3.5 في السمكتين أعلاه على التوالي وبوفرة قدرها 15 و 4،

على التوالي. أما الطفيلي الأخير فقد ظهر بنسبة 1% من أسماك الهامور فقط مع شدة إصابة قدرها 2 ووفرة قدرها 0.02. تمثل الدراسة الحالية أول تسجيل لهذين النوعين من الطفيليات من أسماك البحر الأحمر في المياه اليمنية. فضلا عن ذلك تعدّ سمكة الهامور مضيفا جديدا للذودة *D. scombri*.