American Journal of Biology and Life Sciences
2014; 2(6): 135-140
Published online November 20, 2014 (http://www.openscienceonline.com/journal/ajbls)

Cestodes of the silver grunt *Pomadasys argenteus* (Forsskål, 1775) from the Yemeni coastal waters of the Red Sea

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To cite this article

Ali Bannawi Al-Zubaidy, Furhan Thumad Mhaisen. Cestodes of the Silver Grunt *Pomadasys argenteus* (Forsskål, 1775) from the Yemeni Coastal Waters of the Red Sea. *American Journal of Biology and Life Sciences.* Vol. 2, No. 6, 2014, pp. 135-140.

Abstract

During the period from September 2010 till February 2012, a total of 218 specimens of the silver grunt *Pomadasys argenteus* were purchased from Al-Mehwat fish market at Hodeidah city, Yemen. Fish inspection revealed that 148 (67.9%) fishes were infected with at least one specimen of five larval metacestodes. These cestodes included four trypanorhynchids and one Tetraphyllid. The trypanorhynchids were represented by plerocercoids of four species: *Callitetrarhynchus gracilis* (Rudolphi, 1819), *Callitetrarhynchus speciosus* (Linton, 1897), *Lacistorhynchus tenuis* (van Beneden, 1858) and *Pseudotobothrium dipsacum* (Linton, 1897), while the tetraphyllid was represented by *Scolex pleuronectis* Müller, 1788. Details on parasitic indexes (prevalence, mean intensity and mean abundance of infection) and the infection sites (body cavity, stomach, liver, intestine, mesentery and stomach mucosa) for each larva were demonstrated. *C. speciosus*, *L. tenuis* and *S. pleuronectis* of the present investigation are recorded here for the first time in fishes of the Yemeni coastal waters of the Red Sea.

Keywords

Pomadasys argenteus, Cestoda, Trypanorhyncha, Tetraphyllidea, Red Sea, Yemen

1. Introduction

With no exceptions, all tapeworms are hermaphroditic and characterized by the lack of an alimentary canal (Duijn, 1973). In their connection with fishes, cestodes live as adults in the alimentary canal, while as larvae they inhabit fish body cavity, musculature and viscera. So, fishes serve as final, intermediate or paratenic hosts for cestodes (Amlacher, 1970). Cestodes life cycles are indirect and their developmental stages occur in intermediate or paratenic hosts (Olsen, 1974). Due to their endoparasitic style of life, cestodes exert different injuries in the body of their hosts and may cause the death to the host as in the case of the Asian tapeworm *Bothriocephalus acheilognathi* (Han *et al.*, 2010). In addition, some cestodes, such as the broad fish tapeworm *Diphyllobothrium latum*, have a zoonotical importance as they are known to be transmissible to humans through the consumption of raw or inadequately cooked fishes (Adams *et al.*, 1997).

Adult cestodes of the order Trypanorhyncha are found in the stomach and intestine of sharks and rays, whilst their larval forms infect a wide variety of marine invertebrates and teleosts (Palm *et al.*, 2009). They are characterized by a scolex bearing two or four bothridia (Jones *et al.*, 2004) and tentacular apparatus consisting of four retractile tentacles (Dollfus, 1942). Accidental human infections by larvae of Trypanorhyncha due to ingestion of raw fish meat have been reported (Bates, 1990). Some larvae are responsible for the repugnant aspect of the meat for the final consumer and some trypanorhynchids can provoke allergic reactions in humans (Felizardo *et al*., 2010).

Plerocercoid larvae of the order Tetraphyllidea show different morphological types which make their identification difficult. For this reason, the collective name, *Scolex pleuronectis* Müller, 1788 was proposed for them by Chambers *et al*. (2000). The life cycle of tetraphyllids includes teleost fishes and some marine mammals as the second

intermediate hosts whereas elasmobranches as the definitive (Aznar *et al*., 2007).

Data on trypanorhynchids from the Yemeni side of the Red Sea are restricted to the record of *Pseudogrillotia* sp. and *Nybelinia bisulcata* from *Lethrinus lentjan* by Al-Zubaidy (2006) in addition to *Pseudotobothrium dipsacum*, *Callitetrarhynchus gracilis*, *Floriceps minacanthus*, *Pseudogrillotia* sp. and *N. bisulcata* from 12 fish species by Al-Zubaidy and Mhaisen (2011). The present investigation aims to demonstrate cestode species of Trypanorhyncha and Tetraphyllidea from the silver grunt *P. argenteus* which is an important commercial fish either in local or overseas markets and to demonstrate their parasitological indexes and sites of infection.

2. Materials and Methods

During the period from September 2010 till February 2012, a total of 218 specimens of *P. argenteus* were purchased from Al-Mehwat fish market at Hodeidah city, Yemen. The fishes were placed in bags with ice and transported to the laboratory of the Department of Marine Biology and Fisheries, Hodeidah University where they were measured to the nearest cm total length. Upon dissection, body cavity and viscera were examined with the help of a stereoscopic dissecting microscope, and the capsulated plerocerci were removed from the infected organs. Walls of parasite blastocysts were opened to remove the juvenile scolices. The isolated cestodes were washed in saline solution and fixed in 10% buffered formalin. Some specimens were stained in acetic carmine, dehydrated and then mounted in Canada balsam.

Bush *et al*. (1997) was followed to calculate some indexes of parasitism which included the prevalence of infection, intensity of infection and abundance of infection.

Parasitic identification was done according to some major accounts (Dollfus, 1942; Carvajal and Rego, 1985; Campbell and Beveridge, 1994; Palm *et al*., 1994; Palm, 1997) and confirmed with the assistance of Prof. Dr. Eileen Harris of the British Museum (Natural History), London.

3. Results and Discussion

As a result of fish inspection, five larval cestode species were recovered from body cavity, mesenteries and viscera. These larvae are arranged here in accordance with Global Cestode Database (2014) and WoRMS (2014).

Class Cestoda
- Order Trypanorhyncha
  - Family Lacistorhynchidae
    - *Callitetrarhynchus gracilis* (Rudolphi, 1819)
    - *Callitetrarhynchus speciosus* (Linton, 1897)
    - *Lacistorhynchus tenuis* (van Beneden, 1858)
  - Family Pseudotobothriidae
    - *Pseudotobothrium dipsacum* (Linton, 1897)
- Order Tetraphyllidea
  - Family Tetraphyllidea incertae sedis
    - *Scolex pleuronectis* Müller, 1788

The following is an account on these larvae with emphasis on their indexes of parasitism, location in fish hosts, synonyms and description.

3.1. *Callitetrarhynchus gracilis* (Rudolphi, 1819) Pintner, 1931 (Fig. 1)

3.1.1. Materials Examined

Plerocercoids of *C. gracilis* of the present study were detected from body cavity, mesenteries, stomach mucosa and liver of *P. argenteus*. The prevalence, mean intensity and mean abundance were 35.78%, 3.15 and 1.13, respectively. The 78 infected fishes ranged from 18.6-27.5 cm in total length. This is the second report on *C. gracilis* from *P. argenteus* from the Yemeni waters of the Red Sea. The first report on *C. gracilis* was from *P. argenteus* as well as *Carangoides bajad*, *Epinephelus tauvina*, *Lethrinus nebulosus*, *Sphyraena barracuda*, *Valamugil seheli* (Synonym of *Moolgarda seheli*), *Scomberomorus commerson*, *S. guttatus* and *Thunnus tonggol* by Al-Zubaidy and Mhaisen (2011).

3.1.2. Synonyms

According to WoRMS (2014), *C. gracilis* has four synonyms. These are: *Anthocephalus gracilis* Rudolphi, 1819; *Rhynchobothrium spiracornutum* Linton, 1907; *Tentacularia lepida* Chandler, 1935 and *Tentacularia macfiei* Southwell, 1929. Global Cestode Database (2014) added two other synonyms which are *Tetrarhynchus ceylonicus* Southwell, 1929 and *Tentacularia macfiei* Southwell, 1929.

3.1.3. Description

Based on six specimens, the body is elongated, 8.7-14.3 (12.6) mm long x 0.65-0.95 (0.85) mm wide. The host capsule is a bladder-like to elongated and usually white. Blastocyst is 6.5-38 (24.5) mm long. The post larva is 5.5-31.8 (20.7) mm long and has an elongated scolex, 5.9-8.98 (7.5) mm long with long tail and two short, heart shaped bothridia. This morphological description agrees with that given by Dollfus (1942) and Carvajal and Rego (1985).

The present prevalence of infection (35.78%) is lower than those reported from both *P. argenteus* (52%) and *T. tonggol* (43.3%) from the Red Sea (Al-Zubaidy and Mhaisen, 2011), from 10 fish species (72%) from the northeast Brazilian coasts (Palm, 1997), from *Ethmalosa fimbriata* (50%) of the West African coast (Palm *et al*., 1994) and from both *Centropumus undecimalis* (91.4%) and *Cynoscion acoupa* (60%) from Amazon coast (Dias, 2008). The present prevalence is higher than those reported from seven teleosts (21.13%) from the Arabian Gulf (Haseli *et al.*, 2011), from three fishes (30%) from the Mediterranean Sea, Egypt (Mahmoud *et al.*, 2013), from *Genypterus brasiliensis* (20.2%) from the coastal zone of Rio de Janeiro, Brazil (Sao Clemente *et al*., 2004), from *Balistes capriscus* (9%) purchased from Rio de Janeiro State, Brazil (Dias *et al*., 2009), from *Paralichthys isosceles* (3.33%) from Rio de Janeiro (Felizardo *et al*., 2010), from *Trichiurus lepturus* (12.5%) from Rio de Janeiro (Carvalho and Luque, 2011) and from seven fish species (12.5-34.6%) from the Red Sea (Al-Zubaidy and Mhaisen, 2011).

Fig 1. *Scolex of Callitetrarhynchus gracilis.*

3.2. *Callitetrarhynchus speciosus* (Linton, 1897) Carvajal & Rego, 1985 (Figs. 2 & 3)

3.2.1. Materials Examined

Plerocercoids of *C. speciosus* of the present study (Fig. 2) were detected from body cavity, mesenteries, stomach mucosa and intestine of *P. argenteus*. The prevalence, mean intensity and mean abundance were 1.8%, 3.0 and 0.05, respectively. The four infected fishes ranged from 18.9-25.6 cm in total length. This is the first record of *C. speciosus* from the Yemeni coastal waters of the Red Sea.

3.2.2. Synonyms

According to WoRMS (2014), *C. speciosus* has one synonym which is *Tentacularia pseudodera* Shuler, 1983. Global Cestode Database (2014) added another synonym which is *Rhynchobothrium speciosum* (Linton, 1897).

3.2.3. Description

Based on five specimens, the body is elongated and the total length of larvae released from blastocyst is 13.7-18.3 (16.5) mm x 1.9-2.95 (2.5) mm wide. Pars bothridialis is 2-2.6 (2.5) mm; Pars bulbosa is 1.9-2.7 (2.5) mm; Pars vaginalis is 8.9-10.2 (9.9) mm; Bulb width is 0.25-0.28 (0.26) mm; Pars postbulbosa is 0.15-0.28 (0.25) mm; Strobila (appendix) is 9.50-11.5 (10.85) mm. The host capsule is usually white. The scolex (Fig. 3) has two cardiform bothridia, armature with a single chainette located on the middle of external surface and with no rows of intercalary hooks. No basal swollen armature was detected. This morphological description agrees with that given by Kardousha (1999) for *C. speciosus* from *Argyrops filamentosus*, *Carangoides malabaricus*, *Lutjanus coccineus* (synonym of *L. gibbus*), *P. argenteus*, *Saurida undosquamis* and *Sphyraena jello* from the Arabian Gulf along the coasts of the United Arab Emirates.

The prevalence of infection reported in the present study (1.8%) is slightly lower than that reported from *Balistes capriscus* (2.0%) purchased from Rio de Janeiro, Brazil (Dias *et al*., 2009) and from the above-named six fish species (10-25%) from the Arabian Gulf (Kardousha, 1999).

Fig 2. *Larval stages of Callitetrarhynchus speciosus encapsulated in blastocysts.*

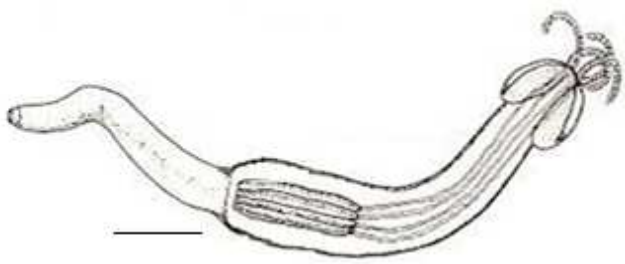

Fig 3. *Scolex of Callitetrarhynchus speciosus isolated from blastocyst. Bar= 3 mm.*

3.3. *Lacistorhynchus tenuis* (van Beneden, 1858) Pintner, 1913 (Figs. 4 & 5)

3.3.1. Materials Examined

Plerocercoids of *L. tenuis* of the present study were detected from body cavity, mesenteries and stomach of *P. argenteus*. The prevalence, mean intensity and mean abundance were 3.2%, 1.86 and 0.06, respectively. The seven infected fishes ranged from 20.5-29 cm in total length. This is the first report on *L. tenuis* from the Yemeni waters of the Red Sea.

3.3.2. Synonyms

According to WoRMS (2014), *L. tenuis* has one synonym which is *Rhynchobothrium heterospine* Linton, 1897. Global Cestode Database (2014) added two other synonyms. These are: *Rhynchobothrium bulbifer* Linton, 1889 and *Tetrarhynchus tenuis* van Beneden, 1858.

3.3.3. Description

Based on three specimens, the host capsule (Fig. 4) is swollen on one end and has a tail on the other end. It varies from 1.8-4.6 (3.45) mm long. The post larva (Fig. 5) is 1.3-3.5 (2.65) mm long. The tentacles of the post larvae emerge from the sides of the anterior end of each bothridium. The post larva has a long scolex and a short tail. The two bothridia are elongated with raised rims; Pars bothridialis is 0.21-0.35 (0.3) mm; Pars vaginalis is 0.65-0.95 (0.93) mm; Pars bulbosa is 0.50-0.85 (0.7), wider than pars vaginalis; Tentacle sheaths are spiral, the bulbs are elongated, 0.22-0.36 (0.34) mm long x 0.04-0.09 (0.07) mm. The scolex bulges around the tentacle bulbs. The plerocerci contain many calcareous bodies in the anterior swollen region (which contains the invaginated scolex) and also in the long narrow tail. This morphological description agrees with that of *L. tenuis* from *Zenopsis nebulosa*, *Agnostomus forsteri* (synonym of *Aldrichetta forsteri*) and *Thyrsites atun* given by Robinson (1959).

The prevalence of infection reported in the present study (3.2%) is higher than that reported from *Rhinonemus cimbrius* (1.4%) from the central North Sea (Klimpel *et al*., 2003b) and lower from those reported from *Belone belone* (8.7%) from the Pomeranian Bay, Southern Baltic (Grabda, 1981) and from *Etmopterus spinax* (5.4%) from the Norwegian Deep (Klimpel *et al*., 2003a).

Fig 4. *Lacistorhynchus tenuis larva inside the blastocysts.*

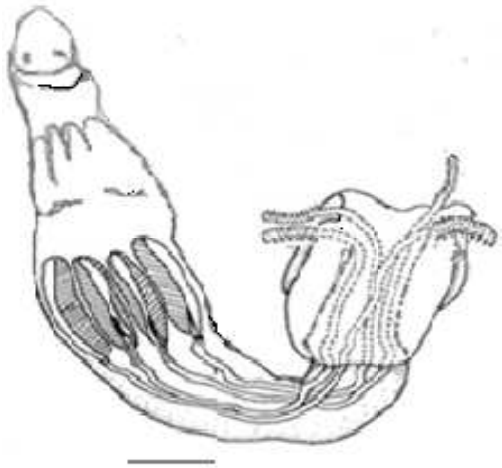

Fig 5. *Lacistorhynchus tenuis isolated from the blastocyst. Bar=0.3 mm.*

3.4. *Pseudotobothrium dipsacum* (Linton, 1897) Dollfus, 1942 (Fig. 6)

3.4.1. Materials Examined

Plerocercoids of *P. dipsacum* of the present study were detected from body cavity and mesenteries of *P. argenteus*. The prevalence, mean intensity and mean abundance were 21.6%, 2.29 and 0.49, respectively. The 47 infected fishes ranged from 19-30 cm in total length. This is the second report of *P. dipsacum* from fishes from the Yemeni coasts of the Red Sea. The first report was from *Lutjanus argentimaculatus*, *P. argenteus*, *S. barracuda* and *T. tonggol* by Al-Zubaidy and Mhaisen (2011).

3.4.2. Synonyms

WoRMS (2014) reported no any synonym for *P. dipsacum*. However, Global Cestode Database (2014) reported one synonym which is *Otobothrium dipsacum* Linton, 1897.

3.4.3. Description

Based on five specimens, the scolex is situated inside large oval blastocysts, 5.8-12.5 (9.9) mm long. Scolex total length is 3.5-5.8 (4.6) mm. Capsule is ovoid, 8-25 (19) mm in length, often darkly colored. The post larva has two bothridia, 1.37-1.54 (1.51) mm long each, with thick margins, a short tail and a striated body. Tentacles are long, tapering at tip with rows of hooks. The tentacle sheaths are spiral. Bothridia have a posterior notch and oval sensory pits on the poster lateral margins. This morphological description agrees with that of *P. dipsacum* from *L. argentimaculatus*, *P. argenteus*, *S. baracauda* and *T. tonggol* given by Al-Zubaidy and Mhaisen (2011).

The prevalence of infection reported in the present study (21.6%) is slightly lower than that reported from *P. maculatus* (22%) from the Northeast Brazilian coastal waters (Palm, 1997) and from *P. argenteus* (24%) and *T. tonggol* (36.7%) from the Red Sea (Al-Zubaidy and Mhaisen, 2011) but higher than that reported from *Haemulon plumieri* (11%) from the Northeast Brazilian coastal waters (Palm, 1997) and from both *L. argentimaculatus* (9%) and *S. baracauda* (15%) from the Red Sea (Al-Zubaidy and Mhaisen, 2011).

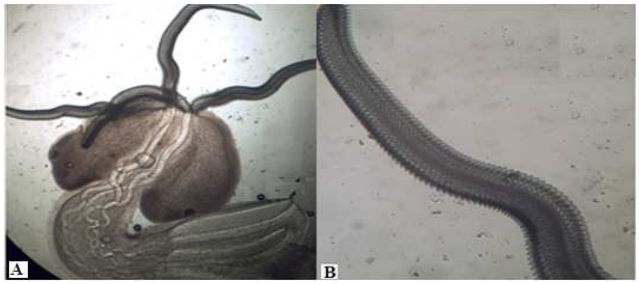

Fig 6. *Scolex (A) and tentacle (B) of Pseudotobothrium dipsacum.*

3.5. *Scolex pleuronectis* Müller, 1788 (Fig. 7)

3.5.1. Materials Examined

S. pleuronectis (larval name) of the present study were detected from the intestine of *P. argenteus*. The prevalence, mean intensity and mean abundance were 5.5%, 2.8 and 0.16, respectively. The 12 infected fishes ranged from 18-26.8 cm in total length. This is the first report on *S. pleuronectis* from the Yemeni waters of the Red Sea.

3.5.2. Synonyms

According to WoRMS (2014), *S. pleuronectis* has no any synonym.

3.5.3. Description

Based on six specimens, this white larva has five suckers on the scolex, a non segmented trunk and a body filled with calcareous corpuscles. Body length is 1.5-1.75 (1.6) mm x 0.35-0.5 (0.4) mm. The terminal (apical) sucker has a diameter of 0.13-0.15 (0.14) mm and the lateral suckers diameter is 0.09-0.11 (0.10) mm. This morphological description agrees with that of *S. pleuronectis* from *Atherina* sp. from Suez Canal given by El-Ekiaby (2009).

The prevalence of infection reported in the present study

(5.5%) is higher than that reported from *Caranx latus* (3.6%) from Brazil (Luque and Alves, 2001) and from *Paranthias colonus* (3.3%) from Elsargento, Baja California Sur, Mexico (Mendoza-Cruz *et al*., 2013). However, this prevalence (5.5%) is lower than that recorded from *Atheresthes stomias* (27.8%) from Northeastern Pacific Ocean (Wierzbicka and Piasecki, 1998), from *Conger conger* (24.32%) from north-west Spain (Sanmartin *et al*., 2000), from *Scomber japonicus* (30%) from the coastal zone of the state of Rio de Janeiro, Brazil (Alves *et al*., 2003), from *C. conger* (34.6%) from Sardinian water, Italy (Culurgioni *et al*., 2006) and from *Ophidion rochei* (33%) from Eastern Black Sea region of Turkey (Tepe *et al*., 2014).

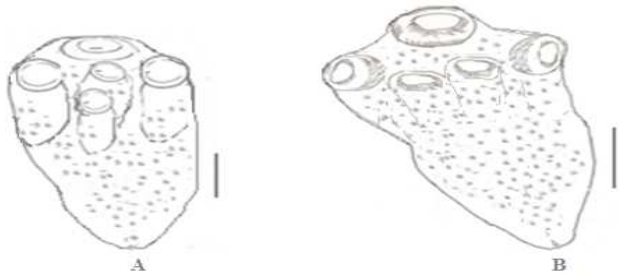

Fig 7. *Scolex pleuronectis, alive (A) and fixed (B) specimens. Bar= 0.25 mm.*

4. Conclusion

Considering ichthyo-sanitary approaches, the presence of trypanorhynchid metacestodes in fish musculature is harmless to humans but affect fish hosts besides the repugnant aspect conferred to the meat. Such fish flesh is often rejected by consumers and thus impeding its commercialization after the sanitary inspection (São Clemente *et al*., 2004; Felizardo *et al*., 2010). Recent studies dealing with medium sized or huge trypanorhynchid plerocerci such as *Molicola horridus* and *Gymnorhynchus gigas* have demonstrated that their ingestion can trigger allergenic processes in humans (Felizardo *et al*., 2010). The presence of medium sized trypanorhynchid plerocerci like *C. gracilis* parasitizing *P. argenteus* of the present investigation, even when appearing with low parasitological indexes, must be of human concern, mainly considering the species infecting fish musculature (Dias *et al.*, 2009). In connection with the occurrence of metacestodes in the musculature of fish specimens, it is suggested that the affected areas should be removed in order to permit the commercialization of the meat. This comes in agreement with data provided by São Clemente *et al.* (2004).

Acknowledgement

Thanks are due to Prof. Dr. Eileen Harris, Parasites & Vectors Division, Department of Life Sciences, British Museum (Natural History), London, for her assistance in cestode identification and for the additional information on some of the trypanorhynchids.

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