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Effects of Sex and Length of *Cyprinus carpio* from Lesser Zab River in Northern Iraq, and Seasonal Variations on the Infection with some Parasites

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ABSTRACT

A total of 300 fishes belonging to *Cyprinus carpio* were collected from the Lesser Zab river near Alton-Kupri town, south of Erbil city in northern Iraq, during the period from November 2000 until the end of October 2001. Fishes were infected with the monogenetic trematode *Dactylogyrus minutus*, the cestode *Bothriocephalus acheilognathi* and the larval stage of the nematode *Contracaecum* sp.. No significant differences were noted in the infection of male and female fishes with these parasites. The infection with *D. minutus* was decreased with the increase of fish length, while the infection with *Contracaecum* sp. was increased, but the infection with *B. acheilognathi* was not affected with fish length groups. The infection with these three parasites showed monthly fluctuations. Generally, it was high during spring and summer and low during autumn and winter.

تأثير جنس وطول سمكة الكارب الاعتيادي *Cyprinus carpio* من نهر الزاب الصغير في شمالي العراق، والتغايرات الفصلية على الإصابة ببعض الطفيليات

الملخص

تم جمع 300 نموذجا من سمكة الكارب الإعتيادي *Cyprinus carpio* من نهر الزاب الصغير عند مدينة التون كوبري في جنوب مدينة أربيل في شمال العراق، خلال المدة من شهر تشرين الثاني 2000 ولغاية نهاية تشرين الأول 2001. كانت الأسماك مصابة بالمخرّم أحادي المنشأ *Dactylogyrus minutus*، والدودة الشريطية *Bothriocephalus acheilognathi* والطور اليرقي للدودة الخيطية *Contracaecum* sp. لم تظهر فروق معنوية في إصابة ذكور وإناث الأسماك بالطفيليات الثلاثة. إنخفضت الإصابة بالمخرّم أحادي المنشأ *D. minutus* بزيادة طول الأسماك، بينما إزدادت الإصابة بالدودة الخيطية *Contracaecum* sp. بزيادة طول الأسماك، في حين لم تتأثر الإصابة بالدودة الشريطية *B. acheilognathi* بمجاميع طول الأسماك. شهدت الإصابة بهذه الطفيليات تذبذبات شهرية. عموماً كانت الإصابة عالية خلال أشهر الربيع والصيف، وواطئة خلال أشهر الخريف والشتاء.

INTRODUCTION

Cyprinus carpio, is considered as one of the most important fishes farmed in different parts of the world in general and in Iraq particular. There are many studies on the parasites of these farm fishes, which are widely spread in the middle and south of Iraq (Salih et al., 2000; Al- Nasiri et al., 2002; Al- Jadoaa, 2002). It is known that *C. carpio* was farmed in Dokan lake of north Iraq since 1970, and was distributed quickly in this lake and then in the rivers and creeks which are connected with this lake including Lesser Zab river (Abdullah, 1990).

In Iraq, some biological and ecological information about the parasites of freshwater fishes were published. Information reported in such investigations included the seasonal changes of infection with host age, site of attachment, geographical distribution, and correlation of infestation with host sex from the river Tigris in Mosul city (Fattohy, 1975; Kasim et al., 1977; Kasim and Rahemo, 1981), from Shatt Al-Arab river in Basrah city (Al-Hadithi and Jawad, 1975; Habish, 1977; Al-Hadithi et al., 1980), from Mehaijeran creek in Basrah city (Khamees, 1983; Khamees and Mhaisen, 1988), from Al-Hammar marsh in Basrah (Al-Daraji, 1986; Mohamad, 1989), from Greater Zab river near Erbil city (Ali, 1989), from the Qarmat Ali river north of Basrah city (Khamees, 1996), from Bahr Al-Najaf depression (Al-Awadi, 1997), from the Euphrates river (Al-Alusi, 1998) and from Dokan lake (Abdullah and Ali, 1999).

There is only one study on the ecology of parasites of *C. carpio* in fish farms of Iraq (Al-Zubaidy, 1998). No previous account was published on the ecology of parasites of this fish in natural environment in Iraq. So, the present study is concerned with this subject.

MATERIALS AND METHODS

Samples of fishes belonging to *C. carpio* were collected from the Lesser Zab river near Alton-Kupri town, about 45 km south of Erbil city in northern Iraq. Fishes were collected by gill-netting, cast-netting or electrofishing twice monthly, during the period from November 2000 until the end of October 2001.

Some fishes were kept in a cool box with river water and transferred to the laboratory as soon as possible and were examined within 24 hours after their capture. However, some specimens were deeply frozen and examined within one week.

In the laboratory, alive fish sample was sacrificed by pithing. Their total length, standard length and weight were measured and sex was detected. Gills from both sides were separated, kept moist in Petri dish and examined under an Olympus dissecting microscope for counting *Dactylogyrus* on each gill lamella. The fishes were opened from the abdominal site, the body cavity, stomach, intestine, kidneys, liver and muscles were all searched for parasites (Amlacher, 1970). Encapsulated nematode larvae were isolated from the intestine and from their walls, and they were liberated in physiological saline with a pin under dissecting microscope, fixed with hot 10% formalin, cleared in lactophenol, mounted in glycerin-jelly, and observed (Chai et al., 1986).

Fish samples were divided into four different length groups (less than 11 cm, 11-20 cm, 21-30 cm and more than 30 cm).

The terms of percentage incidence, mean intensity and abundance of infection were used to denote the percentage of infected hosts in a sample, the number of specific parasite recovered from any one infected host and the number of specific parasite recovered from examined hosts (infected and uninfected), respectively (Margolis et al., 1982). For testing differences in prevalence, intensity and abundance of infection between fish sexes and length groups, two tests (t- test and Complete randomized designs) were conducted (Campbell, 1976).

RESULTS AND DISCUSSION

A total of 300 *C. carpio* were collected during the present study. Gills of these fishes were infected with *D. minutus*, the intestine was infected with *B. acheilognathi* and the intestine and her wall were infected with the cysts of *Contracaecum* sp.. The overall incidences of these parasites were 44.3%, 9.6% and 33.3%, respectively (Table 1).

Males and females of *C. carpio* showed no significant differences in their infection with these three parasites ($t=0.05$ for *D. minutus*, $t=0.22$ for *B. acheilognathi* and $t=0.64$ for *Contracaecum* sp. at $P<0.05$) (Table 1). For this reason, data for both sexes was pooled. The present result agrees with a statement given by Kennedy (1975) that many workers showed the absence of any differences in the infection of both sexes with most parasites. However, the same author gave some examples on the presence of such differences. This result also confirms observations noted by Khamees and Mhaisen (1988) on *Contracaecum* sp. from Mehaijeran creek in Basrah city, by Al-Zubaidy (1998) on *D. vastator* from carps in Al-Furat fish farm, by Al-Alusi (1998) on *Microcotyle donavini* of *Liza abu* in Alus region, upper Euphrates river, by Abdullah and Ali (1999) on *Neoechinorhynchus rutili* of *Barbus esocinus* in Dokan lake and by Abdullah and Mhaisen (2003) on *Ergasilus barbi* of *Barbus luteus* in Greater Zab river .The similarity of the food and feeding habits of male and female *C. carpio* and their occupancy of the same habitat (Dogiel, 1961) may give an evidence on the absence of any differences in the parasitic fauna acquired with food of both sexes. Living in the same habitat and the absence of the morphological differences between both sexes of fishes provides evidences on the similarity of the infection with parasites. However, some authors gave examples on the presence of such differences between males and females (Amin, 1984; Measures, 1988) due to differences in food behaviour and morphological differences between both sexes.

The present results in this study showed that the relationship between the infection with these parasites and length of fishes can be divided into three groups:-

Group 1: In this group the statistical analysis showed no significant differences at the level of 0.05 between the groups of fish length groups with *B. acheilognathi* (Table 2). In connection with changes in the percentage incidence of infection of *C. carpio* with *B. acheilognathi* of the present study, it was not possible to demonstrate the reasons because the infection of fishes was generally low (9.6%).

Group 2: In this group the infection with *D. minutus* was decreased with the increase of fish length. The statistical analysis showed significant differences at the level of 0.05 between the groups of fish length except the group of 11–20 cm. Which showed an increase in the infection, but the other two larger groups (21–30 and more than 30cm) testify clear decreasing in the infection (Table 2). The interpretation given by Amlacher (1970) and Duijn (1973) is that the small fishes are more susceptible to infection with this

parasite in comparison with the large fishes. Similar trends of the fluctuations in percentage incidence were noted in case of *D. legionensis* from *B. barbus bocagei* in spain (Gonzalez-Lanza and Alvarez-Pellitero, 1982).

Group 3: In this group the infection with *Contracaecum* sp. was increased with the increase of fish length (Table 2). The statistical analysis showed significant differences at the level of 0.05 between the groups of fish length. The abundance of infection was high in the largest fish length group (2.8-0.4). The increase in the infection with *Contracaecum* sp. can be attributed to the accumulation of the infective stages consumed with the intermediate host as these parasites encyst in the fish body and stay there. This agrees with the results found by numerous researchers in Iraq for *Contracaecum* sp. in *L. abu* (Habish, 1977; Al-Awadi, 1997; Al-Hadithi andHabish, 1977; Mhaisen et al., 1988), and in *B. luteus* (Khamees and Mhaisen, 1988).

The infection with *D. minutus* showed clear monthly fluctuations. The statistical analysis showed significant differences at the level of 0.05. The abundance of infection was the highest during June (6.0 ± 1.1), and the lowest infection was during December (0.3 ± 0.2) as shown in (Table 3). Here it is inevitable to mention that the infection with this parasite was increased in spring and summer because it reproduces during these seasons, when it either deposits eggs directly into the water. The motile ciliated larvae hatch out and after a short free-swimming period settle on the fish, on which they reach the stage of sexual maturity (Kennedy, 1975). Similar trends in the fluctuations in percentage incidence were noted in case of *D. vastator* from carps in Al-Furat fish farm, Babylon province (Al-Zubaidy, 1998). Al-Alusi (1998) indicated that the infection of *L. abu* with the monogenian *Microcotyle donavini* was high in summer. Also, Mo (1992; 1997) attributed the infection of *Salmo salar* with *Gyrodactylus salaris* and *G. derjavini* in the river Batnfjordselva, Norway was also high in summer. Chapman et al. (2000) indicated that the infection of *Barbus neumayeri* with the monogenian *Neodiplozoon polycotyleus* was high in summer in western Uganda.

In connection with the infection with *B. acheilognathi*, the statistical analysis showed significant differences at the level of 0.05. The abundance of infection was high during May (0.9 ± 0.3) and low during December, February, March and October (0.04 ± 0.04) as shown in (Table 4). The infection with this cestode increased during spring and summer due to the increase in the feeding activity of the fish on the intermediate host (crustacea) of these worms (Olsen, 1974). Watson and Dick (1980) demonstrated that the high infection of the pike *Esox lucius* with the cestode *Diphyllobothrium* sp. in Southern Indian lake in Canada was during spring and summer.

The infection of *C. carpio* with *Contracaecum* sp. showed significant differences at the level of 0.05. The abundance of infection was highest during July (4.7 ± 0.6), and lowest during January (0.1 ± 0.1) as shown in (Table 5). The increase in infection with *Contracaecum* sp. during spring and summer was as a result of abundance of a large number of migratory water birds (the definitive hosts) in the area and the increase in the feeding activity of the fishes. The low infection during the period from September to February can be attributed to both lower feeding activity of the fishes and the rarity of larval stages that infect fishes (Moravec et al., 1997). Similar trends in the fluctuations in percentage incidence were noted in case of *Contracaecum* sp. from *L. abu* (Habish, 1977), from *B. luteus* (Khamees, 1983; Khamees and Mhaisen, 1988) and from *L. abu* (Al-Awadi, 1997).

Table 1: Changes of the infection of different sexes of *C. carpio* with three species of parasites from the Lesser Zab river.

Parasite species	Fish sex	No. fish examined	No. fish infected	Incidence (%)	No. parasites	Mean intensity	Abundance
D. minutus	Male	145	61	42.1	335	5.5	2.3
	Female	155	72	46.5	355	4.9	2.3
	Both	300	133	44.3	690	5.2	2.3
B. acheilognathi	Male	145	15	10.3	29	1.9	0.2
	Female	155	14	9.0	34	2.4	0.2
	Both	300	29	9.6	63	2.2	0.2
Contracaecum sp.	Male	145	50	34.5	225	4.5	1.6
	Female	155	50	32.3	212	4.2	1.4
	Both	300	100	33.3	436	4.4	1.5

Table 2: Changes of the infection of different length groups of *C. carpio* with three species of parasites from the Lesser Zab river.

Parasite species	Fish length group (cm)	No. fish examined	No. fish infected	Incidence (%)	No. parasites	Mean intensity	Abundance
D. minutus	> 11	82	31	37.8	121	3.9	1.5 ± 0.3
	11 – 20	109	65	59.6	428	6.6	3.9 ± 0.5*
	21 – 30	77	33	42.9	133	4.0	1.7 ± 0.3
	< 30	32	4	12.5	8	2.0	0.3 ± 0.1
B. acheilognathi	> 11	82	7	8.5	13	1.9	0.2 ± 0.1
	11 – 20	109	9	8.3	28	3.1	0.3 ±0.1
	21 – 30	77	10	13.0	17	1.7	0.2 ± 0.1
	< 30	32	3	9.4	5	1.7	0.2 ± 0.1
Contracaecum sp.	> 11	82	18	22.0	62	3.4	0.8 ± 0.2
	11 – 20	109	36	33.0	135	3.8	1.2 ± 0.2
	21 – 30	77	31	40.3	151	4.9	1.2 ± 0.3
	< 30	32	15	46.9	89	5.9	2.8 ± 0.4*

* Highest infection
LSD = 0.36 for *D. minutus*.
LSD = 0.27 for *Contracaecum* sp..

Table 3: Monthly fluctuations of the infection of *C. carpio* with *D. minutus* from the Lesser Zab river.

Month	No. fish examined	No. fish infected	Incidence (%)	No. parasites	Mean intensity	Abundance
Nov. 2000	25	6	24	21	3.5	0.8 ± 0.3
Dec.	25	3	12	7	2.3	0.3 ±0.2
Jan. 2001	25	10	40	24	2.4	1.0 ± 0.3
Feb.	25	6	24	25	4.2	1.0 ± 0.4
Mar.	25	15	60	70	4.7	2.8 ± 0.6
Apr.	25	18	72	103	5.7	4.1 ± 0.7
May	25	16	64	85	5.3	3.4 ± 0.8
June	25	18	72	149	8.3	6.0 ± 1.1*
July	25	16	64	92	5.8	3.7 ± 0.7
Aug.	25	10	40	56	5.6	2.2 ±0.7
Sept.	25	9	36	33	3.7	1.3 ±0.5
Oct.	25	6	24	25	4.2	1.0 ±0.5

* Highest infection LSD = 0.34

Table 4: Monthly fluctuations of the infection of *C. carpio* with *B. acheilognathi* from the Lesser Zab river.

Month	No. fish examined	No. fish infected	Incidence (%)	No. parasites	Mean intensity	Abundance
Nov. 2000	25	0	0	0	0	0
Dec.	25	1	4	1	1	0.04 ±0.04
Jan. 2001	25	0	0	0	0	0
Feb.	25	1	4	1	1	0.04 ±0.04
Mar.	25	1	4	1	1	0.04 ±0.04
Apr.	25	4	16	7	1.8	0.3 ± 0.1
May	25	8	32	32	4	0.9 ± 0.3*
June	25	5	20	11	2.2	0.4 ± 0.2
July	25	4	16	9	2.3	0.4 ± 0.2
Aug.	25	2	8	4	2	0.2 ± 0.1
Sept.	25	2	8	6	3	0.2 ± 0.2
Oct.	25	1	4	1	1	0.04 ±0.04

* Highest infection LSD = 0.0.07

Table 5: Monthly fluctuations of the infection of *C. carpio* with *Contracaecum* sp. from the Lesser Zab river.

Month	No. fish examined	No. fish infected	Incidence (%)	No. parasites	Mean intensity	Abundance
Nov. 2000	25	5	20	17	3.4	0.3±0.7
Dec.	25	4	16	14	3.5	0.3±0.6
Jan. 2001	25	2	8	3	1.5	0.1±0.1
Feb.	25	6	24	21	3.5	0.3±0.8
Mar.	25	8	32	37	4.6	0.6±1.5
Apr.	25	8	32	29	3.6	0.4±1.2
May	25	10	40	39	3.9	0.4±1.6
June	25	16	64	80	5	0.6±3.2
July	25	21	84	118	5.6	4.7 ± 0.6*
Aug.	25	12	48	45	3.8	0.5±1.8
Sept.	25	3	12	7	2.3	0.2±0.3
Oct.	25	5	20	27	5.4	0.5±1.1

* Highest infection LSD = 0.24

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