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Larvae of *Scolex pleuronectis* (Müller, 1788) from some Red Sea Serranid Fishes (*Epinephelus* sp.) off Jeddah Coast

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Abstract. Four species of serranid fishes namely *Epinephelus fuscoguttatus*, *E. chlorostigma*, *E. summana* and *E. tauvina* were examined for parasitic infection. Fish samples were collected from Jeddah coast (Red Sea, Saudi Arabia), during the year 2006. Different forms of tetraphyllidean larvae were extracted from the digestive tracts of the studied fish. Larvae were identified as phyllobothrid plerocercoides of *Scolex pleuronectis* (Müller, 1788). *Epinephelus* sp. may play a role as intermediate host for this tetraphyllid cestode. Adult cestodes were not detected in any of the studied fish. The highest prevalence of plerocercoid infection was detected in *E. fuscoguttatus* (19.64%), followed by *E. summana* (9.38%), then in *E. chlorostigma* (5%) and the lowest prevalence was in *E. tauvina* (3.45%). The prevalence of infection was high during spring and autumn, with slight decrease during summer and winter. Identification and full description of these larvae were given using both light and scanning electron microscopy. A comparison between the larval forms was recorded. The present study is the first to report *Scolex pleuronectis* from these host species, as well as from this geographic locality.

Keywords: Epinephelus, cestode larvae,Scolex pleuronectis, SEM, Red Sea, Jeddah

Introduction

Family Phyllobothriidae Braun (1900) includes tetraphyllidean cestodes which, according to Yamaguti (1971), is characterized by: unarmed

scolex; four sessile or pedunculated bothridia (which may be simple, folded, crumpled or may divided into areolae); bothridium may have an accessory sucker; neck distinct or indistinct; strobila distinctly segmented as five terminal proglottids; genital pores marginal, unilateral or alternating regularly or irregularly; eggs are rounded or spindle-shaped; adults parasitic in elasmobranches. Tetraphyllideans have a three-hosts life cycle, comprising a procercoid stage in copepods, plerocercoid stage in teleosts and cephalopods, and adults in elasmobranchs (Mudry and Dailey, 1971). The genus *Scolex* is used as a collective group named for plerocercoids of unknown generic affinity (McDonald and Margolis, 1995). The name *Scolex pleuronectis* or *Scolex polymrphus* is used to describe the small and white cestode larva with 5 suckers in the scolex. These plerocercoid stages are found in the intestine of marine teleosts and cephalopods (Wardle and McLeod, 1952; Yamaguti, 1959). Carvajal and Mellado (2007) recorded larvae of *Scolex pleuronectis* parasitize bivalve mollusks in different parts of the world. Dollfus (1974) and Cake (1976) reported these larvae in polychaetes, isopods, copepods and other crustacean, mollusks and fishes. Plerocercoid larvae have been reported to infect different species of Red Sea fishes (Abdou *et al*., 1999). Banaja and Roshdy (1979) described Trypanorhynchan plerocercoids from the flesh of Red Sea fish *Plectropomus maculatus*, collected from Jeddah, Saudi Arabia. Klimpel *et al.* (2007) isolated tetraphyllidean larvae of *Scolex pleuronectis* from the marine fish *Maurolicus muelleri* from the mid-atlantic ocean and from the Norwegian Sea.

Fish parasites may affect productivity and reproduction of fishes, in addition to transmitting diseases to other vertebrates including humans (Khalil, 1981; William and Jones, 1994; Abdou, 2000; Ventura *et al*., 2008; and Sayasone *et al*., 2009). Infection with pseudophyllidean plerocercoids cestodes may cause loss of weight and even mortality particularly in young fishes (Williams and Jones, 1994). Noga (1996) reported that larval cestodes damage the viscera of fish and decrease carcass value if present in muscles.

Marine serranid fishes (Groupers) have commercial value and are widely distributed in the Red Sea (Heemstra and Randall, 1993; Osman, 2000; and Eschmeyer and Fong, 2009). To the best of our knowledge the present study is the first to report parasites of the Red Sea groupers in

Jeddah coast. The present study was conducted to identify and give full description of the endoparasitic cestodes in the common species of groupers.

Material and Methods

Two hundred and fifty serranid fish (Groupers), namely *Epinephelus fuscoguttatus* (Forsskål, 1775), *E. chlorostigma* (Cuvier and Valenciennes, 1828), *E. summana* (Forsskål, 1775) and *E. tauvina* (Forsskål, 1775), were collected weekly from the Red Sea, off Jeddah coast (Saudi Arabia) during the year 2006. The collected fishes were identified according Randall (1986) and Eschmeyer and Fong (2009). Fishes were dissected immediately after few hours from capture. The digestive tracts including stomach, pyloric caeca and intestine were isolated and searched for cestodes.

Relaxation, fixation, staining and mounting of the collected parasites were carried out according to Lucky (1977) and Pritchard and Kruse (1982). Cestode larvae were flattened between a slide and a cover slip, then immersed in formalin (5%) for about 2-4 hours. Specimens were washed several times in fresh distilled water, then stained by Grenacher's borax carmine stain (Weesner, 1968). Mounted specimens were examined and photographed using a photo-research Microscope (Model Dialux 20EB Leitz). Measurements were carried out using a graduated slide to the nearest 0.01 mm and were expressed as mean (± S.E.).

For scanning electron microscopy, fresh parasitic specimens were fixed immediately after isolation in a mixture of 1:3 gluteraldehyde (2%) and osmium tetraoxide (1%), dehydrated in graded series of alcohol, dried with carbon dioxide, mounted on aluminum stubs, and then coated with gold. Specimens were examined and photographed under scanning electron microscope (Model JEOL, ISM- 63600 LV) at 15 Kv.

Identification of parasites was done according to the morphological similarities with descriptions of Yamaguti (1971), Schell (1970), Ezz El-Dein *et al*. (1994), Martins *et al*. (2000) and Gonzalez-Solis *et al*. (2002). Collected specimens were also identified by Dr. Rod Bray, at the Natural History Museum of London,UK.

Results

Description using Light Microscopy (Plate 1)

The collected larvae were mostly transparent or sometimes white in colour and filled with numerous granules of different sizes. They move vigorously by rapid contractions and extensions. Their bodies were measured ± 0.187- 0.6 mm in length and of ± 0.135- 0.29 mm in width. Each larva has been formed from scolex and tail-like body. The scolex was provided with four equal suckers in addition to a vestigial or clear fifth apical one.

The pleurocercoid larvae of *Scolex pleuronectis* can be differentiated into four forms:

Form 1 (Pl. 1, A): Six specimens were collected from the intestine of *E. fuscoguttatus* and *E. summana*. This form of larva was oval in shape, measuring about ± 0.37 mm long by ± 0.25 mm width. Scolex was partially invaginated and with four rounded suckers. Each sucker was measured about ± 0.043 mm long by ± 0.05 mm width. The apical sucker was hardly visible. Bothridia were also not differentiated in this form. No neck separation was seen between the scolex and the rest of the body.

Form 2 (Pl. 1, B): Five specimens from this form were obtained from the pyloric caeca and intestine of *E. fuscoguttatus* and *E. summana*. The body (b) was oval in shape, measuring about ± 0.503 mm long by ± 0.29 mm width. The scolex (sc) was clear and with four rounded and cup-shaped suckers (s); each of which measures about ± 0.049 mm long by ± 0.058 mm width. The apical sucker (as) was clear at the top of scolex and measured ± 0.033 mm. by ± 0.035 mm. Bothridia were not differentiated in this form. A separation between the scolex and the rest of body was detected and named the neck (n).

Form 3 (Pl. 1, C): Only three specimens of this form were obtained from the stomach, pyloric caeca and intestine of *E. fuscoguttatus* and *E. tauvina*. The body was oval to round in shape, measuring about ± 0.187 mm in length and ± 0.135 mm in width. The scolex was clear, with four rounded suckers; each one measures about ± 0.0625 mm length by ± 0.06 mm width; apical sucker measures ± 0.02 mm by ± 0.027 mm; bothridia were not well differentiated. No neck separation was noticed between the scolex and the rest of the body.

Form 4 (Pl. 1, D): Four specimens were detached from the pyloric caeca and intestine of *E. fuscoguttatus* and *E. chlorostigma*. The body of each larva was elongated and measured about ± 0.6 mm length by ± 0.16 mm width. Scolex was more distinct with four sessile bothridia. Each bothridium was not divided into areolae, arranged in a circle and measured about ± 0.26 mm length by ± 0.12 mm width. The apical sucker was measured about ± 0.21 mm by ± 0.21 mm. Neck separation was slightly seen between the scolex and the rest of the body.

Description using Scanning Electron Microscopy (Plate 2)

The high magnification provided by SEM has revealed with precision a number of details in the sculptures that were not reported by the light microscopy. The SEM photomicrographs declared more detail about the body surface and gave a characterized ornamentation for each larva. The surface of the form 2 contains a number of tubercles (t), which were scattered randomly especially just behind the neck (Pl. 2, B). The scolex (sc) of each type was easily differentiated from each other. The micrographs showed also the presence of the fifth apical sucker (as) in all forms, in addition to the four equal subterminal suckers (s). The distinction of the apical sucker depends on the case of contraction in the specimen. The neck region was distinct in the form 2 and form 4 and less distinct in the other two forms. Form 3 (Pl. 2, C) has a distinct rostellum (r), with a clear apical sucker (as) on its top and each sucker (s) is partially divided into two compartments. The larva of the form 4 (Pl. 2, D) was characterized by its elongated form, smooth body surface, without tubercles, slightly transverse wavy body, with a slender scolex (slightly wider than the neck), without rostellum or apical organ and bearing four compartments elongated bothridia. Each bothridium (bo) consists of two circular invaginations (areola or loculi) separated by a transverse ridge.

Out of two hundred and fifty serranid fish examined, eighteen were infested by tetraphyllidean larvae with a prevalence of 7.2%. The highest prevalence of plerocercoid infection was detected in *E. fuscoguttatus* (19.64%), followed by *E. summana* (9.38%), and *E. chlorostigma* (5%) and the lowest prevalence was in *E. tauvina* (3.45%), (Fig.1). The prevalence of infection was high during spring and autumn, with slight decrease during summer and winter.

Table 1. Main morphometric features of the four forms of *Scolex pleuronectis*.

Measurements	Form 1	Form 2	Form 3	Form 4
Body shape	oval without neck separation	Oval with neck separation	oval to round-shaped	Elongated
Body length (mm)	0.37 ± 0.01	0.503 ± 0.03	0.187 ± 0.02	0.6 ± 0.04
Body width (mm)	0.25 ± 0.02	0.29 ± 0.03	0.135 ± 0.01	0.16 ± 0.01
Sucker length (mm)	0.043 ± 0.007	0.049 ± 0.01	0.0625 ± 0.02	0.26 ± 0.01
Sucker width (mm)	0.05 ± 0.01	0.058 ± 0.02	0.060 ± 0.03	0.12 ± 0.03
Apical sucker length (mm)	hardly visible	0.033 ± 0.02	0.020 ± 0.01	0.21 ± 0.01
Apical sucker width (mm)	Hardly visible	0.035 ± 0.02	0.027 ± 0.002	0.21 ± 0.01
Bothridia (mm)	not well differentiated	not well differentiated	less differentiated	0.26 ± 0.02 L. 0.12 ± 0.01 W.
Hosts	*Epinephelus fuscoguttatus* and *E. summana*	*Epinephelus fuscoguttatus* and *E. summana*	*Epinephelus fuscoguttatus* and *E. tauvina*	*Epinephelus fuscoguttatus* and *E. chlorostigma*
Site of infection	intestine	pyloric caeca and intestine	stomach, pyloric caeca and intestine	pyloric caeca and intestine

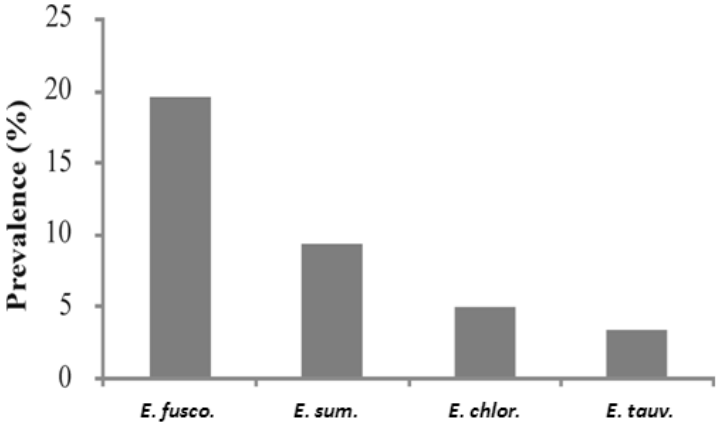

Fig.1. Prevalence of plerocercoid infection in the fish species studied.

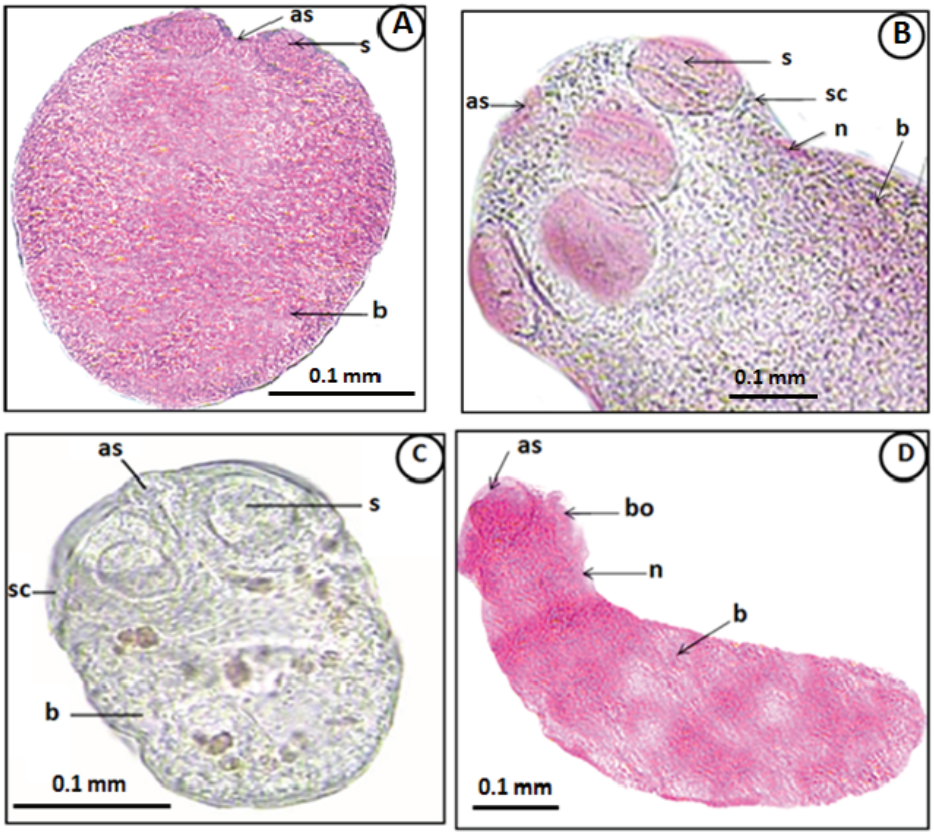

Plate 1. Photomicrographs of the four forms of *Scolex pleuronectis* larvae (A, B, C and D). as, apical sucker; b, body; bo, bothridium; n, neck; s, sucker; sc, scolex.

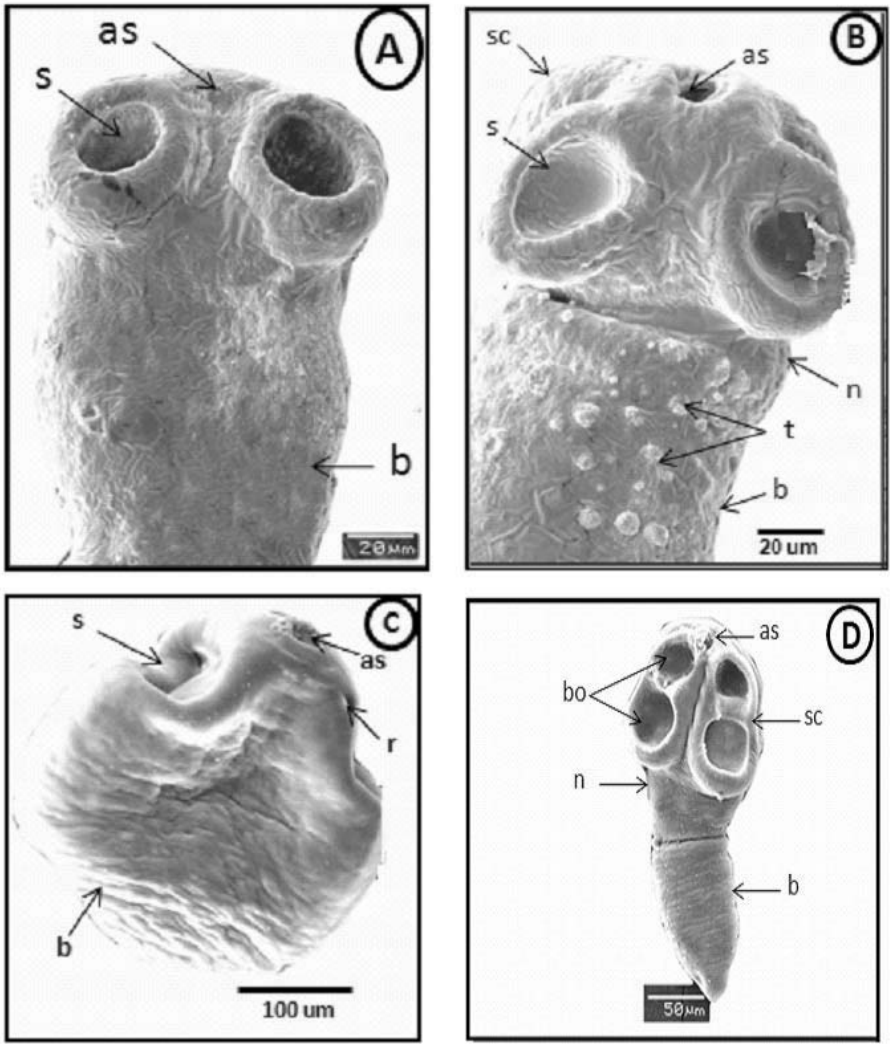

Plate 2. Scanning electron microscopy of the four forms of *Scolex pleuronectis* larvae. as, apical sucker; b, body; bo, bothridium; n, neck; r, rostellum; s, sucker; sc, scolex; t, tubercles.

Discussion

The present study revealed that out of two hundred and fifty examined fishes of the species: *E. fuscoguttatus*, *E. chlorostigma*, *E. summana* and *E. tauvina*, 18 were infested by tetraphyllidean larvae with a prevalence of 7.2%. The prevalence of infection by these larvae was

higher than that mentioned by Mahdy *et al*. (1998) who reported a prevalence of 3.9% from some Red Sea fishes (*Chryosphryes aurata*, *Saurus tumbil* and *Solea* sp.), but lower than that of Al-Mathal (1996), who reported the incidence of infection from the Arabian Gulf fish *Lethrinus* sp. to be 12.08%; Ezz El-Dein *et al.* (1994) who recorded the incidence from the Mediterranean Sea fishes (*Carnx kalla* and *Siganus canaliculatus*) as 21.26%; and Abu-Zinada (1998), who reported 33% from the Red Sea fish (*Plectropomus maculatus*). Such differences in the incidence of cestode larvae may be due to variation in host's species and to some environmental factors (El-Nafar *et al*., 1992).

At the first glance, the photographs of the cestod larval forms by light microscpy (Plate 1) show that the first three forms (A, B & C) are probably the same but in different degrees of contraction and only the last form (D) is definitely different because of the presence of two compartments of each sucker. After observation and recording the basic features of these larvae alive under the dissecting microscope and from the photographs taken by electron microscopy (Plate 2) and comparing the morphological features with the related references (such as Yamaguti, 1971; Martins *et al*., 2000 and Gonzalez-Solis *et al*., 2002), all of tetraphyllidean larvae found in this study can be considered as plerocercoid larvae and are belonging to *Scolex pleuronectis*. This differentiation was confirmed by Dr. Rod Bray (Specialist in the Natural History Museum of London, U.K.), who identified them as different stages of tetraphyllidean larvae of *Scolex pleuronectis* Müller (1788).

It was also noticed that the incidence of infection with cestode larvae was high during spring and autumn seasons, with slightly decrease during summer and winter. This may attributed to the differences in the temperature, extensive feeding of fishes and the availability of the intermediate host of these parasites during these seasons.

The absence of adult stages of the studied cestodes in the fishes under study, indicates that *Epinephelus* sp. play a role as an intermediate host of these cestodes. This is supported by Williams and Bunkley-Williams (1996) and Shih *et al*. (2004), who reported that adult tapeworms are not very common in bony fishes, but larval forms of cestodes use bony fishes as intermediate host, where they reported are found mostly in the intestinal tracts and few are encapsulated in tissues of the marine bony fishes.

More attention should be given to the study of tetraphyllidean larvae to reveal its complete life cycle. The control of these cestode larvae is of great economic and public health importance.

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يرقات الدودة الشريطية *سكولكس بلورونيكتيس* (مولر، ١٧٨٨) المتطفلة على بعض أسماك البحر الأحمر من عائلة الكشر من شاطىء جدة

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المستخلص. تم في هذه الدراسة فحص أربعة أنواع من أسماك الكشر (الهامور) وهى: *إبينفيلس فوسكوجوتاتس*، *إبينفيلس كلورستيجما*، *إبينفيلس سمانا*، *إبينفيلس توفينا* – وجميع هذه الأسماك مصادة من شاطىء جدة بالبحر الأحمر – وذلك بحثًا عن الديدان المتطفلة داخليًا عليها. أظهرت نتائج الدراسة تسجيل الإصابة بأنماط مختلفة من يرقات الدودة الشريطية *سكولكس بلورونيكتيس* (مولر، ١٧٨٨)– وهي من رباعيات الممصات والتي تنتمى لعائلة فيللوبوثرييدي. وهذه اليرقات كانت موجودة في القناة الهضمية لأسماك الكشر (المعدة – الردب البوابى– الأمعاء). ونظرًا لعدم وجود الطور البالغ لهذه الدودة في أي عينة من أنواع الكشر التي فحصت خلال عام كامل (٢٠٠٦)– لذا فإن أسماك الكشر قد تمثل العائل الوسيط لهذه الدودة الشريطية. وقد كانت أعلى نسبة إصابة لهذه اليرقات في الأسماك التي تم فحصها حوالي ١٩,٦٤٪ في أسماك *إبينفيلس فوسكوجوتاتس*، ثم في أسماك *إبينفيلس سمانا* (٩,٣٨٪) ثم في أسماك *إبينفيلس*

كلورستيجما (٥٪) وأقل نسبة إصابة كانت ٣,٤٥٪ في *إبينفيلس توفينا*. كما لوحظ أن نسبة الإصابة كانت عالية خلال فصلي الربيع والخريف، مع انخفاض بسيط خلال فصلي الصيف والشتاء. ولقد تم تعريف هذه اليرقات ووصفها مجهريًا باستخدام المجهر الضوئي والمجهر الإلكتروني الماسح وعمل مقارنة بين الأنماط الأربعة اليرقية. ويعد تسجيل هذه اليرقات رباعية الممصات هي المرة الأولى المسجلة من هذه العوائل والأولى أيضًا من منطقة جدة على البحر الأحمر.