

The Trematode Parasites of *Lophius piscatorius* (Angler Fish) from the Aegean Sea

Ege Denizi'nden Yakalanan *Lophius piscatorius*'ların (Fener Balığı) Trematod Parazitleri

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ABSTRACT

Objective: There is no study on the trematode parasites of *Lophius piscatorius*. The aim of this study is to address the lack of knowledge about the parasites of angler fish from the coasts of Turkish seas.

Methods: Frozen individuals of *L. piscatorius* from the coasts of Izmir were brought to Ataturk University, and their visceral organs were parasitologically investigated. Parasites were fixed with AFA (Acetic acid-Formaline-Alcohol) fixative and permanently mounted with Canada balsam.

Results: Two digenean species were recorded: *Prosorhynchoides gracilescens* (Bucephalidae), which is commonly found in *L. piscatorius*, and *Aphallus tubarium* (Cryptogonimidae), which is rarely harbored in *L. piscatorius*.

Conclusion: Both species comprise the newly discovered parasite fauna of Turkey.

Keywords: Aegean Sea, Bucephalidae, Cryptogonimidae, *Lophius piscatorius*, Turkey

Received: 24.03.2016

Accepted: 08.12.2016

ÖZ

Amaç: Türkiye'de daha önce *Lophius piscatorius*'un trematod parazitleri araştırılmamıştır. Bu çalışmanın amacı Türkiye kıyılarında yaşayan fener balıklarının parazit faunası hakkındaki bilgi eksikliğini gidermektir.

Yöntemler: İzmir kıyılarından yakalanan *L.piscatorius*'lar dondurulmuş olarak Atatürk Üniversitesi'ne getirilmiş ve balıkların iç organlarındaki parazitler araştırılmıştır. Tespit edilen parazitler AFA (Asetik asit-Formalin-Alkol) fiksatifyle tespit edilip, Kanada balsamıyla kalıcı preparatları yapılmıştır.

Bulgular: İncelenen balıklardan iki digenea türü tespit edilmiştir. Bunlar *L. piscatorius*'ta sıkça rastlanan *Prosorhynchoides gracilescens* (Bucephalidae) ve *L.piscatorius*'ta nadiren rastlanan *Aphallus tubarium* (Cryptogonimidae)'dur.

Sonuç: Her iki tür de Türkiye parazit faunası için yeni kayıttır.

Anahtar Kelimeler: Ege Denizi, Bucephalidae, Cryptogonimidae, *Lophius piscatorius*, Türkiye

Geliş Tarihi: 24.03.2016

Kabul Tarihi: 08.12.2016

INTRODUCTION

Majority of the animals live free and the others live together. The association between animals can be divided into two groups: homogenetic and heterogenetic. The association between individuals of the same species is homogenetic, such as ants and bees, and between those of different species is heterogenetic. Parasitism is a lifestyle of heterogenetic association that is much more complex than that of homogenetic association (1).

In general, the parasitic way of the life is successful and found in nearly every phylum of animals from protists to arthropods and chordates as well as in many plant groups. Humans, for example, can be infected with more than hundred types of parasites. It is almost impossible to find animals not infected by even a single parasite on or within it. Organisms that are not parasites are usually hosts (2).

The marine fish fauna of Turkey consists of 512 species (3). Only 84 marine fish species of Turkey have been parasitologically studied and 161 metazoan parasites were found (4).

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DOI: 10.5152/tpd.2017.4806

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Angler fish, a common carnivorous and demersal fish of the Black Sea; Mediterranean Sea; coasts of Europe, Africa, and Northern America; Atlantic Ocean; Arctic Ocean; and Baltic Sea but not the the Pacific and Indian Oceans is one of the important species of the marine fish fauna of Turkey (5). Although there are many papers on parasites, mainly on Protozoa, Monogenea, and Crustacea, of the marine fishes from Turkey, only two studies by Ökter and Trilles (6) and Akmirza (7) mentioned regarding one crustacean and nematod species of *L. piscatorius*, respectively.

The aim of this paper is to contribute to the research on trematod parasite fauna of marine fishes of Turkey.

METHODS

A total nine *L. piscatorius* samples collected by the fishermen from the coasts of the Aegean Sea (İzmir) were brought to the Parasitology Research Laboratory of Ataturk University Science Faculty in April 2014. The alimentary organs, livers, and gallbladders of the fishes were taken out and put into petri dishes filled with 1% saline water after the dissection. The detected parasites were fixed with alcohol-formalin-acetic acid (AFA), dyed with Mayer's carmalum, and mounted with Canada balsam, according to the study by Pritchard and Kruse (8). Identification of the parasites was executed according to studies by Dawes (9), Dawes (10), Yamaguti (11), and Skrjabin (12). Author declared that the study was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" (amended in October 2013).

RESULTS

Family: Cryptogonimidae Ward, 1917

Aphallus tubarium (Rudolphi, 1819) Poche, 1926

Synonyms: *Distoma tubarium* (Rudolphi, 1819); *Distoma fuscescens* (Rudolphi, 1819); *Distomum* (Cryptogonimus) *tubarium* (Rudolphi, 1819 and Nicoll, 1915); *Acanthochasmus inermis* (Stossich, 1905); *Acanthostomum inermis* (Stossich, 1905 and Yamaguti, 1958); *Aphallus fuscescens* (Rudolphi, 1819 and Yamaguti, 1971).

The body is long and slightly wide at the ventral sucker level. The tegument is spinous. The oral sucker is a little larger than the ventral one. The pharynx is slightly rectangular, and the esophagus is longer than the prepharynx. The intestinal ceca extend to the posterior end of the body. The pretesticular ovary is three-lobed, and the uterus extends to the posterior end of the body. The eggs are small and nonfilamentous. The vitellin glands are globular and located between nearly the middle of the body and the posterior of the hind testis. The anterior testis is smaller than the posterior one (Figure 1) (Table 1).

Family: Bucephalidae

Prosorhynchoides gracilescens (Rudolphi, 1819)

Synonyms: *Bucephaloides gracilescens* (Rudolphi, 1819); *Bucephalopsis gracilescens* (Rudolphi, 1819); *Prosorhynchus gracilescens* (Rudolphi, 1819).

The shape of the body, broader anteriorly, is elongated and oval. The oral sucker is larger than the pharynx. The intestine is simple and sac-like. The genital pore is at the posterior end of the body. The testes are slightly globular, and the cirrus sac is long and located at posterior end of the body. The pretesticular ovary is spherical. The vitellin follicles are few in number, globular, slightly larger, and located at the anterior half of the body. The eggs are operculate, small, and ovoid (Figure 1) (Table 2).

DISCUSSION

The cosmopolitan family Cryptogonimidae Ward, 1917, includes a large number of species from marine and freshwater fishes to snakes and crocodiles (13). The metacercariae of Cryptogonimids encyst in the tissues of fishes. The adults are found in the gut sometimes in the other organs of freshwater and marine fishes, occasionally in amphibians and reptiles (14).

A. tubarium was recorded previously in *Dentex dentex*; *L. piscatorius*; *Sciaena umbra*; *Gobius ophiocephalus*; *Sparus pagrus*; *Syngnathus typhle*; *Trachurus trachurus*; and *Umbrina cirrhosa* (13, 15-24).

In light of the literature, it is clear that *A. tubarium* can be found in various fish species of the Atlantic Ocean, Mediterranean Sea, Aegean Sea, and Black Sea, whereas it has not been found in the fish species of Turkish seas.

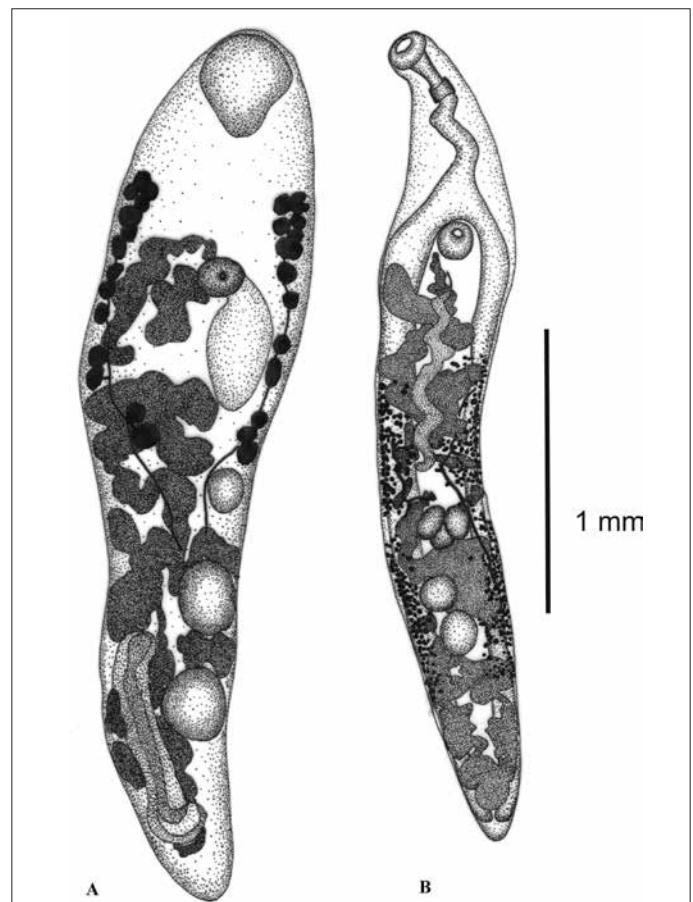


Figure 1. a, b. (a) *Prosorhynchoides gracilescens*, (b) *Aphallus tubarium*

Table 1. The measurements of *Aphallus tubarium* (µm) [min-max (average)]

<i>Aphallus tubarium</i> (Rudolphi, 1819) Poche, 1926	<i>Lophius piscatorius</i> Izmir, Aegean Sea (present study)	<i>Dentex dentex</i> Scandola, Corsica (13)	<i>Syngnathus typhle</i> Black Sea (22)
Length	1990-4001 (2947)	2425-4797 (2894)	2553-3243
Width	264-528 (381)	341-682 (519)	552
Oral Sucker Length	105-145 (122)	124-217 (186)	152-179
Oral Sucker Width	121-162 (141)	152-250 (201)	193-221
Ventral Sucker Length	113-162 (130)	130-234 (187)	152
Ventral Sucker Width	105-145 (120)	124-234 (191)	166
Pharynx Length	73-105 (88)	104-152 (124)	97
Pharynx Width	65-81 (74)	76-130 (103)	110
Prepharynx	121-242 (178)	39-108 (81)	Data not reported
Esophagus	267-687 (492)	130-423 (260)	Data not reported
Anterior Testis Length	81-170 (117)	160-293 (213)	317-386
Anterior Testis Width	73-202 (122)	149-320 (237)	290-317
Posterior Testis Length	73-218 (137)	197-373 (249)	345-400
Posterior Testis Width	73-218 (140)	160-320 (243)	290-386
Ovary Length	105-210 (157)	133-229 (191)	207-276
Ovary Width	81-242 (146)	160-320 (250)	207-386
Egg Length	12-20 (17)	20-24 (22)	19-22
Egg Width	8-10 (9)	7-13 (9)	8-11

Table 2. Some morphometric measures of *Proisorhynchoides gracilescens* (µm) [min-max (average)]

<i>Aphallus tubarium</i> (Rudolphi, 1819) Poche, 1926	<i>Lophius piscatorius</i>		
	Izmir, Aegean Sea (present study)	Gulf of Marseille (27)	Off England (27)
Length	2397-4692 (3323)	2180-5024 (3328)	1643-2830 (2149)
Width	467-995 (739)	537-900 (702)	355-553 (430)
Oral Sucker Length	203-406 (292)	356-425 (385)	191-279 (244)
Oral Sucker Width	41-508 (294)	286-419 (353)	191-267 (232)
Pharynx Length	102-183 (153)	120-190 (146)	106-138 (121)
Pharynx Width	122-183 (159)	147-235 (179)	118-165 (138)
Intestinal Cecum Length	345-630 (470)	254-483 (334)	154-358 (284)
Intestinal Cecum Width	142-284 (232)	160-330 (224)	114-182 (150)
Anterior Testis Length	223-366 (276)	254-380 (312)	199-288 (230)
Anterior Testis Width	162-264 (211)	191-305 (238)	133-189 (154)
Posterior Testis Length	223-366 (282)	224-380 (288)	169-266 (211)
Posterior Testis Width	162-264 (210)	159-330 (224)	77-179 (143)
Ovary Length	122-244 (191)	178-273 (212)	122-224 (169)
Ovary Width	122-223 (166)	133-210 (179)	95-197 (123)
Cirrus-Sac Length	731-1198 (905)	584-1232 (942)	500-635 (574)
Cirrus-Sac Width	122-223 (166)	143-235 (186)	93-154 (117)
Egg Length	20-24 (23)	19-22 (20,8)	19-22 (21.1)
Egg Width	14-18 (16)	15-17 (16.3)	14-17 (16.1)

Table 3. Parasite numbers of *Lophius piscatorius*

Host Number	1	2	3	4	5	6	7	8	9	TPN	%	FREE
<i>Aphallus tubarium</i>	-	-	7	9	2	-	-	9	-	27	44	33
<i>Proserorhynchoides grasilescens</i>	-	-	-	2	-	3	7	2	-	14	44	

TPN: total parasite number; %: prevalence; FREE: the rate of uninfected fishes

Table 4. The parasites of *Lophius piscatorius* from various localities

PARASITE DIGenea	LOCALITY	AUTHOR
<i>Aphallus tubarium</i>	France	(39)
	Greece	(19)
<i>Proserorhynchoides borealis</i>	Northeast Atlantic	(27)
<i>P. gracilescens</i>	England	(9), (10), (29), (31), (32), (33)
	France	(39), (27)
	Germany	(15), (28), (40)
	Icelandic Waters	(35), (41), (42)
	Irish Sea	(34),
	Italy	(16), (30)
	North Sea	(36)
	Ukraine	(21)
	West Africa	(43)
<i>Proserorhynchus aculeatus</i>	France	(39)
<i>P. crucibulum</i>	England	(10), (33)
<i>Derogenes latus</i>	France	(39)
<i>D. varicus</i>	England	(10), (32), (33)
	Icelandic Waters	(35)
<i>Dinosoma</i> sp.	France	(39)
<i>D. lophiomi</i>	Western Mediterranean	(44)
<i>Distomum cesticillum</i>	Germany	(40)
	Italy	(30)
<i>Di. hystrix</i>	Germany	(40)
<i>Ectenurus lepidus</i>	England	(10)
<i>Gonocerca crassa</i>	USA	(45)
<i>Hemiurus communis</i>	England	(10), (32), (33)
<i>Lecithaster gibbosus</i>	Icelandic Waters	(35)
<i>Lecithochirium fusiforme</i>	France	(39)
<i>L. grandiporum</i>	Western Mediterranean	(46)
	France	(39)
<i>L. physcon</i>	England	(10)
<i>L. rufoviride</i>	England	(10), (32), (33)
<i>L. excisum</i>	England	(10)
<i>Metadena brotulae</i>	USA	(10)
<i>Otodistomum</i> sp.	Icelandic Waters	(35)

Table 4. The parasites of *Lophius piscatorius* from various localities (continued)

PARASITE DIGenea	LOCALITY	AUTHOR
<i>O. veliporum</i> (larvae)	England	(10)
<i>Stephanostomum</i> sp.	Icelandic Waters	(35)
<i>S. baccatum</i> (larvae)	England	(10)
<i>S. caducum</i>	England	(10)
<i>S. cesticillum</i>	England	(10)
	Egypt	(47)
	France	(39)
	Italy	(20)
	Western Mediterranean	(48)
<i>Stringophorus furciger</i>	Icelandic Waters	(35)
	England	(10)
<i>Sterrhurus floridensis</i>	USA	(45)
<i>S. fusiforme</i>	England	(10), (33)
<i>S. grandiporus</i>	England	(10)
<i>S. musculus</i>	England	(10)
	England	(10), (32)
<i>Synaptobothrium caudiporum</i>	England	(10), (32)
	France	(39)
<i>Zoogonoides viviparus</i>	Icelandic Waters	(35)
CESTODA		
<i>Bothriocephalus lophii</i>	Germany	(40)
<i>Grillotia</i> sp.	Icelandic Waters	(35)
<i>Rhynchobothrium crassiceps</i>	Germany	(40)
<i>R. palaceum</i>	Germany	(40)
<i>R. tennicolle</i>	Germany	(40)
<i>R. erinaceus</i>	Germany	(40)
<i>Scolex polymorphus</i>	Germany	(40)
<i>S. lophii piscatorii</i>	Germany	(40)
<i>Tetraphyllid plerocercoids</i>	Icelandic Waters	(35)
<i>Tetrarhynchus lophii piscatorii</i>	Germany	(40)
NEMATODA		
<i>Agamonema capsularia</i>	Germany	(40)
<i>A. commune</i>	Germany	(40)
<i>A. lophii piscatorii</i>	Germany	(40)
<i>Anisakis simplex</i>	Icelandic Waters	(35)
<i>Ascaris angulata</i>	Germany	(40)
<i>A. increscens</i>	Germany	(40)
<i>A. rigida</i>	Germany	(40)
<i>Contraecum clavatum</i>	England	(33)
	Italy	(20)
<i>Capillaria</i> sp.	Icelandic Waters	(35)
<i>Dikentrocephalus crinalis</i>	Germany	(40)

Table 4. The parasites of *Lophius piscatorius* from various localities (continued)

PARASITE	LOCALITY	AUTHOR
DIGENEA		
<i>Hysterothylacium</i> sp.	Icelandic Waters	(35)
<i>H. aduncum</i>	Icelandic Waters	(35)
	Turkey	(7)
<i>H. rigidum</i>	England	(33)
	Icelandic Waters	(35)
<i>Cucullanus hians</i>	England	(33)
<i>Spinitectus</i> sp.	Icelandic Waters	(35)
<i>Phocascaris</i> sp.	Icelandic Waters	(35)
<i>Pseudoterranova decipiens</i>	Icelandic Waters	(35)
ACANTHOCEPHALA		
<i>Echinorhynchus acus</i>	Germany	(40)
<i>E. casculosus</i>	Germany	(40)
<i>E. gadi</i>	Icelandic Waters	(35)
<i>E. globosus</i>	USA	(49)
<i>E. propinquus</i>	Italy	(17)
ANNELIDA-HIRUDINEA		
<i>Calliobdella lophii</i>	England	(50)
	Norway To Mediterranean	(51)
ARTHROPODA-CRUSTACEA		
<i>Bomolochus attenuates</i>	Panama	(52)
<i>Chondracanthus lophii</i>	Turkey	(6)

The tegument of *A. tubarium* is spinous, but the tegument of the parasite we mounted is not covered with spines because the fish material was frozen and spines are very easily lost in frozen and poorly fixed materials (14). The width of the samples and the measures of the suckers, pharynx, testis, and ovary are smaller and the prepharynx and esophagus are longer than the measures of the *A. tubarium* described by Bartoli and Bray (13) and Kornychuk and Gaevskaya (22). The variation of the measurements can be due to the host difference. *A. tubarium* has been recorded from Turkey for the first time.

Bucephalids especially found in the gut and intestine, occasionally in the body cavities and tissues of the teleost fishes, rarely found in amphibians (14, 25). *Prosorhynchoides* is a cosmopolitan parasite that lives in marine and some freshwater fishes (26). *P. gracilescens* (Rudolphi, 1819) is a common intestinal parasite of the angler fish *L. piscatorius* in European marine waters (27).

P. gracilescens was previously recorded in *L. piscatorius*; *Sarda* sp. *S. sarda* *Scomber* sp.; *Gadus morhua* and *Merlangius merlangus euxinus* and *Belone belone* (9, 10, 15, 16, 19, 21, 28-37).

P. gracilescens that is generally found in *L. piscatorius* and occasionally in various fish species of the European coasts of the Atlantic Ocean, Mediterranean Sea, Aegean Sea, and Black Sea has not been discovered in the Turkey seas.

The morphometric measures are consistent with those reported by Bartoli et al. (27). *P. gracilescens* has been recorded for the first time in the parasitic fauna of the marine fishes of Turkey.

CONCLUSION

We investigated nine *L. piscatorius* samples and noted that 33% of the fishes were not infected with any trematode. Infection rates of both *P. gracilescens* and *A. tubarium* are 44% (Table 3). We found neither nematode nor any other parasite groups except digenean parasites in *L. piscatorius*. In light of the literature, it is obvious that a lot of parasite taxa were found in *L. piscatorius* of various seas of the world (38-52) (Table 4). Consequently, parasites of the angler fish of Turkish seas must be comprehensively studied.

Ethics Committee Approval: Author declared that the study was conducted according to the principles of the World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects" (amended in October 2013).

Informed Consent: Not required in this study.

Peer-review: Externally peer-reviewed.

Acknowledgements: The author would like to thank Dr. R.A. Bray from the NHM of London for his help on verification of the descriptions.

Conflict of Interest: No conflict of interest was declared by the authors.

Financial Disclosure: The authors declared that this study has received no financial support

Etik Komite Onayı: Yazar çalışmanın World Medical Association Declaration of Helsinki "Ethical Principles for Medical Research Involving Human Subjects", (amended in October 2013) prensiplerine uygun olarak yapıldığını beyan etmiştir.

Hasta Onamı: Bu çalışma için hasta onamına gerek yoktur.

Hakem Değerlendirmesi: Dış Bağımsız.

Teşekkür: Yazar, Londra Natural History Museum'da görevli olan Dr. R.A. Bray'a teşhislerin doğrulanmasındaki yardımlarından dolayı teşekkür eder.

Çıkar Çatışması: Yazarlar çıkar çatışması bildirmemişlerdir.

Finansal Destek: Yazarlar bu çalışma için finansal destek almadıklarını beyan etmişlerdir.

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