A Second Collection of Monogeneans and Trematodes (Phylum Platyhelminthes) Parasitic on Some Fishes from Tigris River at Baghdad Province, Iraq

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Authors’ contributions

This work was carried out in collaboration between both authors. Both of them designed the study, wrote the protocol, interpreted the data, anchored the field study, gathered the initial data, performed preliminary data analysis, managed the literature searches and produced the initial draft. Both authors read and approved the final manuscript.

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ABSTRACT

Aims: This work aims to report on the monogeneans and trematodes that infect some species of fishes from Tigris River in Baghdad Province, Iraq.

Place and Duration of Study: Tigris River in Baghdad Province at three sites in Baghdad province: Al-Taji in the north of Baghdad city, Al-Shawaka in the center of Baghdad city and Al-Zaafaraniya in the south of Baghdad city during the period from January to December 2011.

Methodology: Monthly samples were collected from three stations from Tigris River in Baghdad province with the aid of gill and cast nets. Fishes were examined for external and internal parasites. For each parasite species, prevalence of infection was calculated.

Statistical Analysis: A comparison of parasitic infections of fishes from the three stations was investigated.

Results and Discussion: Result of inspection showed that five (out of eight) fish species were...
infected with 13 species of monogeneans and four species of trematodes. The monogeneans included one species each of Paradiplozoon and Thaparocleidus, two species of Gyrodactylus and nine species of Dactylogyrus, while the trematodes included one species each of Ascocotyle and Clinostomum and two species of Diplostomum. Among all these parasites, A. coleostoma infected the highest number of hosts (five host species), while 13 parasite species infected only one host each.

Among these fishes, Carassius carassius was infected with the highest number of parasite species (nine species), followed by Carasobarbus luteus (eight species) and Chondrostoma regium (four species) while no infection was detected from three fish species (Alburnus caeruleus, Cyprinus carpio and Leuciscus vorax).

In addition, a total of seven new host records in Iraq were reported for seven species of these parasites.

**Conclusion:** Host specificity is clear in monogeneans as 12 out of the 11 monogenean species infected one fish species each. All the trematodes were as metacercariae which later infect piscivorous aquatic birds.

**Keywords:** Monogenea; Trematoda; freshwater fishes; Tigris River; Baghdad; Iraq.

1. **INTRODUCTION**

The study of fish parasites is necessary to increase the productivity of pond farms, to improve the stocks of valuable commercial fisheries in the natural waters and to the possibility of fish acclimatization in new sites or localities [1].

The class Monogenea, used to be known as monogenetic trematodes, includes skin and gill flat worms with direct life cycles [2]. These are important fish pathogens, especially for carp fingerlings under extensive fish culture practice. Their direct life cycles and fish crowding are good conditions for their easy spread among fishes [3].

According to their attachment organs, monogeneans are provided either with hooks and hooklets and hence they are known as monopisthocotyleans or with clamps and hence they are known as polyopisthocotyleans [4]. Monogeneans cause irritation and excessive mucus production and their infection creates an open window for bacterial invasion [5].

With very few exceptions, trematodes include endoparasitic flat worms with non-segmented body, closed digestive system, oral and ventral suckers and indirect life cycles. As adults, trematodes live inside various vertebrates and spend their larval stages in intermediate hosts, mainly snails but also in some fishes [6]. Adult trematodes of fishes usually live in the digestive systems of their hosts but few live in the circulatory system [7]. Some trematodes live as larvae (metacercariae) in fish eyes [8] or gills and skin [2]. They are responsible for important fish diseases such as worm cataract, yellow grub and black spot disease [2,9]. Some trematodes can infect humans that eat metacercaria-infected fishes if such fishes are inadequately cooked [10].

The first published work on fish parasites in Iraq was done by Herzog [11]. After that, extensive surveys were done which resulted in the record of 162 valid monogenean and 46 trematode species from freshwater fishes of Iraq [12]. The present work, which is a continuation of a previous one [13], aimed to investigate monogenean and trematode infections among eight species of fishes from three different sampling sites along Tigris River at Baghdad province.

2. **MATERIALS AND METHODS**

Fishes were sampled from three sites in Tigris River at Baghdad province: Al-Taji in the north of Baghdad city, Al-Shawaka in the center of Baghdad city and Al-Zaafaraniya in the south of Baghdad city, during the period from January to December 2011. These fishes were captured by gill and cast nets of different mesh sizes. Fishes were brought to the laboratory with containers filled with ice. These fishes (Table 1) were identified according to Coad [14] and their scientific names followed Froese and Pauly [15].

Total length and weight of each fish specimen were recorded. Smears from the skin, gills, buccal cavity and eye lenses were examined under a compound microscope. Parasite identification was done according to some major
taxonomical books [4,16,17,18]. The prevalence of infection was calculated according to Margolis et al. [19]. The index-catalogue of parasites and disease agents of fishes of Iraq [12] was followed to indicate number of previous host records for each parasite in order to minimize list of references for each parasite species.

3. RESULTS AND DISCUSSION

A total of 98 fish specimens were captured from the three stations of collection (Table 1). The result of fish inspection showed that five species of these fishes were infected with 13 species of the class Monogenea and four species of the class Trematoda (Table 2).

The recorded monogeneans included one species each of Paradiplodizoon of the family Diplozoidae and Thaparoleidus of the family Ancylophoidea, two species of Gyrodactylus of the family Gyrodactylidae and nine species of Dactylogyrus of the family Dactylogyridae. The trematodes included one species each of Ascocotyle of the family Heterophyidae and Clinostomum of the family Clinostomidae as well as two species of Diplostomum of the family Diplostomidae.

Data on monogenean and trematode infections of fishes of the sampling areas, site of infection and percentage incidence of infection for each parasite species are shown in Table (2). The following is brief account on the occurrence of these parasites.

3.1 Class Monogenea

A total of 13 monogenean species were reported from fishes of the present investigation. Nine of these monogeneans belong to the genus Dactylogyrus, two to the genus Gyrodactylus and one species each to the genera Paradiplodizoon and Thaparoleidus. These monogeneans are alphabetically arranged in the following account.

3.1.1 Dactylogyrus achmerowi Gusev, 1955

This parasite was recorded from gills of C. luteus. The first record of this parasite in Iraq was from gills of C. carpio from Al-Wahda Fish Hatchery at Suwairah and Babylon (now Al-Furat) Fish Farm [20]. After that, it was reported from 10 other hosts in different inland waters and fish farms in Iraq [12] which included C. luteus.

3.1.2 Dactylogyrus anchoratus (Dujardin, 1845)

This parasite was recorded from gills of C. carassius and C. regium. The first report of this parasite in Iraq was from C. carpio from Tigris River at Al-Zaafaranaya, south of Baghdad [21]. Later on, it was reported from five other fish species which included C. carassius but not C. regium [12] which now represents the seventh host for D. anchoratus in Iraq.

3.1.3 Dactylogyrus arcuatus Yamaguti, 1942

This parasite was recorded from gills of C. carassius. Salih et al. [22] recorded this parasite for the first time in Iraq from skin, gills and buccal cavity of C. carpio from Al-Suwaera and Al-Latifya fish farms. Later on, it was reported from five other hosts in Iraq which did not include C. carassius [12] and hence C. carassius represents a new host (the seventh) for D. arcuatus in Iraq.

3.1.4 Dactylogyrus dulkeiti Bychowsky, 1936

This parasite was recorded from gills of C. carassius. The first report of this parasite in Iraq was from gills of C. carpio from Al-Zaafaranaya Fish Farm, south Baghdad [23]. Later on, it was reported from four other fish species which included C. carassius [12].

3.1.5 Dactylogyrus formosus Kulwiec, 1927

This species was found from the gills of C. carassius. Asmar et al. [24] recorded it for the first time in Iraq on gills of Carassius auratus from a fish farm in south of Baghdad. Later on, it was recorded from another host which did not include C. carassius [12] and hence C. carassius represents a new host (the third) for D. formosus in Iraq.

3.1.6 Dactylogyrus minutus Kulwiec, 1927

This parasite was found from gills of C. carassius. D. minutus was recorded for the first time in Iraq on the gills of C. carpio from Tigris River at Al-Zaafaranaya, south of Baghdad as well as from Al-Qadisia Dam Lake, west of Baghdad [21]. After that, it was reported from gills of 11 other fish hosts which included C. carassius [12].
3.1.7 Dactylogyrus skrjabini Achmerow, 1958

This parasite was reported from gills of C. luteus. Its first report in Iraq was from gills and buccal cavity of Hypophthalmichthys molitrix from Al-Suwaiera and Al-Latifya fish farms [22]. Later on, it was reported from five other hosts which included C. luteus [12].

3.1.8 Dactylogyrus varicorniii Bychowsky, 1957

This parasite was recorded from gills of C. luteus. The first report of this parasite in Iraq was from gills of both B. luteus (= C. luteus) and Varicorninis struta (= Capoeta struta) from Tigris River at Baiji town of Salah Al-Deen province, Iraq [25]. Later on, it was reported from only one other host [12].

3.1.9 Dactylogyrus vastator Nybelin, 1924

This parasite was recorded from gills of C. luteus. Its first report from Iraq was from gills of Cypririon macrostomum from Tigris River at Baghdad city and Al-Rashidiah town [26]. D. vastator is the commonest fish monogenean in Iraq as it has so far 33 fish hosts which included C. luteus [12].

3.1.10 Gyrodactylus elegans Nordmann, 1832

This parasite was recorded from gills of C. carassius. The first report on this parasite in Iraq was from gill arches of both C. carpio and Liza abu from Al-Zaafaraniya Fish Farm [27]. Later on, it was reported from 21 other fish hosts in north and mid Iraq which included C. carassius [12]. G. elegans is the commonest gyrodactyld species in fishes of Iraq [28].

3.1.11 Gyrodactylus medius Kathariner, 1895

This parasite was recorded from gills of C. carassius. The first report of this parasite in Iraq was from skin and gills of C. carpio from Babylon (now Al-Furat) Fish Farm near Hilla city [29]. Later on, it was reported from another host which was not C. carassius [12] and hence C. carassius represents a new host (the third) for this parasite in Iraq.

3.1.12 Parapartidoplozon pavlovskii Bychowsky et Naqibina, 1959

This monogenean was found in the gills of Liza abu. It was reported for the first time in Iraq as Diplozon pavlovskii from gills of Aspius vorax (= L. vorax) from Mehaijeran creek, Basrah [30]. Later on, it was recorded from nine other fish hosts from different locations in north, mid and south Iraq which did not include L. abu [12] and hence L. abu represents a new host for this parasite in Iraq.

3.1.13 Thaparocleidus vistulensis (Siwak, 1932)

This monogenean was found in the gills of Silurus triostegus. Its first report from Iraq, as Anycylodiscoides vistulensis, was from gills of S. triostegus from Tigris River at Baiji town of Salah Al-Dien province [25]. According to Lim et al. [31], A. vistulensis is a synonym of T. vistulensis. Later on, this parasite (as A. vistulensis) was reported from seven other hosts from north, mid and south Iraq [12].

3.2 Class Trematoda

The trematodes of the present study included one species each of genera Ascocotyle and Clinostomum and two species of Diplostomum (Table 2). These are alphabetically arranged in the following account.

3.2.1 Ascocotyle coleostoma (Looss, 1896)

Metacercariae of this trematode were recorded from gills and skin of C. luteus, C. carassius, C. regium, L. abu and S. triostegus. This metacercaria was reported for the first time in Iraq from gills of both Heteropneustes fossilis and L. abu from Diyala River, south of Baghdad [32]. This is the commonest trematode infecting freshwater fishes of Iraq as it has so far 34 host species [12] which included the five above-named hosts of the present study. Adults of A. coleostoma infect some piscivorous birds such as the grey heron Ardea cinerea in Babylon (now Al-Furat) Fish Farm, mid Iraq [33].

3.2.2 Clinostomum complanatum (Rud., 1814)

Metacercariae of this parasite were recorded from gills of C. luteus. This metacercaria was reported for the first time in Iraq from gills of C. luteus from Mehaijeran creek, Basrah [30]. Later on, it was reported from 21 different fish hosts [12]. Adults of this worm live in the mouth and pharynx of some fish-eating birds [9].

3.2.3 Diplostomum commutatum (Diesing, 1850)

Metacercariae of this parasite were recorded from eye lenses of C. luteus and C. regium. The
first report of *D. commutatum* in Iraq was from eye lenses of *A. vorax* (= *L. vorax*) from Tigris River at Baghdad [34]. Later on, it was reported from three other hosts which included *C. luteus* but not *C. regium* [12] and hence *C. regium* now represents a new host (the fifth) for *D. commutatum* in Iraq.

### 3.2.4 *Diplostomum spathaceum* (Rud., 1819)

Metacercariae of this trematode were recorded from eye lenses of *C. luteus, C. regium* and *C. carassius*. This parasite was reported for the first time in Iraq from eye lenses of *B. luteus* (= *C. luteus*), *C. macrostomum* and *C. carpio* from

| Fish scientific name          | No. fish examined from: |
|-------------------------------|-------------------------|
|                              | Al-Taji  | Al-Shawaka | Al-Zaafaraniya | Total |
| *Alburnus caeruleus* Heckel, 1843 | - 1 1  | 2 |
| *Carasobarbus luteus* (Heckel, 1843) | 9 20 5 | 19 |
| *Carassius carassius* (Linnaeus, 1758) | 12 2 5 | 20 |
| *Chondrostoma regium* (Heckel, 1843) | 8 9 - | 17 |
| *Cyprinus carpio* Linnaeus, 1758 | - - 1 | 1 |
| *Leuciscus vorax* (Heckel, 1843) | - - 1 | 1 |
| *Liza abu* (Heckel, 1843) | 7 1 11 | 19 |
| *Silurus triostegus* Heckel, 1843 | - 5 - | 5 |
| Total | 36 38 24 | 98 |

### Table 1. Number of the examined fishes from three stations at Tigris River

| Parasite species | Host species | Site of infection* | % Incidence | Sampling area |
|------------------|--------------|--------------------|-------------|---------------|
|                  |              | T  | S  | Z  |
| *Monogenea:*     |              |    |    |    |
| *D. achmerowi*   | *C. luteus*  | G  | 5.9 | √  | √ |
| *D. anchoratus*  | *C. carassius** | G  | 5.3 | √  |   |
|                  | *C. regium*  | G  | 5.9 | √  |   |
| *D. arcuatus*    | *C. carassius** | G  | 10.5 | √  | √ |
| *D. dulkeiti*    | *C. carassius* | G  | 5.3 | √  |   |
| *D. formosus*    | *C. carassius** | G  | 15.8 | √  | √ |
| *D. minutus*     | *C. carassius* | G  | 10.5 | √  | √ |
| *D. skrjabini*   | *C. luteus*  | G  | 32.4 | √  | √ |
| *D. varicorhini* | *C. luteus*  | G  | 76.5 | √  | √ |
| *D. vastator*    | *C. luteus*  | G  | 2.9 |   |   |
| *G. elegans*     | *C. carassius* | G  | 5.3 |   |   |
| *G. medius*      | *C. carassius** | G  | 10.5 |   | √ |
| *P. pavlovskii*  | *L. abu**    | G  | 10.5 |   |   |
| *T. vistulensis* | *S. triostegus* | G  | 80.0 |   |   |
| *Trematoda:*     |              |    |    |    |
| *A. coleostoma*  | *C. luteus*  | S, G | 14.7 |   |   |
| *C. carassius*   | *C. luteus*  | S, G | 5.3 |   |   |
|                  | *C. regium*  | S, G | 5.9 |   |   |
|                  | *L. abu*     | G  | 5.3 |   |   |
|                  | *S. triostegus* | S, G | 40.0 |   |   |
| *C. complanatum* | *C. luteus*  | G  | 2.9 |   |   |
| *D. commutatum*  | *C. luteus*  | El | 2.9 |   |   |
|                  | *C. regium** | El | 11.8 | √  |   |
| *D. spathaceum*  | *C. luteus*  | El | 2.9 |   |   |
|                  | *C. carassius** | El | 5.3 |   |   |
|                  | *C. regium*  | El | 23.5 |   |   |

* Site of infection: G= Gills, S= Skin, El= Eye lenses; ** New host record in Iraq
Dokan Dam Lake [35]. Later on, it was reported from 29 other hosts which did not include C. carassius [12]. So, C. carassius now represents a new host for D. spathaceum in Iraq. The adult worms live in the intestine of fish-eating birds such as some gulls like L. canus and L. ichthyaetus from Shatt Al-Arab River [36].

4. CONCLUSION

To conclude on the monogenean and trematode infections of fishes of the present study, A. coleostoma was the prevalent parasite among these fishes as it was recorded from five fish hosts, followed by D. spathaceum which was recorded from three fish species. On the other hand, all the monogeneans were detected from one host each, except D. anchoratus which was recorded from two host species.

In connection with fish hosts, C. carassius was infected with the highest number of parasite species (nine species), followed by C. luteus (eight species), C. regium (four species), L. abu and S. triostegus (two parasite species each) while no infection was reported from A. caeruleus, C. carpio and L. vorax. The absence of infection from these fish species might be attributed to the few samples of such fishes in comparison with those of other fish species (Table 1). In addition, seven new host records in Iraq were reported for seven species of these parasites.

Differences in the infection among fishes from the three sampling areas indicated that fishes of Al-Shawaka were infected with 15 species, those of Al-Taji with 11 species while those of Al-Zaafaraniya were infected with 10 species. These numbers are, to some extent, in accordance with number of fishes sampled (Table 1).

All the four recorded trematodes of the present study were reported as metacercariae which develop to adults when the infected fishes are predated by piscivorous aquatic birds.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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