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EFFECTS OF CROWDING ON CYNODIPLOSTOMUM AZIMI (TREMATODA : DIGENEA) IN EXPERIMENTALLY INFECTED RATS AND MICE

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ABSTRACT

Albino rats and mice were fed either 20 (non-crowded) or 50 (crowded) metacercarial cysts of Cynodiplostomum azimi to determine the effect of crowding. The worm recovery rate was lower in crowded infections. A chronological decreasing tendency of the worm recovery rate was observed. The incresing tendency of the parasite enlarged its spatial distribution within the intestine of infected animals. Crowding was accompanied by partial inhibition and delay of maturation of the worm as observed by the delay in the appearance of eggs in the stool of infected rats and the decrease in the number of interauterine eggs within the worms as the infection persists. Factors responsible for the crowding effect are discussed.

INTRODUCTION

Cynodiplostomum azimi (Gohar, 1933 Dubois, 1936) inhabits the small intestine of some fishes eaten by birds and mammals (Gohar, 1933; Fahmy and selim, 1959; Dubois and pearson, 1963; and Fahmy *et al.*, 1984). Some authors studied its infectivity, growth and development in naturally and experimenally infectally

infected animals (El- Assal, 1974; Khalil, 1987; and Khalil *et al.*, 1991).

Relatively few authors studied the effect of crowding on digenetic trematodes (Fried and Nelson, 1978; Mansour *et al.*, 1981; and Nollen, 1983). Controversial results have been reported by Hong *et al.* (1983), Fried and Freeborne (1984), and Franco et al. (1988). These studies estimated the effect of crowding through the study of :1) The parasitic burden as expressed by worm recovery rate. 2) The speed at which infection was established as measured by the prepatent priod. 3) The persistence of infection as measured by the time at which the number of worm decreased, 4). The ability of the parasite to mature within the host as indicated by the mean number of interauterine eggs and size and weight of the worms.

This study is undertaken to detect the effect of worm crowding in experimentally infected rats and mice.

MATERIALS AND METHODS

Alive metacercarial cysts of cynodiplostomun azimi were removed from the skeletal muscles of naturally infected *Clarias lazera* and used for experimental infection.

A total of 120 albino rats and 120 albino mice were divided each into two croups according to their sex. Each group was further divided into two subgroups according to the dose of infection. For non - crowded infection each animal was fed with 20

encysted metacercariae, for crowded infection each animal was fed with 50 encysted metacercariae. From each subgroup ten infected animals were sacrificed after one week, four weeks and eight week post infection. Daily Fecal examination, was done for the presence of eggs for ten successive days.

The small intestine was removed and divided into three parts, the fore part (duodenum and jejunum), the mid part (proximal ileum) and the hind part (distal ileum and rectum). Each part was opened in physiological saline. Worms from each part were collected separately in saline, counted and fixed in 70 % alcohol.

The following variables were examined :

a - The percentage of adult worm recovered from the intestine of the host (worm recovery rate) after one week, four weeks and right weeks.

b - The distribution of adult worms within the intestine of the host.

c - The prepatent period

d - The mean number of intrauterine eggs within the adult worm.

Student's t test was used to detect significant differences in the worm recovery rate.

RESULTS

Both rats and mice were found to be susceptible to *C. azimi* infection. Data given in table (1) reveal that the worm recovery rate is greater in animals infected with 20 metacercariae than with 50.A chronological decreasing tendency of the worm recovery rate is apparent.

Table (2) shows the distribution of recovered worms in the intestine of infected rats and mice. In crowded infection the majority of worms were found in the fore part of the intestine, a relatively small number in the mid part and a smaller number in the hind part. In non- crowded infection, almost all of the recovered worms were found in the fore part, few in the mid and none in the hind part of the intestine. After the fourth and eighth week of infection worms were only recovered from the fore part of the intestine in both crowded and non - crowded infections.

Table (3) summarizes the effect of worm crowding on the prepatent period and the mean number of intrauterine eggs within the adult worms. Daily fecal examination showed that in 20 % of rats with non - crowded infection the prepatent period was four days. In the remaining 80 % and in all croded infection the prepatent period was five days. In mice there was no difference in the prepatent period between crowded and non - crowded infection.

Table (1) : Recovery rate of *C. azimi* from experimentally infected rats and mice in relation to the amount of the given metaceriae and the duration of infection.

Host	Number of Metacrcariae Given	Recovery Rate (%) after the		
		1st W*	4th W	8th W
Male rat	20	91.0	51.0	24.0
male rat	50	88.0	33.8	22.0
Female rat	20	82.5	37.5	18.0
Female rat	50	81.4	29.2	16.2
Male mice	20	97.5	39.5	11.5
Male mice	50	91.4	31.2	7.0
Female mice	20	94.5	30.5	7.5
Female mice	50	91.0	28.4	7.2

* week

Table (2) : Distribution of *C. azimi* recovered from experimentall infected rats and mice at different periods and dose of infection.

Host	Number of metacercariae Given	Recovery (%) from the		
		Fore* part	Middle** part	Hind*** part
Male rat (Ist Week)	20	98.9	1.10	0.00
Male rat (Ist Week)	50	92.7	4.35	2.95
Male rat (Ist Week)	20	100	0.00	0.00
Male rat (Ist Week)	50	95.1	3.40	1.50
Male mice (Ist Week)	20	97.95	2.05	0.00
Male mice (Ist Week)	50	94.8	3.50	1.70
Female mice (Ist Week)	20	100	0.00	0.00
Female mice (Ist Week)	50	97.1	2.40	0.50

* Duedenum and jejunum ** Proximal ileum

*** Distal ileum and rectum

In all other periods of infection (4 Weeks and 8 Weeks), All worms were recovered from the first part of the intestine.

Table (3) : Time and percentage of earliest recovery of eggs in stool, and number of trematode intrauterine eggs in experimentally infected rats and mice at different periods and dose of infection.

Host	Number of Metaceracriae Given	Day	Earliest recovery of eggs in stoll	Mean number of intrauterine eggs		
			% of infected animals	Ist W*	4th W*	8th W
Male rat	20	5th	80%	6	9	12
		4th	20%			
Male rat	50	5th	100%	5	6	7
Female rat	20	5th	80%	5	8	11
		4th	20%			
Female rat	50	5th	100%	5	6	7
Male mice	20	4th	100%	7	9	12
Male mice	50	4th	100%	5	7	8
Female mice	20	4th	100%	6	8	11
Femal mice	50	4th	100%	5	7	8

* Week

There is no apparent difference in the number of intrauterine eggs between crowded and non - crowded infection of both rats and mice after one week of infection. As the infection persists, worms recovered from non - crowded infections contained more eggs than those from crowded ones.

DISCUSSION

The crowding effect of *C. azimi* was apparent in the present study. The worm recovery rate was greater in non - crowded infections of rats and mice than in crowded ones. Fried and Nelson(1978), Mansour *et al.* (1981), and Nollen (1983) reported similar results in *Zygocotyle lunata*, *Pygidiopsis genata* and *Philophtalmus gralli* infections, respectively. On the other hand, Hong *et al.* (1983) and Franco *et al.* (1988) did not find an exact correlation between worm recovery rate and the amount of metacercariae given in *Fibricola seoulensis* and *Echinostoma revolutum* infection, respectively.

There have been many explanations for the worm crowding effect. Shrob (1933) suggested that heavy infection could provoke a strong defense mechanism in the host. Masour *et al.* (1981) suggested that more cysts may pass through the body, some may be digested or even excysted but fail to attach themselves to the intstinal mucosa. Hong *et al.* (1983) and Nollen (1983) related the crowding effect to the biological capcity of the infected organ or part of the organ. They belived that if the number of the parasites

exceeds the biological capacity, the remainder of the parasites tend to shift to other parts of the organ where they are not normally found.

The present study, as well as those of Mansour *et al.* (1981), Hong *et al.* (1983), Nollen (1983), Franco *et al.* (1988); and Fried *et al.* (1988) showed that an increase in the dosage of a trematode parasite than a certain level enlarges the spatial distribution of the parasite.

The presence of *C. azimi* in the proximal and distal ileum in crowded infection after one week of infection can be interpreted on the basis of the biological capacity theory mentioned before. The present study showed that *C. azimi* failed to live in the ileum after four weeks of infection . Therefore, adults that did not succeed in the intraspecific competition in the duodenum were rejected.

Crowding also caused partial inhibition and a delay of sexual maturation as observed by the delay in the appearance of eggs in the stool of rats and by the smaller number of intrauterine eggs observed in both rats and mice after four weeks in crowded infection. slow rate of development and extending of maturation time of the parasite in relation to crowding was also reported by Fried and Nelson (1973), Fried and Freeborne (1984), Franco *et al.* (1988) and Fried *et al.* (1988). Franco *et al.* (1988) attributed their findings to intraspecific competition between the parasite. Fiachthal *et al.* (1982) suggested that chemical factors released by

worms associated with crowding may influenc worm growth.

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تأثير التزاحم على سينود بلوستومم عظيمى (تريماتو دا ، ثنائية العائل) فى العدوى التجريبية للفأر الأبيض الكبير والفأر الصغير

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لدراسة تأثير التزاحم تم عدوى كل من الفأر الأبيض الكبير والفأر الصغير بعدد عشرين (عدوى غير متزاحمة) أو عدد خمسين (عدوى متزاحمة) يرقة متحوصلة (ميتاسركاريا) لطفيل سينود بلوستومم عظيمى . وقد بينت الدراسة أن نسبة الديدان المسترجعة من أمعاء العائل المصاب يقل مع زيادة كمية العوى كما أن نسبة الديدان المسترجعة تقل مع مرور الوقت .

وكذلك وجد أن زيادة كمية العدوى تؤدى إلى زيادة فى إنتشار الطفيل فى الأمعاء المصابة .

وقد أظهرت الدراسة أيضاً أن التزاحم أدى إلى تثبيط جزئى وتأخر فى نضج الطفيل وقد لوحظ ذلك من التأخر فى ظهور البيض فى براز الفأر المعدى معملياً وكذلك فى قلة عدد البيض بداخل رحم الطفيل فى المراحل المتأخرة من العدوى.