e-ISSN: 3023-7343

TETHYS ENVIRONMENTAL SCIENCE
an International Journal

Presence and potential threats of the cymotoid isopod *Ceratothoa oestroides* (Risso 1816) in meagre *Argyrosomus regius* (Asso, 1801) caught in Mersin Bay, Northeastern Mediterranean

Cafer Erkin Koyuncu[1]*, Deniz Ayas[1,2]

[1]Mersin University, Fisheries Faculty, 33160, Yenişehir, Mersin, Türkiye. [2]Mersin University Marine Life Museum, Fisheries Faculty, 33160, Yenişehir, Mersin, Türkiye.

Research Article

Citation: Koyuncu, C. E., Ayas, D. (2025). Presence and potential threats of the cymotoid isopod *Ceratothoa oestroides* (Risso 1816) in meagre *Argyrosomus regius* (Asso, 1801) caught in Mersin Bay, Northeastern Mediterranean. *Tethys Env. Sci.* 2(1): 24-30.

DOI: 10.5281/zenodo.15031840

Received: 8 February 2025

Accepted: 10 March 2025

Available Online: 15 March 2025

Publication Date: 17 March 2025

Abstract

This study investigates the detection of the parasitic isopod *Ceratothoa oestroides* (Risso, 1816) in meagre *Argyrosomus regius* (Asso, 1801) caught from the Paradeniz Lagoon (Mersin Bay) and the possible impact of this parasite on aquaculture. A review of the extant literature pertaining to the host species and distribution of the parasite was also conducted, with particular attention to the effects of the parasite on species farmed in the Mediterranean and Adriatic Seas. Drawing attention to the negative impact of this parasite on fish health and aquaculture and raising awareness about the precautions to be taken were also discussed. *C. oestroides* poses a grave threat to Mediterranean aquaculture, and as a critical resource for Mediterranean fish farms, the findings of this study are of great importance for the regional aquaculture sector.

Keywords: *Ceratothoa oestroides, Cymothoidae, Parasitic isopod, Argyrosomus regius, Northeastern Mediterranean.*

Introduction

Meagre *Argyrosomus regius* (Asso, 1801) is a species belonging to the family Sciaenidae, found commonly in the Mediterranean Sea, the Atlantic Ocean, and the Black Sea, living at depths between 15 and 300 meters (Froese and Pauly, 2024). The recorded length of fully mature specimens is 50-150 cm, with a mean weight of 50 kg (FAO, 2018). The coloration of the adult specimen is silvery

Correspondence: Cafer Erkin Koyuncu
ekoyuncu@mersin.edu.tr

grey. The diet of the fish is composed of small fish, molluscs, and crustaceans. The reproductive cycle of the species occurs during the spring and summer months, with females capable of producing thousands of eggs. The species is of high commercial value and is vulnerable to threats including overfishing and the loss of its habitat. The IUCN categorizes it as Vulnerable (VU) (Sadovy and Cheung, 2003), and it is cultivated in aquaculture.

Cymothoid isopods are parasites of the family Cymothoidae, which feed on blood and tissue by attaching to the oral cavity, gills, or body surface of fish (Brusca, 1981; Rohde, 2005). These isopods firmly attach with their jaws and claws and have been observed to cause anemia, tissue destruction, delayed growth, and reduced reproductive capacity in fish (Lester and Roubal, 1995). Smit et al. (2014) reported that one of the Cymothoidae family parasites, *Cymothoa exigua*, attaches to the tongue of a fish, destroys it and replaces it. This parasitism has the potential to impact fish populations, disrupt ecological dynamics, and result in economic losses within fisheries. Control methods encompass biological and chemical solutions, as well as hygiene measures. It is a known fact that cymothoid isopods infect a wide variety of fish families in tropical and subtropical habitats and show no host specificity (İnnal et al., 2007; Ramdane et al., 2007).

Ceratothoa oestroides (Risso, 1816), a species of isopod, lives as a parasite in marine fish and has a significant impact on the economy. This parasite, which is widespread in the Mediterranean and Atlantic Ocean, causes growth retardation, stress, and mortality by negatively affecting the health of fish, especially in marine farms (Horton and Okamura, 2001; Rohde, 2005). The physical damage caused by *C. oestroides*, which settles in the oral cavity, results in a loss of yield and commercial value in aquaculture (Lester and Roubal, 1995; Bunkley-Williams and Williams, 1998).

This study provides the first record of *C. oestroides* from natural stocks of *A. regius* as a host species in the northeastern Mediterranean (Mersin Bay) and presents a comprehensive discussion of its impact and potential threats to aquaculture.

Material and Methods

This study was conducted on *Argyrosomus regius* specimens captured using gill nets in Mersin Göksu Paradeniz Lagoon in April 2021 (Figure 1). Following a thorough morphological examination, a single parasitic isopod was identified in the oral cavity of one of the captured fish. The parasite was meticulously extracted and transferred to the laboratory under sterile conditions. The location of the parasite on the host fish and any physical signs of its presence (tissue damage, discoloration, etc.) were recorded.

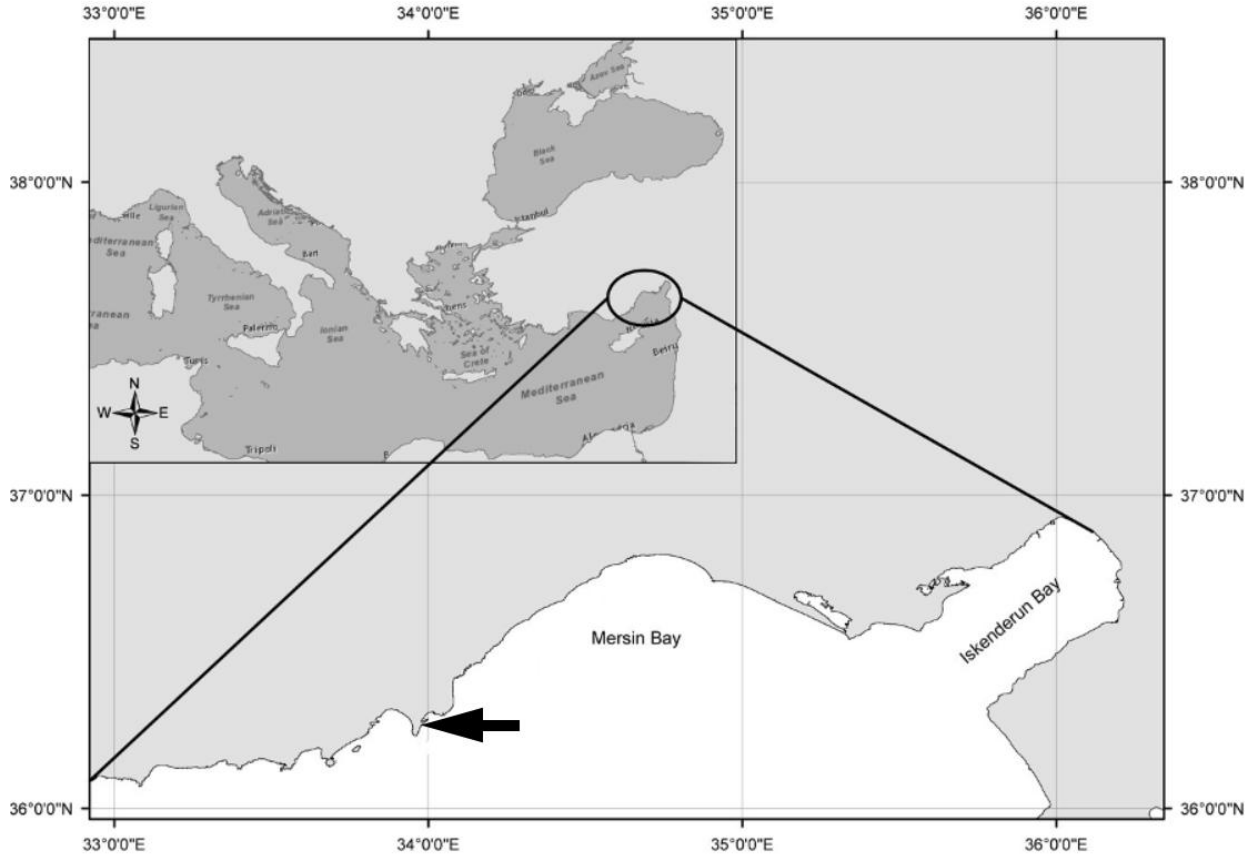

Figure 1. Map indicating the area where individuals of *Argyrosomus regius* were caught.

A detailed morphological examination of the parasite sample was performed, and the structural integrity of the sample was preserved for a prolonged period by storing it in a 70% ethanol solution. The identification of the parasitic isopod individual in the laboratory was carried out using a dissecting microscope (Kırkım, 1998; Horton and Okamura, 2003; Gökpınar et al. 2009; Hadfield et al., 2016).

Photographs were then taken of the parasite, and their basic morphological characteristics were measured in detail, including total length and width, to the nearest millimeter. The parasite sample was subsequently archived at the Mersin University Marine Life Museum under the catalog number MEUISC-21-11-003.

Result and Discussion

This research determined that the parasite was cream-yellow and measured 22 x 7 mm. The two pairs of 7-segmented antennae on the head of the parasite began broad and narrowed towards the tip. Pereonite V was found to be wider than the other pereonites, and it was observed to have 7 pairs of pereiopods, one pair from each pereonite. The merus in the first three pereiopods of the specimen showed a slight medial expansion and a laterally narrowing of the protrusion, while this was not observed in the merus in the last four pereiopods. A single robust claw was observed at the distal end of each pereiopod. The parasite also had two pairs of uropods, each with four segments. (Figure 2a, b).

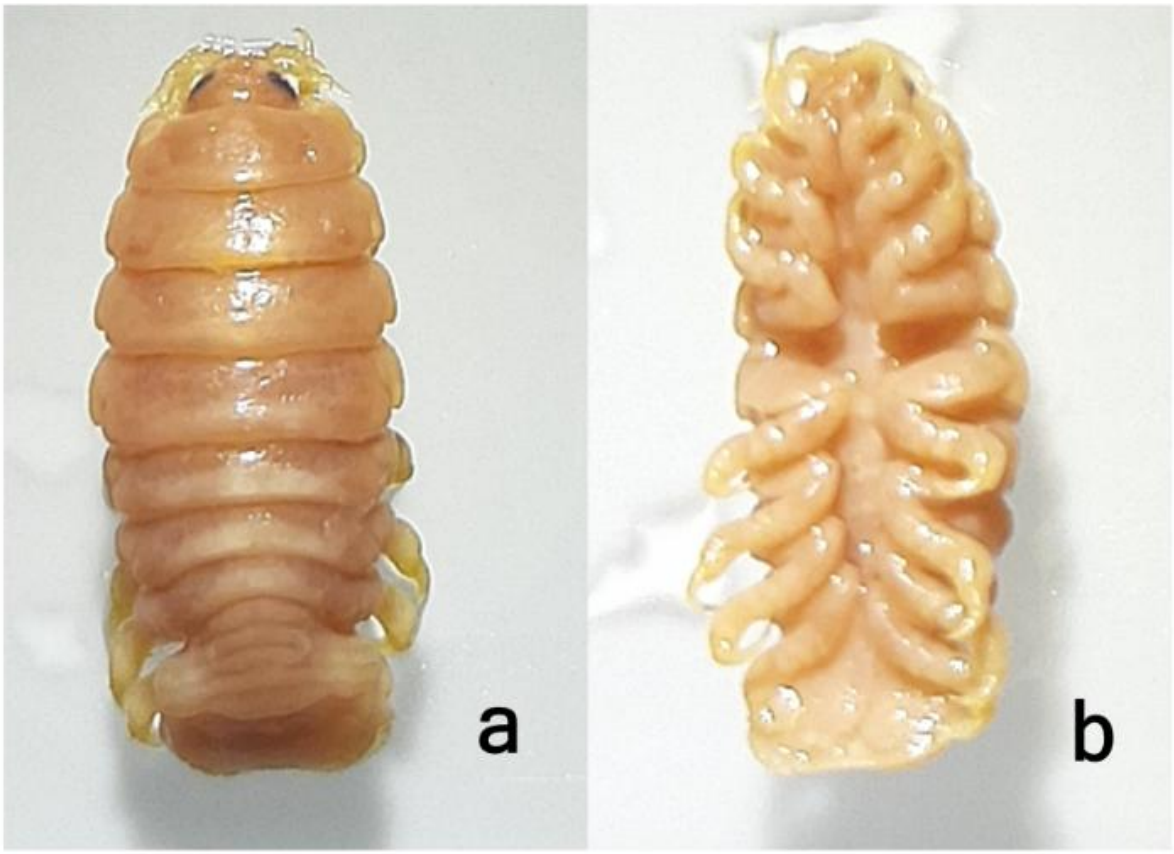

Figure 2. The appearance of *Ceratothoa oestroides* obtained from the oral cavity of *Argyrosomus regius* specimen caught in Mersin Bay (a) dorsal view (b) ventral view.

Tissue damage and discoloration were detected in the oral cavity of *A. regius* specimens caught from the Paradeniz lagoon (Mersin Bay), which serves as a host species for *C. oestroides*. These findings are consistent with the detrimental effects of *C. oestroides* on the health status of the host fish, as previously documented by Horton and Okamura (2001). The presence of the parasite in *A. regius* poses significant challenges, as it is a highly valued species in aquaculture. The physical damage to the oral cavity, as well as the reduced feeding efficiency, growth retardation, and increased susceptibility to secondary infections observed in infected individuals, are likely consequences of the parasite. The validity of these observations is further substantiated by documented economic losses suffered by Mediterranean aquaculture species, such as sea bass (*Dicentrarchus labrax*) and sea bream (*Sparus aurata*), due to *C. oestroides* (Mladineo, 2002).

Recent studies have emphasized the importance of understanding the dynamics of host-parasite interactions in aquaculture contexts and the detrimental effects of parasite infestations on fish health. These effects include the disruption of ecological dynamics and the sustainability of aquaculture systems (Koyuncu and Ayas, 2024). Table 1 presents a comparison with previous studies, showing that *C. oestroides* has a wide geographical distribution and affects a variety of host species in aquaculture systems.

Table 1. *Ceratothoa oestroides* and its host species in the Mediterranean Sea.

Host species	Family	Location	References
Dicentrarchus labrax	Sparidae	Fish farm, Türkiye	Horton and Okamura (2003)
Dicentrarchus labrax	Sparidae	Fish farm, Croatia	Šarušić (1999)
Dicentrarchus labrax	Sparidae	Fish farm, Adriatic Sea	Mladineo (2002)
Sparus aurata *Dicentrarchus labrax*	Sparidae	Fish farm and lagoon, Greece	Vagianou et al. (2006)
Argyrosomus regius	Sciaenidae	Fish farm, Adriatic Sea	Čolak et al. (2017)
Spondyliosoma cantharus	Sparidae	Aegean Sea, Türkiye	Gökpınar et al. (2009)
Argyrosomus regius	Sciaenidae	Mediterranean Sea, Türkiye	Present study

The present study provides the first record of *C. oestroides* parasitism in natural stocks of *A. regius* in Mersin Bay and highlights that *C. oestroides* is expanding its known host-parasite range. It is therefore imperative that parasite infestations in both wild and cultured fish populations be closely monitored. The presence of *C. oestroides* in a natural fish population suggests potential spillover risks to nearby aquaculture facilities, where such interactions may increase the prevalence of the parasite in confined systems due to the increased influence caused by environmental and stress-related factors. This underscores the necessity for the implementation of effective proactive management strategies, including regular monitoring, improved hygiene practices, biological or chemical controls, and routine health assessments. Consequently, concerted efforts among researchers, aquaculture stakeholders, and policymakers are imperative to formulate comprehensive strategies that ensure the long-term viability of fish farming in the Mediterranean (Turan et al., 2024).

In conclusion, this study demonstrates the first observation of the parasitic isopod *C. oestroides* on *A. regius* as a host species in Mersin Bay and highlights the need for broader attention to parasite management measures in aquaculture. The findings provide a critical resource for aquaculture and contribute to the growing body of knowledge about the impacts of parasitic isopod invasions on marine ecosystems.

Acknowledgment

This study was supported by the Research Fund of Mersin University in Türkiye with Project Number: 2023-2-TP2-4964.

Conflict of Interest

The authors declare that for this article they have no actual, potential or perceived conflict of interest.

Author Contributions

C.E.K. and D.A. performed all the experiments and drafted the main manuscript text. Authors reviewed and approved the final version of the manuscript.

Ethical Approval Statements

No ethics committee permissions are required for this study.

Data Availability

The data used in the present study are available upon request from the corresponding author.

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