

Monogenean Infections on Some Fishes from Lesser Zab River, Kurdistan Region, Iraq

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Abstract

A total of 362 fishes, belonged to six species namely: *Barbus kersin*, *Capoeta trutta*, *Carassobarbus luteus*, *Cyprinion macrostomum*, *Cyprinus carpio* (Family Cyprinidae) and *Liza abu* (Family Mugilidae) were collected from Lesser Zab River, southeast of Koysinjaq City, east of Erbil Province, Kurdistan Region, Iraq, from April 2012 to the end of January 2013. The fishes were examined for monogenean parasites. The study revealed the existence of 14 monogenean species which included six species of *Dactylogyrus* (*D. barburli*, *D. baueri*, *D. elegantis*, *D. extensus*, *D. formosus* and *D. vistulae*), two species of *Dogilius* (*D. mokhayeri* and *D. persicus*), three species of *Gyrodactylus* (*G. elegans*, *G. khathrineri* and *G. sprostonae*), two species of *Paradiplozoon* (*P. homoion* and *P. tadjikistanicum*) and one species of *Microcotyle* (*M. donavini*). The record of *G. khathrineri* and *P. tadjikistanicum* in the present study are considered as the first record in Iraq, and *P. homoion* and *M. donavini* in Kurdistan Region. Also, three species of fishes were regarded as new hosts in Iraq for nine species of the studied monogeneans.

Keywords

Monogenea, Fishes, Lesser Zab River, Kurdistan Region, Iraq

1. Introduction

Class Monogenea (Phylum Platyhelminthes) includes small ectoparasites living on the skin, fins and gills of fishes. It represents the largest group of fish parasites with direct life cycles (Hoole *et al.*, 2001). Monogeneans possess a posterior organ of attachment known as the haptor. 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 (Gussev, 1985).

Monogeneans are important fish pathogens, especially for carp fingerlings under extensive fish culture practice and their direct life cycles and fish crowding are good conditions for their easy spread among fishes (Bauer, 1961). These worms cause irritation, excessive mucus production and create an open window for bacterial invasion (Reed *et al.*, 1996). Behavioral changes of infected fish may be restricted to lethargy, anorexia and seeking sheltered habitats. External macroscopic lesions and change of appearance may be

darkening of the skin and emaciated fins. Also, feeding activities of the worm impose epithelium damage (Woo and Buchmann, 2012).

The objectives of this work are to identify the monogeneans which infected some fishes from Lesser Zab River near Koysinjaq City in Kurdistan Region. Furthermore, to study the relationship between the infection with some species of monogeneans and their hosts.

2. Materials and Methods

Lesser Zab River is located in the northeast of Iraq. It is situated between 34°- 36° north latitude and 43°- 46° east longitude. This river is the largest tributary of the Tigris River with a length of 400 km. In the present study, the fishes were collected from the southern part of the Lesser Zab River, which is called Kanibi River, passing through Kanibi village, far about 35 km to the southeast of Koysinjaq City and 105 km of Erbil province, Kurdistan region, north of Iraq (Al-Sahaff, 1976).

A total of 362 fishes were collected by gill netting, cast

netting, electrofishing and hook by local commercial fishermen, during the period from April 2012 until the end of January 2013. The specimens were placed in container contains local river water, transferred to laboratory as soon as possible and were examined within 48 hours after their capture. Fishes were identified according to Coad (2010) and scientific names of fishes follow those provided in FishBase (Froese and Pauly, 2012). In the laboratory, the fishes were examined externally. Smears from skin, fins and buccal cavity were prepared by slight scraping and examined under a light compound microscope. The gill arches from both sides were separated, kept moist in Petri-dish and examined under dissecting microscope for counting monogenean parasites on each gill lamella, then were stained with aqueous neutral red, and permanent slides were prepared with glycerol-gelatin (Gushev *et al.*, 1993). Photography was done by photomicroscope type Olympus. Drawing was done by

using a camera Lucida. The measurement of parasites was achieved by ocular micrometer, and the terminology was used as recommended by Gushev (1985). Parasitic identification was done according to Bykhovskaya-Pavlovskaya *et al.* (1962) and Pugachev *et al.* (2010).

3. Results and Discussion

Fourteen species of monogenean parasites were recorded in the present study. These included six species of *Dactylogyrus*, two species of *Dogielius*, three species of *Gyrodactylus*, two species of *Paradiplozoon* and one species of *Microcotyle* (Table 1). The following is an account on the description and measurements of these parasites, especially those which were recorded here for the first time in Kurdistan region and in Iraq.

Table (1). The distribution of monogenean parasites from six fish hosts from Lesser Zab River.

Parasite	Host	No. of fishes		Prevalence (%)	Site of infection
		Examined	Infected		
<i>Dactylogyrus barbui</i>	<i>Barbus kersin</i> #	8	2	25	Gills
<i>D. baueri</i>	<i>Capoeta trutta</i> #	111	9	8.1	Gills
	<i>Cyprinus carpio</i>	19	11	57.8	Gills
<i>D. elegantis</i>	<i>C. trutta</i> #	111	48	43.2	Gills
<i>D. extensus</i>	<i>C. carpio</i>	19	2	10.5	Gills
<i>D. formosus</i>	<i>C. carpio</i> #	19	4	21	Gills
<i>D. vistulae</i>	<i>C. trutta</i> #	111	4	3.6	Gills
	<i>C. trutta</i>	111	29	26.1	Gills
<i>Dogielius mokhayeri</i>	<i>Cyprinion macrostomum</i> #	133	20	15	Gills
	<i>Carassobarbus luteus</i>	74	10	13.5	Gills
<i>D. persicus</i>	<i>C. macrostomum</i> #	133	9	6.8	Gills
<i>Gyrodactylus elegans</i>	<i>C. trutta</i> #	111	7	6.3	Gills and skin
<i>G. khathrineri</i> *	<i>C. carpio</i>	19	4	21.05	Gills
<i>G. sprostonae</i>	<i>C. trutta</i> #	111	11	9.9	Gills
<i>Paradiplozoon homoion</i> **	<i>C. macrostomum</i> #	133	14	10.5	Gills
<i>P. tadjikistanicum</i> *	<i>C. trutta</i>	111	11	9.9	Gills
<i>Microcotyle donavini</i> **	<i>Liza abu</i>	17	4	23.5	Gills

New host in Iraq.

* New record in Iraq.

** New record in Kurdistan Region.

3.1. *Dactylogyrus barbui* Gushev, Ali, Abdul-Ameer, Amin *et* Molnár 1993

This monogenean was recorded on the gills of *B. kersin* with a prevalence of 25% (Table 1). *D. barbui* was described as a new species on the gills of *B. barbulus* from Tigris River in Iraq (Gushev *et al.*, 1993). After that, it was recorded on the gills of *B. barbulus* and *B. xanthopterus* from Lesser Zab River, Darbandikhan Lake and Badinan River (Abdullah, 2002; Abdullah and Mhaisen, 2004; Abdullah, 2005; Bilal, 2006). According to the Mhaisen (2015), *D. barbui* is so far recorded on five different fish hosts in Iraq exclusive of *B. kersin*. So, *B. kersin* represents as a new host for *D. barbui* in Iraq.

3.2. *Dactylogyrus baueri* Gushev, 1955

This species was obtained from the gills of *C. trutta* and *C. carpio* with a prevalence of 8.1% and 57.8%, respectively

(Table 1). *D. baueri* was recorded for the first time in Iraq from *C. carpio* from Al-Zaafaraniya Fish Farm (Al-Aubaidi, 1999). After that, it was reported from *Carassius carassius* from the same farm (Salih *et al.*, 2000). In Kurdistan region, it was recorded from *C. carpio* in Lesser Zab River (Mama, 2012), and from *C. auratus* from Darbandikhan Lake (Abdullah, 2013). No further records are available for *D. baueri*. So, *C. trutta* is now considered as a new host for *D. baueri* in Iraq.

3.3. *Dactylogyrus elegantis* Gushev, 1966

This species was obtained from the gills of *C. trutta* with a prevalence of 43.2 % (Table 1). *D. elegantis* was recorded for the first time in Iraq from *Condrostoma regium* from Lesser Zab River (Abdullah, 2002). Also, it was recorded from *Squalius lepidus* from Darbandikhan Lake (Abdullah, 2013). No further host was reported after that. So, *C. trutta* in this study is considered as a new host for this parasite in Iraq.

3.4. *Dactylogyrus extensus* Mueller et Van Cleave, 1932

This monogenean was obtained from the gills of *C. carpio* with a prevalence of 10.5% (Table 1). *D. extensus* was recorded for the first time in Iraq from *C. carpio* from fish ponds in Suwairah and Latifiyah, south of Baghdad (Salih *et al.*, 1988). After that, it was reported from 16 different fish hosts (Mhaisen, 2015). In Kurdistan region, *D. extensus* was reported on the gills of *C. carpio* from Dokan Lake, Lesser Zab and Greater Zab rivers, Darbandikhan Lake and Ainkawa Fish Hatchery (Abdullah, 1990; Abdullah and Mhaisen, 2004; Abdullah, 2005; Al-Marjan and Abdullah, 2009).

3.5. *Dactylogyrus formosus* Kulwiec, 1927

This species was found from the gills of *C. carpio* with a prevalence of 21% (Table 1). *D. formosus* in the present study shows a great similarity with the specimens of Asmar *et al.* (2004), who recorded it for the first time in Iraq on the gills of *C. auratus* from some fish farm, south Baghdad. Later on, it was reported from the same host (*C. auratus*) from Darbandikhan Lake (Abdullah, 2013). No further record was reported for *D. formosus*. Therefore, *C. carpio* represents as a new host for this parasite in Iraq.

3.6. *Dactylogyrus vistulae* Prost, 1957

This parasite was recorded on the gills of *C. trutta* with a prevalence of 3.6% (Table 1). This parasite was recorded for the first time in Iraq on the gills of the *Leuciscus lepidus* from Lesser Zab and Greater Zab rivers (Abdullah, 2002). After that it was recoded on the gills of the same host from Darbandikhan Lake and Badinan River (Abdullah, 2005; Bilal, 2006). So, *C. trutta* in this study is considered as new host for this parasite in Iraq.

A total of 77 species of *Dactylogyrus* are so far known from different species of fishes in Iraq. Among these species, 46 species were recorded in Kurdistan Region, most of them

were found on the gills of cyprinid fishes (Mhaisen, 2015).

3.7. *Dogielius mokhayeri* Jalali et Molnár, 1990

This species was found on the gills of *C. trutta* and *C. macrostomum* with a prevalence of %18 and %21.8, respectively (Table 1). *Dogielius mokhayeri* was recorded for the first time in Iraq on the gills of the *Aspus vorax* from Greater Zab River (Abdullah, 2002; Abdullah and Mhaisen, 2005). Later on, it was reported from *B. luteus* and *C. trutta* from Darbandikhan Lake (Abdullah, 2013). No further host was reported for this worm. So, *C. macrostomum* is considered as a new host for this parasite in Iraq.

3.8. *Dogielius persicus* Molnár et Jalali, 1992

This monogenean was found on the gills *C. luteus* and *C. macrostomum* with a prevalence of 13.5% and 6.8%, respectively (Table 1). This parasite was recorded for the first time in Iraq on the gills of the *B. luteus* in Greater Zab River (Abdullah, 2002; Abdullah and Mhaisen, 2005). Also, it was recorded on the gills of *B. barbustus* and *B. sharpeyi* from Euphrates river near Al-Musaib city (Al-Sa'adi, 2007), and from *B. grypus* from Darbandikhan Lake (Abdullah, 2013). So, *C. macrostomum* is considered as a new host for *D. persicus* in Iraq.

3.9. *Gyrodactylus elegans* Nordmann, 1832

This worm was found on skin and gills of *C. trutta* with a prevalence of 6.3% (Table 1). This species was reported for the first time in Iraq on the skin of *C. carpio* and *Liza abu* from Al-Zaafaraniya Fish Farm (Ali and Shaaban, 1984). After that, it was reported on 22 fish species exclusive of *C. trutta*. So, *C. trutta* represents a new host for *G. elegans* in Iraq (Mhaisen, 2015). In Kurdistan region, it was reported on *C. carpio* from Lesser Zab River, Darbandikhan Lake and Ainkawa Fish Hatchery (Abdullah and Mhaisen, 2004; Abdullah, 2005; Al-Marjan and Abdullah, 2009, respectively).

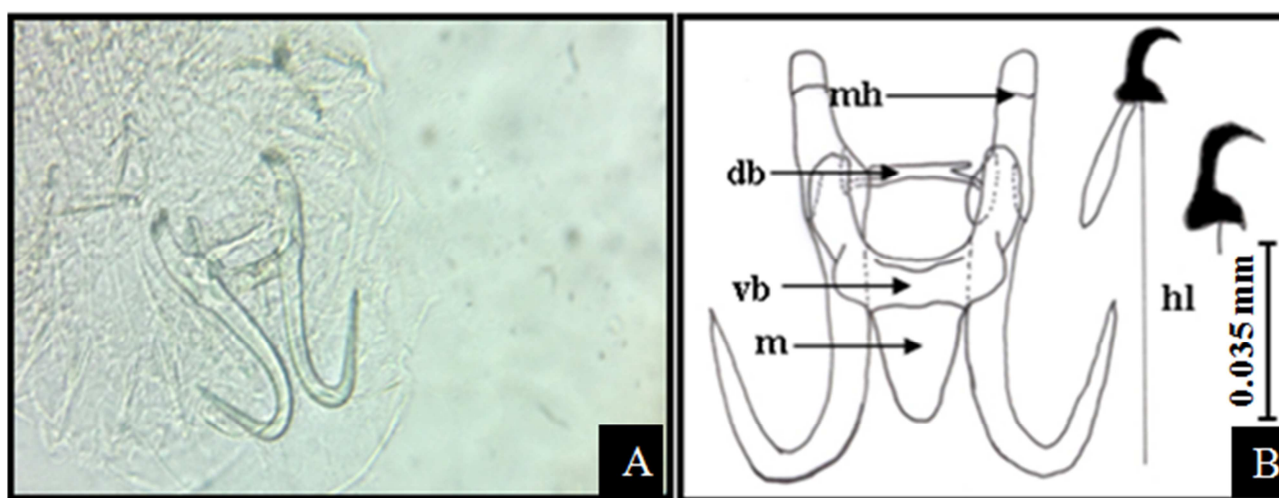


Fig. (1). *Gyrodactylus kathariner*. Photomicrograph of the haptor (350X). B- Camera Lucida of the haptor: db= dorsal bar, hl= hooklet, m= membrane, mh= median hook, vb= ventral bar.

3.10. *Gyrodactylus katharineri* Malmberg, 1964

This parasite was found on skin and gills of *C. carpio* with a prevalence of 10.5% (Table 1). Body length 0.7-0.9 mm and width 0.20-0.25 mm. Total length of hooklets 0.045-0.050 mm. Total length of median hooks 0.075-0.090 mm, main part 0.050-0.075 mm, point 0.025-0.045 mm, inner root 0.015-0.025 mm. Size of dorsal bar 0.002-0.005 x 0.025-0.040 mm, membrane 0.018-0.040 mm. Size of ventral bar 0.008-0.011 x 0.033-0.045mm (Fig. 1).

The description and measurement of the present specimen are similar to those reported by Pugchev *et al.* (2010) for *G. katharineri* found on gill filaments of *C. carpio*, *Carassius carassius*, *C. auratus* and other cyprinids throughout Europe and Asia. This parasite was never reported from any fish species in Iraq before. Therefore, the present recording is considered to be the first one in Iraq.

3.11. *Gyrodactylus sprostonae* Ling, 1962

This worm was found on skin and gills of *C. trutta* with a prevalence of 9.9% (Table 1). The present worm shows a great similarity with the specimens of Al-Zubaidy (1998),

who recorded *G. sprostonae* for the first time in Iraq on the gills of *C. carpio* and *L. abu* from Al-Furat Fish Farm. After that, it was reported from six different fish hosts excluding *C. trutta* (Mhaisen, 2015). So, *C. trutta* represents now a new host for this parasite in Iraq. In Kurdistan region, it was recorded on the gills of both *C. auratus* and *C. carpio* from Darbandikhan Lake (Abdullah, 2013).

The first information on genus *Gyrodactylus* from the Iraq freshwater fishes was given by Ali and Shaaban (1984), who recorded *G. elegans* from *C. carpio* and *L. abu* from Al-Zaafaraniya Fish Farm in Baghdad. By recording two species of *Gyrodactylus* (*G. katharineri* and *G. schulmani*) in the present study, the total of 22 species of *Gyrodactylus* becomes known in Iraq (Mhaisen, 2013). Among this number, only 15 species were recorded in Kurdistan namely: *G. baicalensis*, *G. barbi*, *G. cyprini*, *G. elegans*, *G. gobioninum*, *G. katharineri*, *G. kherulensis*, *G. longoacuminatus*, *G. gussevi*, *G. medius*, *G. molnari*, *G. paralatus*, *G. schulmani*, *G. sprostonae* and *G. vicinus*. All of them (except *G. gussevi*) were found on *C. carpio* (Abdullah and Mhaisen, 2004; Abdullah, 2005; Al-Marjan and Abdullah, 2009; Mama, 2012; Abdullah, 2013).

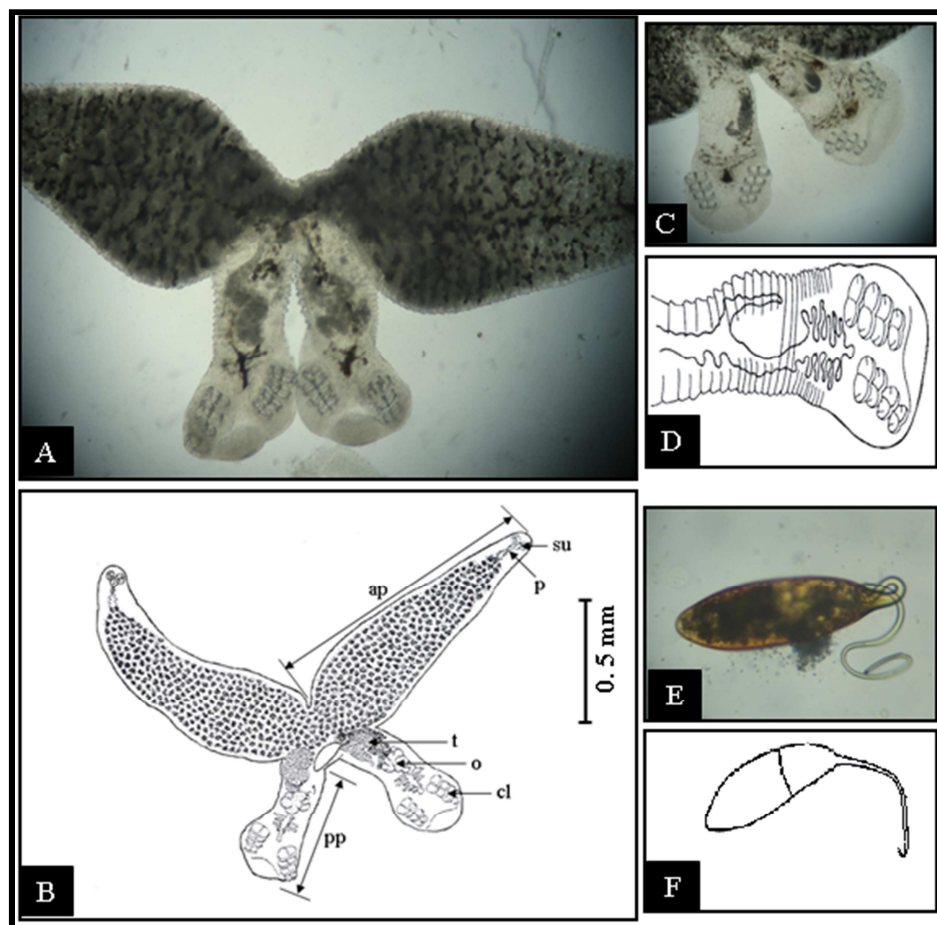


Fig. (2). *Paradiplozoon homoion*. A- Photomicrograph of whole mount worm (30x). B- Camera Lucida of drawing the whole mount worm. C- Photomicrograph of attaching disc. D- Camera Lucida drawing of attaching disc. E- Photomicrograph of egg (250x). F- Camera Lucida drawing of egg. ap= anterior part, cl= clamp, o= ovary, p= pharynx, pp= posterior part, su= sucker, t= testis.

3.12. *Paradiplozoon homoion* (Bychowsky *et* Nagibina, 1959)

This species was found on the gills of *C. macrostomum* with a prevalence of 10.5% (Table 1). Body length 1.8-5.2 mm, anterior part 0.8-3.0 mm, posterior part 0.5-2.0 mm. Size of clamps 0.05-0.09 x 0.09-0.21 mm. The anterior end of the median sclerite slightly broadened, fish tail shaped and connected to the clamp jaws by two sclerites. Lateral edges of the posterior end of the median sclerite are rounded. Length of hooks anchors 0.018-0.022 mm, handles 0.038-0.047 mm. Diameter of sucker 0.05-0.08 mm, pharynx 0.04-0.07 mm. Intestine near its posterior end has few lateral diverticula. Testis lobed. Size of eggs 0.26-0.30 x 0.08-0.12 mm (Fig. 2).

The above description and measurement are similar to those reported by Al- Saadi *et al.* (2009), who recorded it for

the first time in Iraq on the gills of *B. xanthopterus* from Al-Husainia creek, Karbala province. No further host was reported for this monogenean. So, *C. macrostomum* is considered as a new host for this parasite in Iraq. Also, the recording of *P. homoion* represents the first record of this worm in Kurdistan region.

3.13. *Paradiplozoon tadzhikistanicum* (Gavrilova *et* Dzhililov, 1965)

This species was found on the gills of *C. trutta* with a prevalence of 9% (Table 1). Body length 3.4-4.4 mm, anterior part 1.6-2.6 mm, posterior part 1.0-1.4 mm. Size of clamps 0.07-0.010 x 0.09-0.012 mm. Length of hooks anchors 0.023-0.026 mm, handles 0.05-0.06 mm. Diameter of sucker 0.06-0.09 mm, pharynx 0.06-0.08 mm. Intestine lacks lateral projections in the posterior part of the body. Testis lobed. Size of eggs 0.03-0.040 x 0.14 mm (Fig. 3).



Fig. (3). *Paradiplozoon tadzhikistanicum*, A- Photomicrograph (50X). B- Camera Lucida drawing.

The description and measurement of the present specimen are similar to those reported by Pugchev *et al.* (2010) for *Paradiplozoon tadzhikistanicum* which was found on gill filaments of *Capoeta capoetasevangi*, *C. c heratensis*, *Barbus lacerta*, *Luciobarbus* and *L. brachycephals* in rivers of south Caspian and Aral seas. This parasite has never been reported from any fish species in Iraq before. Therefore, the present record is considered to be the first record in Iraq.

The index-catalogue of parasites and disease agents of fishes of Iraq includes 13 species of *Paradiplozoon*, one species of *Diplozoon* and one species of *Eudiplozoon* (Mhaisen and Abdul-Ameer, 2014). In Kurdistan region, only *P. barbi*, *P. kasimi*, *P. cyprinid* and *P. pavloskii* were recorded from Dokan Lake, Lesser Zab River and Greater Zab River (Abdullah, 1990; Abdullah and Mhaisen, 2004; Mama, 2012).

3.14. *Microcotyle donavini* van Benden *et* Hesse, 1863

This parasite was found on the gills of *L. abu* with a prevalence of 21% (Table 1). Body lanceolate, length 4-4.5 mm. Opisthohaptor triangular with row of 8-12 small clamps of uniform structure commencing behind the level of

the testis and projecting backward beyond body proper, terminal anchors absent. The two lateral (buccal) suckers length 0.07 mm, esophagus simple with lateral diverticula. Intestine crura do not extend in to haptor and are not united posteriorly. Testes are numerous, about 20- 30, the ovary looped with distal end and directed backward, median, pretesticular (Fig. 4).



Fig. (4). Photomicrograph of the *Microcotyle donavini* (30X).

The classification was confirmed due to the confidence of the characters described here with those reported by Ali *et al.* (1989), who recorded it from *L. abu* from Babylon Fish Farm near Hilla city. After that, *M. donavini* was reported from ten different fish hosts (Mhaisen, 2015). This is the first record of *M. donavini* in Kurdistan region.

4. Conclusions

During this study, 14 species of monogeneans were recorded from fishes obtained from Lesser Zab River near Koysinjq city. Among these parasites two species have been recorded for the first time in Iraq (*Gyrodactylus katharineri* and *Paradiplozoon tadzhikistanicum*) and two species in Kurdistan Region (*Paradiplozoon homoion* and *Micocotyle donavini*). Four species of fishes are regarded as new hosts in Iraq for ten species of monogeneans. The fish *C. trutta* was more infected with parasites (seven species) while, *B. kersin* and *L. abu* were less infected (one species).

References

- [1] Abdullah, S. M. A. 1990. Survey of the parasites of fishes from Dokan Lake. M. Sc. Thesis, Coll. Sci., Univ. Salahaddin: 115pp (In Arabic).
- [2] 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).
- [3] Abdullah, S. M. A. 2005. Parasitic fauna of some freshwater fishes from Darbandikhan Lake, north of Iraq. J. Dohuk Univ., 8(1): 29-35.
- [4] Abdullah, S. M. A. and Mhaisen, F. T. 2004. Parasitic infections with monogenetic trematodes on fishes of Lesser Zab and Greater Zab rivers in northern Iraq. Zanco, 16(4): 43-52.
- [5] Abdullah, S. M. A. and Mhaisen, F. T. 2005. The first record of three species of *Dogielius* (Monogenea) from three cyprinid fishes from the Greater Zab River, north of Iraq. Ibn Al-Haitham J. Pure Appl. Sci., 18(3): 7-12.
- [6] Abdullah, Y. S. 2013. Study on the parasites of some fishes from Darbandikhan Lake in Kurdistan region, Iraq. M. Sc. Thesis, Sci. Coll., Univ. Sulaimani: 115pp
- [7] Al-Aubaidi, I. K., Mhaisen, F. T. and Balasem, A. N. 1999. The external parasites of the common carp (*Cyprinus carpio*) in Al-Zaafaraniya Fish Farm, Baghdad. Ibn Al-Haitham J. Pure Appl. Sci., 12(1): 32-40.
- [8] Ali, M. D. and Shaaban, F. 1984. Some species of parasites of freshwater fish raised in ponds and Tigris-Al-Tharthar canal region. 7th Sci. Conf., Iraqi Vet. Med. Ass., Mosul. (Abstract).
- [9] Ali, N. M., Mhaisen, F. T., Abul-Eis, S. E. 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.
- [10] Al-Marjan, K. S. N. and Abdullah, S. M. A. 2009. Some ectoparasites of the common carp (*Cyprinus carpio*) in Ainkawa Fish Hatchery, Erbil province, Duhok, J. Duhok Univ. (Special Issue), 14(1): 102-107.
- [11] Al-Saadi, A. A. J., Mhaisen, F. T. and Hassan, H. R. 2009. Description of five monogenetic trematodes for the first time from fishes of Iraq. Iraqi J. Agric., (Special Issue), 14(1): 187-193.
- [12] Al-Sa'adi, B. A.-H. E. 2007. The parasitic fauna of fishes of Euphrates River: Applied study in Al-Musaib city. M. Sc. Thesis, Al-Musaib Technical Coll., Found. Tech. Educ.: 102pp (In Arabic).
- [13] Al-Sahaff, M. 1976. Water resources in Iraq and maintenance of pollution. Freedom House Print, Baghdad: 307 pp
- [14] 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).
- [15] Bauer, O. N. 1961. Relationships between host fishes and their parasites. In: V. A. Dogiel, G. K. Petrushevski and Yu. I. Polyanski (Eds.). Parasitology of fish (Engl. Transl.). Oliver and Boyd Ltd., Edinburgh and London: 84-103.
- [16] Bilal, S. J. 2006. Parasitic fauna of some cyprinid fishes from Bahdinan River in Kurdistan region- Iraq. M. Sc. Thesis, Coll. Educ., Univ. Salahaddin: 90 pp
- [17] 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).
- [18] Coad, B. W. 2010. Freshwater fishes of Iraq. Pensoft Publisher, Sofia: 275pp+ 16pls
- [19] Froese, R. and Pauly, D. 2012. FishBase. World web electronic publication. www.Fishbase.org. (4/ 2012).
- [20] Gussev, A. V. 1985. Parasitic metazoans: class Monogenea In: O. N. Bauer. (Ed.). Key to the parasites of freshwater fish fauna of the U. S. S.R. Nauka, Leningrad 2: 1-42.
- [21] Gussev, 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 Tigris river, Iraq. Syst. Parasitol., 25(3): 229-237.
- [22] Hoole, D., Bucke, D., Burgess, P. and Wellby, I. 2001. Disease of carp and other cyprinid fishes. A catalogue record for this title is available from the British Library ISBN 0-85238-252-9: 79-81.
- [23] Mama, K. S. 2012. A comparative study on the parasitic fauna of the common carp *Cyprinus carpio* from Ainkawa Fish Hatchery (Erbil) and Lesser Zab River in Kurdistan region, Iraq. M. Sc. Thesis, Coll. Educ., Univ. Salahaddin: 89pp
- [24] Mhaisen, F. T. 2015. Index-catalogue of parasites and disease agents of fishes of Iraq. (Unpublished: mhaisenft@yahoo.co.uk).
- [25] 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.
- [26] Pugachev, O. N., Gerasev, P. I., Gussev, A. V., Ergens, R. and Khotenowsky, I. 2010. Guide to monogenoidea of freshwater fish of Palaearctic and Amur regions. Ledizioni Ledi Publishing, Milano: 567pp

- [27] Reed, P., Francis-Floyd, R., Klinger, R. E. and Petty, D. 1996. 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).
- [28] Salih, A. M., Balasem, A. N., Al-Jawda, J. M., Asmar, K. R. and Mustafa, S. R. 2000. On a second survey of fish parasites in Al-Zaafaraniya Fish Farm - Baghdad. J. Diyala, 1(8 Part 1): 220-238.
- [29] 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.
- [30] Woo, P. T. K. and Buchmann, K. (Eds.). 2012. Fish parasites: Pathology and protection. CAB Int., Wallingford: 383pp