Study of some internal Parasites from Boops boops fish in Syrian marine waters

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الملخص

ABSTRACT

This study aimed to investigate the internal Parasites from *Boops boops* fish. To classify the isolated internal parasites, and to determine the prevalence and intensity of infection by these parasites in the study fish in Syrian marine waters.

Fish samples were collected from different fishing areas, including the Port of Fishing and Picnic area, and the marine research area, during the period from 12/01/2024 to 12/12/ 2024. The Total number of individuals collected was 270 of *B. boops* fish. The internal organs (stomach, intestines, liver, muscles, swim bladder, kidneys and body cavities of all the fish were examined to detect parasitic infection.

During the research, three types of internal parasites were isolated: Tetraphyllidae which belonging to family Tetraphylidea and *Hysterothylacium aduncum* belonging to the Family Raphidascarididae, from the stomach and intestines of the studied fish. The results showed that the highest pravelence of infection with this isolated parasite was in summer, reaching 52%, which coincided with the rise in temperature. The parasite *Anisakis simplex*, belong to Anisakidae family, was also isolated from intestine and on the membranes between organs. The infection rate with the parasite increased in spring and summer. These parasitic species were isolated for the first time from *B. boops* cought in Syrian marine waters.

Keywords: *Boops boops,* Tetraphyllidae*, Hysterothylacium aduncum, Anisakis simplex*, Syrian marine waters.

دراسة لبعض الطفيليات الداخلية المعزولة من أسماك الغبس *Boops boops* في المياه البحرية السورية

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الملخص

الهدف الأساسي من البحث الحالي هو التقصي عن الإصابة بالطفيليات الداخلية التي تصيب النوع السمكي الغبس *Boops boops*، وتصنيف الطفيليات الداخلية المعزولة وتحديد نسبة الإصابة بهذه الطفيليات وشدتها على النوع السمكي المذكور في المياه السورية البحرية. جمعت عينات الأسماك من مناطق صيد مختلفة (ميناء الصيد والنزهة ومنطقة البحوث البحرية) خلال الفترة الممتدة من 2024 /12/01 حتى 12/12/2024. بلغ إجمالي عدد الأفراد التي تم جمعها 270 سمكة من نوع *B. boops*، فحصت الأعضاء الداخلية (المعدة، الأمعاء، الكبد، العضلات، الكيس السباحي، الكلى وتجاويف الجسم) لجميع الأفراد السمكية المصطادة للكشف عن الإصابة بالطفيليات. عزل خلال البحث ثلاثة أنواع من الطفيليات الداخلية وهي: الطفيلي التابع لفصيلة Tetraphyllidae كما عزل الطفيلي *Hysterothylacium aduncum* الذي ينتمي إلى الديدان الخيطية من معدة وأمعاء الأسماك المدروسة. وقد أظهرت النتائج أن أعلى نسبة إصابة بهذا الطفيلي المعزول كانت في فصل الصيف إذ بلغت 52 %وقد تزامن ذلك مع ارتفاع درجة الحرارة. كما عزل الطفيلي *Anisakis simplex* الذي ينتمي إلى الديدان الخيطية. وهذه الأنواع الطفيلية عزلت للمرة الأولى من أسماك الغبس المصطادة من المياه البحرية السورية.

الكلمات المفتاحية: الغبس *Boops boops*، Tetraphyllidae، *aduncum Hysterothylacium*، *Anisakis simplex*، المياه البحرية السورية.

Introduction:

Fish are an important source of vitamins (A, D) and minerals such as magnesium, phosphorus and iodine. In addition to being rich in protein, amino acids, and essential fatty acids, especially omega-3, which contributes to the growth and development of the human body [1,2,3].

Parasitic diseases, which are infectious diseases, constitute about 80% of warm-water diseases. They are caused by protozoa or parasitic sequences [4,5]. Fish are hosts for a large number of parasites, some of which are pathogenic to other fish or to carnivorous vertebrates, including humans [6]. Some parasites caused mechanical damage when they migrate through tissues, du to pressure on connective tissue, which hinders growth and reproduction. Additionally, a number of fish parasites or their larval stages are transmitted to humans through the consumption of raw or undercooked fish [7].

Parasites are among the most important pathogens affecting fish. These parasites may be external or internal. Some types of parasites have direct life cycle, while others have more than one host during their life cycle, leading to their easy transfer from one host to other.

The presence of parasites in freshwater and marine fish indicates a diseases infection, but it does not necessarily mean that symptoms will appear. A large proportion of parasitic infections can be latent. The importance of such infections lies in their significant role in reducing the immunity of the infected fish, making it more susceptible to other fungal, bacterial, or viral diseases. They also reduce its growth and productivity [7]. Consequently, they cause significant harm to fish stocks, as they are susceptible to death from parasitic diseases that may be transmitted to them by water birds throught the excretion of feces containing the larval stages of some parasites into the water many fish parasites or their larval stages may also be transmitted to humans through the consumption of fish meat food safety standards [7, 8].

Studies in Syria on the internal marine fish parasites are relatively few, the first being in 2010 and aimed to determine some species of parasitic Trematoda- class in intestinal of of four species of Mugilidae marine fish, the study revealed the occurrence of four Trematoda species belonging to Haploporidae family [9], another

study was the first record of parasitic acanthocephalan in mugilidae marine fish in the Coastal Region of Lattakia/ Syria [10], the study of [11] was performed to discover parasitic Nematoda in digestive system of *Siganus rivulatus* in beach water of Lattakia, the study showed one species of Nematoda, *Hysterothylacium fabri*. Taxonomic study was conducted on internal and external parasites on the fish species *Sardinella aurita* in latakia city coast [12]. Record of parasitic *Hysterothylacium aduncum* (Nematoda: Anisakidae) from Sparus aurata fishes in the marine waters of the coast of Lattakia. [13], Also a study [14].

In Syria, studies on the parasitic fauna of *Boops boops* are very rare and still incomplete. There are only one study that aimed to Investigation of Exo-parasites of some fish species in the Syrian coast [15]. This study included 140 fishes belonging to two species of Sparidae (*Sparus aurata, Boops boops*) collected from different regions of the coastal water of Lattakia city.

Research objectives and importance:

The importance of this research comes from the fact that studies on internal and external marine fish parasites in Syria are relatively few. It is the first research to investigate internal parasites in *Boops boops* fish, representing a new addition to the biodiversity database, particularly regarding parasites. It also allows for the recording of new parasite species in intermediate and final Host, as well as the possibility of description new parasitic species for the first time in Syrian marine waters.

The current study aimed to investigation the presence of parasitic infections in *B. boops* fish, which is one of the species belonging to the Marine Sparidae Family and is one of the economically important fish species in Syrian marine waters, identify the isolated internal parasite species, Studying the temporal (seasonal) and spatial changes in the rates and intensity of infection with these parasites.

2. METHODS AND MATERIALS:

Stydy areas:

Our study inclouded two areas with different environmental conditions in Syrian marine waters:

Marine research area: This area is located near the Higher Institute for Marine Recearch and is characterized by a rocky beach. It is relatively far from sources of pollution, but it is relatively exposed to pollution during the

summer tourist months, which originates from the sewage of nearly tourist resorts figure (1):



Figure (1): Marine research area

Latakia port Area (fishing and Recreation Port):
This area is the main entrance to the port of Latakia and is quite limited, covering approximately 2 km^2. The water depth ranges between 3.5 and 16 maters. The sewage system serving the city of Latakia flows into this area, making it an area with organic and oil pollution. Figure (2)



Figure (2) Latakia port Area

270 individuals of *B. boops* were collected from different fishing areas, (the Port of Fishing and Picnic area, the marine research area), during the period from 12/01/2024 to 12/12/ 2024. Fish samples were collected and transported to the marine Biology and Fisheries Laboratory at the Higher Institute of Marine Research – Latakia University for the purpose of laboratory examination Figure (3).

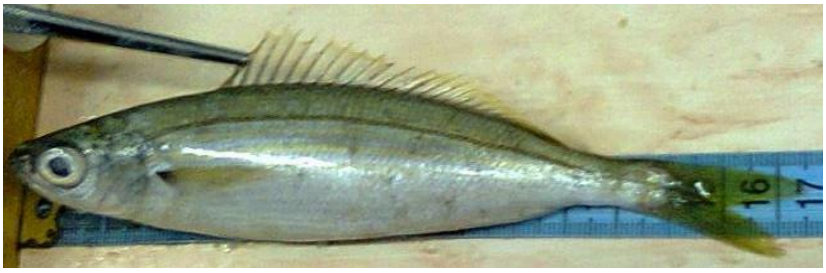


Figure (3) *Boops boops*

The fish were then dissected according to the method described by researchers [16, 17] by making a longitudinal incision along the ventral midline, extending from the head to the end of the Anus. A second incision was then made, extending from the end of the first incision to the gill cover. The internal organ were then exposed for examination. The body cavity was then visually inspected for the presence of nematodes inhabiting the cavity. The digestive tract was separated at its connection to the oral cavity and anus. The intestine was opened lengthwise in a petri dish using forceps and scissors and examined for worms. After finding the worms, they were extracted from the intestine and preserved in bottles containing 10% formalin. The contents of the intestine were examined by direct smear and lactic acid according to researchers [16, 18, 19]. Parasites were identified by relying on a number of global classification keys that cared about the external and internal formal qualities of the isolated parasite, the front and rear ends of the body and others using the method described in [20, 21, 22, 23, 24, 25, 26].
The rate and intensity of infection were also determined based on the following two relationships [27, 28]:
Prevalence % = (number of infected fish /number of fish tested) * 100.
Intensity = number of isolated parasites /number of infected fish.

3. RESULTS AND DISCUSSION

In the current study, three parasite species: Tetraphyllidae which belongs to the family Tetraphyllidae, *H. aduncum* which belongs to the family Raphidascaridid and *Anisakis simplex* which belongs to the family Anisakidae, this species were isolated and identified for the first time from the stomach and intenstine of *B. boops* Fish in marine waters.

Tetraphyllidae: Class Cestoda, Order Tetraphyllidea, Family Tetraphyllidae incertae sedis. [29]. The parasite observed in the internal organs (pyloric

appendages- intestine) of infected fish. Its larva are small and equipped with four suckers. The edges of the suckers are oval. It lacks an apical sucker. It absorbs food through the suckers. The larval body is retractable. Measuring 90-115 mm in length and 54-85 mm in width. The suckers are not retractable. The live worms are active and fast- moving constantly contracting and relaxing by means of flexible, expandable muscular appendages, or by inserting the head into the body. The larval body is unsegmented. These larvae are found in the digestive tract of most fish. They are not classified and are considered immature larvae that can only be identified by their order. There are no complete life cycle details of this parasite species, but the larvae have been divided into groups, and this group belong to the larvae of V [30]. Figure (4).



Figure (4) the body shapes of the parasites Tetraphyllidea with the four suckers

The number of fish samples infected with this parasite (160) individuals of 270 specimens of *B. boops* in the two study areas. This parasite was found in the infected areas in all season. The higher infection rate recorded in summer and spring Table (1) Table (4). Our study consistent with [12], which investigated larval infection of *Sardinella aurita* in all season and the highest infection rate was in summer.

Hysterothylacium aduncum **(**Rudolphi, 1802**):**

Belong to Family Raphidascarididae, *genus Hysterothylacium*, *species Hysterothylacium aduncum*, [31].

The species was named *H. aduncum*, based on the presence of three lips, anchoring papillae, and a large number of caudal papillae in the male. Body measurments showed that the male worms were smaller than the female, measuring 13.9- 18 mm in length and 0.26-0.34 mm in width, while the female measured 20.5- 24 mm in length and 0.52-0.41 mm in width [32].

The isolated species has three lips and an esophagus containing posterior sinusoidal appendages. The intestine has an enterocele that increases the intestinal surface area, such that the size of these appendages may indicate the species ability to parasitize prey [25]. The excretory opening is located at the base of the neural ring figure (5). Anisakid nematodes of the genus *Hysterothylacium* use fish as both intermediate and definitive hosts, in which they attain maturity. Some *Hysterothylacium* species were reported from sparid fishes, namely, *Pagellus acarne* [33] and a related species *Diplodus sargus* from the Mediterranean [34].

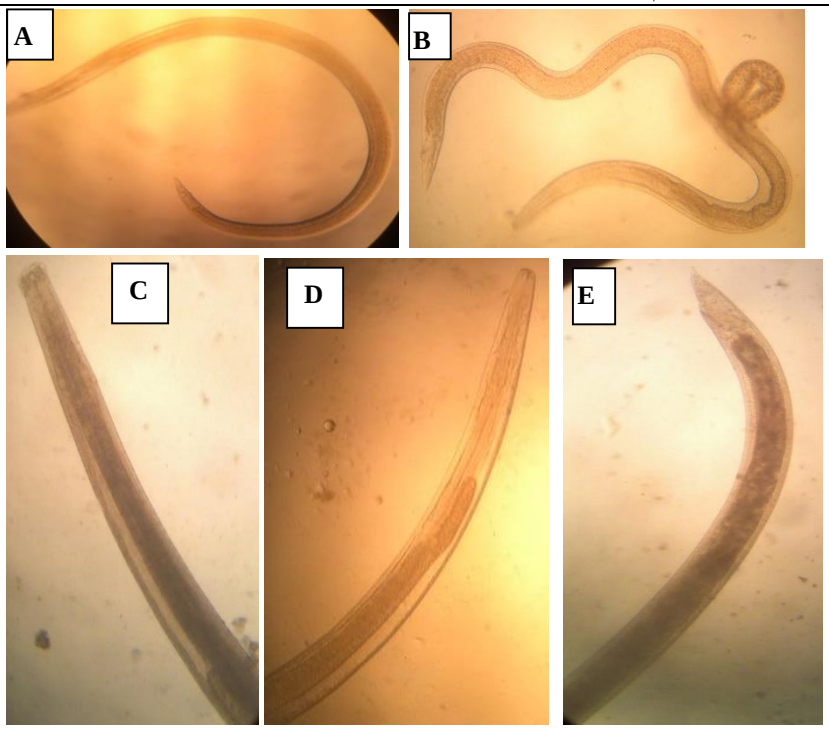


Figure (5): A, B: general Form of *H. aduncum,* C,D: Anterior end of the body; E: posterior end of the body

In this study, 14 out of 270 specimens were found infected by *H. aduncum*. Table (2), table (5) shows the number of fish examind, the number of infected individuals, and the prevalence of the infection during the study seasons. The infection rate with this parasite increased in spring and summer, representing rate of 7.41%, 15 %. While no infections were recorded in the winter. This may indicate an abudance of intermediate hostes, inclouding crustaceans. Consequently, increased fish feeding occurs at the beginning of the spring and summer months to increase reproduction. This is consistent with the study conducted on *sparua aurata* fish in Latakia. The results showed the isolation of *H. aduncum* for the first time on the Syrian coast, the infection rate was highst during the summer, attributed to the abudance of phytoplankton and Zooplankton that the fish feed on [13].

Furthermore, the rise in temperatures is an important factor in the emergence of the larval stages of intermediate hosts, thus increasing parasitic infection during this period.

As [35] indicated, the high incidence during the spring and summer months indicates the flourishing of animal species during this period, such as insects and crustaceans, which plays an important role in the nutrition of many organisms. The decrease in incidence during the autumn and winter months may be due to a lack of food, or to environmental and physiological effects on the host itself, thus leading to fewer parasitic infections [36].

The species *H. aduncum* has been reported in fish colleted in the northeast Atlantic and Northern Europe [26], the Adriatic sea [37], and the Southwestern Medeterranean [38], Northeast Mediterranian [39], Northeast Mediterranian in the Golf of Mersin [40], also isolated from fish taken from turkey [41].

Anisakis simplex **(Rudolphi, 1809)**:Belong to Family Anisakidae, genus Anisakis, species *Anisakis simplex*, [42].

Morphologically, the larvae of this parasite in fish are characterized by its color and cylindrical shape, ranging in length from 10 to 35 mm. the body is unsegmented and tapered at both ends Figure (6). The anterior end contains a mouth surrounded by three small, inconspicuous lips, with a prominent, slanted tooth protruding forward from the center. This tooth is a distinctive feature of the third-instar larvae and used to pierce the intestinal wall. The esophagus is relatively long and divided into two parts: an anterior muscular part and a posterior glandular part. A distinct ventricle connects the esophagus and intestine. This species lacks an appendix or cecum. The body terminates in a tail containing the anus and ending in a prominent, pointed spine. The outer epidermis is distinctly striated along the body, a taxonomic characteristic of the larvae of the of the species *A. simplex* [43, 44].

Its life cycle begins with mating in the digestive tract of the definitive host, which is a marine Mammalia such as whales and dolphins. After mating, and egg- laying, the eggs released into the digestive tract of these hosts. The eggs excreted with feces into the external environment. The larva hatches from the eggs within a few days. This stage is called the second stage (L2), where the larva able to swim. The second- stage larvae eaten by a small crustacean vector

host. No growth or development of the larvae occurs until the vector host is eaten by an intermediate host of large crustaceans or fish. The larvae, which are a few millimeters long, migrate to the body cavity and digestive tract of fish or crustaceans. They quickly encapsulate themselves and develop into third- stage (L3) Larvae, which migrate to different areas of the fish body, such as the reproductive system and muscles. This stage is the infectious stage, and humans can become infected by eating raw or under cooked fish. When the definitive marine mammal host feeds on fish, the worm is digested [45, 46] and it develops into an adult worm and repeats cycles.

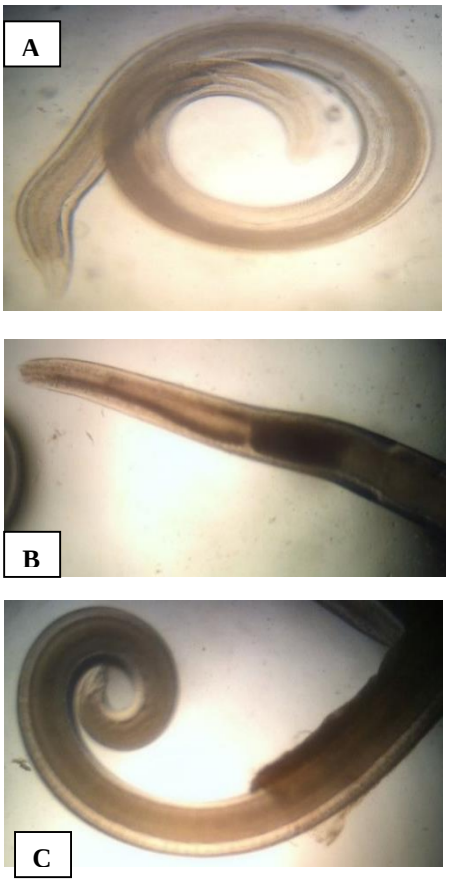


Figure (5): A: general Form of *A.semplex,* B: Anterior end; C: posterior end of the body

The infection rate with the parasite increased in spring and summer , representing rate of 7.41,10% during the research period, while no infection in winter were recorded .This parasite is common in various fish species. The parasites were also recorded in our marine waters by [47] in *Dentex Macrophthalmus* fish, and in *Euthynnus alletteratus* fish by [48].

Anisakis sp isolated at the first time from the inner wall of the intestine of *Sardinella aurita* in Syrian marine waters and the parasite recorded only im sommer [49]. These results are in agreement with our result. Also these results have coincided with data obtained by [50,51, 52] in which the third– stage larvae Species belonging to the family Anisakidae such as *H. aduncum* and *Anisakis simplex* are responsible for human infections resulting from the consumption of raw or undercooked food of the definitive hosts of this parasites [53], and salted decomposed, or smoked seafood is not associated with this infection [54].

Table 1: The number of *Boops boops* fish infected with Tetraphyllidae and the number of parasites isolated from them at the location of the Port of Fishing and Picnic area,

Season	The number of studying fish	The number of infected fish	The number of isolated parasites	Prevalence %	Intensity (parasites/ fish)
Winter	29	15	64	51.72	4.27
Spring	29	21	129	72.41	6.14
Summer	35	22	147	62.86	6.68
Autumn	37	19	119	51.72	6.26

Table 2: The number of *Boops boops* fish infected with *H. aduncum* and the number of parasites isolated from them at the location at the Port of Fishing and Picnic area

Season	The number of studying fish	The number of infected fish	The number of isolated parasites	Prevalence %	Intensity (parasites/ fish)
Winter	29	0	0	0	0
Spring	29	1	1	3.45	1
Summer	35	1	1	2.86	1
Autumn	37	2	2	5.41	1

Table 3: The number of *Boops boops* fish infected with *Anisakis simplex* and the number of parasites isolated from them at the location of the Port of Fishing and Picnic area

Season	The number of studying fish	The number of infected fish	The number of isolated parasites	Prevalence %	Intensity (parasites/ fish)
Winter	29	-	-	0	-
Spring	29	1	1	3.45	1
Summer	35	-	-	0	-
Autumn	37	-	-	0	-

Table 4: The number of *Boops boops* fish infected with Tetraphylida and the number of parasites isolated from them at the location of the marine research area

Season	The number of studying fish	The number of infected fish	The number of isolated parasites	Prevalence %	Intensity (parasites/ fish)
Winter	29	14	50	48.28	3.57
Spring	27	20	152	74.07	7.6
Summer	40	34	230	85	6.76
Autumn	44	15	69	34.1	4.6

Table 5: The number of *Boops boops* fish infected with *H. aduncum* and the number of parasites isolated from them at the location of the marine research area

Season	The number of studying fish	The number of infected fish	The number of isolated parasites	Prevalence %	Intensity (parasites/ fish)
Winter	29	0	0	0	0
Spring	27	2	3	7.41	1.5
Summer	40	6	7	15	1.25
Autumn	44	2	3	4.55	1.5

Table 6: The number of *Boops boops* fish infected with Anisakis and the number of parasites isolated from them at the location of the marine research area

Season	The number of studying fish	The number of infected fish	The number of isolated parasites	Prevalence %	Intensity (parasites/ fish)

Winter	**0**	**0**	**0**	**0**	**0**
Spring	**27**	**2**	**4**	**7.41**	**2**
Summer	**40**	**4**	**4**	**10**	**1**
Autumn	**44**	**2**	**1**	**2.27**	**1**

4- CONCLUSIONS AND RECOMMENDATIONS

In this study, three parasitic species were isolated for the first time in Syrian marine waters from *Boobs boops* fish: Tetraphyllidae which belongs to the family Tetraphyllidae, *H. aduncum* which belongs to the family Raphidascaridid and *Anisakis simplex* which belongs to the family Anisakidae. The infection rate with the parasite increased in spring and summer. **We recommended to**:

1. Continuing the study of the Marine Fish Parasites to establish a taxonomic database for the Marine Fish Parasites.

2. Studying the effect of parasites on the productivity of these economically important fish.

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