POPULATION BIOLOGY OF WORM CATARACT DUE TO METACERCARIAE OF *Diplostomum spathaceum* (Rud., 1819) FROM TWO CYPRINID FISHES IN GREATER ZAB RIVER, NORTH OF IRAQ

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ABSTRACT

During the period from November 2000 until the end of October 2001, a total of 336 cyprinid fishes: 216 *Barbus luteus* and 120 *Cyprinion macrostomum,* were collected from Greater Zab river, north of Iraq. They were infected with the metacercariae of *Diplostomum spathaceum*. The prevalence of infection was 54.2% for *B. luteus* and 65% for *C. macrostomum*. No significant differences were observed in the infection of male and female fishes of both species with this parasite. Prevalence, mean intensity and mean abundance of infection with *D. spathaceum* increased with the increase in length of both fish species. The infection with this worm was high during spring and summer and low during autumn and winter.

INTRODUCTION

Worm cataract, diplostomiasis or diplostomatosis is a widespread disease of fishes present in natural waters and ponds (9). The causative agents of this disease are larvae (metacercariae) of species of the family Diplostomatidae (15). These metacercariae have been recorded among 23 species of British freshwater fishes (28) and over 125 species worldwide (11). This disease caused an increase concern among anglers who have been catching a steadily falling numbers of fishes in several regions of England as this disease prevents fishes from seeing the angler's bait (10). Also, this disease can exert a negative influence on the production of fish in aquaculture (14). According to Hoffman (18), *D. spathaceum* was found in lens cataracts of a 5-month- old child and a 55-year- old fisherman in England. Metacercariae live in the eyes of fishes, while the adult parasites inhabit the intestine of aquatic piscivorous birds (27).

The first information on *D. spathaceum* from Iraqi freshwater fishes was presented by Abdullah (1), who detected metacercariae of this parasite from *Barbus luteus*, *Cyprinus carpio* and *Cyprinion macrostomum* from Dokan lake, north of Iraq. According to Mhaisen (24), seven species of *Diplostomum* were recorded from the lenses of 23 species of freshwater fishes of Iraq, in addition to the record of unidentified species of this genus from lenses of 16 fish species of which four fish species were additional hosts for this genus in Iraq.

The experimental life cycle of *D. spathaceum* was studied out by Abdullah and Mhaisen (7) in which two snails (*Lymnaea lagotis* and *L. truncatula*) served as the first intermediate hosts, two fishes (*C. carpio* and *C. macrostomum*) served as the second intermediate hosts and one bird (*Larus canus*) as the final host.

As no previous account was published on population biology of *D. spathaceum* in Iraq, the present work was designed to shed the light on the ecological aspects of this parasite in two cyprinid fishes in Greater Zab of north Iraq as such aspects are important for management application to disrupt the parasite life cycle in its weakest point (29).

Part of Ph. D. thesis of the first author.

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MATERIALS AND METHODS

The Greater Zab river is a large river (392 km) in north of Iraq. It is situated between 36°-37° north latitude and 43°-44° east longitude. The sampling area of the present study is located near Iski-kalik town which is located at about 40 km to the west of Erbil city.

Monthly samples of fish specimens were taken by gill netting, cast netting and electrofishing by local fishermen during the period from November 2000 until the end of October 2001. Specimens were placed in plastic tanks filled with local river water, immediately transported to the laboratory and examined within 24 hours after their capture. However, some specimens were deeply frozen and examined within one week.

In the laboratory, live fishes were sacrificed by pithing. Their total length and weight were measured and sex was determined upon dissection. Whole eyes of fishes were removed, lenses were dissected out and teased apart under a stage of 4 and 12 power-dissecting microscope. The number of metacercariae in each lens was counted. Metacercariae recovered were first washed in saline solution and then fixed in 70% ethanol. Worms were stained in Mayer's acid carmine, dehydrated in ascending concentrations of ethanol, cleared in xylene and whole mounted in Canada balsam (9). The scientific names of fishes were according to Froese and Pauly (16).

Data on metacercariae were categorized according to sex of the host fish and month. Fishes were divided into length groups (<6, 6-10, 11-15 and >15 cm for *B. luteus* and <6, 6-10 and >10 cm for *C. macrostomum*). The terms of infection parameters (prevalence, mean intensity and mean abundance) were used as recommended by Margolis *et al.* (23) to denote the percentage of infected hosts in a sample, the mean number of worms recovered from all infected fishes in a sample and the mean number of worms recovered from all examined fishes (infected and uninfected) in a sample, respectively. For testing the differences in infection parameters between fish sexes, t- test was conducted, while complete randomized design (CRD) was conducted to test the differences in infection parameters among different fish length groups and different months (12).

RESULTS AND DISCUSSION

A total of 336 cyprinid fishes (216 *B. luteus* and 120 *C. macrostomum*) were collected from Greater Zab river during the present study. Eye lenses of these fishes were infected with metacercariae of *D. spathaceum*. The overall prevalence of infection was 54.2% for *B. luteus* and 65% for *C. macrostomum*. The mean intensity of infection for both species was 8.3 and 12.8, respectively. The mean abundance of infection was 4.5 and 8.3, respectively (Table 1).

Table 1: Changes in the infection parameters of male and female *B. luteus* and *C. macrostomum* with *D. spathaceum* in Greater Zab river

	B. Lutus			*C. macrostomum*		
Infection parameter	**Males**	**Females**	**Both**	**Males**	**Females**	**Both**
No. fish examined	94	122	216	55	65	120
No. fish infected	56	61	117	38	40	78
No. parasites	464	504	968	476	524	1000
Prevalence (%)	59.6	50	54.2	69.1	61.5	65
Mean intensity	8.3	8.3	8.3	12.5	13.1	12.8
Mean abundance	4.9	4.1	4.5	8.7	8.1	8.3

The relatively high prevalence of infection of both cyprinid fish species of the present investigation is due to the abundance of the first intermediate hosts,

Lymnaea spp. (2) and due to the fact that most *Diplostomum* infections in Iraq were from cyprinid fishes (24). According to Abdullah (2), *Diplostomum* infections occurred in 35.6% of ten species of cyprinid fishes against 15.9% of four species of non-cyprinid fishes in Greater Zab river.

Variations in Infection with Host Sex:

Males and females of *B. luteus* and *C. macrostomum* of the present study showed insignificant differences in their infection with *D. spathaceum* (t= 0.8 and 0.34, respectively at $p<0.05$). For this reason, data of both sexes were pooled for further analysis. The present result agrees with Kennedy (19) who stated that many investigators demonstrated the absence of any differences in the infection of both fish sexes with most parasites. However, the same author gave some examples on the presence of such differences. The present result also confirms observations recorded by Khamees and Mhaisen (20) on the third stage larval nematode *Contracaecum* sp. and the acanthocephalan *Neoechinorhynchus agilis* (now *N. iraqensis*) both from *Carasobarbus luteus* (synonym of *B. luteus*) in Mehaijeran creek, south of Basrah, by Ali (8) on the acanthocephalan *Neoechinorhynchus rutili* from *Barbus esocinus* in Greater Zab river, by Abdullah and Mhaisen (4) on the crustacean *Ergasilus barbi* from *Liza abu* in Greater Zab river, by Abdullah and Mhaisen (5) on the cestode *Bothriocephalus acheilognathi* from *Cyprinus carpio* in Lesser Zab river and by Abdullah and Mhaisen (6) on the acanthocephalan *Pomphorhynchus spindletruncatus* from *B. xanthopterus* in Lesser Zab river. The absence of morphological differences between male and female fishes and their occupancy of the same habitat give evidence on the absence of differences in their parasitic fauna (13).

Variations in Infection with Host Length:

Generally, the infection with *D. spathaceum* occurred in fishes of all length groups. The prevalence of infection in length groups of *B. luteus* ranged from 33.3 – 74.4%, while the prevalence in length groups of *C. macrostomum* ranged from 33.3 – 89.7% (Table 2).

The present result showed that the infection parameters of both fish species with *D. spathaceum* increased with the increase in fish length. The statistical analysis showed significant differences at the level of ($p<0.05$) among the length groups of both fish species. Generally, the changes in prevalence of infection of both fish species coincided with those of the mean intensity and mean abundance. This is a common phenomenon in fish parasitology with most parasites (19).

Table 2: Changes in the infection parameters of different length groups of *B. luteus* and *C. macrostomum* with *D. spathaceum* in Greater Zab river.

Infection parameter	length groups (cm) of *B. luteus*				Length groups (cm) of *C. macrostomum*		
	< 6	6 - 10	11 - 15	>15	< 6	6 – 10	>10
No. examined fish	45	59	69	43	39	42	39
No. infected fish	15	28	42	32	13	30	35
No. parasites	35	133	387	416	55	298	647
Prevalence (%)	33.3	47.5	60.9	74.4	33.3	71.4	89.7
Mean intensity	2.3	4.8	9.2	13	4.2	9.9	18.5
Mean abundance	0.8	2.3	5.6	9.7	1.4	7.1	16.6

***** LSD= 0.673 for *B. luteus* and 0.9002 for *C. macrostomum*.

The increase in fish infection with *D. spathaceum* with the increase in fish length results from the fact that this infection occurs through penetration of the

swimming cercaria of this parasite in the water to attach itself to fish skin and gills and then migrates to the eye, or through direct contact with fish eye (15). So, the increase in fish body surface area with the increase in fish length and the increased accumulation of larvae in the eye lens account for the increase of infection (19). Moravec *et al.* (26) showed that infection of *Barbus barbus* with the larvae of *D. spathaceum* was increased with the increase in fish length in different areas of Europe. The present result comes in agreement with many accounts in Iraq which demonstrated the increase of infection with the increase in fish length such as those of Khamees and Mhaisen (20), Mhaisen *et al.* (25), Abdullah and Ali (3), Khamees and Mhaisen (21, 22) and Abdullah and Mhaisen (4, 5, 6).

Monthly Variations in Infection:

Table (3) demonstrated the monthly changes in infection parameters of both fish species with *D. spathaceum*. It is clear that this parasite occurred in both fish species throughout the year with significant differences among months at the level of $p<0.05$. As indicated earlier in this paper, changes in infection parameters are coincided with each others as it is a common phenomenon in parasitology (19).

Generally, the infection was high during spring and summer months due to the activity of both the snails (first intermediate host) and the fishes (second intermediate host). Such activity facilitates snail infection with the miracidia and fish infection with the cercariae (17). The lower infection recorded during autumn and winter months is due to the rarity of larval stages infecting fishes and the less activity of fishes (26). Similar patterns of such monthly changes in infection were also reported by some Iraqi investigators (4, 5, 6, 20, 25).

Table 3: Monthly variations in infection parameters of *B. luteus* (upper row) and *C. macrostomum* (lower row) with *D. spathaceum* in Greater Zab river.

Month	No. fish examined	No. fish infected	No. parasites	Prevalence (%)	Mean intensity	Mean abundance
Nov. 2000	18 10	6 6	12 56	33.3 60	2 9.3	0.7 5.6
Dec.	18 10	9 7	33 70	50 70	3.7 10	1.8 7
Jan. 2001	18 10	8 7	36 63	44.4 70	4.5 9	2 6.3
Feb.	18 11	8 5	30 54	44.4 45.5	3.8 10.8	1.7 4.9
Mar.	18 8	10 5	57 75	55.6 62.5	5.7 15	3.2 9.4
Apr.	18 11	11 9	65 107	61.1 81.8	5.9 11.9	3.6 9.7
May	18 11	10 9	67 148	55.6 81.8	6.7 16.4	3.7 13.5
June	18 9	14 9	284 201	77.8 100	20.3 22.3	15.8 22.3
July	18 9	12 6	206 88	66.7 66.7	17.2 14.7	11.4 9.8
Aug.	18 9	12 6	84 77	66.7 66.7	7 12.8	4.7 8.6
Sept.	18 13	9 3	62 9	50 23.1	6.9 3	3.4 0.7
Oct.	18 9	8 6	32 52	44.4 66.7	4 8.7	1.8 5.8

*** LSD= 0.81 for *B. luteus* and 1.45 for *C. macrostomum.***

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حياتية المجموعة السكانية لمرض السد الدودي الناجم عن ميتاسركاريا المخرم ثنائي المنشأ *Diplostomum spathaceum* (Rud., 1819) في نوعين من أسماك العائلة الشبوطية في نهر الزاب الكبير، شمال العراق

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الملخص

تم خلال المدة من شهر تشرين الثاني 2000 ولغاية نهاية شهر تشرين الأول 2001 جمع 336 سمكة من العائلة الشبوطية: 216 سمكة حمري *Barbus luteus* و120 سمكة بنيني كبير الفم *Cyprinion macrostomum*. كانت الاسماك مصابة بميتاسركاريا المخرم الثنائي المنشأ *Diplostomum spathaceum* إصابة كلية بنسبة 54.2% لأسماك الحمري و65% لأسماك البنيني الكبير الفم. لم تظهر فروق معنوية في إصابة ذكور وإناث كلا نوعي الأسماك بهذا الطفيلي. لوحظت زيادة في نسبة الإصابة ومعدل شدتها ومعدل وفرتها بزيادة طول كلا نوعي الأسماك. كانت الإصابة بهذه الدودة عالية خلال أشهر الربيع والصيف وواطئة خلال أشهر الخريف والشتاء.

البحث مستل من أطروحة دكتوراه للباحث الأول.

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