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New hosts records for some fish parasites from Al-Dalmaj marsh/Iraq

Rasha H. Abd AL-Khenifsawy

Biology Department, College of Education, University of Al-Qadisiyah, Iraq
Corresponding author email: sci.bio.mas.20.14@qu.edu.iq

Hadi M. Hamza Al-Mayali

Biology Department, College of Education, University of Al-Qadisiyah, Iraq

Abstract---The current study conducted in Al-Dalmaj marsh, (180 km south of Baghdad and northeastern part of Al-Diwaniyah province) from November 2021 - May 2022. A total of 345 fish specimens were collected and examined, the collected fish were belonging to three families, including Cichlidae, Mugilidae and Cyprinidae family, were including *Cyprinus carpio*, *Coptodon zillii* and *Planiliza abu*, (120, 100 and 125 specimens respectively). Fish bodies were examined, to detect internal and external parasites, examined fish were found to be infected with 29 species of parasites, included four species of Ciliophora, twenty species of Monogenia, one species of Cestoda, two species of Acanthocephala and two species of crustacean. The *Cyprinus carpio* fish was highly infection rate (37.5%) and its infected with 4 new species of parasites, followed by *Planiliza abu*, which 42.4% and 4 new species, while *Coptodon zillii* was lowest infection rate (43%) and it was infected with 3 new species of parasites. *Cyprinus carpio*, *Coptodon zillii* and *Planiliza abu*, were conducted as new hosts of 11 species of parasites for the first time in Iraq, Nine species of Monogenia, One species of Cestoda and One species of Ciliophora. The detected species of parasites were *Gyrodactylus cotti*, *G. rarus*, *Khawia rossittensis* and *Cichlidogyrus sclerorus* in *Cyprinus carpio* as new host. *Dactylogyrus lenkoranoides*, *Gyrodactylus barbi*, *G. vimbi* and *Paradiplozoon homoion* in *Planiliza abu* as new host, finally *Trichodina gracilis*, *Microcotyle donavani* and *Diplozoon* spp. in *Coptodon zillii* as a new host in Iraq.

Keywords---new hosts records, fish parasites, Iraq.

Introduction

Parasites are part of an ecosystem and therefore all scientists have called for more studies in order to understand this life interaction, and many references indicated that it is easy to know the level of pollution in the environment by measuring the amount of heavy metals of parasites, as it is an evidence about environmental pollution (Abdel-Mawla & El-Lamie, 2018).

Kimpel *et al.* (2006) indicated that fish in general are often exposed to infection with more than three species of parasites during their life, and it is not possible in any case to study the effect of parasites on their straits without full knowledge of the characteristics and species of this parasite. The nutritional value of fisheries, there were many species of parasites that infect fish, including ciliates, sporophytes, nematodes, tapeworms, mollusks and arthropods. There are no real studies about fish parasites in the AL-Dalamj marsh, except for one study that included the AL-Dalamj Marsh and the Nasiriyah Marshes by Mohammad (2016) during which he collected 60 samples from the AL-Dalamj Marsh, and he revealed that no parasites were recorded in the studied fish.

In Iraq, Muhaisen (2022) indicated to a record three species of amoebic animals, one species from the choanozoa, one species from the Pikeria group, 11 species of Myzozoa, 47 species of Ciliophora, 34 species of Myxozoa, seven types of Trematoda, 47 types of Monogonea, five types of Cestoda, 11 types of nematodes, nine species of Acanthocephala, one species of Annelids (leeches), two species of Mollusks and 17 species of arthropods, in *Planiliza abu* not including the species recorded in this study.

In *Cyprinus carpio*, the infections included one species of *Amoebae*, three species of *Euglena*, one species of the *Choanozoa*, nine species of *Myzozoa*, 36 species of Ciliophora, 19 species of *Myxozoa*, and 16 species of Trematoda, 101 species of monogonea, 13 species of Cestoda, 13 species of Nematodes, five species of Acanthocephala, three species of Annelids (leeches), one species of mollusks and twenty species of arthropods (Muhaisen 2022), not including species recorded in this study.

In *Coptodon zillii*, which was first recorded in Iraq by Al-Saadi (2007) in the Euphrates River at the city of Musayyib, 65 species of parasites have been recorded so far, including one species of *Euglena*, two species of *Myzozoa*, 13 species of Ciliophora, one species of *Myxozoa*, nine species of Trematoda, 27 species of Monogonea, two species of Cestoda, one species of Nematodes, two species of mollusks and seven species of arthropods not including the parasites recorded in current study (Muhaisen 2022). The current study aimed to investigate the parasitic infections of three common freshwater fish and their fish hosts in Al-dalmaj marsh / middle of Iraq.

Materials and Methods

Fish collecting

A total of 345 of freshwater fish were collected from region of Al-Dalmaj marsh / Al-Diwaniyah province, this collected fish including *Cyprinus carpio*, *Coptodon zillii* and *Planiliza abu*, (120, 100 and 125 specimens fish respectively) which belonging to three families, Cichlidae, Mugilidae and Cyprinidae family, from the period from November 2021 - May 2022. The fish was caught a live once a week with several tools of fishing, including the hand-throwing nets and the gills nets, then transferred to the advanced parasitology laboratory / college of education / university of Al-Qadisiyah

Fish examination

The external parts of the body of fish (skin, fins, eyes and oral cavity) , visceral cavities and outer digestive tracts were examined with the naked eye for any external parasites, then swabs were taken using the Spatula scraper from the outer areas, mixed with a drop of saline solution and placed on a clean glass slide, to keep the parasite in its freshness, then add drops of glycerin and put on the slide cover, it was examined under a compound light microscope (Olympus, Japan) as described by Amlacher (1970).

Gills were isolated from the gill lumen and placed in a Petri dish, contains a little tap water to prevent it from drying out, then each arc is isolated and examined under a microscope. The eyes were also isolated and examined as same method . A smear was taken from the vitreous fluid and examined under a microscope (Amlacher, 1970). Then the specimens dissected and examined for internal parasites under microscope as described by (Lasee, 2004) .

Parasite fixation, preservation and staining

Various methods were used for the purpose of fixing, preserving and staining the parasites that were isolated from fish, as described by Masoumian *et al.* (1996) for ciliophora , Beckert (1967) Gussev *et al.* (1993) and Bullough (1962) 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) .

Results and Discussion

The current study recorded 29 species of internal and external parasites in the examined fish of the study area, including eleven new hosts recorded for the first time in Iraq ,as shown in Table(1,2) and photos (1-11) .

Table (1): Parasitic species recorded from Al-Dalmaj marsh fish, arranged according to their taxonomic position, based on the GBIF (2022) website.

Phylum: Ciliophora

Class: Oligohymenophorea

Order: Hymenostomatida

Family: Ichthyophthiriidae

Ichthyophthirius multifiliis Fouquet, 1876

Order: Peritrichida

Family: Trichodinidae

Trichodinacottidarum Dogiel, 1948

Trichodina gracilis Polyanskii, 1955 *

Trichodina strelkovi Chan, 1961

Phylum: Platyhelminthes

Class Monogenea

Subclass: Monopisthocotylea

Order: Dactylogyridea

Family :Ancyrocephalidae

Cichlidogyrus sclerosus (Paperna& Thurston, 1969)*

Cichlidogyrus tiberianus (Paperna, 1960)

Family: Dactylogyridae

Dactylogyrus extensus (Mueller& Van Cleave, 1932)

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

Dactylogyrus wegneri (Kulwicz, 1927)

Order: Gyrodactylidea

Family :Gyrodactylidae

Gyrodactylus barbi (Ergens, 1976)*

Gyrodactylus cotti (Roman, 1956)*

Gyrodactylus dzhaliilovi (Ergens&Ashurova, 1984)

Gyrodactylus elegans (vonNordmann, 1832)

Gyrodactylus masu (Ogawa, 1986)

Gyrodactylus matovi (Ergens&Kakacheva-Avramova, 1966)

Gyrodactylus rarus (Wegener, 1909)*

Gyrodactylus sprostonae (Ling, 1962)

Gyrodactylus vimbi (Shul'man, 1954)*

Class Monogenea

Subclass :Polyopisthocotylea

Order: Mazocraeidea

Family: Diplozoidae

Paradiplozoon barbi (Reichenbach-Klinke, 1951)

Paradiplozoon cyprini (Khotenovsky, 1982)

*Diplozoon spp. Adult and larva**

Paradiplozoon homoion (Bychowsky&Nagibina, 1959)*

Family:Microcotylidae

*Microcotyle donavini**

Class: Cestoda

Order: Caryophyllidea

Family: Lytocestidae
*Khawia rossittensis**

Phylum: Acanthocephala

Class: Eoacanthocephala
 Order: Neoechinorhynchida
 Family: Neoechinorhynchidae
Neoechinorhynchus iraqensis (Amin, Al-Sady, Mhaisen & Bassat,2001)
Neoechinorhynchus rutili (Müller, 1780) Hamann, 1892

Phylum: Arthropoda

Subphylum: Crustacea
 Class: Hexanauplia
 Order: Cyclopoida
 Family: Ergasilidae
Ergasilus mosulensis (Rahemo, 1982)
Ergasilus sieboldin (von Nordmann, 1832)
 Registration of a new host for the parasite in Iraq

Table (2): New fish hosts recorded for some internal and external parasites and the site of parasitism in common fish in Al-dalmaj marsh /Iraq

Host	Parasite	No. of examined fish	NO. of infected fish	infection rate	infection severity	Parasite site
<i>Captodon zillii</i>	<i>Trichodina gracilis</i>	100	10	10	-	Fins
<i>C.zillii</i>	<i>Microcotyle donavani</i>		1	1	-	Gills
<i>C.zillii</i>	<i>Diplozoon spp.</i>		1	1	-	Gills
<i>Planliza abu</i>	<i>Dactylogyrus lenkoranoides</i>	125	13	10.40	6.5	Gills
<i>P.abu</i>	<i>Gyrodactylus barbi</i>		3	2.4	5	Fins
<i>P.abu</i>	<i>Gyrodactylus vimbi</i>		7	5.6	1.4	Fins
<i>P.abu</i>	<i>Paradiplozoon homoion</i>		8	6.6	1.2	Gills
<i>Cyprinus carpio</i>	<i>Khawia rossittensis</i>	120	1	1.6	1.5	Intestine
<i>C. carpio</i>	<i>C.sclerosus</i>		10	8.3	50	Fins
<i>C.carpio</i>	<i>Gyrodactylus cotti</i>		2	1.6	1	Fins
<i>C. carpio</i>	<i>G.rarus</i>		2	1.6	5	Skin

The following is a brief review of the parasitic groups and their new hosts:

Phylum- Ciliophora

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).

Trichodina gracilis Polyanskii, 1955

This parasite was recorded from the fins of *C.zilli* with an infection rate of 10%. This parasite was first recorded in Iraq from finger lings of common carp in the Middle East fish farm in Babylon province by Hussein (2005), and later recorded from three other species of hosts (Mhaisen, 2022) not including *C.zilli*, and therefore it is considered a new host for this parasite in Iraq and It is the fifth host of this species in Iraq.

Platyhelminthes - Monogenea

The class monogenea belonging to the platyhelminths includes members that have a direct life cycle and are externally parasites 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 (Mhaisen, 1983).

Genus : Cichlido gyrus

This genus belongs to the phylum of platyhelminths 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; Pouyaud *et al.*, 2006).

Cichlido gyrus sclerosus (Paperna & Thurston, 1969)

this species of recorded from *C.zillii* with infection rate 25% and the severity of the infection is 33.3, and *C.carpio* 8.3% and the severity is 50 it is a new host for this species in Iraq In the current study, which was the four host (Mhaisen, 2022).

Genus : Dactylogyrus

Parasites of this genus contain in its anterior front four extensions, and it contains four ocular, and there is a ventral chamber, and it contains a posterior disc that carries two middle dogs connected by one link, and on the edge of this disc there are 14 small dogs. 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 kin and fins of the fish. These parasites are oviparous (Mhaisen, 1983).

Dactylogyrus lenkoranoides El-Gharbi, Renaud & Lambert, 1993

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

Genus : Diplozoon

Members of this genus are linked to each other eternally to form one integrated parasite in the form 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 anterior part of the parasite by the presence of many branches, but without To connect with each other, the front part also contains the vitelline glands, and the back part is characterized by the presence of folds or dilatations 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 connected to two rows parallel and two medial dogs (Pugachev *et al.*, 2010).

This parasite was recorded as the adult stage of the gills of *C.zillii* with an infection rate of 1% and severity of infection of 1, and the larval stage called diporpa larva was recorded from the gills of *p.abo* with an infection rate of 0.8% and intensity of infection of 1. In Iraq, the species *Diplozoon barbi* was first recorded from *Carasobarbus luteus* from Al-Husseiniya trocar in Karbala province (Al-Saedi, 2007) and later recorded from four other fish species in Iraq (Mhaisen, 2022). It should be noted that the name of this species is now considered synonymous with the legal name *Paradiplozoon barbi* based on the website. 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). Among the undiagnosed species of the adult species order, none of the *C.zillii* was recorded, and therefore *C.zillii* in the current study is a new host for this undiagnosed species in Iraq, which was the fifteenth host.

Genus : Gyrodactylus

The body of the parasite in the species of this genus is 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 and a small animal can be seen inside each parasite and inside each small animal there is an animal smaller than it and so on. This phenomenon is called scatulation externally parasitizing the skin and fins (Mohesen, 1983).

Gyrodactylus barbi Ergens, 1976

This species was recorded from *P.abu* fins only, with an infection rate of 2.4% and an infection severity of 5. This species was recorded for the first time in Iraq from the *C.carpio* from the Ainkawa fish hatchery in Erbil provine (Mama, 2012) and later recorded from four other species of hosts (Mhaisen, 2022) not including *p.abu*, and thus its considered a new host in the current study, is This species is the sixth host of parasite in Iraq.

Gyrodactylus cotti Roman, 1956

This species was recorded from the fins of the *C. carpio* only, with an infection rate of 1.6% and an severity infection 1. This species was first recorded in Iraq from *p.abu* from the Tigris River at Al-Shawaka area, Baghdad by Rashid (2016) and was not recorded later from any other host in Iraq (Mhaisen, 2022). Therefore, the *C. carpio* in the current study is a new host for this species of Parasites in Iraq and it is the second host.

Gyrodactylus rarus (Wegener, 1909)

this species was Record only from the skin of *C. carpio* with a rate of infection 1.6% and a severity of 6. the *C. carpio* in the current study is a new host for this species in Iraq and it is the Third host.

Gyrodactylus vimbi Shul'man, 1954

This species was recorded from *p.abu* fins only, with an infection rate of 5.6% and severity infection 1.4. This species was recorded for the first time in Iraq from Asian running in the Al-Hammar marsh by Jori (2006) and was not recorded later from any other species of fish in Iraq (Mhaisen, 2022) . this is the second host in current study .

Genus : Microcotyle

One of the characteristics of the species of this genus is that it is lanceolate shape and the body consists of a front part and a back part carrying a number of small hooks. Yamaguti (1968) 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 the freshwater fish of North America.

Microcotyle donavani

This species was recorded from the gills of *C. zillii* with an infection rate of 1% and an intensity infection 1. The *C. zillii* is a new host for this parasite species because its not recorded in this species of fish previously (Mhaisen, 2022).

Genus: Paradiplazon

Species 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 *Diplazon*.

Paradiplazon homoion (Bychowsky&Nagibina, 1959)

This species was recorded from *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 *Luciobarbus xanthopterus* from from Al-Hussainiya stream in Karbala province by Al-Saedi

(2007) and later recorded from four other species of hosts, not including *P.abu* (Mhaisen, 2022), and accordingly that *P.abu* in the current study is considered as a new host to this species in Iraq and it is the sixth host.

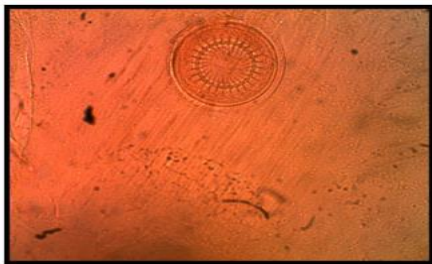
Phylum - Platyhelminthes

Class: Cestoda

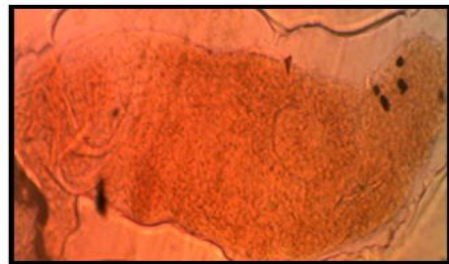
The class Cestoda belonging to the phylum of platyhelminthes includes endoparasites that do not have any trace of the presence of the digestive system in them. Therefore, their adult stages live in the small intestine of their hosts of fish and other vertebrates. The body of the adult worm consists of a small head (head) scolex and a number of proglottides. It contains both male and female reproductive organs (Mohesen, 1983). Only one species of cestodes belonging to this phylum has been diagnosed, and this species was:

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

This species of worms was recorded from the intestines of the *C.carpio* only, with a rate and severity of infection of 1.6% and 1.5, respectively, and the common carp fish is a new host for this worm in Iraq (Mhaisen, 2022). This species was recorded for the first time in Iraq by Al-Ayyash (2011), this worm was recorded from the intestines of the *C.carpio*. 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 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 scolex is not separated from the body by a clear neck, but what distinguishes it is its wider sides of the body.



Figure(1). *Trichodina gracilis*



figure(2). *D. lenkoranoides*.



figure (3) : *Diplozoon* sp



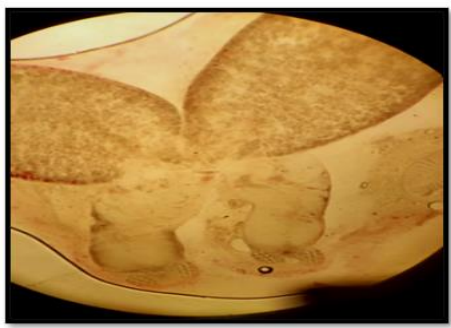
figure (4) : *G. barbi*



Figure (5) *M. donavini*



Figure (6) *G. cotti*



Figure(7) *P. homaion*



Figure (8) *G. yimbi*



Figure(9) *K. rosstensis*

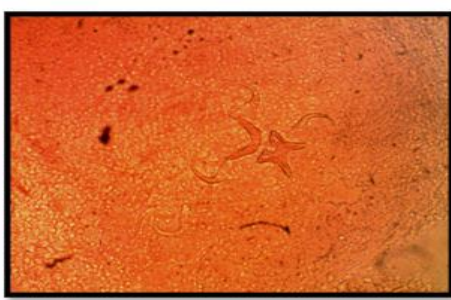


Figure (10) *C. sclerosus*



Figure (11) : *G. varus*.

Figure 1 (A - J) : photos of parasites recorded in this study

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