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Isolation and description of the (*Gnathia sp*) parasite that infects (*Epinephelus costae*) fish in the marine waters of Sirte-Libya

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Abstract:

Fish are important hosts for many parasites that cause them various damage, such as weight loss, reduced mobility, and an inability to escape predators, as well as affecting reproduction when their gonads are infected with parasites. Ectoparasites that infect the skin, mouth, gills of fish can negatively affect their health by interfering with respiration. One such parasite is *Gnathia sp*., which infects many species of fish, including *Epinephelus costae* in the marine waters off the coast of Sirte in Libya. This study aims to investigate *Gnathia sp*., a species of isopod parasite that infests the mouth and gills of *Epinephelus costae* fish, and to isolate and describe this parasite. In this study, 50 samples of *Epinephelus costae* were collected from the marine waters off Sirte, Libya, between December 2023 and February 2024. The fish were examined externally, as well as in the mouth and gills. The results showed that 24 fish were infected with the *Gnathia sp*, parasite. Six fish were infected only in the mouth, four in the gills, and 14 in both the mouth and gills. This study on the *Gnathia sp*. parasite represents a significant achievement in the field of research, as it is the inaugural study to be conducted in the city of Sirte, Libya, and the inaugural documentation of this parasite in the study area.

Keywords: *Epinephelus costae*, Ectoparasites, *Gnathia sp*.

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عزل ووصف طفيل القناثيا الذي يصيب أسماك الدوت في المياه البحرية لمدينة سرت– ليبيا

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الملخص:

تعد الأسماك مضيفات مهمة للعديد من الطفيليات التي تسبب لها أضرارًا مختلفة، مثل فقدان الوزن، وانخفاض القدرة على الحركة، وعدم القدرة على الهروب من المفترسات، فضلاً عن التأثير على التكاثر عندما تصاب غددها التناسلية بالطفيليات. يمكن أن تؤثر الطفيليات الخارجية التي تصيب جلد الأسماك وفمها وخياشيمها سلبًا على صحتها من خلال التداخل مع عملية التنفس. أحد هذه الطفيليات هو طفيل القناثيا، الذي يصيب العديد من أنواع الأسماك من بينها أسماك الدوت، في المياه البحرية قبالة سواحل سرت في ليبيا. تهدف هذه الدراسة إلى التحقق من إصابة أسماك الدوت بطفيل القناثيا، وهو نوع من طفيليات متماثلات الأرجل التي تصيب فم وخياشيم الأسماك، وعزل ووصف هذا الطفيل. في هذه الدراسة، تم جمع 50 عينة من سمك الدوت من المياه البحرية قبالة سرت، ليبيا، بين ديسمبر 2023 وفبراير 2024. تم فحص الأسماك خارجيًا، وكذلك تم فحص الفم والخياشيم. أظهرت النتائج أن (24) سمكة مصابة بطفيلي القناثيا. كانت ستة أسماك مصابة في الفم فقط، وأربعة في الخياشيم، و(14) في الفم والخياشيم. تمثل هذه الدراسة حول الطفيلي إنجازًا مهمًا في مجال البحث، حيث إنها الدراسة الأولى التي تُجرى في مدينة سرت، ليبيا، والتوثيق الأول لهذا الطفيلي في منطقة الدراسة.

الكلمات المفتاحية: سمك الدوت، الطفيليات الخارجية، القناثيا.

Introduction:

Fish are an important source of animal protein, so increasing fish production is necessary to meet demand. However, fish on fish farms may be exposed to diseases caused by parasites, which can spread quickly due to the close proximity of the fish in a small area (Kabata, 1985).

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Within aquatic ecosystems, all fish species act as hosts for numerous parasites, which can influence the biology of fish. Furthermore, fish act as intermediate hosts for numerous parasites, providing a habitat for the larval stages of these organisms. For instance, fish inhabiting California estuaries act as hosts for numerous parasites (Lafferty, 2008).

Crustaceans are found in all aquatic ecosystems and have many adaptations to live in these systems, as they adapt to temperatures, oxygen levels, pressure, and salinity. The majority of parasitic isopods are found in warm seas where they live freely and feed mainly on blood. It has been determined that a significant proportion of the species under consideration are present within the oral cavity of fish. In addition, a number of the species have been found to be located on the gills or the surface of the body and fins. Isopods have been demonstrated to cause injuries and disease symptoms in fish that can result in death, including damage and erosion of the gills and damage to the affected areas (Ganapathy *et al*., 2012).

Gnathiid isopods are a prevalent external parasite of coral reef fish, exerting both direct and indirect effects on the fish. In their adult stage, these organisms have been observed to feed on blood (Mary *et al*., 2020).

Gnathiid isopod parasites, which infect numerous species of fish, have been demonstrated to exert a detrimental effect on the physiology, behaviour and survival of their hosts. The young of this species of parasite emerge from the depths of the Caribbean Sea in order to parasitize fish and feed on their blood. Gnathiid has been observed to inhabit dead coral, yet it is incompatible with live coral due to its feeding habits, as previously documented by (Jose *et al*., 2021).

Despite the significant biological and economic importance of isopods, the majority of research conducted on them is of a taxonomic nature. The necessary biological studies to understand their life cycle have not been conducted (Lucy *et al*., 1998).

The life cycle of the Gnathiid has long been a subject of scientific intrigue; however, the biological aspects related to these parasites are limited. As stated by Nico *et al*. (2003), the life cycle of merely six species out of a total of more than 170 Gnathiid species has been described.

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The objective of the present study was to ascertain the extent of infection of *Epinephelus costae* fish with external parasites of the *Gnathia* species, and to isolate and describe these parasites.

Materials and methods:

A total of 50 samples of the fish *Epinephelus costae* were collected from the marine waters of Sirte, Libya, between December 2023 and February 2024. Sirte is located in central Libya, overlooking the Mediterranean coast, 450 km east of the capital Tripoli.

The fish samples were transferred to the zoology laboratory at the Faculty of Science at the University of Sirte in Libya. Various measurements were taken for each sample in the laboratory, and each sample was also examined externally with the naked eye and under appropriate lighting. The oral cavity and gills were then carefully examined with a magnifying glass and under appropriate lighting.

The parasites belonging to the genus *Gnathia sp* were enumerated and their location recorded. The transmission of some of these parasites was facilitated by means of a fine brush. The brush was placed on a glass slide containing a drop of lactophenol solution, and then placed under a microscope. The parasites were then examined, studied, described, and photographed in different ways and with different magnification powers.

Results:

In the present study, 50 samples of *Epinephelus costae* fish were examined in order to detect the presence of the *Gnathia sp*. parasite in the buccal cavity and gills of these fish.

Following a thorough examination, it was determined that 24 fish samples were found to be infected with the *Gnathia sp*. parasite. The prevalence of fish infected with the parasite in the oral cavity area only was six samples, none of which were infected in the gills. Similarly, in the gills only category, only four fish were infected. Finally, in the oral cavity and gills area together category, 14 samples were infected (Figure 1).

The body of the prenatal larva of *Gnathia sp*. is divided into three regions: the cephalosome, the pereon and the pleon.

The cephalosome comprises the antenna, the antennule and the mouthparts. The anterior end of the cephalosome is pointed and contains a pair of compound eyes that protrude laterally (Figure 2).

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The person, comprising six pairs of pereopods (PD), is regarded as the largest body region. It is oval in shape and contains the host's blood (Figures 2 and 3).

The third region of the body under consideration is the pleon, which is comprised of five pairs of pleopods (PL) and the telson, which contains one pair of uropods (UP) (Figures 2 and 4).

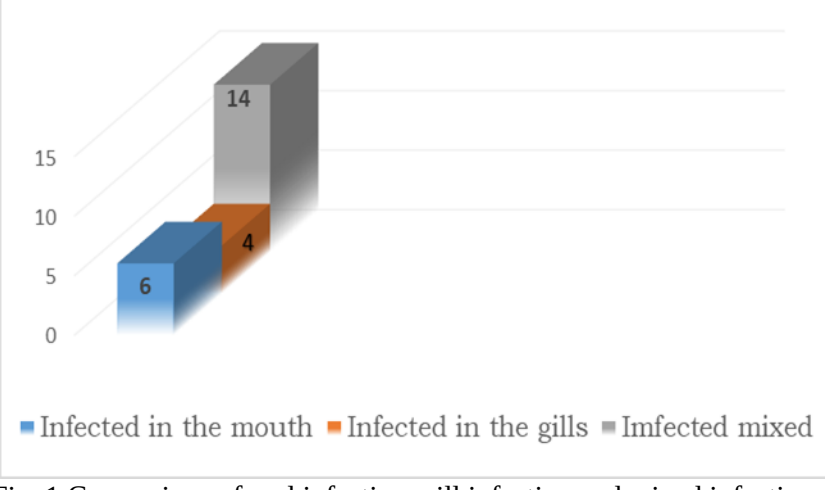

Fig. 1 Comparison of oral infection, gill infection and mixed infection with the *Gnathia sp* parasite shows that gill infection is the lowest and mixed infection in both mouth and gills is the highest.

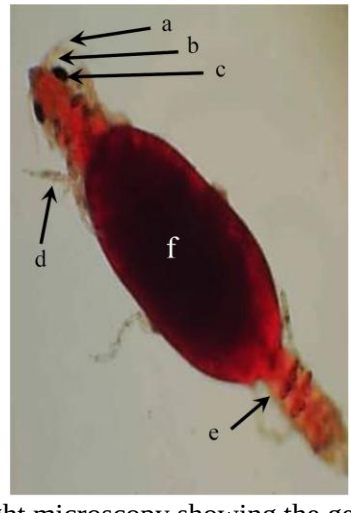

Fig. 2 Under a light microscopy showing the general shape of the *Braniza* larva of the *Gnathia sp.*
a: Antenna, b: Antenule, c: Compond eye, d: Pereopod, e: Pleopod, f: Blood meat.

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Fig. 3 Under a light microscope, the body of a *Branisa* larva of the parasite *Gnathia sp*.
a: Pereonite.

Fig. 4 Under a light microscope showing the posterior region of the *Braniza* larva of the *Gnathia sp*.
a: Uropod.

Discussion:

Isopod larvae have been observed to parasitise a wide range of intertidal fish species around the globe. *Gnathia africana* has been documented in multiple species of intertidal fish along the cold western and southern African coasts (Kerry *et al*., 2008).

Following a comprehensive examination of 550 samples of teleost fish, it was determined that these fish were infected with eight distinct species of ectoparasites, four species of copepods, three species of isopods, and one species of *Hirudinae* (Hela *et al*., 2020). A recent study has revealed the presence of two species of ectoparasites isopods in the southern islands of the Korean Peninsula. The species, *Rocinela excavata sp*. nov. and *Gnathia obtusispina sp*. *nov*., were identified in the study, which also included *Gnathia obtusispina sp*. *nov*. The second species exhibited differences from the other species in the following characteristics:

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1. The body is covered in a multitude of tubercles and setae. The cephalon exhibits tooth-like paraocular ornamentations. As posited by Sung *et al*. (2023), the frontal border is characterised by the presence of two inferior frontolateral processes.

The species *Gnathia jimmybuffetti* was extracted from the Florida Keys, and the morphological characteristics of males, females and juveniles were studied. The life cycle was also followed (Anja *et al*., 2023).

Examination of the gill chambers of *Epinephelus chlorostigma* fish revealed the presence of Praniza larvae of the isopod species Gnathiid (Eman *et al*., 2023).

A study was conducted on ectoparasites of *Mullus surmuletus* fish, with the results indicating an infection rate of 32% in the gills, fins and tongue of the fish. The parasites in question were identified as Praniza larvae of the *Gnathia sp*. parasite. The parasitic infection in question has been shown to cause respiratory symptoms, congestion in the gills, and an increase in mucus secretion in the infected fish (Walaa and Nahla, 2023).

Gnathia larvae were retrieved from the southern Turkish coast of the Aegean Sea and were identified in the gill filaments of the following fish: As demonstrated in the study by Ahmet (2020), *Upeneus moluccensis*, *Parupeneus forsskali*, and *Sargocentron rubrum* exhibited infection rates of 47%, 63%, and 58%, respectively, in the mouth and filaments.

Following a comprehensive examination of 150 samples of *Serranus scriba* fish and 138 samples of *Serranus cabrilla*, the results indicated the presence of 19 species of parasites belonging to six taxonomic groups, in addition to two species of isopods (*Nerocila bivittata* and *Gnathia sp*) (Khouloud *et al*., 2019).

A study was conducted on 664 samples of *Boops boops* and 823 samples of *Mullus barbatus* fish extracted from the eastern coast of Algeria. The results demonstrated the presence of 11 species of parasites (two monogeneans, three copepods, five isopods and one branchiura) from *B. boops*, and four parasitic species (two copepods and two isopods) from *M. barbatus* (Zouhir *et al*., 2013).

A new species of gnathiid was discovered and collected from various locations in the eastern Caribbean in June and August 2008 and 2009. Third stage pranizae were collected from the host fish and maintained in a seawater environment until they moulted into males and females (Charon *et al*., 2021).

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Gnathia sp. has been extracted from the oral cavity and gill filaments of *Mullus surmuletus* fish (Alas *et al*., 2009).
The larval stage of *Gnathia sp*. parasite was discovered in the gills of the *Mullus surmuletus* fish (Sven *et al*., 2008).
Following a thorough examination of samples of *Epinephelus marginatus* fish, the presence of juveniles of *Gnathia sp*. in the buccal cavity of these fish was revealed (Ercument, 2007).
In the isopods of the family *Gnathiidae*, the adult stages are free-living in the water, and the juveniles are parasitic, feeding on the blood and tissue fluids of teleost and elasmobranch fishes (Smit and Davies, 2004).

Conclusion:
The results of the study demonstrated that 24 out of 50 fish examined were found to be infected with the parasite Cynotia. Six fish (6) were found to be infected in the mouth area, four fish (4) were infected in the gill area, and fourteen fish (14) were infected in both the mouth and gill areas.

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