

Monogenean Parasites of Fishes from the Euphrates River at Al-Musaib City, Mid Iraq

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Abstract

A total of 472 fish specimens belonging to 24 species from the Euphrates River at Al-Musaib city, mid Iraq were inspected for parasites during the period from July 2006 till the end of June 2007. Thirty-six monogenean species were detected. These included one species each of genera *Ligophorus*, *Mastacembelocleidus*, *Octomacrum*, *Diplozoon*, *Eudiplozoon* and *Microcotyle*, two species of both *Dogielius* and *Thaparocleidus*, three species of *Paradiplozoon*, five species of *Gyrodactylus* and 18 species of *Dactylogyrus*. In addition, 35 new host records in Iraq were reported for 20 species of these monogeneans. Number of fish hosts reported for these monogeneans fluctuated from one host in case of 18 monogenean species to a maximum of nine hosts in case of *Dactylogyrus extensus*. Among the inspected fishes, number of monogenean species fluctuated from a minimum of one monogenean species in four fish species to a maximum of 11 monogenean species in case of *Carasobarbus luteus*, while five fish species showed no any monogenean infections.

Keywords

Monogenea, Freshwater Fishes, Euphrates River, Al-Musaib City, Babylon Province, Iraq

1. Introduction

Monogeneans are a group of parasitic flatworms that are commonly found on fishes and lower aquatic invertebrates (Reed *et al.*, 2012). These worms are characterized by having a posterior attachment organ known as the haptor or opisthaptor (Gusev, 1985). Monogeneans can be divided into two major groups, the monopisthocotyleans which have hook-like organs on their haptors to attach to their host, and the polyopisthocotyleans which use clamp-like structures for attachment (Reed *et al.*, 2012). Monogeneans have a direct life cycle. The larva is usually a small ciliated oncomiracidium, which hatches from the egg and swims to locate and infect another host (MonoDb, 2015). Monogenean pathogenicity is due to their attachment organs, gland secretion and feeding strategy (Buchmann and Bresciani, 2006). Other information on pathogenicity is demonstrated by Noga (2010) and Reed *et al.* (2012).

Among notable parasitological investigations achieved on monogeneans of fishes from Euphrates River within the Iraqi territory are those of Asmar *et al.* (1999), Al-Jadoaa (2002), Al-Awadi (2003), Balasem *et al.* (2003), Mhaisen *et al.*

(2003), Al-Saadi (2007), Al-Zubaidy (2007), Hussain (2007) and Al-Salmany (2015). Two checklists of some species of monogeneans of fishes of Iraq were so far published. The first one was on the *Gyrodactylus* species (Mhaisen and Abdul-Ameer, 2013) while the other one was on diplozoid species (Mhaisen and Abdul-Ameer, 2014). The present article was aimed to contribute on the monogenean parasites of fishes from the Euphrates River at Al-Musaib city of Babylon Province as no previous study was done on fishes of this area.

2. Materials and Methods

During the period from July 2006 till the end of June 2007, fish specimens were collected from the Euphrates River at Al-Musaib city (32°47'N, 44°17'E), Babylon Province, mid Iraq. Fishes were caught with the aid of a cast net and were transported to the laboratory where they were measured, weighed and sexed. Fishes were freshly examined by making smears from skin, fins and buccal cavity. Gills were removed

and placed in Petri dishes with water and microscopically inspected. Gill smears were examined and after removing the monogeneans from gill filaments, they were put on slides. Few drops of glycerin jelly were used to make permanent slides (Jalali *et al.*, 2000). Prevalence of infection was calculated (Margolis *et al.*, 1982). Parasite identification was done according to some major taxonomical references (Bykhovskaya-Pavlovskaya *et al.*, 1962; Gusev, 1985; Khotenovsky, 1985). Names and authorities of the monogeneans were checked according to some taxonomical accounts (Khotenovsky, 1985; Gibson *et al.*, 1996; Timofeeva *et al.*, 1997; Lim *et al.*, 2001; Harris *et al.*, 2004; Pugachev *et al.*, 2009; Soo and Lim, 2012; MonoDb, 2015).

It is appropriate to emphasize on a statement given by Lim *et al.* (2001) in connection of awareness that the names of some authors, especially Russian and Chinese, tend to have different transliterations. Examples included “Gusev”, (the correct transliteration), for example, have been transliterated as “Gussev” in original or translated publications in English. This is also true for Bychowsky (also known as Bychovskii, Bykhovski), Akhmerov (also spelled Akhmerow, Achmerow, Achmerov) and some Chinese authors, e.g. Long (Lang) and Zhang (Tchang). Whether such names should be changed or retained as given in the original publications is a matter of opinion. Either action can result in difficulties in relation to literature searchers, since many databases use names as published. In this work, Russian names have been standardised and Chinese names left as original. The valid scientific names of the studied fishes were based on Froese and Pauly (2015). Such names are similar to those reported by Eschmeyer (2015), except for both *Barbus grypus* and *Tilapia zillii* which were considered as synonyms of *Arabibarbus grypus* and *Coptodon zillii*, respectively by the latter reference.

3. Results and Discussion

During the period of this study, 472 fish specimens belonging to eight families and 24 species were inspected for parasites. These fishes are demonstrated below with their families and numbers:-

Family Cyprinidae

- 16 *Alburnus caeruleus* Heckel, 1843
- 10 *Alburnus orontis* Sauvage, 1882
- 24 *Alburnus sellal* Heckel, 1843
- 12 *Barbus barbulus* Heckel, 1847
- 9 *Barbus grypus* Heckel, 1843
- 2 *Capoeta damascina* (Vaenciennes, 1842)
- 77 *Carasobarbus luteus* (Heckel, 1843)
- 4 *Carassius carassius* (Linnaeus, 1758)
- 3 *Chondrostoma regium* (Heckel, 1843)
- 2 *Ctenopharyngodon idella* (Valenciennes, 1844)
- 60 *Cyprinion kais* Heckel, 1843
- 15 *Cyprinion macrostomum* Heckel, 1843
- 7 *Cyprinus carpio* Linnaeus, 1758
- 22 *Garra rufa* (Heckel, 1843)
- 33 *Leuciscus vorax* (Heckel, 1843)

- 11 *Luciobarbus xanthopterus* Heckel, 1843
- 2 *Mesopotamichthys sharpeyi* (Günther, 1874)
Family Bagridae
- 18 *Mystus pelusius* (Solander, 1794)
Family Siluridae
- 5 *Silurus triostegus* Heckel, 1843
Family Sisoridae
- 13 *Glyptothorax steindachneri* (Pietschmann, 1913)
Family Heteropneustidae
- 12 *Heteropneustes fossilis* (Bloch, 1794)
Family Cichlidae
- 29 *Tilapia zillii* (Gervais, 1848)
Family Mugilidae
- 48 *Liza abu* (Heckel, 1843)
Family Mastacembelidae
- 38 *Mastacembelus mastacembelus* (Banks & Solander, 1794)

The inspection of fishes of the present investigation revealed the occurrence of 36 monogenean species which belong to two subclasses, three orders, seven families and 11 genera. These parasites are arranged here according MonoDb (2015) to the generic rank in order to economize space as all the 36 species will be demonstrated later.

Class Monogenea

Subclass Monopisthocotylea

Order Dactylogyridea

Family Ancylo-discoididae

Thaparocleidus (two species)

Family Ancyrocephalidae

Ligophorus (one species)

Mastacembelocleidus (one species)

Family Dactylogyridae

Dactylogyrus (18 species)

Dogielius (two species)

Order Gyrodactylidea

Family Gyrodactylidae

Gyrodactylus (five species)

Subclass Polyopisthocotylea

Order Mazocraeidea

Family Diplozoidae

Diplozoon (one species)

Eudiplozoon (one species)

Paradiplozoon (three species)

Family Discocotylidae

Octomacrum (one species)

Family Microcotylidae

Microcotyle (one species)

The following is a brief account on the occurrence of these parasites.

3.1. *Thaparocleidus gomitus* (Jain, 1952) Lim, 1996

This parasite was recorded from gills of *S. triostegus* with an incidence of 100%. The first report on this parasite in Iraq, as *Haplocleidus gomitus* Jain, 1952, was from *S. triostegus* and *L. abu* from Tigris River at Al-Zaafaraniya, south of Baghdad (Mhaisen *et al.*, 1997) and published later as

Ancylo-discoides gomitus by Mhaisen *et al.* (2003). According to Lim *et al.* (2001), *H. gomitus* and *A. gomitus* are synonyms of *T. gomitus*. No other hosts are so far known for this parasite in Iraq (Mhaisen, 2015).

3.2. *Thaparocleidus vistulensis* (Siwak, 1932) Lim, 1996

This parasite was recorded from gills of *S. triostegus* with an incidence of 80%. Its first report from Iraq, as *Ancylo-discoides vistulensis* (Siwak, 1932), was from *S. triostegus* from Tigris River at Salah Al-Dien province (Abdul-Ameer, 1989). According to Lim *et al.* (2001) and Pugachev *et al.* (2009), *A. vistulensis* is a synonym of *T. vistulensis*. Later on, it was reported (as *A. vistulensis*) from eight hosts from north, mid and south Iraq (Mhaisen, 2015) which included *S. triostegus*.

3.3. *Ligophorus vanbenedenii* (Parona & Perugia, 1890) Euzet & Suriano, 1977

This parasite was recorded from gills of *L. abu* with an incidence of 16.7%. The first report on this parasite in Iraq, as *Ancyrocephalus vanbenedenii* (Parona & Perugia, 1890), was from *L. abu* from Tigris River at Al-Zaafaraniya, south of Baghdad (Mhaisen *et al.*, 2003). According to Soo & Lim (2012), *A. vanbenedenii* is a synonym of *L. vanbenedenii*. No other hosts are so far known for this parasite in Iraq (Mhaisen, 2015).

3.4. *Mastacembelocleidus heteranchorus* (Kulkarni, 1969)

This parasite was recorded from gills of *M. mastacembelus* with an incidence of 55.3%. Its first report from Iraq was from gills of *M. mastacembelus* from Greater Zab River (Kritsky *et al.*, 2004). No other hosts are so far known for this parasite in Iraq (Mhaisen, 2015).

3.5. *Dactylogyrus achmerowi* Gusev, 1955

This parasite was recorded from gills of both *C. luteus* and *L. xanthopterus* with an incidence of 2.6% and 18.2%, respectively. Its first report from Iraq was from gills of *C. carpio* from Al-Wahda fish hatchery at Al-Suwaira and Babylon fish farm, mid Iraq (Mhaisen *et al.*, 1988). Later on, it was reported from ten other hosts (Mhaisen, 2015) from different inland waters and fish farms in mid Iraq which included both *C. luteus* and *L. xanthopterus*.

3.6. *Dactylogyrus affinis* Bychowsky, 1933

This parasite was recorded from gills of *B. barbulus* and *L. xanthopterus* with an incidence of 8.3% and 9.1%, respectively. The first report on this parasite in Iraq was from gills of both *Luciobarbus esocinus* (reported as *B. esocinus*) and *L. xanthopterus* (reported as *B. xanthopterus*) from Dokan Lake, north Iraq (Abdullah, 1990). Later on, it was reported from three other hosts (Mhaisen, 2015) from mid Iraq which included *B. barbulus*.

3.7. *Dactylogyrus arcuatus* Yamaguti, 1942

This parasite was recorded from gills of both *C. luteus* and *C. kais* with an incidence of 23.4% and 1.7%, respectively. Its first report from Iraq was from gills, skin and buccal cavity of *C. carpio* from Al-Suwaira and Al-Latifiya fish farms, mid Iraq (Salih *et al.*, 1988). Later on, it was reported from four other hosts from mid Iraq which included *C. luteus* but not *C. kais* and hence, *C. kais* is considered now as a new host record for this parasite in Iraq (Mhaisen, 2015).

3.8. *Dactylogyrus barbioides* Gusev, Ali, Abdul-Ameer, Amin & Molnár, 1993

This parasite was recorded from gills of *B. grypus* and *L. xanthopterus* with an incidence of 22.2% and 9.1%, respectively. It was described as a new species from *B. grypus* from Tigris River near Baiji town (Gusev *et al.*, 1993). Later on, it was reported from *C. carpio* only (Al-Taei, 2013). So, *L. xanthopterus* is considered now as a new host record for this parasite in Iraq (Mhaisen, 2015).

3.9. *Dactylogyrus barbuli* Gusev, Ali, Abdul-Ameer, Amin & Molnár, 1993

This parasite was recorded from gills of *B. barbulus*, *L. xanthopterus* and *M. sharpeyi* with an incidence of 33.3%, 36.4% and 100%, respectively. It was described as a new species from *B. barbulus* from Tigris River near Baiji town (Gusev *et al.*, 1993). Later on, it was reported from four other hosts from north and mid Iraq which included *L. xanthopterus* but not *M. sharpeyi* and hence, *M. sharpeyi* is considered now as a new host record for this parasite in Iraq (Mhaisen, 2015).

3.10. *Dactylogyrus carassobarbi* Gusev, Jalali & Molnár, 1993

This parasite was recorded from gills of *C. luteus* with an incidence of 36.4%. Its first report from Iraq was from *C. luteus* (reported as *B. luteus*) from Garimat Ali River, Basrah (Al-Ali, 1998). Later on, it was reported from three other hosts (Mhaisen, 2015).

3.11. *Dactylogyrus dogieli* Gusev, 1953

This parasite was recorded from gills of *A. sellal*, *C. luteus*, *C. idella*, *C. kais* and *M. sharpeyi* with an incidence of 4.3%, 5.2%, 50%, 1.7% and 50%, respectively. As this is the first occurrence of *D. dogieli* in Iraq, a detailed account on its description, measurements and occurrence were given by Al-Sa'adi *et al.* (2013). Later on, it was reported from another host in Iraq (Mhaisen, 2015).

3.12. *Dactylogyrus dulkeiti* Bychowsky, 1936

This parasite was recorded from gills of *C. carassius* with an incidence of 50%. Its first report from Iraq was from *C. carpio* from Al-Zaafaraniya fish farm (Mohammad-Ali *et al.*, 1999). Later on, it was reported from four other hosts from mid Iraq which included *C. carassius* (Mhaisen, 2015).

3.13. *Dactylogyrus elegantis* Gusev, 1966

This parasite was recorded from gills of *C. luteus* with an incidence of 6.5%. Its first report from Iraq was from *C. regium* from Lesser Zab River (Abdullah, 2002). Later on, it was reported from two other hosts which did not include *C. luteus* and hence *C. luteus* is considered as a new host for this parasite in Iraq (Mhaisen, 2015).

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

This parasite was recorded from gills of nine hosts: *A. caruleus*, *A. orontis*, *A. sellal*, *C. luteus*, *C. kais*, *C. carpio*, *L. vorax*, *M. mastacembelus* and *M. sharpeyi* with an incidence of 12.5%, 30%, 21.7%, 1.3%, 26.7%, 42.9%, 12.1%, 2.6% and 50%, respectively. Its first report from Iraq was from gills and buccal cavity of *C. carpio* from Al-Suwaira and Al-Latifiya fish farms, mid Iraq by Salih *et al.* (1988) who reported this species by its synonym *Dactylogyrus solidus* Akhmerov, 1948 according to Gibson *et al.* (1996). Later on, it was reported from 12 other host species from fish farms and inland waters in mid Iraq (Mhaisen, 2015) which included *A. caruleus*, *C. luteus*, *C. carpio*, *L. vorax* and *M. sharpeyi* but not included *A. orontis*, *A. sellal*, *C. kais* and *M. mastacembelus*. So, *A. orontis*, *A. sellal*, *C. kais* and *M. mastacembelus* of this study are considered as new host records for this parasite in Iraq.

3.15. *Dactylogyrus inexpectatus* Izjumova in Gusev, 1955

This parasite was recorded from gills of *C. carassius* with an incidence of 25%. Its first report from Iraq was from gills and skin of *C. idella* from Al-Suwaira and Al-Latifiya fish farms, mid Iraq (Salih *et al.*, 1988). Later on, it was reported from four fish species, which included *C. carassius*, from fish farms and inland waters in mid Iraq (Mhaisen, 2015).

3.16. *Dactylogyrus inutilis* Bychowsky, 1949

This parasite was recorded from gills of *B. barbulus*, *B. grypus* and *L. xanthopterus* with an incidence of 25%, 11.1% and 45.5%, respectively. The first report of this parasite in Iraq was from *L. xanthopterus* (reported as *B. xanthopterus*) from Tigris River near Baiji town (Gusev *et al.*, 1993). Later on, it was reported from two other fish hosts in north of Iraq which included *B. barbulus* but not *B. grypus* (Mhaisen, 2015) and hence *B. grypus* of this study is considered as a new host record for this parasite in Iraq.

3.17. *Dactylogyrus lamellatus* Akhmerow, 1952

This parasite was recorded from gills of *C. idella* with an incidence of 100%. Its first report from Iraq was from skin, gills and buccal cavity of *C. idella* from Al-Suwaira and Al-Latifiya fish farms, mid Iraq (Salih *et al.*, 1988). Later on, it was reported from two other hosts from mid Iraq (Mhaisen, 2015).

3.18. *Dactylogyrus minutus* Kulwiec, 1927

This parasite was recorded from gills of *A. orontis*, *A. grypus*, *C. luteus*, *C. idella* and *C. kais* with an incidence of 10%, 11.1%, 2.6%, 50% and 1.7%, respectively. The first report on this parasite in Iraq was from gills of *C. carpio* from both Tigris River at Al-Zaafaraniya, south of Baghdad and Al-Qadisia Dam Lake (Mhaisen *et al.*, 2003). Later on, it was reported from nine other fish hosts from fish farms and inland waters in north and mid Iraq, which included *B. grypus*, *C. luteus* and *C. idella* but not *A. orontis* and *C. kais* (Mhaisen, 2015). So, *A. orontis* and *C. kais* of the present study are considered as two new host records for this parasite in Iraq.

3.19. *Dactylogyrus pavlovskiy* Bychowsky, 1949

This parasite was recorded from gills of *B. barbulus*, *B. grypus*, *C. luteus* and *L. abu* with an incidence of 25%, 44.4%, 13% and 4.2%, respectively. The first report on this parasite in Iraq was from *B. grypus* and *M. sharpeyi* (reported as *B. sharpeyi*) from Tigris River near Baiji town (Gusev *et al.*, 1993). No other hosts are known for this parasite in Iraq (Mhaisen, 2015). So, *B. barbulus*, *C. luteus* and *L. abu* of the present study are new host records for this parasite in Iraq.

3.20. *Dactylogyrus simplex* Bychowsky, 1936

This parasite was recorded from gills of *L. vorax* and *L. abu* with an incidence of 6.1% and 8.3%, respectively. The first report on this parasite in Iraq was from gills of *C. carpio* from the new fish farm of the Fish Research Center at Al-Zaafaraniya, south of Baghdad (Sadek, 1999). No other hosts are so far known for this parasite in Iraq (Mhaisen, 2015) and hence *L. vorax* and *L. abu* are considered as new hosts for this parasite in Iraq.

3.21. *Dactylogyrus vastator* Nybelin, 1924

This parasite was recorded from gills of *B. grypus* with an incidence of 22.2%. Its first report from Iraq was from skin and gills of *C. macrostomum* from Tigris River at Baghdad (Ali *et al.*, 1987). Later on, it was reported from 32 other hosts from north, mid and south of Iraq (Mhaisen, 2015) which included *B. grypus*.

3.22. *Dactylogyrus wegneri* Kulwiec, 1927

This parasite was recorded from gills of *B. barbulus* with an incidence of 8.3%. Its first report from Iraq was from gills of *C. carpio* from a manmade lake at Baghdad (Abdul-Ameer, 2006). No other hosts are known for this parasite in Iraq and hence *B. barbulus* is considered as a new host for this parasite in Iraq (Mhaisen, 2015).

3.23. *Dogielius persicus* Molnár & Jalali, 1992

This parasite was recorded from gills of *B. barbulus*, *C. luteus* and *M. sharpeyi* with an incidence of 8.3%, 31.2% and 50%, respectively. The first report on this parasite in Iraq was

from gills of *C. luteus* (reported as *B. luteus*) from Greater Zab River, north of Iraq (Abdullah, 2002). Later on, it was reported from two other fish hosts in Iraq, which included *C. luteus* but not *B. barbulus* and *M. sharpeyi* and hence *B. barbulus* and *M. sharpeyi* are considered as new hosts for this parasite in Iraq (Mhaisen, 2015).

3.24. *Dogielius planus* Bychowsky, 1957

This parasite was recorded from gills of *B. barbulus* with an incidence of 8.3%. Its first report from Iraq was from gills of *C. luteus* (reported as *B. luteus*) from Darbandikhan Lake (Abdullah, 2005). Later on, it was reported from one other fish host in Iraq, which did not include *B. barbulus* and hence *B. barbulus* is considered as a new host for this parasite in Iraq (Mhaisen, 2015).

3.25. *Gyrodactylus elegans* Nordmann, 1832

This parasite was recorded from gills of *A. orontis*, *C. carpio* and *L. abu* with an incidence of 10%, 14.3% and 6.3%, respectively. The first report of this parasite in Iraq was from the gill arches of both *C. carpio* and *L. abu* from Al-Zaafaraniya fish farm (Ali and Shaaban, 1984). Later on, it was reported from 20 other fish hosts in north and mid Iraq which did not include *A. orontis* (Mhaisen, 2015). So, *A. orontis* of this study is considered as a new host record for this parasite in Iraq.

3.26. *Gyrodactylus gussevi* Ling, 1962

This parasite was recorded from gills of *H. fossilis* with an incidence of 16.7%. Its first report from Iraq was from the skin of *H. fossilis* from Greater Zab River (Abdullah, 2002). Pugachev *et al.* (2009) considered *G. gussevi* as species inquirenda. No other hosts are so far known for this parasite in Iraq (Mhaisen, 2015).

3.27. *Gyrodactylus markevitschi* Kulakovskaya, 1952

This parasite was recorded from gills of *B. grypus*, *C. kais* and *C. carpio* with an incidence of 11.1%, 1.7% and 14.3%, respectively. The first report of this parasite in Iraq was from the gill of *Capoeta trutta* (reported as *Varicorhinus trutta*) from Tigris River at Salah Al-Dien province (Abdul-Ameer, 1989). Later on, it was reported from three other hosts in mid and south Iraq which included *C. carpio* but not *B. grypus* and *C. kais* (Mhaisen, 2015). So, *B. grypus* and *C. kais* of this study are considered as new host records for this parasite in Iraq.

3.28. *Gyrodactylus medius* Kathariner, 1895

This parasite was recorded from gills of *C. luteus* with an incidence of 2.6%. Its first report from Iraq was from the skin and gills of *C. carpio* from Al-Furat fish farm (Al-Zubaidy, 1998). No other hosts are known for this parasite in Iraq (Mhaisen, 2015). So, *C. luteus* of this study is considered as a new host record for this parasite in Iraq.

3.29. *Gyrodactylus sprostonae* Ling, 1962

This parasite was recorded from gills of *A. orontis*, *A. sellal*, *C. carassius* and *C. kais* with an incidence of 70%, 13%, 25% and 3.3%, respectively. The first report of this parasite in Iraq was from skin and fins of *C. carpio* from Al-Furat fish farm (Al-Zubaidy, 1998). Later on, it was reported from two other hosts from north of Iraq which did not include *A. orontis*, *A. sellal*, *C. carassius* and *C. kais* (Mhaisen, 2015). So, *A. orontis*, *A. sellal*, *C. carassius* and *C. kais* of this study are considered as new host records for this parasite in Iraq.

3.30. *Diplozoon paradoxum* Nordmann, 1832

This parasite was recorded from gills of *C. carpio*, *L. vorax* and *L. abu* with an incidence of 14.3%, 6.1% and 4.2%, respectively. The first report of this parasite in Iraq was from the gill of *C. luteus* (reported as *B. luteus*) from Al-Husainia creek at Karbala province (Al-Saadi, 2007). Later on, it was reported from another host from mid Iraq which did not include *C. carpio*, *L. vorax* and *L. abu* (Mhaisen, 2015). So, *C. carpio*, *L. vorax* and *L. abu* of this study are considered as new host records for this parasite in Iraq.

3.31. *Eudiplozoon nipponicum* (Goto, 1891)

This parasite was recorded from gills of *C. carpio* with an incidence of 14.3%. Its first report from Iraq (as *Diplozoon nipponicum*) was from gills of *C. carpio* from a manmade lake at Baghdad (Al-Nasiri, 2003). Later on, it was reported from two other hosts in mid Iraq (Mhaisen, 2015).

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

This parasite was recorded from gills of *C. carpio*, *L. vorax* and *L. xanthopterus* with an incidence of 14.3%, 3% and 9.1%, respectively. The first report of this parasite in Iraq was from gills of *L. xanthopterus* (reported as *B. xanthopterus*) from Al-Husainia creek at Karbala province (Al-Saadi, 2007). Later on, it was reported from one other host in north Iraq which did not include *C. carpio* and *L. vorax* (Mhaisen, 2015). So, *C. carpio* and *L. vorax* of this study represent new host records for this parasite in Iraq. It is appropriate to mention here that Pugachev *et al.* (2009) considered *P. homoion* as a synonym of *P. homoion homoion*.

3.33. *Paradiplozoon megan* (Bychowsky & Nagibina, 1959)

This parasite was recorded from gills of *C. luteus* with an incidence of 1.3%. Its first report from Iraq was from gills of both *L. vorax* (reported as *A. vorax*) and *L. xanthopterus* (reported as *B. xanthopterus*) from Al-Husainia creek at Karbala province (Al-Saadi, 2007). No other records are known for this parasite in Iraq (Mhaisen, 2015). So, *C. luteus* of this study is considered as a new host record for this parasite in Iraq.

3.34. *Paradiplozoon vojteki* (Pejčoch, 1968)

This parasite was recorded from gills of *L. vorax* with an incidence of 6.1%. Its first report from Iraq was from gills of *L. xanthopterus* (reported as *B. xanthopterus*) from Al-Husainia creek at Karbala province (Al-Saadi, 2007). Later on, it was reported from one other host in mid Iraq which did not include *L. vorax* (Mhaisen, 2015). So, *L. vorax* of this study is considered as a new host record for this parasite in Iraq.

3.35. *Octomacrum europaeum* Roman & Bychowsky, 1956

This parasite was recorded from gills of *C. kais*, *C. macrostomum* and *G. rufa* with an incidence of 1.7%, 6.7% and 9.1%, respectively. As this is the first occurrence of *O. europaeum* in Iraq, a detailed account on its description, measurements and occurrence were given by Al-Sa'adi *et al.* (2013). No other hosts are known for this parasite in Iraq (Mhaisen, 2015).

3.36. *Microcotyle donavini* van Beneden & Hesse, 1863

This parasite was recorded from gills of *L. abu* with an incidence of 2.1%. Its first report from Iraq was from gills of *L. abu* which was found in great numbers in Babylon (now Al-Furat) fish farm (Ali *et al.*, 1989). Later on, it was reported from nine other hosts in mid and south Iraq but mostly on *L. abu* as a total of 17 reports documented its occurrence on this fish in different inland waters in mid and south Iraq as well as some fish farms (Mhaisen, 2015).

4. Conclusions

Firstly, It is appropriate to emphasize here that the terms "monogenetic trematodes" and "flukes" which are often used to describe the group of monogenean parasites, are both incorrect because monogeneans are not trematodes or flukes (Reed *et al.*, 2012). As stated by Lim *et al.* (2001), readers should be aware that the names of some authors, especially Russian and Chinese, tend to have different transliterations and hence in this work, Russian names have been standardised and Chinese names left as original.

To conclude on the monogenean infections of fishes from the Euphrates River at Al-Musaib city, species of the genus *Dactylogyrus* constitute 50% of all recorded monogenean species. Although 18 monogeneans of the present study were reported from one host each which demonstrates that most monogeneans have a narrow host range in nature (Noga, 2010), but other monogeneans infected two or more host species and even one of them (*D. extensus*) was reported from a total of nine fish hosts.

It seems that the cyprinid fish *C. luteus* represents a catch-up host as it was infected with 11 monogenean species and followed by both *B. barbulus* and *C. kais* which were infected with seven monogenean species each.

As the values in 16% of the percentage incidence of

infection recorded from fishes of the present study were more than 50%, the percentage of infection in most fishes was generally light. However, in addition to the effect of monogeneans on their hosts (Buchmann and Bresciani, 2006), the infected fishes might demonstrate a risk to fish culture in the region as many fish farms are supplied with water from the nearby Euphrates River. Some wild fishes, such as *C. luteus* and *L. abu* are known to enter fish farms in Iraq with the supplied water and thus the cultured fishes might gain the infection from such wild fishes (Mhaisen, 1993).

References

- [1] Abdul-Ameer, K.N. 1989. Study of the parasites of freshwater fishes from Tigris River in Salah Al-Dien province, Iraq. M. Sc. Thesis, Coll. Sci., Univ. Baghdad: 98pp (In Arabic).
- [2] Abdul-Ameer, K.N. 2006. On the occurrence of the monogenetic trematode *Dactylogyrus wegneri* for the first time in Iraq on gills of the common carp *Cyprinus carpio*. Babylon Univ. J., Pure Appl. Sci., 13(3): 1052-1055.
- [3] Abdullah, S.M.A. 1990. Survey of the parasites of fishes of Dokan Lake. M. Sc. Thesis, Coll. Sci., Univ. Salahaddin: 115pp (In Arabic).
- [4] Abdullah, S.M.A. 2002. Ecology, taxonomy and biology of some parasites of fishes from Lesser Zab and Greater Zab rivers in north of Iraq. Ph. D. Thesis, Coll. Educ. (Ibn Al-Haitham), Univ. Baghdad: 153pp (In Arabic).
- [5] Abdullah, S.M.A. 2005. Parasitic fauna of some freshwater fishes from Darbandikhan Lake, north of Iraq. J. Dohuk Univ., 8(1): 29-35.
- [6] Al-Ali, Z.A.J.R. 1998. A study of some trematodes and its histopathological effects from three species of fish (family Cyprinidae) in Basrah province. M. Sc. Thesis, Coll. Agric., Univ. Basrah: 107pp (In Arabic).
- [7] Al-Awadi, H.M.H. 2003. Parasitic faunae (Protozoa and Monogenea) of six species of fish from Euphrates River near Kufa district (Najaf Al-Ashraf province), Iraq. Babylon Univ. J., Pure Appl. Sci., 8(3): 529-532.
- [8] Ali, M.D. and Shaaban, F. 1984. Some species of parasites of freshwater fish raised in ponds and in Tigris- Al-Tharthar canal region. Seventh Sci. Conf. Iraqi Vet. Med. Assoc., Mosul: 23-25 Oct. 1984: 44-46. (Abstract).
- [9] Ali, N.M.; Salih, N.E. and Abdul-Ameer, K.N. 1987. Parasitic fauna of some freshwater fishes from Tigris River, Baghdad, Iraq. II: Trematoda. J. Biol. Sci. Res., 18(2): 19-27.
- [10] Ali, N.M.; Mhaisen, F.T.; Abul-Eis, E.S. and Kadim, L.S. 1989. Helminth parasites of the mugilid fish *Liza abu* (Heckel) inhabiting Babylon fish farm, Hilla, Iraq. Proc. 5th Sci. Conf., Sci. Res. Council., 5(2): 225-233.
- [11] Al-Jadoaa, N.A.A. 2002. The parasitic infections and pathological changes of some local and cultured fishes from Al-Qadisiya and Babylon provinces. Ph. D. Thesis, Coll. Educ., Al-Qadisiya Univ., 158pp (In Arabic).
- [12] Al-Nasiri, F.S. 2003. First occurrence of the monogenetic trematode *Diplozoon nipponicum* Goto, 1891 in Iraq from common carp *Cyprinus carpio* (Pisces). Iraqi J. Agric. (Spec. Issue), 8(6): 95-99.

- [13] Al-Saadi, A.A.J.J. 2007. Ecology and taxonomy of parasites of some fishes and biology of *Liza abu* from Al-Husainia creek in Karbala province, Iraq. Ph. D. Thesis, Coll. Educ. (Ibn Al-Haitham), Univ. Baghdad: 155pp. (In Arabic).
- [14] Al-Sa'adi, B.A.; Mhaisen, F.T. and Al-Rubaie, A.-R.L. 2013. The first record of two monogeneans: *Dactylogyrus dogieli* Gussev, 1953 and *Octomacrum europaeum* Roman & Bykhovskii, 1956 from fishes of Iraq. Basrah J. Agric. Sci., 26 (Spec. Issue 1): 1-7.
- [15] Al-Salmany, S.O.K. 2015. Parasitic infection of some fish species from Euphrates River at Al-Qaim city, Anbar province. M. Sc. Thesis, Coll. Sci., Univ. Tikrit (Under preparation).
- [16] Al-Taei, N.T.M. 2013. Study of some of the environmental aspects for a group of the external parasitic animals for common carp *Cyprinus carpio* L. in cages and pond at Al-Saddah/ Babylon province. M. Tech. Thesis, Al-Musayab Technic. Coll., Found. Technic. Educ.: 117 pp (In Arabic).
- [17] Al-Zubaidy, A.B. 1998. Studies on the parasitic fauna of carps in Al-Furat fish farm, Babylon province, Iraq. Ph. D. Thesis, Coll. Sci., Univ. Babylon: 141pp (In Arabic).
- [18] Al-Zubaidy, A.B. 2007. First record of three monogenetic parasite species from Iraqi freshwater fishes. J. King Abdulaziz Univ., Mar. Sci., 18: 83-94.
- [19] Asmar, K.R.; Balasem, A.N.; Mhaisen, F.T.; Al-Khateeb, G.H. and Al-Jawda, J.M. 1999. Survey of the parasites of some fish species from Al-Qadisiya Dam Lake, Iraq. Ibn Al-Haitham J. Pure Appl. Sci., 12(1): 52-61.
- [20] Balasem, A.N.; Mhaisen, F.T.; Adday, T.K.; Al-Jawda, J.M. and Asmar, K.R. 2003. A second survey of parasitic infections in freshwater fishes from Al-Qadisiya Dam Lake, Euphrates River, Iraq. Mar. Mesopot., 18(2): 123-140. (In Arabic).
- [21] Buchmann, K. and Bresciani, J. 2006. Monogenea (Phylum Platyhelminthes). In: P.T.K. Woo (Ed.). Fish diseases and disorders, Vol. 1: Protozoan and metazoan infections, 2nd ed., CAB Int., Wallingford: 297-344.
- [22] Bykhovskaya-Pavlovskaya, I.E.; Gusev, A.V.; Dubinina, M.N.; Izyumova, N.A.; Smirnova, T.S.; Sokolovskaya, I.L.; Shtein, G.A.; Shul'man, S.S. and Epshtein, V.M. 1962. Key to parasites of freshwater fish of the U.S.S.R. Akad. Nauk, S.S.S.R., Moscow, 727pp (In Russian).
- [23] Eschmeyer, W.N. (Ed.) 2015. Species by family/ subfamily in the Catalog of fishes. <http://research.calacademy.org/research/ichthyology/Catalog/SpeciesByFamily.asp>. (Accessed March 2015).
- [24] Froese, R. and Pauly, E. (Eds.) 2015. FishBase. World Wide Web electronic publications, www.fishbase.org. (Accessed March 2015).
- [25] Gibson, D.I.; Timofeeva, T.A. and Gerasev, P.I. 1996. A catalogue of the nominal species of the monogenean genus *Dactylogyrus* Diesing, 1850 and their host genera. Syst. Parasitol., 35: 3-48.
- [26] Gusev, A.V. 1985. Parasitic metazoans: Class Monogenea. In: O.N. Bauer (Ed.). Key to the parasites of freshwater fish fauna of U.S.S.R., vol. 2. Nauka, Petersburg: 1-424. (In Russian).
- [27] Gusev, A.V.; Ali, N.M.; Abdul-Ameer, K.N.; Amin, S.M. and Molnár, K. 1993. New and known species of *Dactylogyrus* Diesing, 1850 (Monogenea, Dactylogyridae) from cyprinid fishes of the river Tigris, Iraq. Syst. Parasitol., 25: 229-237.
- [28] Harris, P.D.; Shinn, A.P.; Cable, J. and Bakke, T.A. 2004. Nominal species of the genus *Gyrodactylus* von Nordmann 1832 (Monogenea: Gyrodactylidae), with a list of principal host species. Syst. Parasitol., 59: 1-27.
- [29] Hussain, H.T. 2007. Survey of ectoparasites of some fishes of Al-Hilla River in Babylon province. J. Babylon Univ., Sci., 14(3): 228-232. (In Arabic).
- [30] Jalali, B.; Shamsi, S. and Molnár, K. 2000. New *Dactylogyrus* species (Monogenea: Dactylogyridae) from cyprinid fishes of Bahu-Kalat River in south east Iran. Acta Parasitol., 45: 289-294.
- [31] Khotenovsky, I. A. 1985. Suborder Octomacrinea Khotenovsky (Fauna of the USSR, Monogenea, New Series No. 132). Nauka Publishing House, Petersburg: 262pp (In Russian).
- [32] Kritsky, D.C.; Pandey, K.C.; Agrawal, N. and Abdullah, S.M.A. 2004. Monogenoids from the gills of spiny eels (Teleostei: Mastacembelidae) in India and Iraq, proposal of *Mastacembelocleidus* gen. n., and status of the Indian species of *Actinocleidus*, *Urocleidus* and *Haplocleidus* (Monogenoidea: Dactylogyridae). Fol. Parasitol., 51: 291-298.
- [33] Lim, L.H.S.; Timofeeva, T.A. and Gibson, D.I. 2001. Dactylogyridean monogeneans of the siluriform fishes of the Old World. Syst. Parasitol., 50: 159-197.
- [34] Margolis, L.; Esch, G.W.; Holmes, J.C.; Kuris, A.M. and Schad, G.A. 1982. The use of ecological terms in parasitology (Report of *ad hoc* committee of the American Society of Parasitologists). J. Parasitol., 68(1): 131-133.
- [35] Mhaisen, F.T. 1993. The role of wild fishes in fish farms of Iraq from parasitological and pathological points of view. Iraqi J. Vet. Med., 17: 126-136.
- [36] Mhaisen, F.T. 2015. Index-catalogue of parasites and disease agents of fishes of Iraq. (Unpublished: mhaisenft@yahoo.co.uk).
- [37] Mhaisen, F.T. and Abdul-Ameer, K.N. 2013. Checklists of *Gyrodactylus* species (Monogenea) from fishes of Iraq. Basrah J. Agric. Sci., 26 (Spec. Issue 1): 8-25.
- [38] Mhaisen, F.T. and Abdul-Ameer, K.N. 2014. Checklists of diplozoid species (Monogenea) from fishes of Iraq. Bull. Iraq Nat. Hist. Mus., 13(2): 95-111.
- [39] Mhaisen, F.T.; Ali, N.M.; Abul-Eis, E.S. and Kadim, L.S. 1988. First record of *Dactylogyrus achmerowi* Gussev, 1955 with an identification key for the dactylogyrids of fishes of Iraq. J. Biol. Sci. Res., 19(Suppl.): 887-900.
- [40] Mhaisen, F.T.; Balasem, A.N.; Al-Khateeb, G.H. and Asmar, K.R. 1997. Recording of five monogenetic trematodes for the first time from fishes of Iraq. Abst. 14th Sci. Conf., Iraqi Biol. Soc., Najaf: 11-13 March 1997.
- [41] Mhaisen, F.T.; Balasem, A.N.; Al-Khateeb, G.H. and Asmar, K.R. 2003. Recording of five monogenetic trematodes for the first time from fishes of Iraq. Bull. Iraq Nat. Hist. Mus., 10(1): 31-38.
- [42] Mohammad-Ali, N.R.; Balasem, A.N.; Mhaisen, F.T.; Salih, A.M. and Waheed, I.K. 1999. Observations on the parasitic fauna in Al-Zaafaraniya fish farm, south of Baghdad. Vet., 9(2): 79-88.

- [43] MonoDb 2015. MonoDb.org. A web-host for the Monogenea. (Accessed Mar. 2015).
- [44] Noga, E.J. 2010. Fish disease: Diagnosis and treatment, 2nd ed. Wiley-Blackwell, Hoboken, New Jersey, 519pp
- [45] Pugachev, O.N.; Gerasev, P.I.; Gussev, A.V.; Ergens, R. and Khotenowsky, I. (Eds.). 2009. Guide to Monogenoidea of freshwater fish of Palaearctic and Amur regions. Ledizioni Ledi Publishing, Milano: 567pp
- [46] Reed, P.; Francis-Floyd, R.; Klinger, R.E. and Petty, D. 2012. Monogenean parasites of fish. Institute of Food and Agricultural Sciences, University of Florida, FA28: 10pp (Original publication date June, 1996, Reviewed May 2009, Revised June 2012).
- [47] Sadek, A.A. 1999. Ectoparasites of the common carp (*Cyprinus carpio* L.) fingerlings intensively stocked during autumn and winter. M. Sc. Thesis, Coll. Educ. (Ibn Al-Haitham), Univ. Baghdad: 100pp (In Arabic).
- [48] Salih, N.E.; Ali, N.M. and Abdul-Ameer, K.N. 1988. Helminthic fauna of three species of carp raised in ponds in Iraq. J. Biol. Sci. Res., 19(2): 369-386.
- [49] Soo, O.Y.M. and Lim, L.H.S. 2012. Eight new species of *Ligophorus* Euzet & Suriano, 1977 (Monogenea: Ancyrocephalidae) from mugilids off Peninsular Malaysia. Raffles Bull. Zool., 60(2): 241-264.
- [50] Timofeeva, T.A.; Gerasev, P.I. and Gibson, D.I. 1997. A catalogue of the nominal species of the monogenean family Dactylogyridae Bychowsky, 1933 (excluding *Dactylogyryus* Diesing, 1850). Syst. Parasitol., 38: 153-158.