International Journal of Biochemistry and Biotechnology ISSN 2169-3048 Vol. 9 (9), pp. 001-003, September, 2020.
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Short Communication

Interaction between *Biomphalaria pfeifferi*, the snail intermediate host of *Schistosoma mansoni*, and *indoplanobis exustus*, a possible competitor snail

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Accepted 13 May, 2020

Biological control of snail intermediate host of human schistosome parasites has been suggested. In this study, the effect of *Indoplanobis exustus* a planorbid snail and possible competitor snail of *Biomphalaria pfeifferi* on the fecundity and growth rate of the later was evaluated. The results showed a significant difference in the growth rates and fecundity of *I. exustus* and *B. pfeifferi*. Maintaining the snails together, the fecundity and growth rate of *B pfeifferi* were greatly reduced. There was direct relationship between fecundity and growth rate. *I. exustus* could therefore be a control agent of *B. pfeifferi* under similar prevailing condition.

Key words: *Indoplanobis exustus*, *Biomphalaria pfeifferi*, *Schistosoma mansoni*, fecundity, growth rate.

INTRODUCTION

Schistosomiasis is a serious public health problem and second most important parasitic disease (WHO 2000). About five species of the schistosome parasite; *Schistosoma mansoni, S. haematobium, S. intercalatum, S. japonicum* and *S. mekongi*, are responsible for the disease condition in man and animals. More than 600 million people in 74 countries are at risk while more than 200 million were infected (Gibodat and Bergquit, 2000). About 120 million are symptomatic while 20 million have severe disease (Chitsulo et. al., 2000).

The schistosome parasites are transmitted by snail intermediate hosts found in water bodies like lakes, ponds, streams, rivers, irrigation canals and dams. *Biomphalaria pfeifferi* and *Indoplanobis exustus* are among the snail intermediate hosts of schistosome parasites but only *B. pfeifferi* transmit those (*S. mansoni*) infecting humans.

The control of intermediate host snails is important in integrated schistosomiasis control. Methods of control include chemical (use of molluscicides) and biological control measures. Molluscicides are expensive, toxic to life and environment and have temporary effect (Ukoli, 1992). Biological control is cheaper and based on the use of predators or parasites, genetic manipulation, alteration of habitat and introduction of competitors to reduce target species (Negron-Aponte and Jobin, 1979; Jobin et al., 1984). A lot of research work on biological control of schistosomes using animals which are natural enemies of the snail intermediate hosts have been reported (Berg, 1973; Hairston, Wurzinger and Burch, 1975; Jobin and Laracuente, 1979; Pointer and Mc cullough, 1989; Pointer et al., 1989; Gomez et al., 1990; Chimbari et al., 1997, Shlegel et.al., 1997). An ideal method of biological control of disease vector should be based on competitive displacement by introduction of a non-vector species with similar ecological requirement as vector but with higher biological potential and adaptability (Frandsen and Madsen, 1979). In the case of schistosomiasis, a snail species with higher growth rate, better utilization of food resources, rRefractory to parasite, longer life span, harmless to surrounding crops will be preferred (Frandsen and Madsen, 1979). The purpose of this study was to determine the effects of the interaction between *I. exustus* and *B. pfeifferi* on the later under laboratory conditions.

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Table 1. Average length of *I.exustus* and *B. pfeifferi* snails (mm) per week.

Weeks	*I. exustus* I	*I. exustus* II	*I. exustus* III	*B. pfeifferi* I	*B. pfeifferi* II	*B. pfeifferi* III
1	1.86	1.93	1.89	1.77	1.78	1.68
2	2.64	3.02	3.56	2.23	2.25	1.88
3	3.00	3.8	3.89	2.74	2.64	2.15
4	3.48	4.14	4.17	3.06	2.87	2.75
5	3.74	4.73	4.41	3.44	2.98	2.83
6	4.33	5.54	4.63	3.68	3.13	3
7	4.88	5.69	4.98	4.34	3.77	3.2
8	4.94	5.88	5.06	4.4	3.9	3.51
9	5.08	6.02	5.38	4.54	4.03	3.82
10	5.39	6.2	5.69	4.69	4.16	4.01
11	5.54	6.44	5.92	4.86	4.26	4.11

MATERIALS AND METHODS

Four 2-liter glass aquaria were used in the experiment. To breed the snails, four 500 ml beakers and some crystallizing dishes were used. Stayed (dechlorinated,) tap water was used in the aquaria and at weekly intervals, the aquaria were cleaned and their water changed.

Juvenile snails cultured in the laboratory at about 4 weeks of age were randomly selected for the experiment. A total of thirty juveniles of each type were used. 10 of each snail kind, *B. pferiferi* I and *I. exustus* I, were placed in two separate aquaria as controls. The same number were kept together (*B. pfeifferi* II and *I. exustus* II) in the third aquarium while the fourth aquarium partitioned with gauze contained the same number in each partition (*B. pfeifferi* III and *I. exustus* III). The snails were fed with dry lettuce leaves and each groups' food was added according to their requirements. The rate of growth and rate of egg production for each group were observed and recorded weekly. Days of onset of egg production for each snail groups were also recorded. The experiment was conducted for eleven weeks. The results were compared to assess the performance of the snail groups under the experimental condition and consequently the possible effect of the interference between *B. pfeifferi* and *I. exustus.*

RESULTS

The difference in the average length was significant (P 0.05) between the snail species (^{2} [calculated]=5.86; degree of freedom=2; confidence interval=95%), and experimental and the controls of the different snail species after eleven (11) weeks of study (^{2} [calculated]=5.88; degree of freedom=2; confidence interval=95%). The growth curve showing the weekly changes in average length of the snail species were shown in Table 1. *I. exustus* I and *B. pfeifferi* 1,II and III started laying eggs when they were 8 weeks old while *I. exustus* II and III when they were 7 weeks. The difference in the rate of egg production was significant (P <0.05) between the snail species (^{2} [calculated]=12390; degree of freedom=2; confidence interval=95%), and the experimental and control groups of each snail species (^{2} [calculated]=12519; degree of freedom=2; confidence interval=95%).

There was direct relationship between rate of egg and rate of growth for the different snail groups (*I. exustus* I = 0. 75; II = 0.88; III = 0.81; *B. pfeifferi* 1 = 0.98; II = 0.72; III = 0.94). *I. exustus* had more egg cells/week than *B. pfeifferi* as shown in Table 2. *I. exustus* II (43 out of 9812 egg cells) and *B. pfeifferi* II (231 out of 999 egg cells) recorded loses in egg cells. Nevertheless, the eggs of *I. exustus* were better protected than those of *B. pfeifferi.* These loses were not recorded for *I. exustus* and *B. pfeifferi* I. and III, respectively.

DISCUSSION

The growth rate of *B. pfeifferi* was affected by the presence of *I. exustus*. The reduction in groth rate could be associated to the fact that *I .exustus* on observation appeared to utilize more food than *B. pfeifferi*. But the marked reduction in growth rate of *B. pfeifferi* II and III could not only have been as a result of *I. exustus* being a better competitor for food as the rate of growth between *B. pfeifferi* II and III was almost the same. It could also be that *I. exustus* removes some essential ions needed for *B. pfeifferi's* growth, thus the drastic increase in the growth rates of *I. exustus* II and III. *Helisoma duryi* has been reported to influence the growth of *Bulinus truncatus* and *B. alexandrina* in this way (Abdallah and Nasr, 1973). It may also be that *I. exustus* secretes growth limiting/inhibiting factors which suppress specific growth factors of *B. pfeifferi*, the way *Helisoma* species influenced the rate of growth of *Biomphalaria camerunensis* (Thomas, 1973; Frandsen and Madsen, 1979; Madsen, 1983). On the contrary, it could be that *B. pfeifferi* stimulated *I. exustus* to release chemicals which affect its rate of growth as *Biomphalaria* species affected *Thiara granifera* and *T. tuberculata* (Gomez et al., 1990).

There was increased fecundity for *I. exustus* II and III than I, while for *B. pfeifferi* II and III there was a reduction in their fecundity. The variations observed could not only have been natural differences. It may be that *I. exustus*

Table 2. Total egg cells/week for the different snail groups.

Weeks	*I. exustus* I	*I. exustus* II	*I. exustus* III	*B. pfeifferi* I	*B. pfeifferi* II	*B. pfeifferi* III
1	0	64	369	0	0	0
2	325	204	780	125	23	12
3	235	593 (7)*	897	230	49(14)	42
4	270	809	987	292	127(38)	117
5	1327	2220 (20)	2301	284	168(50)	158
6	1107	1673 (10)	1050	264	178(32)	219
7	1092	1908	1870	449	253(57)	190
8	1189	2341 (6)	1648	233	201(40)	228
Total	5545	9812 (43)	9902	1877	999 (231)	966

*Values in parenthesis indicate the number of damaged egg cells observed.

when in the same water medium with *B. pfeifferi* not only suppressed its rate of growth but rate of egg production. *Helisoma duryi* was reported to utilize this means in controlling the population of *B. camerunensis* (Frandsen and Madsen, 1979; Madsen, 1979). A direct relationship existed between the rate of growth and rate of egg production of the snail species. The rate of growth reduces as the snails started laying eggs. It may be that the factors which encourage growth also affect reproduction. In addition, it could be associated to the fact that the energy originally used for growth was now utilized for the two.

The mechanical interference/predatory activity observed in the second tank is encouraging. *I. exustus* eggs were better protected than those of *B. pfeifferi*. Thus, a large number of *B. pfeifferi* eggs were destroyed while fewer of *I. exustus* eggs were destroyed. *Helisoma duryi* has been reported to have similar effect on the eggs and juvenile of *Biomphalaria camerunensis* under laboratory condition (Frandsen and Madsen, 1979; Madsen, 1979, 1983).

The decoy snail technique is the most promising of the possible biological control methods (Fandsen and Christensen, 1977; Frandsen, 1979).This incorporates competition predation and miracidal interception. *I. exustus* is refractory to *S. mansoni* and this study has shown that it could share same ecological habitat and could compete favourably with *B. pfeifferi* for food. *I. exustus* also have higher rates of reproduction and growth than *B. pfeifferi* and preys on the later's eggs. Thus *I. exustus* could replace *B. pfeifferi* in a habitat when they are together. Though, this has been investigated in the laboratory, experiments in the field will more relevant and infact needed for a closer evaluation of these results.

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