



## Detection of internal and external parasites of some common fish species from Al-Dalmaj Marsh/ Iraq

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### Abstract

The current study conducted at Al-Dalmaj marsh (20km north of Afaq district-Al-Diwaniyah province/ middle of Iraq), for the period from first November 2021 - end of May 2022, The study aimed to isolation and identification of external and internal parasites on some common fish species in the Al-Dalamaj Marsh region, A total of 345 specimens of fish were collected, this fish were belonging to three families, including Cichlidae, Mugilidae and Cyprinidae, were including *Cyprinus carpio* (120 specimens) *Coptodon zillii* (100 specimens) and *Planiliza abu* (125 specimens).

The study showed that the three species were infected with 29 species of internal and external parasites, it included four species of Ciliophora, twenty species of Monogenea, one species of Cestoda, two species of Acanthocephala and two species of crustaceans.

*C.zillii* was highly infection (43%) followed by *P.abu* (42.4%) and lowest infection was in *C.carpio* (37.5%).

It was observed that the *Cyprinus carpio* was infected with 15 species of parasites, followed by *Planiliza abu*, which was infected with 10 species, while *Coptodon zillii* was infected with only 8 species of parasites.

Eleven new hosts for some registered parasites in this study were recorded for the first time in Iraq, nine of them belong to Monogenea, One species of Cestoda and one species of Ciliophora.

The detected new species were four species in *Cyprinus carpio* (*Gyrodactylus cotti*, *G.rarus*, *Khawia rossittensis* and *Cichlidogyrus sclerorus*). Four species in *Planiliza abu* (*Dactylogyrus lenkoranoides*, *Gyrodactylus barbi*, *G. vimbi* and *Paradiplozoon homoion*), and three species in *Coptodon zillii* (*Trichodina gracilis*, *Microcotyle donavani* and *Diplozoon* spp.).

**Keywords:** fish parasites, common fish species, Al-Dalmaj Marsh\Iraq

### Introduction

The fish wealth in all countries of the world, especially the poor countries, an important source of national income and the economies of those countries, it was one of the livelihood sources for these countries. Fish is one of the important diets rich in many substances and nutrients. high population, increases fish consumption, consequently, leads to the need to increase production to 5% annually (FAO, 2016) [24].

Most parasites cause mechanical damage during migration in the fish's body, thus hindering the process of growth and reproduction, and a number of parasites are transmitted to humans by eating raw or undercooked fish meat (Hoffmann, 1999) [32].

In Iraq studies and local information in the field of fish parasites are many and varied, but It does not cover all rivers and waterbodies, especially the Al-Dalmaj marsh in Al-Diwaniyah province, and it did not receive any attention from researchers. Only one study carried out in this region by Mohammad (2016) included Al-Dalmaj marsh and Al-Nasiriyah marshes, during which only 60 specimens were collected from Al-Dalmaj marsh, and no parasites were recorded in the studied fish. Therefore the current study, which aimed to isolation and identification of internal and external parasites of common fish species in the region, rates and density of infection according to the species of studied fish.

### Materials and Methods

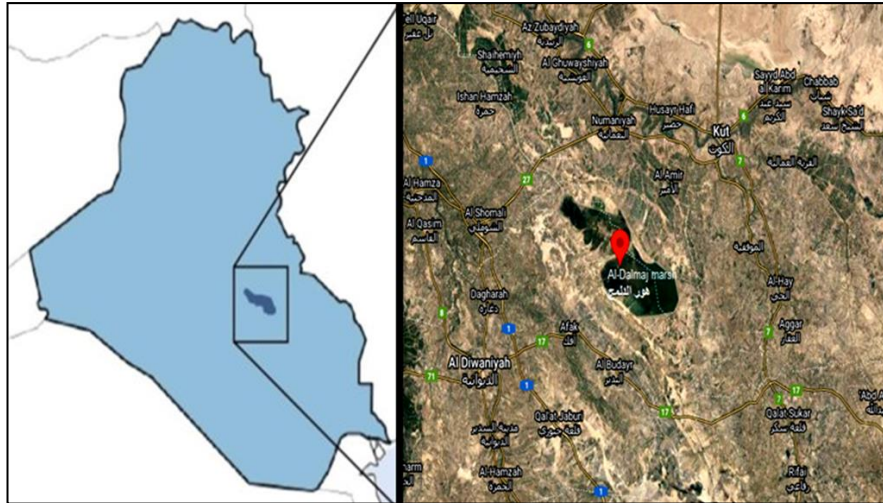
#### Description of the study area

Al-Dalmaj marsh is an aquatic region its total area is about 682 km, 170 km away from Baghdad city, located in the northeastern part of Al-Diwaniyah province and the southwestern part of Wasit province and has a wide range of environmental habitats (Salim, 2002, it has great ecological and biological diversity, contains different species of local, immigrant birds and fish (Alkam, 2007)). Figure (1).

#### Specimens Collection

A total of 345 fish specimens of *Cyprinus carpio*, *Coptodon zillii* and *Planiliza abu* (120, 100 and 125 specimens respectively) were collected, for the isolation and identification of the internal and external parasites from Al-Dalmaj marsh for the period from the first of November - end of May 2022, the samples were collected once a

week by the fishery, using several tools of fishing, including the hand-throwing nets and the gulps nets. fish transferred alive to the advanced Parasitology laboratory / college of education / university of Al-Qadisiyah



**Fig 1:** Map shows the location of Al-Dalmaj marsh in Iraq (left); and recent satellite image shows Al-Dalmaj marsh and the surrounding areas (right). The area PNG Wing represents the study area.

### Fish examination

The external surface of fish (skin, fins, eyes and oral cavity) were examined with the naked eye, also using a magnifying glass, to detect external parasites, then swabs were taken using the Spatula scraper and placed on a clean slide, then examined under a compound light microscope, Gills were isolated from the gill lumen and placed in a Petri dish, contains a Small amount of tap water to prevent its drying out and then Isolated and examined under a microscope, eyes were also isolated, it was placed in a Petri dish containing tap water and examined under a microscope as described by (Amlacher, 1970) [17].

### Fish Dissection

Fish were dissected to isolate internal parasites, by a longitudinal incision starting from the head to the outlet opening, then another incision was made extending from the end of the first incision to the cover of the gills along the lateral line of the fish so that the internal organs of the fish became clear and examined for internal parasites under microscope as described by (Lasee, 2004) [36].

### Parasite fixation, preservation and staining

Various methods were used for the purpose of fixing, preserving and staining the parasites that were isolated from collected fish, as described by Masoumian *et al.* (1996) [38] for ciliophora; Beckert (1967) [19] Gussev *et al.* (1993); Bullough (1962) [21] for Monogenia and Amin *et al.* (2001) for Cestoda.

### Identification

Identification of the parasites was carried out using morphometric and morphology criteria as described by Bykhovskaya, (1964) and Yamaguti & Nishida (1968) [49].

### Results and Discussion

The results showed that studied species were infected with 29 species of internal and external parasites, it included four species of Ciliophora, twenty species of monogenia, one species of Cestoda, two species of Acanthocephala and two species of crustaceans. *C.zilii* was highly infection and the total infection was 43% followed by *P.abu* (42.4%) and lowest infection was in *C.carpio* (37.5%) as shown in the tables (1,2).

It was observed that the *Cyprinus carpio* were infected with 15 species of parasites, it was followed by *Planiliza abu*, which was infected with 10 species, while *Captodon zillii* was infected with only 8 species of parasites. Ten new hosts of some registered parasites were recorded in this study, for the first time in Iraq, seven of them were monogenea one species of Cestoda and Ciliophora, as shown in Tables (2,3&4) bellow.

### Phylum: Ciliophora

In the current study, four species of parasites belonging to this phylum were diagnosed, and they include one species of the genus *Ichthyophthirius* and three species of the genus *Trichodina* (Tables 3&4). The division of ciliates includes parasitic species on various species of fish and is considered the most dangerous as it leads to many diseases and thus causes severe damage to the gills and skin of infected fish (Hoffman, 1998). The following is a list of these three species of ciliates.

***Ichthyophthirius multifiliis* Fauquet, 1876**

This species was recorded from the gills of the *C. carpio* with an infection rate 1.6%.

This species recorded for the first time in Iraq by Herzog (1969)<sup>[30]</sup> from the green bay fish *Chelonsub viridis*, then registered under the name *Mugilduss mieri*, from the Tigris River in Baghdad. In *P. abu* It recorded From the first time in Iraq by Fattohy (1975)<sup>[25]</sup>, In *C. carpio* by Khalifa (1982)<sup>[35]</sup> and in *C. zilli* it was recorded for the first time in Iraq by Al-Saadi (2007)<sup>[12]</sup>, later it was recorded from 39 species of hosts (Mhaisen, 2022)<sup>[40]</sup>.

**Genus: *Trichodina***

In the current study, three species of this genus were recorded as parasitic on *C. carpio*, *C. zill* and *P. abu* as shown below:

***Trichodina cottidarum* Dogiel, 1948**

This species was recorded from the skin of common carp *C. carpio* with an infection rate of 25%, It was recorded for the first time in Iraq from the gills of *C. carpio* from an artificial lake in Al-Zawraa Park in Baghdad by Abdul-Ameer (2004)<sup>[2]</sup>, and later recorded from 14 species of hosts (Mahaisen, 2022)<sup>[40]</sup>.

This species was recorded from the fins of *C. zilli* with an infection rate of 10%. This species was recorded for the first time in Iraq from the fingerlings of the *C. carpio* in the Middle East fish farm in Babylon province by Hussein (2005)<sup>[33]</sup>, and later recorded from three other species of hosts (Mhaisen, 2022)<sup>[40]</sup> *C. zillii* is not included, and therefore *C. zilli* is now considered a new host for this species in this study in Iraq as the fourteen host.

***Trichodina gracilis* Polyanskii, 1955**

This species was recorded from the fins of *Coptodon zillii* with an infection rate of 10%. This species was recorded for the first time in Iraq from the fingerlings of the common carp *C. carpio* in the Middle East fish farm in Babylon province by Hussein (2005)<sup>[33]</sup>, and later recorded from three other species of hosts (Mhaisen, 2022)<sup>[40]</sup> *C. zillii* is not included, and therefore it is now considered a new host for this species in this study in Iraq as the fifth host.

***Trichodina Strelkovi* Chan, 1961**

This species was recorded from the gills of the *C. carpio* with an infection rate of 20.8% and from the gills of *P. abu* with an infection rate of 12%. This species was recorded for the first time in Iraq from *P. abu* fish registered at the time under the name *Liza abu*, which was taken from the fish markets in Baghdad by Al-Saadi (2014)<sup>[12]</sup>, it was later recorded from nine other species of hosts (Mhaisen, 2022)<sup>[40]</sup>, including *C. carpio* and *C. zillii*, where this species was first recorded from both of the two species by Atwan (2016)<sup>[18]</sup>.

species of this genus of ciliates infect various freshwater fish species (Bykhovskaya-Pavlovskaya *et al.*, 1962)<sup>[22]</sup> and they are among the parasites that commonly infect farm fish. When the environmental conditions are bad, such as slow water flow or crowding of fish, and thus produce accumulated organic materials and lack of oxygen, and accordingly, these conditions become more suitable for the spread of species of this genus (Amlacher, 1970)<sup>[17]</sup>.

**Phylum Platyhelminthes****Class: Monogenea**

The monogenea class belonging to the phylum Platyhelminthes includes parasites that have a direct life cycle and are externally parasitic on the body of the fish and have an organ at the back of the body that they use for fixation called the posterior disc or haptor, and it contains a number of small hooks (Muhaisen, 1983).

**Genus: *Cichlidogyrus***

This genus belongs to the group of flatworms of single origin and differs from the genus *Gyrodactylus* and the genus *Dactylogyrus* in that it has a pair of median hooks, one of which is connected dorsally with the penis connecting the letter x while the other is connected ventrally with the penis connecting the letter v (Pariselle & Euzet, 2004; Pouyau *et al.*, 2006).

In the current study, two species of this genus were recorded as parasitic on *C. zilli* and the parasites of this genus contain in its anterior front four extensions, and it contains four eyes spots, there is a ventral sucker, and it contains a posterior disc that bears two middle hooks connected by one connecting bar, and on the edge of this disc there are 14 small hooks. The place of parasitism in the fish is the gills, where the parasite fixes itself on the gill threads, but when the numbers of these parasites increase, they spread on the skin and fins of the fish. These parasites are oviparous (Muhaisen, 1983). The registered species are:

***Cichlidogyrus sclerosus* (Paperna & Thurston, 1969)**

The species was recorded from the gills *C. zilli* with an infection rate of 25% and a severity of infection 33.3, and from the gills of *C. carpio* with an infection rate of 8.3% and a severity of infection 50.

This species was first recorded in Iraq from *Oreochromis aureus* from the Tigris River at Al-Qurayat area, Baghdad by Atwan (2016)<sup>[18]</sup> and later recorded from two other species of hosts (Mhaisen, 2022)<sup>[40]</sup>, including the *C. zillii*, it was first recorded in Iraq by Atwan (2016)<sup>[18]</sup> also. it is a new host for this species in Iraq In the current study, which was the four host (Mhaisen, 2022)<sup>[40]</sup>.

***Cichlidogyrus tiberianus* Paperna, 1960**

This species was recorded from the gills of *C.zilli* with an infection rate of 20.8%, and a severity infection of 20. This species was first recorded in Iraq from *C.zilli* from the Tigris River at Al-Qurayat area, Baghdad by Atwan (2016)<sup>[18]</sup> and was not recorded later from any other host in Iraq (Mhaisen, 2022)<sup>[40]</sup>.

**Genus: *Dactylogyrus***

In the current study, three species of this genus were recorded as parasitic on, *P.abu* as shown below:

***Dactylogyrus extensus* Mueller & Van Cleave, 1932**

This species was recorded from the gills of the *C.carpio*, with an infection rate of 6.6% and a severity infection of 1.25. This species was recorded for the first time in Iraq from *C.carpio* from Al-Suwaira and Latifiya farms (Salih *et al.*, 1988)<sup>[45]</sup> and later recorded from 21 fish species (Mhaisen, 2022)<sup>[40]</sup>.

***Dactylogyrus lenkoranoides* El-Gharbi, Renaud & Lambert, 1993**

This species was recorded from *C.carpio* only, with an infection rate of 10.4% and a severity infection of 6.5. This species was recorded for the first time in Iraq from *Cyprinion macrostomum* and *Carasobarbus luteus* from the Tigris River at Al-Grayat area, Baghdad by Atwan (2016)<sup>[18]</sup> and later recorded from four other species of hosts (Mhaisen, 2022)<sup>[40]</sup> not including *P.abu* in the current study is a new host for this species in Iraq, and it is the seventh host.

***Dactylogyrus wegneri* Kulwiec, 1927**

This species was recorded from the gills of *C.zilli* with an infection rate of 7% and a severity infection of 1.4. Abdul-Ameer (2006)<sup>[3]</sup> recorded this species for the first time in Iraq from *C.carpio* from the artificial lake in Al-Zawra Park in Baghdad, and in *C.carpio* was recorded for the first time in Iraq by Al-Hujaimi (2021). Later recorded from five other species of hosts (Mhaisen, 2022)<sup>[40]</sup>, including *C.zilli*.

**Genus: *Diplozoon***

Members of this genus are linked each to other eternally to form one integrated parasite in the shape of the letter X, where at first two larvae unite to form two large worms. The body is divided into an anterior part and is located before the area of attachment, and the other part is a posterior part located behind. The front part of the body contains a pair of suckers, between which are located the mouth opening leading to the pharynx, then the esophagus, and then the intestine. The intestine is characterized in the front part of the parasite by the presence of many branches but without being connected to each other, the front part also contains the vitelline glands, while the back part is characterized by the presence of folds or dilatation widths that vary in size and can be divided into three parts: the front part contains the reproductive system, the middle part contains the end of the intestine, and the back part contains four clamps were associated with two parallel rows and two intermediate clamps (Pugachev *et al.*, 2010)<sup>[41]</sup>.

This genus was recorded as an adult stage of the gills of *C.zillii* with an infection rate of 1% and a severity of infection of 1, and the larval stage called *diporpa* larva was recorded from the gills of *p.abu* fish with an infection rate of 0.8% and an infection intensity (Tables 1 and 2).

*Diplozoon barbi* was first recorded in Iraq, from *Carasobarbus luteus* from Al-Hussainiya trocar in Karbala province (Al-Saedi, 2007)<sup>[13]</sup> and later recorded from four other fish species in Iraq (Mhaisen, 2022)<sup>[40]</sup>. It should be noted that the name of this species is now considered synonymous with the legal name *Paradiplozoon barbi* based on the website GBIF (2022). In addition, other unclassified specimens of this genus were recorded from 14 different species of Iraqi fish, some specimens were adults and others were larvae, *diporpa* larva (Mhaisen, 2022)<sup>[40]</sup>. Among the undiagnosed species of the adult species order, none of the *C.zilli* was recorded, and thus *C.zilli* in the current study is a new host for this undiagnosed species in Iraq, which is the fifteenth host. However, the larval stage was previously recorded from *P.abu* by AbdAl-Rahman (1999) based on the reference guide to parasites and diseases of fish in Iraq (Mhaisen, 2022)<sup>[40]</sup>.

**Genus: *Gyrodactylus***

The body of the species in this genus are elongated and the front end contains two crests with which glands open and there are no eye spots. The mouth opening is located on the ventral side at the front end of the parasite body. Members of this genus are viviparous (Mhaisen, 1983)<sup>[40]</sup>. In the current study, seven species of this genus were recorded as parasitic on *C.carpio*, *C.zilli* and *P.abu* They were shown below:

***Gyrodactylus barbi* Ergens, 1976**

This species was recorded in the current study from *P.abu* fins only, with an infection rate of 2.4% and a severity infection of 5. This species was recorded for the first time in Iraq from *C.carpio* from Ainkawa fish hatchery in Erbil province (Mama, 2012)<sup>[37]</sup> and later recorded from four other species of hosts (Mhaisen, 2022)<sup>[40]</sup>, not including *P.abu* and therefore it is considered a new host for this species of parasite in the current study and it is the sixth host in Iraq.

***Gyrodactylus cotti* Roman, 1956**

This species was recorded in the current study from *C. carpio* fin only, with an infection rate of 1.6% and an severity infection of 1. This specie was first recorded in Iraq from *P. abu* from the Tigris River at Al-Shawka, Baghdad by Rashid (2016) <sup>[44]</sup> and was not recorded later from any other host in Iraq (Mhaisen, 2022) <sup>[40]</sup>. In iraq its the second hostof the parasite.

***Gyrodactylus dzhalilovi* Ergens&Ashurova, 1984**

This specie was recorded from the gills of the *C. carpio* only, with an infection rate of 3.3% and a infection severity 3. This species was first recorded in Iraq from *C. carpio* from the Tigris River at Al-Shawka District, Baghdad by Rashid(2016) <sup>[44]</sup> and later recorded from eight other species of hosts (Mhaisen, 2022) <sup>[40]</sup>.

***Gyrodactylus elegans* von Nordmann, 1832**

This species was recorded from the gills of *C. carpio* only with an infection rate of 2.5% and a severity infection of 3 in the current study. This specie was recorded for the first time in Iraq from both *C. carpio* and *P. abu* from the two fish farms of Essaouira city and Latifiya by Ali & Shaaban (1984) and later recorded from 21 other species of hosts (Mhaisen, 2022) <sup>[40]</sup>.

***Gyrodactylus masu* Ogawa, 1986**

This species was recorded in the current study from the skin of *C. zilli* with an infection rate of 4% and an severity infection of 2. This species was first recorded in Iraq from *C. zilli*, *C. carpio* and *Mesopotamichthys sharpeyi* from the Tigris River at Al-Grayat area, Baghdad by Atwan (2016) <sup>[18]</sup> and later recorded from two other speciess of hosts (Mhaisen, 2022) <sup>[40]</sup>.

***Gyrodactylus matovi* Ergens&Kakacheva-Avramova, 1966**

This species was recorded in the current study from the gills of the *C. carpio* only, with an infection rate of 2.5% and an severity infection of 4. This species was first recorded in Iraq from *C. carpio* from the Tigris River at Al-Shawka District, Baghdad by Rashid (2016) <sup>[44]</sup> and later recorded from five other species of hosts (Mhaisen, 2022) <sup>[40]</sup>.

***Gyrodactylus rarus* Wegener, 1909**

This species was recorded in the current study from the skin of *C. carpio* only, with an infection rate of 1.6% and an severity infection of 5. This species was first recorded in Iraq from a *C. carpio* from the Tigris River at Al-Shawka, Baghdad by Rashid (2016) <sup>[44]</sup> and later recorded only from one another species of hosts (Mhaisen, 2022) <sup>[40]</sup>.

***Gyrodactylus sprostonae* Ling, 1962**

This species was recorded in the current study from *C. carpio* fins only, with an infection rate of 4.1% and an severity infection of 4. This species was first recorded in Iraq by Al-Zubaidi (1998) <sup>[14]</sup> and later recorded from 13 other species of hosts (Mhaisen, 2022) <sup>[40]</sup> in Iraq.

***Gyrodactylus vimbi* Shul'man, 1954**

This species was recorded from *P. abu* fins only, with an infection rate of 5.6% and severity infection of 1.4. This species was recorded for the first time in Iraq from *silurus triostegusin* in the Hammar marsh by Jori (2006) <sup>[34]</sup> and it was not recorded later from any other species of fish in Iraq (Mhaisen, 2022) <sup>[40]</sup>. *P. abu* is The second host for species in iraq.

**Genus: *Microcotyle***

One of the characteristics of the species of this genus is that it is lanceolate and the body consists of a front part and a back part carrying a number of small hooks. Yamaguti (1968) <sup>[49]</sup> showed the presence of 72 species belonging to this genus parasitic on marine fish in different regions of the world, and Gussev (1985) found only one species in Freshwater fish of the former Soviet Union, and Hoffman (1998) isolates three species that infect freshwater fish of North America.

***Microcotyle donavani***

This species was recorded in the current study from the gills of *C. zilli*, with an infection rate of 1% and an intensity infection of 1. In this study *C. zilli* is a new host for this parasite in Iraq (Mhaisen, 2022) <sup>[40]</sup>.

**Genus: *Paradiplozoon***

Members of this genus are characterized by not containing the midsection of the back of the body to expand, as is the case in the case of parasites of the genus *Diplozoon*. In the current study, three species of this genus were recorded as parasitic on *C. carpio* and *P. abu* as shown below:

***Paradiplozoon barbi* (Reichenbach-Klinke, 1951)**

This species was recorded from the gills of the common carp *C. carpio* with an infection rate of 1% and an severity infection of 1. This species was first recorded in Iraq as *Diplozoon barbi* from both *C. carpio* and *Chondrostoma regium* and *C. nasus* from the Tigris river at Baghdad city by Rasheed (1989), but this species is now synonymous with *Paradiplozoon barbi*. The number of registered hosts in Iraq for this specie (with its synonym and its legal name together) is eight, including the *C. carpio* (Mhaisen, 2022)<sup>[40]</sup>.

***Paradiplozoon cyprinid* Khotenovsky, 1982**

This species was recorded from the gills of the *C. carpio* only, with an infection rate of 0.83% and a severity of infection of 1. This species was first recorded in Iraq from *C. carpio* from the Tigris River at Salah al-Din province (Al-Nasiri & Mahaisen, 2009a) and later recorded from six other host species (Mhaisen, 2022)<sup>[40]</sup>, including the *Cyprinus carpio* which was recorded by Mama (2012)<sup>[37]</sup>.

***Paradiplozoon homoion* (Bychowsky & Nagibina, 1959)**

This species was recorded from gills *p. abu* only, with an infection rate of 1.6% and an infection severity of 1.5. This species was first recorded in Iraq from Al-Hussainiya trocar in Karbala province by Al-Saedi (2007)<sup>[13]</sup> and later recorded from four other species of hosts, not including *P. abu* (Mhaisen, 2022)<sup>[40]</sup>, and accordingly the *P. abu* in the current study is considered as a new host to this species in Iraq, is the sixth host.

**Phylum: Platyhelminthes****Class: Cestoda**

The class of tapeworms belonging to the phylum of Platyhelminths includes endoparasites that do not have the digestive system. Therefore, their adult stages live in the small intestine of their hosts of fish and other vertebrates. The body of the adult worm consists of a small head (scolex) and a number of proglottides. It contains both male and female reproductive organs (Mhaisen, 1983)<sup>[39]</sup>.

Only one species of Cestoda belonging to this phylum has been diagnosed:

***Khawia rossittensis* (Szidat, 1937) (Markevich, 1951)**

This worm was recorded from the intestines of the *C. carpio* only, with an infection rate of 1.6% and an severity infection 1.5. This species was recorded for the first time in Iraq by Al-Ayyash (2011), this worm was recorded from the intestines of the *Leuciscus vorax*, The maximum body width is 0.8-2.2 and the body width gradually decreases towards the rear end of the worm, especially the last third. The Scolex head has a structure that is wider than the body and the front end is flat and its surface is smooth without cracks or grooves. The head is not separated from the body by a clear neck, but what distinguishes it is its wider sides of the body. The *C. carpio* is a new host for this worm in the current study (Mhaisen, 2022)<sup>[40]</sup>.

**Phylum: Acanthocephala**

There are many genera belonging to this group of worms that are parasitic on vertebrate animals.

Among them is the genus *Neoechinorhynchus*, which parasitizes a wide variety of fish. Amin *et al.* (2003)<sup>[15]</sup> found that there are about 89 different species belonging to this genus.

Within this phylum, only two species of spiny-headed worms belonging to the genus *Neoechinorhynchus* have been diagnosed, as shown in Table (1). They were:

***Neoechinorhynchus iraqensis* Amin, Al-Sady, Mhaisen & Bassat, 2001**

This species was recorded from the intestines of *P. abu* only, with an infection rate of 1.6% and an infection severity 1.5. The first described as a new species from the intestine of *P. abu* in Iraq, under the synonym *liza abu* from the Euphrates River at Fallujah city, Anbar province was by Amin *et al.* (2001)<sup>[16]</sup> and later recorded from 23 species of hosts in Iraq (Mhaisen, 2022)<sup>[40]</sup>.

***Neoechinorhynchus rutili* (Müller, 1780) Hamann, 1892**

This species was recorded from the intestines of *P. abu* only, with an infection rate of 1.6% and a severity of infection of 1.5. It was first recorded in Iraq from the intestines of *Luciobarbus xanthopterus* and *P. abu* from an oasis in Fallujah, Anbar province (Herzog, 1969)<sup>[30]</sup> and later recorded from 14 other species of fish hosts in Iraq (Mhaisen, 2022)<sup>[40]</sup>.

**Phylum: Arthropoda****Subphylum: Crustacea**

Crustaceans include a group of arthropod animals. Some of these animals, it parasitizes on fish and causes great damage to it, including the crustaceans of the genus *Ergasilus*, which are common in infecting farmed fish and tropical regions (Sarig, 1971)<sup>[37]</sup>.

Only two species of crustaceans belonging to the genus *Ergasilus* were recorded and diagnosed within this subphylum (Tables 1,2), Which:

***Ergasilus mosulensis* (Rahemo, 1982) [42]**

This species isolated only from gills of *p.abu* with an infection rate of 10.4% and a severity of infectiof 6.5. This crustacean was described for the first time in Iraq from *P.abu* from the Tigris River at the city of Mosul (Fattohy, 1975) [25] and then the article was published after the recording of this crustacean from *Cyprinion macrostomum* fish from the Tigris River at the city of Mosul also (Rahemo, 1982) [42] and later recorded from 23 other species of hosts (Maisen, 2022).

***Ergasilus sieboldi* (vonNordmann, 1832)**

Only this species of intestine of *C.zilli* was recorded with an infection rate of 7% and an severity infection 1.4. This crustacean was first recorded in Iraq from AL-shaikh in AL-Habbaniyah Lake ((Herzog, 1969) [30] and later recorded from 25 other species of fish hosts in Iraq (Mhaisen, 2022) [40] including *C.zilli*, which was recorded for the first time in Iraq before Al-Janae'e (2010).

**Table 1:** The numbers and percentages of total Infection/infestation in studied fish species in AL-Dalmaj marsh / Iraq.

Fish types	Total	State	
		Infected	Uninfected
<i>Cyprinus carpio</i>	120	45 (37.50%)	75 (62.50%)
<i>Coptodon zillii</i>	100	43 (43.00%)	57 (57.00%)
<i>Planiliza abu</i>	125	53 (42.40%)	72 (57.60%)
P. Value		0.646*	

\*No significant differences at 0.05

**Table 2:** The species of parasites, percentages, severity and site of Infection/infestation in studied fish species in AL-Dalmaj marsh/ Iraq.

Parasite	Host	No. of fish		Infection (%) rate	Infection severity	Site of parasite
		examined	Infected			
<i>I. multifiliis</i>	<i>C. carpio</i>	120	2	1.6	-	Gills
	<i>P. abu</i>	125	5	4	-	Gills
	<i>C. zillii</i>	100	3	3	-	Fins
<i>T. cottidarum</i>	<i>C. carpio</i>	120	30	25	-	Skin
<i>T. gracilis</i>	<i>C. zillii</i>	100	10	10	-	Fins
<i>T. strelkovi</i>	<i>C. carpio</i>	120	25	20.8	-	Gills
	<i>P. abu</i>	125	15	12	-	Gills
<i>C. sclerosus</i>	<i>C.zilli</i>	100	30	25	33.3	Skin
	<i>C.carpio</i>	120	10	8.3	50	Fins
<i>C. tiberianus</i>	<i>C. zillii</i>	100	25	20.8	20	Gills
<i>D. extensus</i>	<i>C. carpio</i>	120	8	6.6	1.25	Gills
<i>D. lenkorani</i>	<i>P. abu</i>	125	13	10.4	6.5	Gills
<i>D. wegneri</i>	<i>C.zill</i>	100	7	7	1.4	Gills
<i>diporpa larva</i>	<i>p.abu</i>	125	1	0.8	1	Gills
<i>Diplozidaespp</i>	<i>C.zilli</i>	100	1	1	1	Gills
<i>G.barbi</i>	<i>P.abu</i>	125	3	2.4	5	Fins
<i>G. cotti</i>	<i>C. carpio</i>	120	2	1.6	1	Fins
<i>G. dzhaliovi</i>	<i>C. carpio</i>	120	4	3.3	3	Gills
<i>G. elegans</i>	<i>C. carpio</i>	120	3	2.5	3	Gills
<i>G. masu</i>	<i>C.zilli</i>	100	4	4	2	Skin
<i>G. matovi</i>	<i>C. carpio</i>	120	3	2.5	4	Gills
<i>G. rarus</i>	<i>C. carpio</i>	120	2	1.6	5	Skin
<i>G. sprostonae</i>	<i>C. carpio</i>	120	5	4.1	4	Fins
<i>G. vimbi</i>	<i>p.abu</i>	125	7	5.6	1.4	Fins
<i>P. barbi</i>	<i>C. carpio</i>	120	13	10.4	6.5	Gills
<i>P. cyprinid</i>	<i>C. carpio</i>	120	7	7	1.4	Gills
<i>P. homoion</i>	<i>p.abu</i>	125	8	6.6	1.25	Gills
<i>Microcotyle donavini</i>	<i>C.zilli</i>	100	1	1	1	Gills
<i>Khawia rossittensis</i>	<i>C. carpio</i>	120	1	1.6	1.5	Intestine
<i>N. iraqensis</i>	<i>p.abu</i>	125	13	10.4	76.9	Intestine
<i>N. rutili</i>	<i>p.abu</i>	125	7	5.6	71.4	Intestine
<i>E. mosulensis</i>	<i>p.abu</i>	125	13	10.4	6.5	Gills
<i>E. sieboldi</i>	<i>C. carpio</i>	120	7	7	1.4	Gills

**Table 3:** The species of parasites recorded in Al-Dalmaj marsh fish, distributed according to the species of host

Host	Parasites
<i>Cyprinus carpio</i> 15 species	<i>Trichidina strelkovi</i> <i>T.cottidarum</i> <i>Dactylogyrus extensus</i> <i>Gyrodactylus sprostonae</i> <i>G.elegans</i> <i>G.cotti</i> <i>G.dzhaliovi</i> <i>G.mutovi</i> <i>G.rarus</i> <i>Paradiplozoon cyprinid</i> <i>Paradiplozoon barbi</i> <i>Cichlidogyrus sclerosus.</i> <i>Khawia rossittensis</i> <i>Ergasilus sieboldi</i> <i>Ichthyophthirius multifiliis</i>
<i>Coptodon zillii</i> 8 species	<i>Cichlidogyrus sclerosus</i> <i>C.tiberianus</i> <i>Microcotyle donavini</i> <i>Ichthyophthirius multifiliis</i> <i>Trichidina gracilis</i> <i>Dactylogyrus wegneri</i> <i>Gyrodactylus masu</i> <i>Diplozidae sp.</i>
<i>Planiliza abu</i> 10 species	<i>Gyrodactylus barbi</i> <i>G.vimbi</i> <i>Paradiplozoon homoion</i> Diporpa larva <i>Trichidina strelkovi</i> <i>Ichthyophthirius multifiliis</i> <i>Neoechinorhynchus rutili</i> <i>Dactylogyrus lenkorani</i> <i>Ergasilus mosulensis</i> <i>Neoechinorhynchus iraqensis</i>

**Table 4:** Parasitic species recorded from Al-Dalmaj marsh fish, arranged according to their taxonomic position, based on the GBIF (2022) website.

<b>Phylum: Ciliophora</b>
Class: Oligohymenophorea
Order: Hymenostomatida
Family: Ichthyophthiriidae
<i>Ichthyophthirius multifiliis</i> Fouquet, 1876
Order: Peritrichida
Family: Trichodinidae
<i>Trichodinacottidarum</i> Dogiel, 1948
<i>Trichodina gracilis</i> Polyanskii, 1955 *
<i>Trichodina strelkovi</i> Chan, 1961
Phylum: Platyhelminthes
Class Monogenea
Subclass: Monopisthocotylea
Order: Dactylogyridea
Family: Ancyrocephalidae
<i>Cichlidogyrus sclerosus</i> (Paperna & Thurston, 1969) *
<i>Cichlidogyrus tiberianus</i> (Paperna, 1960)
Family: Dactylogyridae
<i>Dactylogyrus extensus</i> (Mueller & Van Cleave, 1932)
<i>Dactylogyrus lenkoranoides</i> (El-Gharbi, Renaud & Lambert, 1993) *
<i>Dactylogyrus wegneri</i> (Kulwiec, 1927)
Order: Gyrodactylidea
Family: Gyrodactylidae
<i>Gyrodactylus barbi</i> (Ergens, 1976) *

<i>Gyrodactylus cotti</i> (Roman, 1956) *
<i>Gyrodactylus dzhailovi</i> (Ergens&Ashurova, 1984)
<i>Gyrodactylus elegans</i> (vonNordmann, 1832)
<i>Gyrodactylus masu</i> (Ogawa, 1986)
<i>Gyrodactylus matovi</i> (Ergens&Kakacheva-Avramova, 1966)
<i>Gyrodactylus rarus</i> (Wegener, 1909) *
<i>Gyrodactylus sprostonae</i> (Ling, 1962)
<i>Gyrodactylus vimbi</i> (Shul'man, 1954) *
Class Monogenea
Subclass: Polyopisthocotylea
Order: Mazocraeidea
Family: Diplozoidae
<i>Paradiplozoon barbi</i> (Reichenbach-Klinke, 1951)
<i>Paradiplozoon cyprini</i> (Khotenovsky, 1982)
<i>Diplozoon spp. Adult and larva</i> *
<i>Paradiplozoon homoion</i> (Bychowsky&Nagibina, 1959) *
Family: Microcotylidae
<i>Microcotyle donavini</i> *
Class: Cestoda
Order: Caryophyllidea
Family: Lytocestidae
<i>Khawia rossittensis</i> *
Phylum: Acanthocephala
Class: Eoacanthocephala
Order: Neoechinorhynchida
Family: Neoechinorhynchidae
<i>Neoechinorhynchus iraqensis</i> (Amin, Al-Sady, Mhaisen & Bassat,2001)
<i>Neoechinorhynchus rutili</i> (Müller, 1780) Hamann, 1892
Phylum: Arthropoda
Subphylum: Crustacea
Class: Hexanauplia
Order: Cyclopoida
Family: Ergasilidae
<i>Ergasilus mosulensis</i> (Rahemo, 1982)
<i>Ergasilus sieboldin</i> (von Nordmann, 1832)

\*Registration of a new host for the parasite in Iraq

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