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Metazoan ectoparasites of *Lithognathus mormyrus* (Linnaeus, 1758) from the western coast of Libya

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ABSTRACT

Background: *Lithognathus mormyrus* fish is one of the fish of high economic importance in the countries of the world in general and the Mediterranean countries in specific, including the Libyan Sea waters, for this it is necessary to know everything related to this type of fish, including its infection with parasites. Parasites are considered one of the factors threatening the life of fish, being one of the food chains and the ecological composition of life.

Aim: The current study aims to isolate and identify the parasites that infect the *L. mormyrus*.

Methods: A total of 368 specimens of *L. mormyrus* were collected by fishermen, from the western coast of Libya. The study was focused on metazoan parasites. When fish were fully examined for the presence of ectoparasites under a dissecting microscope with incident light, the software camera connected with a microscope and semichon' acetocarmine technique for identification of parasites.

Results: Two species of Monogenea (*Encotyllabe valley, Pagellicotyle mormyri,* and *Lamellodiscus* spp.), Isopoda (Gnathia), Copepoda (*Lernaeolophus sultanus*), and Annelidae (*Trachelobdella lubrica*) has been isolated from this species of fish. The highest prevalence of infection was Gnathia parasites (8.47%).

Conclusion: There were differences in the parasite species that infect *L. mormyrus* from one country to another, and also from city to other cities in the same country, as in the Tunisian waters.

Keywords: *Lithognathus mormyrus*, *Encotyllabe valley, Lernaeolophus sultanus*, *Trachelobdella lubrica*, Libya.

Introduction

Striped sea bream (*Lithognathus mormyrus*) is a valuable economic resource in the Mediterranean Sea, including Libya. This demersal marine fish, which is a member of the Sparidae family, has over 100 species worldwide. The Northeast Atlantic and Mediterranean Seas have the most diversity, with 24 described species from 11 genera (Kallianiotis *et al*., 2005). In Libya, these species of fish live in groups near the sandy bottoms and sometimes on Posidonia beds at a depth of 30 m. These species of fish are very mobile and depend on the sea bottom to get their food: crustaceans, worms, and molluscs. They reproduce in spring and summer; hermaphroditic protandrous, where juveniles are male, after 14 cm total length; however, the female character is dominant, and it reaches maturity at 2 years (about 14 cm) (Bauchot and Hureau, 1990; Aydın, 2018; Karadurmus and Aydin, 2022). Geographically distributed throughout the Mediterranean and Atlantic, from the Bay of Biscay to the Cape of Good Hope; the Canaries, Cape Verde, the Black Sea, and elsewhere the Red Sea and the south-western Indian Ocean (Smith and Smith, 1986; Bauchot and Hureau, 1986; Bauchot and Hureau, 1990; Wirtz *et al*., 2008; Russell *et al*., 2014).

Different species of *L. mormyrus*'s parasites have been recorded in many previous studies from different geographical locations around the world: the Western Mediterranean Sea (Euzet, 1984; Bartoli *et al*., 1989, 1993; Bartoli and Bray, 1996; Jousson *et al*., 1999, 2000; Sasal *et al*., 1999; Benmansour *et al*., 2001; Jovelin and Justine, 2001; Desdevises *et al*., 2002; Bartoli *et al*., 2005; Ramdane *et al*., 2007, 2009; Gargouri Ben Abdallah and Maamouri, 2008; Boudaya *et al*., 2009; Boualleg *et al*., 2010, 2011; Gargouri Ben Abdallah *et al*., 2011, 2015; Poisot *et al*., 2011; Derbel *et al*., 2012; Samn *et al*., 2014; Antar *et al*., 2015); the Eastern Mediterranean Sea (Saad Fares and Maillard, 1990; Saad Fares and Combes, 1992; Bruce *et al*., 1994; Akmırza, 2010; Cafer *et al*., 2015; Demirkale *et al*., 2015) and from Adriatic (Radujkovic and Raibaut, 1989; Radujkovic and Euzet, 1989; Orecchia *et al*., 1988; Radujkovic *et al*., 1989; Bray and Bartoli, 1996), and from the North-Eastern Atlantic Ocean

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(Gijon-Botella and Lopez-Roman, 1989). Also, from the South-Eastern Atlantic Ocean (Gaevskaya and Aleshkina, 1988), the Aegean Sea (Akmirza, 2013; Çinar, 2014), and the Red Sea (Bray and Cribb, 1989). Some of these parasites may affect the fisheries economy significantly, by damaging and killing these fish. Also, heavy infestation by different types of parasites causes significant loss of fish condition, which may result in reduced growth rates and delayed reproductive effort, and thus, affects the health status, which may lead to mortality (Mehanna, 2020). If there are no visible significant effects on wildlife, it will accidentally influence the human population as a consumer of marine seafood, and also, in the fish aquacultures (Koyuncu *et al*., 2015). Although parasites cause severe damage to marine organisms, especially fish, they can be used as an indicator of fish health, as well as a biological and ecological indicator for the environment surrounding fish, through which fish migration can be tracked and the presence of pollutants can be determined (Derbel *et al*., 2012). In Libya, there are not many studies on fish parasites, especially in Striped sea bream fish, for which no parasites have been recorded that may infect them. For this reason, this study aimed to detect and identify metazoan ectoparasites that can infect this species of fish.

Materials and Methods

A total of 368 specimens of *L. mormyrus* (Fig. 1) were collected from fishermen and immediately transferred to the laboratory of the Marine Biology Department of Zoology, Faculty of Science at the University of Tripoli. These specimens were collected from the western coast of Libya, during the period from September 2020 to October 2021. Morphometric measurements have been taken, and the total weight of each individual has been measured in grams (Dwivedi and Menezes, 1974). The study was focused on metazoan parasites, where fish were fully examined for the presence of ectoparasites under a dissecting microscope with incident light. The parasite examination was carried out according to Euzet and Trilles (1960). Identification of parasites, and staining by using the software camera connected with a microscope and semichon' acetocarmine technique. Parasitic indicates adopted in the calculations by Bush *et al*. (1997).

Ethical approval

Not needed for this study.

Results

One hundred and fifty-two different genera of ectoparasites were isolated from three hundred sixty-eight individuals of *L. mormyrus*. The percentage of infection was 28.3% of the total examined fish (intensity 1.46 and abundance 0.41). Parasite prevalence was significantly higher in the *Bychowskicotyla mormyri* at 13.23% (intensity 1.14 and abundance 0.13) and the lowest infection rate was in *Encotyllabe spari* (0.27%) and *Lamellodiscus* sp. (0.27%) as shown in Table 1.

Fig. 1. *Lithognathus mormyrus* (Linnaeus, 1758).

***Encotyllabe spari* Yamaguti, 1934**

Family: Capsalidae

Genus: Encotyllabe

Species: *Encotyllabe spari* Yamaguti, 1934

Sites: Gills

Description: A total of one *Encotyllabe spari* belongs to the Capsalidae family was collected. The main characteristics of this species depend on the Body ellipsoidal, sub cylindrical long sides of the body to folded ventrally tegument smooth as in (Fig. 2), total length is 1.818 mm long and 0.243 mm wide; anterior suckers 0.086 long. Mouth bordered by digitiform projections on the anterior border two pairs of eye spots are present. The pharynx is muscular, 0.75) 0.226, Two pairs of eyespots are at the level of the pharynx. The haptor is bell-shaped (0.122× 0.112; marginal membrane 0.015 wide; one pair of large anchors, one pair of small anchors and 14 marginal hooks. Large anchors (0.077× 0.027). Testes are two juxtaposed, pre-equatorial, differ in size; left, right part (0.190 ×0.192)— left part (0.190 × 0.212). Ovary noticed pretesticular, oval, (0.135 ×0.149). The Vitelline reservoir is pre-ovarian, (0.114 × 0.166).

***Bychowskicotyla mormyri* (Lorenz, 1878)**

Family: Microcotylidae

Genus: Bychowskicotyla Unnithan, 1971

Species: *B. mormyri* (Lorenz, 1878)

Synonyms: *Microcotyle mormyri* Lorenz, 1878.
Atrispinum mormyri (Lorenz, 1878) , Orecchia and Paggi, 1983.
Pagellicotyle mormyri (Lorenz, 1878) Mamev, 1984.

Sites: Gill

Description: The elongated body's total length is about 7 to 8 mm while the width is approximately 0.6 mm; the haptor, symmetrical, is triangular in shape as in (Fig. 3), which has clamps 90–100 on each side. The mouth,

Table 1. Parasites have been found in the *L. mormyrus.*

Parasites species	No. of parasites	Stage	Site of infection	No. of examined fish	No. of non-infected fish	No. of infected fish	Prevalence (%)	Intensity	Abundance
Monogenea									
*Encotyllabe spari Yamaguti, 19*34	1	Adult	Gills		367	1	0.27	1	0.003
B. mormyri (Lorenz, 1878)	49	Adult	Gills		325	43	13.23	1.14	0.13
Lamellodiscus Johnston and Tiegs, 1922	4		Gills		367	1	0.27	4	0.011
Annelida									
T. lubrica (Grube, 1840)	26	Adult	Skin	368	249	19	5.16	1.4	0.067
Isopoda									
Gnathia Leach, 1814 larvae (Praniza)	65	Adult	Skin and Gills		335	33	8.97	1.97	0.18
Copepoda									
L. sultanus (Milne Edwards, 1840)	7	praniza Larvae	Mouth and Skin		361	7	1.90	1	0.019
Total	**152**				**265**	**104**	**28.3**	**1.46**	**0.41**

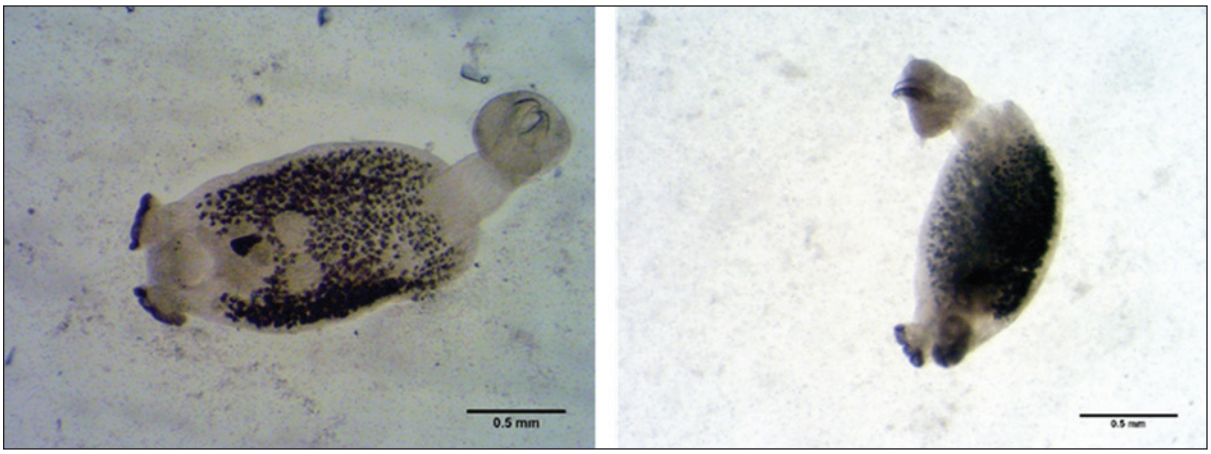

Fig. 2. *Encotyllabe spari Yamaguti, 1934* (left: whole worm; right: lateral view).

ventral sub terminal, is located at the anterior end. The pharynx is median. The esophagus, initially straight, bifurcates at the level of the genital atrium. The two intestinal branches descend laterally along the body, forming numerous axial and lateral caeca The ventral genital opening is located at the anterior end. The atrium size is 150 µm which includes in its anterior part ten large slender spines, arranged in an arc of a circle their size 75 µm, and in its posterior two lateral groups of hooked small spines. These two groups, symmetrical with respect to the mid-sagittal plane, each have about twenty spines their size is about 35 µm.

***Lamellodiscus* Johnston and Tiegs, 1922**

Family: Diplectanidae

Genus: *Lamellodiscus*
Species: *Lamellodiscus* Johnston and Tiegs, 1922**.**
Sites: Gills
Description: In this study, the gills of 300 *Lithognathus mormy* were examined, which revealed a parasite of the genus Lamellodiscinae Oliver, 1969. It haptor is characterized by three transverse bars (two dorsal and one ventral medial) as in (Fig. 4); Two pairs of handles (each consisting of a dorsal grip and a ventral grip), and a dorsal grip at the lateral end of each dorsal rod. The lamellidian discus consists of 10 pairs of plates, the former closed, almost heart-shaped, and the latter in a circular arc. Fourteen uncinuli. Three pairs of cephalic glandular organs. Eye spots are present (two pairs) or absent, left vas deferens. The male copulatory apparatus generally consists of a genital part and a more or less complex accessory part. The ovary surrounds the right intestinal branch. The opening of the vagina, lateral, is in the left half of the body (exceptionally on the right). Eggs opposite, tetrahedral, with long filaments at one of the apexes opposite the operculum.

***Trachelobdella lubrica* (Grube, 1840)**
Class: Clitellata
Genus: Trachelobdella
Species: *T. lubrica*
Orig. name *Pontobdella lubrica* Grube, 1840
Synonyms: *P. lubrica* Grube, 1840
Trachelobdella kolleri (Diesing, 1850)
Trachelobdella luederitzi (Augener, 1936)
Trachelobdella muelleri (Diesing, 1850)
Sites: Skin
Description: Form body slender, sub-fusiform, it is symmetrical bilateral. The colour of living specimens is yellow-orange. The body has obvious paired pulsatile

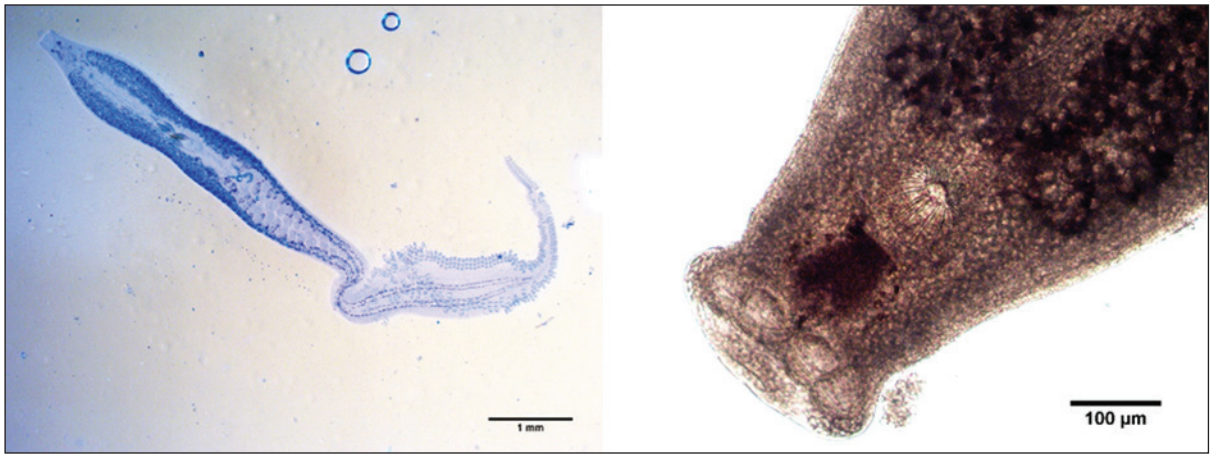

Fig. 3. *Bychowskicotyla mormyri (Lorenz, 1878) Unnithan, 1971* (left: whole worm; right: genital atrium).

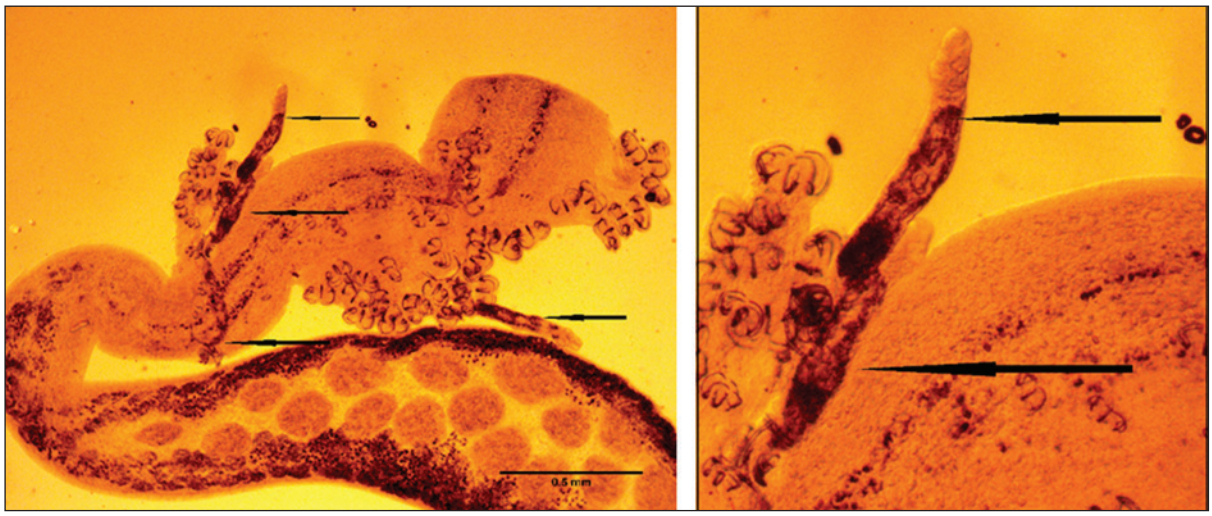

Fig. 4. Left: Lamellodiscus Johnston and Tiegs, 1922 attached with haptor of *B. mormyri* Scale-bars: 0.5 mm. Right: magnification to lamellodiscus.

vesicles. The head region dilated into a circular sucker (Fig. 5), distinct from the body and has one pair of eyes, its body has two ellipses that represent suckers, trapeziums situated between them, and the body structure is an anterior sucker. Trachelosome, which is divided into many trapeziums, is located in the anterior part of the body. Another structure is located in the posterior part of their body, which is called the urosome and posterior sucker which is very small.

Gnathia Leach, 1814 larvae (*Praniza*)

Family: Gnathiidae

Genus: Gnathia

Sites: Skin and Gills

Description: A total of 65 Gnathia larvae (Praniza) were collected through this study. Its body is described as divided into the cephalosome, the peroen with five pairs of pereopods; the pleon consists of five pleonites each with a pair of pleopods, and the telson with one pair of uropods. The cephalon is narrowing anteriorly with a truncate frontal margin; the antennae are slightly longer than the antennule extended pereonite 1, the posterior margin of cephalon being is much narrower than the anterior margin of pereonite 1, the compound eyes are large, oval, and located on the lateral margin as in (Fig. 6).

Fig. 5. *Trachelobdella lubrica* (Grube, 1840).

***Lernaeolophus sultanus* (Milne Edwards, 1840)**

Family: Pennellidae Burmeister, 1835

Genus: Lernaeolophus Heller, 1865

Species: *L. sultanus* (Milne Edwards, 1840)

Original name: *Pennella sultana* Milne-Edwards, 1840

Synonymised names: *Lernaea hemirhamphi* Krøyer, 1863 ·
Lernaea sieboldi Koch, 1860 ·
Lernaeolophus hemirhamphi (Krøyer, 1863) ·
Lernaeolophus recurvus Wilson C.B., 1913 ·
Pennella sultana Milne-Edwards, 1840 ·

Sites: Mouth and Skin

Description: Mouth region, the most highly modified elongated body was deeply embedded into the host's tissue. the globular cephalosome is attached with three cephalic horns as in (Fig. 7), the globular head had a width of 2.19 mm, while the sigmoid trunk had 2.09 mm. Three pairs of lobes in the circular oral region have an anterior lobe size of 0.32 mm, middle lobe of 0.47, and posterior lope of 0.74 mm, continuously after the neck there were found the cylindrical truck measured 6.68 mm. The abdomen was shorter than the trunk with a length of 2.45mm. branched posterior processes giving it a brush-like appearance with spirally coiled egg sacs.

Discussion

Today, the world is looking for knowledge of the biodiversity of living organisms, especially the marine biodiversity, which plays a major role in the marine environmental balance in addition to its food

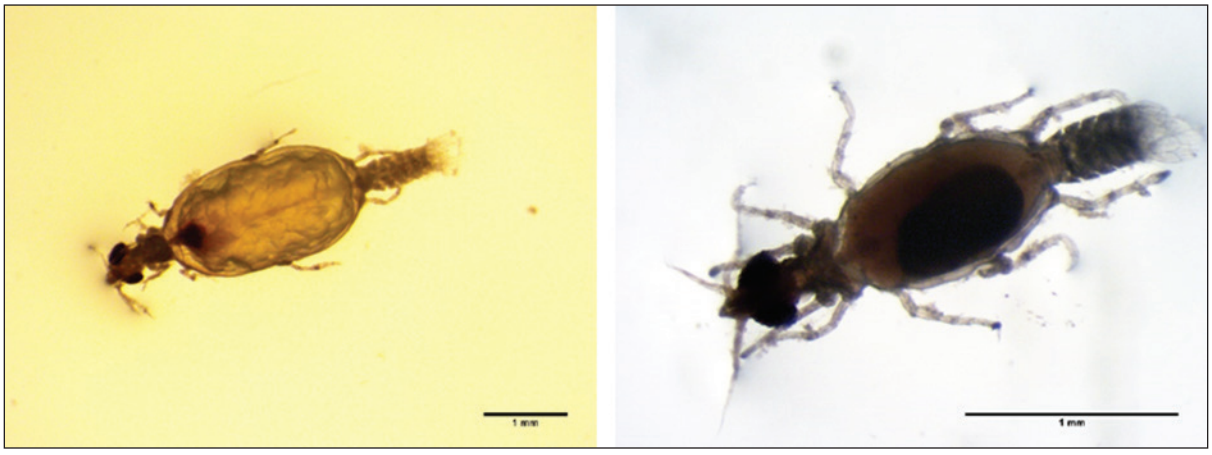

Fig. 6. Left and right: Praniza larvae.

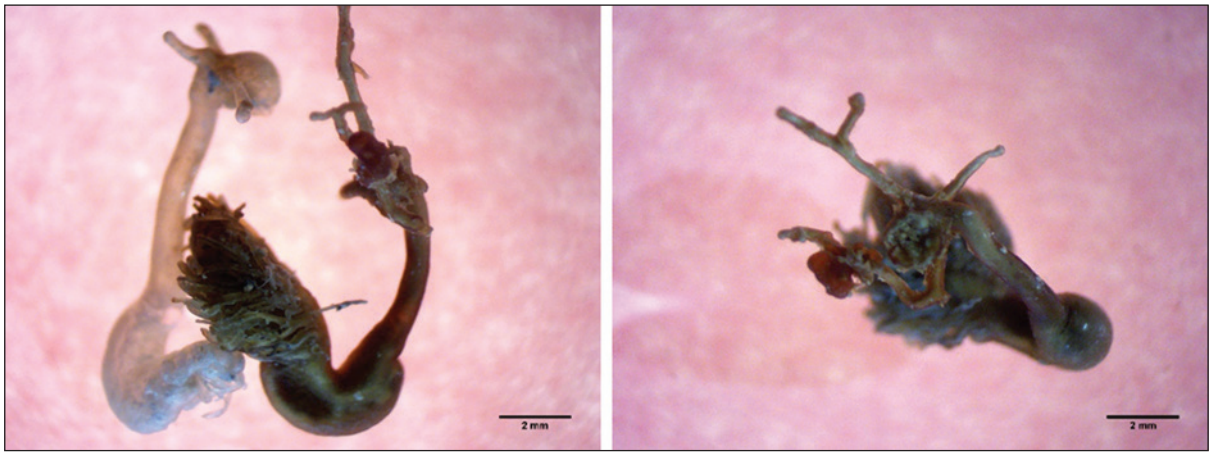

Fig. 7. *Lernaeolophus sultanus* (Milne Edwards, 1840) (left: whole body; right: the head).

importance as it follows this path with research studies that study the risks that can threaten these marine organisms, including worms parasitizing on fish and other such organisms. Moreover, these parasites are considered one of the marine biodiversity. For this reason, it is necessary to study and identify them, as this study was conducted in which they isolated the Monogenea (*Encotyllabe valley*, *Pagellicotyle mormyri*, and Lamellodiscus). Isopoda (Gnathia), Copepoda (*L. sultanus*), and Annelidae (Leeches). By searching for previous studies in particular, especially in the waters of the sea of the countries adjacent to the marine water of the Libyan state, such as Tunisia on the western side and Egypt on the eastern side. a difference has been found in the isolated parasites in the same fish species (*L. mormyrus*). Alaa *et al*. (2014) have isolated *Nerocila bivittata* from *L. mormyrus* of Abu Qir Bay, Alexandria, showed higher digenean diversity (*Derogenes latus*, *Allopodocotyle pedicellate*, *Diphterostomum brusinae*, *Holorchis pycnoporus*, *Lepocreadium album*, *Lepocreadium pegorchis*, *Macvicaria maillard*, *Macvicaria mormyri*, *Proctoeces maculatus*, and *Pycnadenoides senegalensis*) in the *L. mormyrus* was catch from Bizerte Lagoon-Tunisia (Gargouri Ben Abdallah *et al*., 2011). In addition, mature spermatozoon of *Holorchis pycnoporus* from the digestive tract of the Striped seabream from off the Gulf of Gabès at La Chebba (Tunisia) were isolated, and Ramdane *et al*. (2007) have isolated *Anilocra frontalis* and *Solea vulgaris* from *L. mormyrus* in the gulf of Béjaïa and gulf of Jijel from Algerian fauna.

Distomum mormyri was redescribed from the intestine of *L. mormyrus* L. in the western Mediterranean Scandola Nature Reserve, Corsica, France (Bartoli *et al*., 1993). Differences have been noted in the type of parasites that infect spindle fish from one country to another, and even within the same country, the types that have been isolated from this type of fish also vary from one city to another.

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Authors' contributions

All authors contributed equally to this research.

Funding

None.

Conflict of interest

The authors declare that there is no conflict of interest.

Data availability

All data are provided in the manuscript.

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