



First record of the parasite *Anisakis simplex* from the Anisakidae in the Bullet Tuna (*Auxis rochei*) in Syrian marine waters

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Abstract

Anisakid nematodes are among the most important zoonotic parasites globally, causing severe gastrointestinal *anisakiasis* in humans transmitted through the consumption of raw or undercooked infected fish. Infection with *A. simplex* can cause significant economic losses to the fisheries industry due to aesthetic damage to fish muscle. This study shown the first scientific documentation of the presence of the parasite *Anisakis simplex* in the bullet tuna (*Auxis rochei*) in Syrian marine waters. From September 2024 to August 2025, 15 fish of this species were examined. Samples were collected monthly from the main fishing port in Latakia and transported to the Department of Zoology laboratory at Latakia University. Each fish was subjected to both macroscopic and microscopic examination. The viscera and muscle tissue were individually inspected under a stereomicroscope to detect and recover the larval stages of the parasites, which were then preserved for morphological identification. The results showed that four individuals were infected, representing a prevalence rate of 26.67%. The parasite was located in the abdominal cavity on the outer wall of the stomach, intestines, and gonads, with the intensity of infection ranging from one to 122 parasites. Furthermore, the high intensity of infection observed (up to 122 larvae) indicates an active transmission cycle in the coastal ecosystem. The formal documentation of *A. rochei* as a new potential reservoir host in the region underscores a critical local health risk, necessitating immediate public awareness campaigns regarding proper fish handling and preparation techniques to mitigate the risk of anisakiasis.

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Introduction

Parasitic nematodes of the genus *Anisakis* Dujardin, 1845, are among the most widespread and significant marine parasites globally due to their notable impact on human health and fishery economics. Humans can be infected with *anisakiasis*, a zoonotic parasitic disease, by the accidental consumption of raw or undercooked fish or cephalopods containing the larvae of these worms (1). The life cycle of *Anisakis* parasites is complex, with whales and dolphins as their definitive hosts, while small marine crustaceans like krill serve as the first intermediate hosts. Fish and

cephalopods act as second intermediate or paratenic hosts, where the larvae infective to humans are found (2).

The bullet tuna, *Auxis rochei* (Risso, 1810), is a migratory pelagic fish belonging to the *Scombridae* family. This fish has significant economic and ecological value in the Mediterranean Sea, forming a key part of artisanal fisheries in many regions (3). Due to its predatory nature, feeding on small fish and crustaceans, it is an ideal host for many parasites, including *Anisakis* larvae. The infection of this fish with various types of *Anisakis* parasites has been documented in multiple regions worldwide (4).

Although studies on fish parasites in Syrian marine waters are still limited, recent research has begun to highlight the first-time presence of *Anisakis simplex* in several commercial fish species on the Syrian coast in recent years. For instance, (5) recorded its presence in *Euthynnus alletteratus*, (6) in *Lepidorhombus whiffiagonis*, and (7) in *Dentex macrophthalmus*. However, no study has yet been conducted to verify the presence of this parasite in *Auxis rochei*. Therefore, this study documents for the first time the presence of the parasite *Anisakis simplex* in Bullet tuna (*Auxis rochei*) in Syrian marine waters.

The importance of this research lies in its alignment with the directives of governmental and scientific bodies in the Syrian Arab Republic toward completing biological and environmental studies on economically important marine fish and the diseases that affect them due to parasitism (internal-external) and the methods to combat them. It also contributes to establishing a database on fish resources and methods for their development. Therefore, studying the species composition of parasites that infect bullet tuna in the marine waters of the Latakia Governorate, and the negative effects they cause on length and weight growth, reduced productivity, and decreased meat quality, is of great scientific and practical importance and is being undertaken for the first time. This study aimed to identify the parasites in *Auxis rochei* fish in the marine waters off the coast of Latakia Governorate coast.

Materials and methods

Sample collection

Individuals of Bullet tuna were collected from Syrian marine waters between September 15.9. 2024, and August 27.8. 2025, using Trawl nets from the Ras al-Basit area (Figure1).

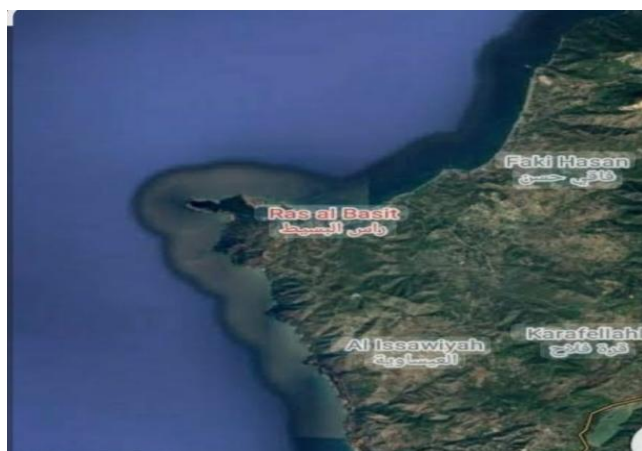


Figure 1: Shows the location of the Ras al-Basit area on the map according to Google Earth (2025).

Work method

Measurement stage

The samples were transported to the fish laboratory at the Faculty of Sciences. Measurements related to the total length, standard length, and weight of the studied fish were taken in Centimeters and weighed in Grams using a sensitive digital scale (Figure 2).



Figure 2: General view of an *Auxis rochei* fish (Total length 43 cm, Standard length 39 cm, and weight 850g) caught in the Ras al-Basit area on February 18, 2, 2025.

Examination stage

After taking measurements, the fish were dissected according to the method described by researchers (8,9). This was done by making a longitudinal incision along the ventral midline from the head to the end of the anus, followed by another incision from the end of the first cut to the Operculum. The internal organs were then exposed for examination, first with the naked eye and then using a magnifying glass to see the parasitic worms. The internal organs were examined, and their contents were placed in a Petri Dish with a little water to prevent the sample from drying out. The Stomach, Intestines, and Liver were sliced to detect parasites within them. The parasitic species in this study was isolated after being placed in a Lactic acid solution according to researchers (9). Identification was based on several international taxonomic keys focusing on external and internal morphological characteristics, and the anterior and posterior ends of the parasite's body, by using light microscope X40, according to researchers (10-13). The parasitic species (*Anisakis simplex*) was found in the abdominal cavity on the outer wall of the Stomach, Intestines, and Gonads in 4 of the examined fish. The parasites were isolated and fixed in 70% alcohol.

Results

A total of 15 specimens of *Auxis rochei* were examined during this study. The biometric measurements of the sampled fish showed that the total length ranged from 42 to 49 cm, while the standard length ranged between 38 and 44 cm. The body depth of the examined fish varied from 7.5 to 10 cm. Additionally, the total weight of the specimens ranged from 850 to 1600 g.

In this research, the parasitic species *Anisakis simplex* was isolated and identified for the first time in Syrian marine waters. The parasites were found in the abdominal cavity, specifically on the outer wall of the stomach and intestines of four individuals of the examined bullet tuna (*Auxis rochei*). The collected parasites were isolated and fixed in 70% alcohol (Table 1; Figure 3-5).

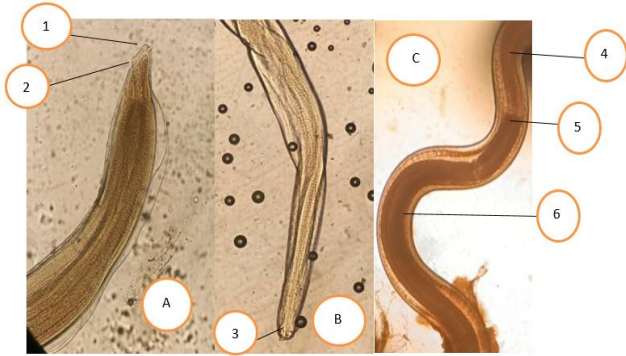


Figure 3: Morphology of *A. simplex* isolated from *Auxis rochei* caught in Syrian marine waters (magnification: 40x). A: Cephalic region (1- Boring tooth, 2- Papillated lips). B: Caudal region (3- Anal opening). C: Digestive system (4- Esophagus, 5- Ventriculus, 6- Intestine).



Figure 4: General view of the *Anisakis simplex* parasite under a stereomicroscope.

Table 1: Classification of the species *Anisakis simplex* (14)

Kingdom	Animalia
Phylum	Nematoda
Class	Chromadorea
Order	Rhabditida
Family	Anisakidae
Genus	Anisakis
Species	<i>A. simplex</i>



Figure 5: Image of the cephalic region at 40x magnification showing the boring tooth.

Discussion

The presence of *Anisakis simplex* larvae within the abdominal cavity of the examined bullet tuna (*Auxis rochei*) is explained by the parasite's life cycle dynamics. In marine ecosystems, marine mammals serve as definitive hosts, shedding parasite eggs that develop into infective third-stage larvae within crustaceans, which act as the first intermediate hosts (15). Small pelagic fish, including *A. rochei*, acquire the infection by feeding on these crustaceans or through trophic transmission, functioning as paratenic hosts where larvae settle in their viscera and muscles (16).

Our findings regarding the infection patterns in *A. rochei* within the Mediterranean basin align with observations previously reported by (4) and (17). Furthermore, this larval recruitment reflects the continuous susceptibility of pelagic feeders along the Syrian coast, showing a strong correlation with the localized parasitic distribution previously documented in other marine hosts by (6,7,18,19).

General characteristics of the parasite

Anisakis simplex belongs to the phylum Nematoda and has a cylindrical, unsegmented body that is tapered at both ends. The third-stage larva (L3), which is the infective stage for humans and marine mammals, ranges in length from 2 to 3 cm and is often found in the abdominal cavity and muscles

of fish, coiled in a distinctive spiral shape resembling a "watch spring" (15). The larvae is characterized by an anterior "boring tooth" that helps it penetrate the host's tissues (Figure 5), in addition to a simple digestive system that includes an esophagus and a ventriculus, which connects to the intestine obliquely, a distinctive diagnostic feature of the genus (20,21).

Conclusions

The parasitic species *Anisakis simplex* was isolated and identified from the abdominal cavity on the outer wall of the stomach, intestines, and gonads of the Bullet tuna (*Auxis rochei*) for the first time in Syrian marine waters. As this study is the first record of *Anisakis simplex* in bullet tuna (*Auxis rochei*) in Syria, it is recommended to conduct future studies to evaluate the role of this fish species as a paratenic host. It is also suggested to conduct a comparative survey to determine the prevalence and intensity rates in *A. rochei* and compare them with other previously recorded fish hosts on the Syrian coast.

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Conflict of interest

There is no conflict of interest.

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التسجيل الأول لطفيلي *Anisakis simplex* من فصيلة *Auxis* على سمكة البلميذا المبرومة *Anisakidae rochei* في المياه البحرية السورية

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الخلاصة

تُعد أنيساكيد nematodes من أهم الطفيليات المشتركة (Zoonotic Parasites) على مستوى العالم، وتتسبب في داء Anisakiasis المعوي الشديد لدى البشر الذي ينتقل عبر الأسماك المصابة النيئة أو غير المطهية جيداً. يمكن أن تسبب الإصابة بـ *A. simplex* خسائر اقتصادية كبيرة لقطاع مصائد الأسماك نتيجة

إصابة ٤ أفراد، مما يمثل نسبة انتشار بلغت ٢٦,٦٧%. تركز وجود الطفيلي في التجويف البطني على الجدار الخارجي للمعدة والأمعاء والمناسل، وتراوحت شدة الإصابة بين طفل واحد و ١٢٢ طفلاً. علاوة على ذلك، تشير شدة الإصابة العالية الملحوظة (ما يصل إلى ١٢٢ يرقة) إلى وجود دورة نقل نشطة في النظام البيئي الساحلي. يؤكد التوثيق الرسمي لـ *A. rochei* كمضيف مستودع جديد محتمل في المنطقة وجود خطر صحي محلي حرج، مما يستلزم حملات توعية عامة فورية بخصوص تقنيات التعامل مع الأسماك وإعدادها بشكل سليم للتخفيف من خطر الإصابة بمرض Anisakiasis.

الأضرار الجمالية التي تلحق بعضلات الأسماك. تقدم هذه الدراسة أول توثيق علمي لوجود الطفيلي *Anisakis simplex* في سمكة البلميدا المبرومة (*Auxis rochei*) في المياه البحرية السورية. وخلال الفترة الممتدة من سبتمبر ٢٠٢٤ إلى أغسطس ٢٠٢٥، تم فحص ١٥ سمكة من هذا النوع. تم جمع العينات شهرياً من ميناء الصيد الرئيسي في اللاذقية ونقلها إلى مختبر قسم علم الحيوان في جامعة اللاذقية. خضعت كل سمكة لفحص مجهري وعياني. تم فحص الأحشاء والأنسجة العضلية بشكل فردي تحت مجهر التشريح للكشف عن المراحل اليرقية للطفيليات واستعادتها، ومن ثم حفظها لتحديد الهوية المورفولوجية. أظهرت النتائج