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# Diagnosis of external parasites of species of fish of Tigris River passing through Al-Dour district / Iraq

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**Abstract**
The current study included diagnosing types of ectoparasites on five types of fish of Tigris River passing through Al-Dour district/Iraq, and the study was conducted at College of Education/University of Samarra and Tikrit Universit/College of Education for women/Department of Biology.
A total of 772 fish included five species, and it was found that they were infected with 6 types of parasites with different rates of infection, which included two types of protozoa: *Trichodina mutabilis* and recorded in four types of hosts for the first time in Iraq with a rate of 9.0% in *Leuciscus vorax* and *Barbus luteust* fish, and a rate of 6.7% In *Tenualosa ilisha* fish, and the percentage of 6.0% in the fish of *Cyprinion macrostomum*, and the sporozoa *Myxobolidae sharpeyi* was recorded in four new hosts locally in Iraq from *Cyprinion carpio*, *Tenualosa ilisha*, *Leuciscus vorax* and *C. macrostomum*, and the infection rates were 10.0%, 6.1%, 9.0%, and 6.8%, respectively.. And two types of trematodes: *Dactylogyrus vastator*, with an infestation rate of 11.9% in *B. luteust* and 9.0% in *C. carpio*, and *G. gussevi*. Five new hosts were recorded locally in Iraq of *C. carpio*, *B. luteust*, *L. vorax*, *T. ilisha*, and *C. macrostomum*, with a rate of 12.0%, 9.6%. 8.1%, 6.7%, and 5.1%, respectively. And two types of Crustaceans, namely, *Pseudulamproglena annulata*, the infection rate was recorded only in *C. carpio* 12.0%, and *Lamproglena pulchella*, where the infection rate was 12.0% in *B. luteust* and 5.0% in *C. carpio*.

**Keywords:** diagnosis, ectoparasites, fish of the Tigris River, Iraq

## Introduction
Fish is one of the important food sources for humans, as fish protein consists of amino acids essential for human growth, in addition to the fact that fish fat contains unsaturated fatty acids, which reduce the level of cholesterol in human blood, and reduce the incidence of heart disease (Mohanty *et al*.., 2019) [32].
And that all living organisms are vulnerable to parasitic infections and diseases due to their presence in the environment, and despite the great ability of fish to resist diseases, they, like all other living things, are exposed to the risk of disease and parasites, and parasites are pathogens that affect the temperature of the host, where they appear on the host. Pathophysiological symptoms (Bruneaux *et al*., 2017) [19]. Parasites infect all animals, including humans in general, and fish in particular, as they are no less dangerous than other pathogens, such as viruses, bacteria and fungi. Parasites have caused the death of many fish around the world (FAO / UNDP, 1982) [22].
The importance of studying parasites that infect fish, whether they are Protozoa, Trematoda, Cestoda, Nematoda, Acanthacephala, is due to the importance of fish itself, which is one of the most natural food resources around the world. Which man has long sought to study and exploit as direct food for him (Hoffman, 2019) [24].
Fish are infected with many types of parasites belonging to different phyla of the animal kingdom, fish may be infected by one or more protozoa, Monogeneans, Digeneans, Nematodes, Acanthocephalans Lee, Mochesllworms, worms and leeches and Crustaceans (Somatkar, 2015) [38].
Al-Maliki *et al*. (2015) [13] during the study he conducted by examining tilapia fish taken from the Tigris River north of Qurna, that they were infected with parasites, and confirmed that adult fish were more infected than other juvenile fish, and that females were more infected than males.
Al-Nasiri & Balbuena (2016) [16] identified the parasite Paradiplozoon iraqensis during their study on the large-mouthed Benin fish taken from the Tigris River in Tikrit city in Iraq. And Abdul-Ameer (2017) [2, 6] recorded, during the study that she conducted on the gills of tilapia fish in the Al-Grayat area of Baghdad, that it was infected with the monogenetic parasite C.tiberianus.
Abdul-Ameer & Atwan (2017) [2, 6] identified four mono-parasites of Gyrodactylus in fish of the Tigris River in Al-Kurai'at area in Baghdad city. Abdul-Ameer & Atwan (2018a) [3] identified two types of parasites belonging to the genus Trichodina of tilapia fish in the Tigris River in Al-Kurai'at district in Baghdad city. Abdul-Ameer & Atwan (2018b) [4] recorded two types of parasites belonging to Dipartilla in gills of Cyprinion carpio fish at Tigris River in Al-Kuraiat area in Baghdad city.
Abdul-Ameer & Abbas (2019) [5] diagnosed during the study on the intestines of C. carpio in Tigris River in Al-Atifiyah district in Baghdad, that they were infected with Asymphylodora imitans. Abdul-Ameer & Atwan (2019) [5] identified six types of mucospores during swabs on the gills of tilapia at the Tigris River, Al-Qurayat area in Baghdad.
Mendoza-Franco *et al*. (2019) [28] a monogenetic parasite, on gill plates of Brycon guatemalensis fish caught from the Rio Lacantun River in Mexico.
Written Habib *et al*. (2019) [23] Three groups of parasites, namely ciliates, monogenic parasites, mucospores, infecting 5 species of carp family and taken from Lake Chashma in Pakistan, and the highest rate of infestation was in fish in

winter as it was suitable for all carp fish and external parasite activity.
The study aimed to diagnose ectoparasites of a species of fish of Tigris River passing through Al-Dour district.

## Materials and methods

### 1. Studying Area

The study area is located on the Tigris River passing in the district of Al-Dur within Salah Al-Din Governorate, between lines (33.34 - 35.20) north and longitudes (42.30 - 33.10) as in the picture (1).

### 2. Studying Stations

**Station 1:** It is located on the Tigris River, passing through the district of Al-Dour from the northern side, near Asala, in the district of Albu Ajil.

**Station 2:** It is located in the district of Al-Dour (the crossing) and is about 8 km away from the first station.

**Station 3:** It is the last station, which is located near the wheat marketing silo in Al-Dour district, about 7 km away from the second station.

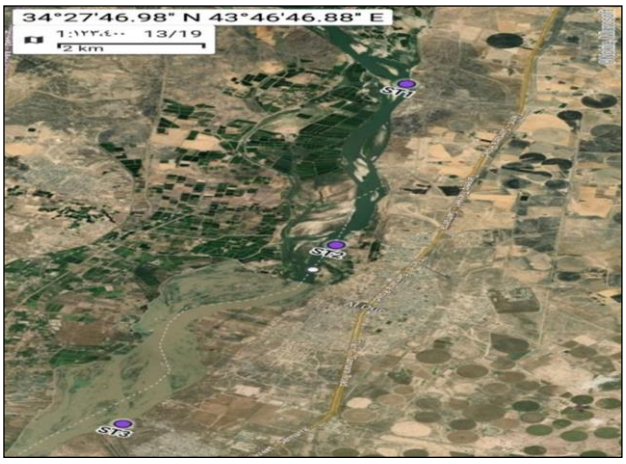


**Fig 1:** stations of Tigris River passing through Al-Dur district
(Google earth, 2022).

### 3. Fish Sampling

Fish were caught randomly, three times a week, during the period from November 2021 to April 2022, as 772 fish were caught of the types of *C. macrostomum, L. vorax, C. carpio, B. luteust and T. ilisha*. The fish were caught in more than one location along Tigris River passing in Al-Dur district.

### 4. Fish Inspection

The fish were transferred to the laboratory, alive or dead within a few hours in order to ensure the survival of ectoparasites that are removed from the surface of the fish, and the sample was examined directly, and a special form was prepared for collecting samples and recorded information about the fish and parasites that were isolated from them, and the fish were examined visually and during which the investigation was carried out About some skin injuries (ulcers - bleeding - scars and falling off scales), as well as the color and quantity of the mucous substance that surrounds fish body. The gills were also examined visually with the aim of observing the color and integrity of its gill sutures, as well as the amount of mucus that is present in them, and the eyes of fish were examined. And observing its color and shape, and also the surface of the fish was examined from the outside using a magnifying hand glasslens to look for external parasites visually (Duijn, 1973) [20]. An Olympus Compound microscope was used for microscopic examination of samples.
After completing the visual examination, swabs were taken from the scales, gills, and fins by means of a spatula, then they were placed on a slide containing a few drops of water, then examined under a microscope with a different magnification power, then the gills were extracted and placed in a clean Petri dish containing water. Separating each gill arch we visually examine gill sutures.

### 5. Fixation and Preservation of Parasites

**First- Protozoa**

The parasite primaries were fixed after making direct swabs taken from the body of the fish and placed on the glass slide and a drop of Lugal iodine was added and then the Cover Slide was placed, and it was examined microscopically, under the power of magnification 40X, 100X, in order to take measurements of the parasite and draw it with a reconnaissance camera, and it was diagnosed According to (Yamaguti, 1961) [40].

**Second-Crustacea**

The crustaceans were fixed with 70% ethyl alcohol, and kept until diagnosis. Then a glass slide was used and the parasite was placed on it, after a drop of a normal physiological solution was placed, and a drop of Lugal iodine was used to stain it, then a cover slide was placed, and it was examined microscopically.

### 6. Identification of Parasites

Parasites were diagnosed based on taxonomic sources (Worms, 2016; Eshmeyer, 2016) [39].
Parasite infection was determined on the basis of percentage, as in the equation
100 x (infected fish number)/(examined fish number) = percentage of infection percentage
As for the severity of the injury, it was calculated by the following equation, based on a study (Margolis *et al*., 1982).
100× (parasite number)/(infected fish number) = infestation severity

## Results and discussion

During this study, 772 fish were collected in Tigris River passing through Al-Dur / Salah al-Din district, belonging to five types of fish known in Iraq, namely *C. carpio* with 100 fish, *B. luteust* with 166 fish, *T. ilisha* with 162 fish, and *C. macrostomum* with 166 fish. 233 fish, and *L. vorax* with 111 fish. The results of the examination showed the registration of six types of parasites.
The ciliary *Trichodina mutabilis* et Migata, 1968, was recorded as a parasitizer on the skin of *L. vorax*, *B. luteust*, shrike, and *C. macrostomum*, from Tigris River, with an infection rate of 9.0%, 9.0%, 6.7%, and 6.0%, respectively (Table 6-4). The parasite is classified into:
**Kingdom:** Protista
**Phylum:** Mastigophora
**Class:** Kinetoplastida
**Order:** Peritricha
**Family:** Trichodinidae
**Genus:** *Trichodina mutabilis* et Migata, 1968

The parasite has a circular, ciliated shape, its diameter ranges between 66-53 µm, and it has an adhesive disc with a ring called the denticular ring containing Teeth teeth with long, oblique, thin and spiny outer appendages between which are a central conical part. The diameter of the fixing disc is between 54-43 µm, the diameter of the dental ring is between 36-31 µm, the number of teeth is between 29-25, the length of the internal appendix is 18-14 µm, the central conical part is 2µm, a large nucleus is a macronucleus and a small micronucleus, and the animal has two sides. The lower concave side for fixation, and the upper, smooth and fringed side, contain two types of cilia and their movement is fast (Fig. 1).

This type of gills of common carp fish was recorded in fresh water in the Philippines by (Abaladeio & Arthur, 1989) [1], and it was also isolated from *C. carpio* fish in Turkey by (Ozer & Erdem, 1998) [34], *T. mutabilis* infection of *C. carpio* was recorded by researchers (Abdullah, 2002; Abdullah & Mahasen, 2006; Al-Marjan, 2007; Al-Marjan & Abdullah, 2007) [9, 8, 14] and Muhammad *et al*. (2013) [33] recorded parasite infection from fish Asian running.

The highest percentage of infection with T. mutabilis appeared in each of the *L. vorax* and *B. luteust* fish, which amounted to 9.0%, followed by the shrike fish by 6.7%, then the lowest percentage was recorded in *C. macrostomum* (6.0%), while no infection was recorded in *C. carpio*.

The highest rate of infection was in *B. luteust*, April, which amounted to 13.6%, and the lowest was in February, with a rate of 5.8%. In *L. vorax* fish, the highest rate of infection was 23.0% in April, and the lowest rate was 3.5% in January 2022. The highest rates of infection with spit fish were recorded in April with a rate of 17.6%, while the lowest infection was recorded in December 2021 and March 2022 with a rate of 5.2%, and the highest percentage of infection with *C. macrostomum* was in April, reaching 12.5%, and the lowest was 2.5% in February. The table also shows (1).

**Table 1:** Monthly variation in percentage of infection with the parasite *Trichodina mutabilis* in fish under study.

| Table(1) | Fish types | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Months | *C. macrostomum* | | | *T. ilisha* | | | *B. luteus* | | | *L. vorax* | | |
| | *(%)* | Inf.sam | No.sam | *(%)* | Inf.sam | No.sam | *(%)* | Inf.sam | No.sam | *(%)* | Inf.sam | No.sam |
| November 2021 | 8.6 | 2 | 23 | 14.2 | 2 | 14 | 6.6 | 2 | 30 | 11.7 | 2 | 17 |
| December | 6.3 | 6 | 95 | 5.2 | 2 | 38 | 10.7 | 3 | 28 | 7.4 | 2 | 27 |
| January2022 | 4.7 | 1 | 21 | 6.3 | 3 | 47 | 13.6 | 3 | 22 | 3.5 | 1 | 28 |
| February | 2.5 | 1 | 40 | 0 | 0 | 27 | 5.8 | 2 | 34 | 0 | 0 | 11 |
| March | 5.2 | 2 | 38 | 5.2 | 1 | 19 | 8.0 | 2 | 25 | 13.3 | 2 | 15 |
| April | 12.5 | 2 | 16 | 17.6 | 3 | 17 | 11.1 | 3 | 27 | 23.0 | 3 | 13 |
| total | 6.0 | 14 | 233 | 6.7 | 11 | 162 | 9.0 | 15 | 166 | 9.0 | 10 | 111 |

No. sam. = number of examined samples
Inf. sam. = infection samples

The parasite Myxobolidae sharpeyi Molnar, Masoumian et Abbasi, 1996 was recorded as parasitizing on the skin of *C. carpio*, *B. luteus*, chrysalis, and *C. macrostomum* and shriveled fish, with an infection rate of 10.0%, 9.6%, 9.0%, 6.8%, and 6.1%, respectively (Table 2), and is classified under:

**Kingdom:** Protista
**Phylum:** Myxozoa
**Class:** Myxosporea
**Order:** Bivalvulida
**Family:** Myxobolidea
**Genus:** *Myxobolidae sharpeyi* Molnar,Masoumian et Abbasi, 1996.

The spores of this genus are characterized by being oval or spherical, containing two polar capsules at the anterior end and within them a polar filament coiled in a helical manner, and the presence of an iodine vacuole in the cytoplasm of the spore, but it does not have the caudate projections (Kudo, 1971) [25]. Their length ranged between 9.5-9 micrometers, and their width ranged between 8-7.4 micrometers. The two polar capsules are equal in size and occupy about half the size of the spore, their length ranges between 4-3.4 µm, width ranges between 2.4-2 µm, the iodine gap is small (Fig. 2).

*M. bramae* was recorded from *Luciobarbus xanthopterus* fish from Sadat Lake (Asmar *et al*., 1999) [17].

The highest percentage of infestation with *M. sharpeyi* was recorded in *C. carpio* fish 10.0%, followed by *B. luteust* 9.6%, then *L. vorax* 9.0%, then *C. macrostomum* 6.8%, then the lowest percentage was recorded in *L. vorax* by 6.1%.

The highest rate of infection in *C. carpio* fish was 17.8% in November 2021 and the lowest infection rate by 5.5% in February 2022, while no infection was recorded in January and April, and in *B. luteust* it reached the highest rate of 18.1% in January 2021 and the lowest in February 2022 with a recorded rate of 2.9% Also, no infection was recorded in November, and in *L. vorax* fish, the highest rate of infection was 23.0% in April 2022 and the lowest rate of 3.5% in January 2022, and no infection was recorded in February 2022, and the highest rates of infection with *C. macrostomum* fish were recorded in November At a rate of 13.0%, while the lowest infection was recorded in December at a rate of 6.3%, and no infection was recorded in February 2022, and the highest rate of infection with *T. ilisha* fish came in November 2021, reaching 14.2%, and the lowest was 4.2% in January 2022, as well as no infection was recorded in February 2022(Table 2).

*M. sharpeyi* was also reported from *C. luteus* by Mansoor (2019) [26], and from C. regium and M. sharpeyi Abdullah (2002) [9] and M. sharpeyi Abdullah&Mhaisen (2005) [7].

**Table 2:** Monthly variation in percentage of infection with ectoparasite *M. sharpeyi* in fish under study

| Table (2) | Fish types | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Months | *C. macrostomum* | | | *T. ilisha* | | | *B. luteus* | | | *C. carpio* | | | *L. vorax* | | |
| | *%* | Inf. sam | No. sam | *(%)* | Inf. sam | No. sam | *(%)* | Inf. sam | No. sam | *(%)* | Inf. sam | No. sam | *(%)* | Inf. sam | No. sam |
| November 2021 | 13 | 3 | 23 | 14.2 | 2 | 14 | 0 | 0 | 30 | 17.8 | 5 | 28 | 11.7 | 2 | 17 |
| December | 6.3 | 6 | 95 | 7.9 | 3 | 38 | 14.2 | 4 | 28 | 10.5 | 2 | 19 | 11.1 | 3 | 27 |
| January2022 | 9.5 | 2 | 21 | 4.2 | 2 | 47 | 18.1 | 4 | 22 | 0 | 0 | 8 | 3.5 | 1 | 28 |
| February | 0 | 0 | 40 | 0 | 0 | 27 | 2.9 | 1 | 34 | 5.5 | 1 | 18 | 0 | 0 | 11 |
| March | 7.9 | 3 | 38 | 5.2 | 1 | 19 | 16 | 4 | 25 | 12.5 | 2 | 16 | 6.6 | 1 | 15 |
| April | 12.5 | 2 | 16 | 11.7 | 2 | 17 | 11.1 | 3 | 27 | 0 | 0 | 11 | 23.0 | 3 | 13 |
| Total | 6.8 | 16 | 233 | 6.1 | 10 | 162 | 9.6 | 16 | 166 | 10 | 10 | 100 | 9.0 | 10 | 111 |

No. sam. = number of examined samples
Inf. sam. = infection samples

Dactylogyrus vastator Nyblin, 1924, was recorded as parasitizing on gill filaments of *C. carpio* and *B. luteust*, with an infestation rate of 12.0% and 11.4%, respectively (Table 3). Which goes back to:
**Phylum:** Platyhelminthes
**Class:** Monogenea
**Order:** Dactylogyridea
**Family:** Ancyrocephalida *Dactylogyrus vastator* Nyblin, 1924.

The length of the worms is one millimeter, and these worms are characterized by having four extensions from the anterior end of the body, and there are four black eye spots at the anterior end and there is a ventral volume, and the stabilization organ (the posterior disc) carries two middle dogs connected by one link, and on the edge of the disc there are 14 small dogs. These worms are oviparous eggs and the eggs hatch from ciliated larvae that gradually grow into adult animals without passing through an intermediate host.

This parasite lives as a parasitic on the sutures (Fig. 3), but when it is present in large numbers, it may spread over the entire body and no symptoms or signs of disease appear unless the infection is severe, where the operculum appears to be open, where the epithelial cells are destroyed, blood vessels are ruptured, and platelets are covered The glioma is covered with an opaque layer of mucus and ciliated epithelial cells. As the number of respirations increases, and behaviorally, the fish rise towards the surface of the water and begin to jump out of the water as a sign of suffocation.
The highest rate of infection with *D. vastator* was recorded in *B. luteust*, which amounted to 11.4%, while *C. carpio* fish recorded a rate of 9.0%, where there were no infestations in *L. vorax*, Penni and *T. ilisha*. It recorded a rate of 5.5%, and in *C. carpio*, the highest rate of infection was 10.5% in April and the lowest rate of 8.2% in November 2021, while the infection was absent in *L. vorax*, *C. macrostomum* and *T. ilisha* fishe, Table (3).

**Table 3:** Monthly variation in the percentage of infection with the ectoparasite *D. vastator* in the fish under study.

| Table (3) | Fish types | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Months | *C. carpio* | | | | *B. luteus* | | | |
| | Inf. Sev | *(%)* | Inf. Sev | No.sam. | Inf. Sev | *(%)* | Inf.sam | No.sam. |
| Nov. 2021 | 6.6 | 26.6 | 8 | 30 | 8.2 | 17.8 | 5 | 28 |
| Dec. | 0 | 0 | 0 | 28 | 9.6 | 15.7 | 3 | 19 |
| Jan. 2022 | 0 | 0 | 0 | 22 | 0 | 0 | 0 | 8 |
| Feb. | 7.8 | 14.7 | 5 | 34 | 0 | 0 | 0 | 18 |
| March | 5.5 | 8.0 | 2 | 25 | 8.5 | 12.5 | 2 | 16 |
| April | 9.2 | 14.8 | 4 | 27 | 10.5 | 18.1 | 2 | 11 |
| Total | 7.3 | 11.4 | 19 | 166 | 9.0 | 12 | 12 | 100 |

No. sam. = number of examined samples
Inf. sam. = infection samples
Inf. Sev. = infestation severity

Record of the parasite *Gyrodactylus gussevi* Lin. Mo-en, 1962, is a parasitic on the skin of *L. vorax* fish, *C. carpio*, *B. luteust*, *T. ilisha* and *C. macrostomum*, from Tigris River passing through Al-Dour district, with a hit rate of 8.1%, 12.0%, 9.6%, 6.7%, and 5.1%, respectively, table (4). The parasite returns to:
**Kingdom:** Animalia
**Phylum:** Platyhelminthes
**Class:** Monogenea
**Order:** Gyrodactylidea
**Family:** Gyrodactylidea
**Genus:** *Gyrodactylus gussevi* Lin. Mo-en, 1962

This genus includes small-sized worms, its front end extends in the form of two extensions and there are no eye spots in it. The fixation device consists of 16 barefoot small dogs, two middle dogs and two connecting poles, which are worms and viviparous, and cause Gyrodactylosis, where the color of the affected fish responds, the fins become loose and gradually rupture as it becomes The skin is more mucous than normal and appears with small blood spots. Behaviorally, the fish becomes lethargic and weak, stops moving repeatedly at the surface, increases the number of respirations in it, and finally the fish dies from complete stress.

The length of the body ranged between 0.64-0.57 mm, width 0.12 mm, the total length of the small back dogs ranged between 0.025-0.02 mm, the length of the average dogs ranged between 0.055-0.045 mm, the length of its fork 0.03-0.025 mm, and the length of the inner wall between 0.015-0.01 mm, the length of the main rod is 0.017-0.015 mm, the width is between 0.007-0.006 mm, the length of the membranous expansion membrane is 0.016 mm, the length of the secondary rod is 0.013 mm, and the width is mm (Figure 4).

The highest percentage of infection with G. gussevi was found in *C. carpio*12.0%, followed by *B. luteust* 9.6%, then *L. vorax* 8.1%, then the lowest percentage was recorded in *C. macrostomum* 5.1%.

The highest rate of infection in *C. carpio* was 25.0% in January 2022, and the lowest infection rate was 14.3% in November 2021, while no infection was recorded in April and February, and in *B. luteust*, the highest rate was 14.8% in April and the lowest in November with a recorded rate of 3.3%. In *C. carpio*, the highest rate of infection was 15.4% in April 2022, and the lowest rate was 3.5% in January 2022, and no infection was recorded in February 2022. The highest percentage of infection with shrivel fish was recorded in April, at a rate of 11.7%, while the lowest infection was recorded in February, at a rate of 11.7%. 3.7%, and the highest rate of infection with *C. macrostomum* came in November 2021, reaching 8.6%, and the lowest was 5.0% in February. Also, no infection was recorded in January 2022 (Table 4).

*G. gussevi* was first identified in Iraq as an external parasitizer on the skin of a stinging fish in the Great Zab River (Abdullah, 2002) [9], and then also recorded (Mahaisen *et al*., 2015) from a stinging fish at the Euphrates River in the city of Musayyib.

**Table 4:** Monthly variation in percentage of infection with ectoparasite G. gussevi in the fish under study.

| Table (4) | Fish types | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthes | *C. macrostomum* | | | *T. ilisha* | | | *B. luteus* | | | *C. carpio* | | | *L. vorax* | | |
| | *(%)* | Inf. sam | No. sam | *(%)* | Inf. sam | No. sam | *(%)* | Inf. sam | No. sam | % | Inf. sam | No. sam | *(%)* | Inf. sam | No. sam |
| November 2021 | 8.6 | 2 | 23 | 7.1 | 1 | 14 | 3.3 | 1 | 30 | 14.3 | 4 | 28 | 11.7 | 2 | 17 |
| December | 5.2 | 5 | 95 | 7.9 | 3 | 38 | 10.7 | 3 | 28 | 15.7 | 3 | 19 | 7.4 | 2 | 27 |
| January 2022 | 0 | 0 | 21 | 4.2 | 2 | 47 | 9.0 | 2 | 22 | 25.0 | 2 | 8 | 3.5 | 1 | 28 |
| February | 5.0 | 2 | 40 | 3.7 | 1 | 27 | 8.8 | 3 | 34 | 0 | 0 | 18 | 0 | 0 | 11 |
| March | 5.2 | 2 | 38 | 10.5 | 2 | 19 | 12.0 | 3 | 25 | 18.7 | 3 | 16 | 13.3 | 2 | 15 |
| April | 6.2 | 1 | 16 | 11.7 | 2 | 17 | 14.8 | 4 | 27 | 0 | 0 | 11 | 15.4 | 2 | 13 |
| Total | 5.1 | 12 | 233 | 6.7 | 11 | 162 | 9.6 | 16 | 166 | 12.0 | 12 | 100 | 8.1 | 9 | 111 |

No. sam. = number of examined samples
Inf. sam. = infection samples

The crustacean *Pseudulamproglena annulata* Boxsh1976 was recorded as parasitizing on the gills of *C. carpio* fish under study and caught from Tigris River, with an infection rate of 12.0%, and it is attributed to:

**Phylum:** Arthropoda
**Class:** Maxillopda
**Order:** Copepoda
**Family:** Lernaeidae *Pseudulamproglena annulata* Boxsh1976.

It is cylindrical in shape, clearly lobed, and the cortex consists of a broad, concave head on the dorsal side, and the chest consists of four pieces. The first piece of it unites from the front with the head, forming the cephalothorax. The abdomen consists of two pieces ending in two lobes, each lobe carrying a short caudal branch Very, with an average length of 1.97 mm, (Figure 5).

The results of infection with the crustacean P. annulata appeared in carp fish only at a rate of 12.0%, and the highest rate of infection was 37.5% in January 2022 and the lowest was 18.1% in April 2022, and the percentages of infection were 21%, 18.7% in December and March, respectively. The infection was absent during the months of November and February.

This crustacean parasitoid was recorded as a new species in the gills of C. macrostomum, from the Tigris River in Mosul city Boxshall (1976) [18], and ten other types of Iraqi fish were recorded after that, according to the reference guide to parasites and pathogens of fish in Iraq (Mahaisen, 2018). Including *B. luteust*.

In Al-Daraji (1986) [11] this parasite was recorded on two species of freshwater fish in Iraq, *Barbus sharpyi* and *Silurus triostegus*, while Abdul-Rahman (1999) [10] recorded this type of nine species in freshwater fish.

The record of the crustacean *Lamproglena pulchella* Nordmann, 1832 [2, 32], as an intruder on the gills of fishes of red and carp, and goes back to:

**Phylum:** Arthropoda
**Class:** Maxillopda
**Order:** Cyclopida
**Family:** Lernaeidae *Lamproglena pulchell* Nordmann [2, 32], 1832.

The infection rate was 12.0% in *B. luteust* fish, and 5.0% in *C. carpio*. The crustacean is characterized by its long body (average length of 3.5 mm), its head is square in shape and the chest consists of five pieces, and the abdomen consists of three body pieces ending with two short appendages, and it connects to a sac. The eggs are in the back of the last pectoral piece, (figure 6).

This parasite was recorded on gills, This parasite was recorded by Rahemo in 1977 [35] on the royal oak, *Chondrostma regium*, fish and the spotted petal *Capoeta trutta*, which was under the name *Varicorhinus truuta*, and Ali and his group diagnosed it in 1987 on the *Garra ruffa*, and recorded by Rasheed and Hussain 1989 on *Barbus esocinus* fishes.

The results of infection with the parasite and *L. pulchella* appeared in *B. luteust* with an infection rate of 12.0% and the highest was in November 2022 with a rate of 26.6% and the lowest in March was 12.0%, and in December and April it was recorded with an infection rate of 17.8%, 14.8%,

respectively, while it was not recorded. An injury occurred in January and February 2022. While the rate of infection in *C. carpio* was 5.0%, the highest rate was 27.2% in April and the lowest in November 2021, when it was recorded 7.1%, and no injury was recorded in the rest of the months of the study, while no injury was recorded. The *L. vorax*, *T. ilisha*, and *C. macrostomum* are protected from this parasite.

Then recorded 18 other species of fish from Iraq, according to the evidence Reference for parasites and pathogens of fish in Iraq (Mhaisen, 2018) [30, 31]. As well as Al-Daraji (1986) [11] was recorded by *Mesopotamichthys sharpeyi*.

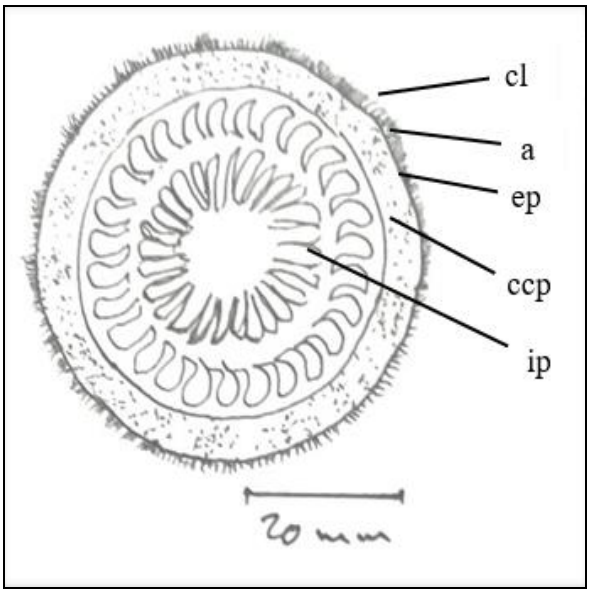


**Fig 1:** Perforated *T. mutabilis* isolated from gills of *C. carpio* under study.

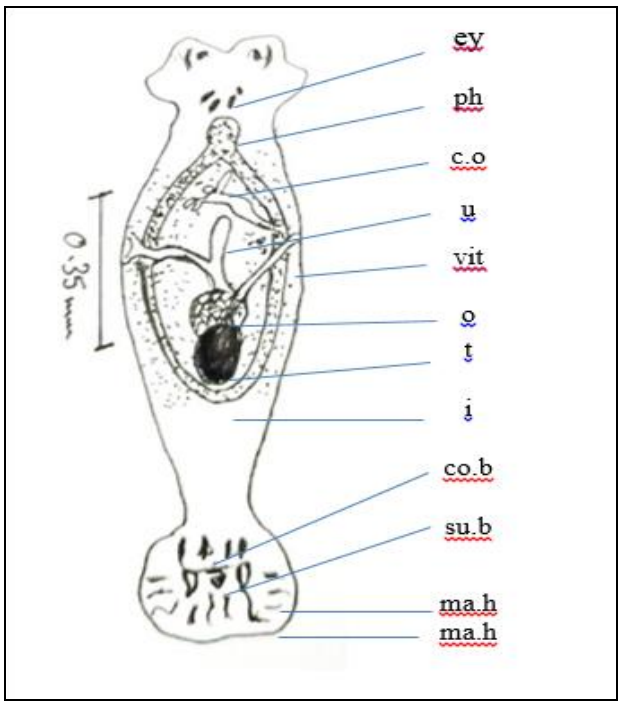


**Fig 2:** Perforated *D.vastator* isolated from gills of *C.carpio* under study

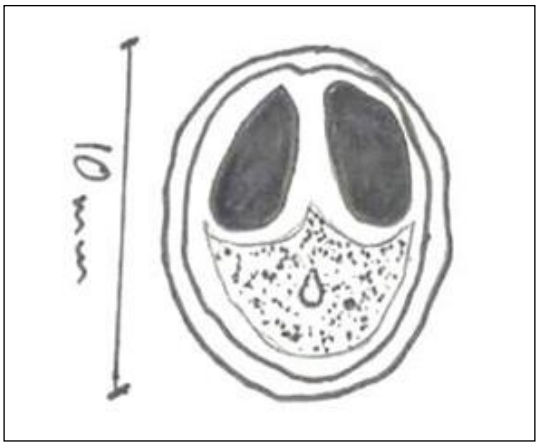


**Fig 3:** Perforated *M. sharpeyi* isolated from gills of *C. carpio* fish under study

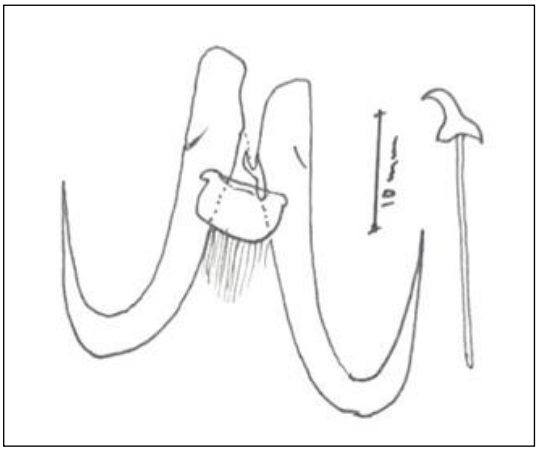


**Fig 4:** Perforated *G. gussevi* isolated from gills of *C. carpio* fish under study

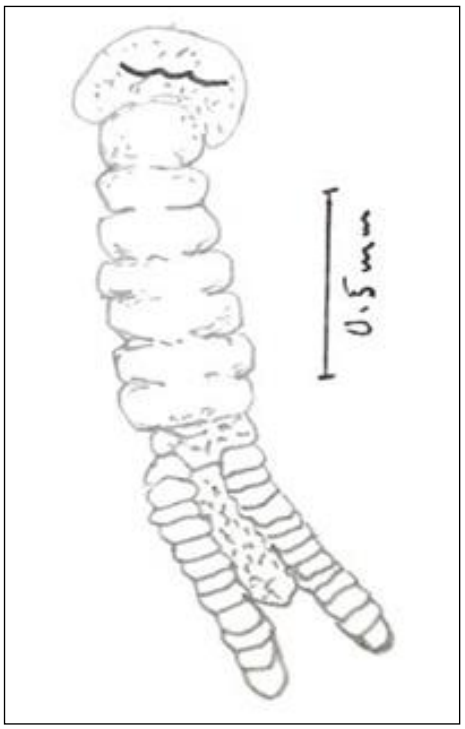


**Fig 5:** Perforated *P. annulata* isolated from gills of *C. carpio* fish under study

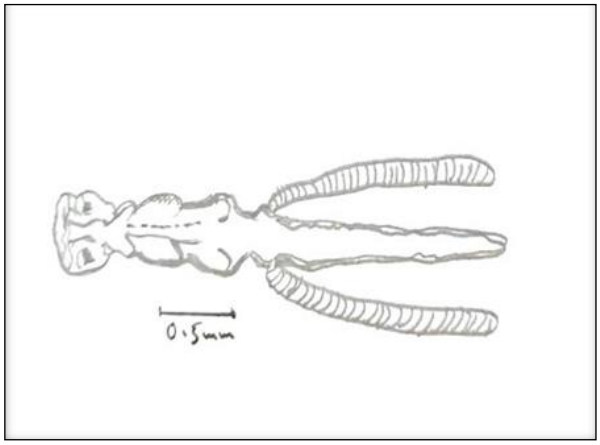


**Fig 6:** Perforated *L. pulchella* isolated from gills of *C. carpio* fish under study

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