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PRELIMINARY LABORATORY OBSERVATIONS ON THE PREDATION OF EGGS AND JUVENILES OF MEDICALLY IMPORTANT PULMONATE SNAILS BY A PROSOBRANCH SNAIL

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Abstract: The present study is an attempt to investigate the fate of newly hatched eggs and one week old juveniles of *Lymnaea acuminata*, *L. rufescens*, *Indoplanorbis exustus* and *Physa acuta* in the presence of well fed and starved adult (72 week old) and juvenile (one week old) *Bellamaya bengalensis* Lamarck. Results revealed that both juvenile and adult *B. bengalensis* cause damage to the eggs and newly hatched juveniles of the above mentioned pulmonate snails. It was further observed that extent of damage was more with the increasing number of unfed *B. bengalensis* as compared to the well fed *B. bengalesnsis*.

Key words: Biological control, pulmonate snails, viviparid snail.

INTRODUCTION

Bellamaya bengalensis (Lamarck) has been proposed as a biological control agent of those molluscs which contribute to the transmission of diseases to man and his live stock (Tanveer and Khan, 1991). Tanveer (1991) further reported that *B. bengalensis* suppress the population of lymnaeid and planorbid snails in competitive interactions and damage to the pulmonate snails increased with the increasing number of *B. bengalensis*. Keeping in view such results it was planned to investigate the fate of newly hatched eggs and juveniles of *Lymnaea acuminata*, *L. rufescens*, *Indoplanorbis exustus* and *Physa acuta* in the presence of well fed and starved adults (72 week old) and one week old juvenile *B. bengalensis*.

MATERIALS AND METHODS

Gastropod snails used in the present study belonged to four different families *i.e.*, Lymnaeidae (*Lymnaea acuminata*, *L. rufescens*), Planorbidae (*Indoplanorbis exustus*), Physidae (*Physa acuta*) and Viviparidae (*Bellamaya bengalensis*). For collection sites and maintenance see Tanveer and Khan (1989) and Tanveer *et al.*, 1989.

Experimental design

For obtaining eggs, 14 small earthen pots of surface area 624.52 cm^2, with one liter water capacity and 20 cm water depth were stocked with 4 *L. acuminata* (age 32 week, wight 0.5 908$\pm$0.00021 g; shell length 26.08$\pm$1.8 mm). Fresh lettuce leaves was the only food provided to them. Lettuce leaves also icrease the surface area for egg laying. Laboratory temperature was kept at 25.0$\pm$1.5°C. Lymnaeid, Planorbid, Physid snails used for obtaining eggs were 32-36 week old. Water was changed very carefully and new fresh tap water was filled up to the mark daily. No aeration was provided. After 4 days a desirable number of egg masses were deposited on the base, side walls of the pot

and on the lettuce leaves. Then adult *L. acuminata* were removed, water was replaced and number of egg masses and eggs were counted very carefully by a hand lens. Only desired number of eggs were kept in the pots while extra egg masses were removed. These pots were daily filled with fresh tap water, lettuce was supplied as food and submitted to the action of adult *B. bengalensis* (age, 72.0±6.00 weeks; weight 2.056±0.0031 g; shell length 20.33±1.19 mm). The number of *B. bengalensis* was gradually increased as 1, 2, 3, 4, 6, 8, 10 in each pot. Two replicates for each density were run and two pots, run without sdult *B. bengalensis*, were termed as control groups. The exact number of eggs and egg masses were recorded before the introduction of test snails (*i.e.*, at zero day) and the number of undamaged eggs and egg masses were counted on 8th day and after this time the juveniles start hatching. The number of juveniles hatched were counted on 16th day and average of percentage values +S.D. have been presented. Similar experimental set up was made for *L. rufescens*, *I. exustus* and *P. acuta*. The above experiments with similar protocol were also repeated without any food. Fate of egg masses of *L. acuminata*, *L. rufescens*, *I. exustus* and *P. acuta* was also observed in the presence of their respective adutl snails. Two experimental groups one with food and other without food were run with the protocol mentioned above.

In another series of experiments fate of newly hatched juveniles of *B. bengalesnsis* in the presence of adult *L. acuminata*, *L. rufescens*, *I. exustus* and *P. acuta* was determined. For this purpose newly hatched actively crawling juveniles (up to the age of 24 hours) were kept in earthen pots (as described above) alongwith 1, 2, 3, 4, 6, 8, 10 adult *L. acuminata*, a control was run without any adult snail and one with 5 adult *B. bengalensis* (a number which was half of the number of test snails as mentioned earlier). The experimental protocol for maintenance and time for observations was similar to that mentioned earlier.

RESULTS

The results of the present investigation revealed that both juvenile and adult *B. bengalensis* caused damage to the eggs and newly hatched juveniles of *L. acuminata*, *L. rufescens*, *I. exustus* and *P. acuta* (Figs. 1-2, Table I).

The extent of damage was greater by adult *B. bengalensis* as compared to the juvenile snails. This damage was also increased with the corresponding increase in the number of adult *B. bengalensis* and in the absence of food. However, in a reciprocal experiment it was noted that juvenile *B. bengalensis* were not affected by the presence of adult *L. acuminata*, *L. rufescens*, *I. exustus* and *P. acuta* even in the absence of food.

It is also evident from the Table I that in the control groups of competing snail species less than 70 % eggs developed into juveniles, while other 30 % died or destroyed due to unknown reasons (may be due to some born defects or any other reason not known). The maximum damage in the experimental groups took place in the pots where 10 snsils per pot were kept (*i.e.* only 10-14 % eggs left in this group after 16 days) the similar value for the group without food were 5-9 %. The minimum reduction was found in the group where only one *B. bengalensis* was kept *i.e.* 23-33 %

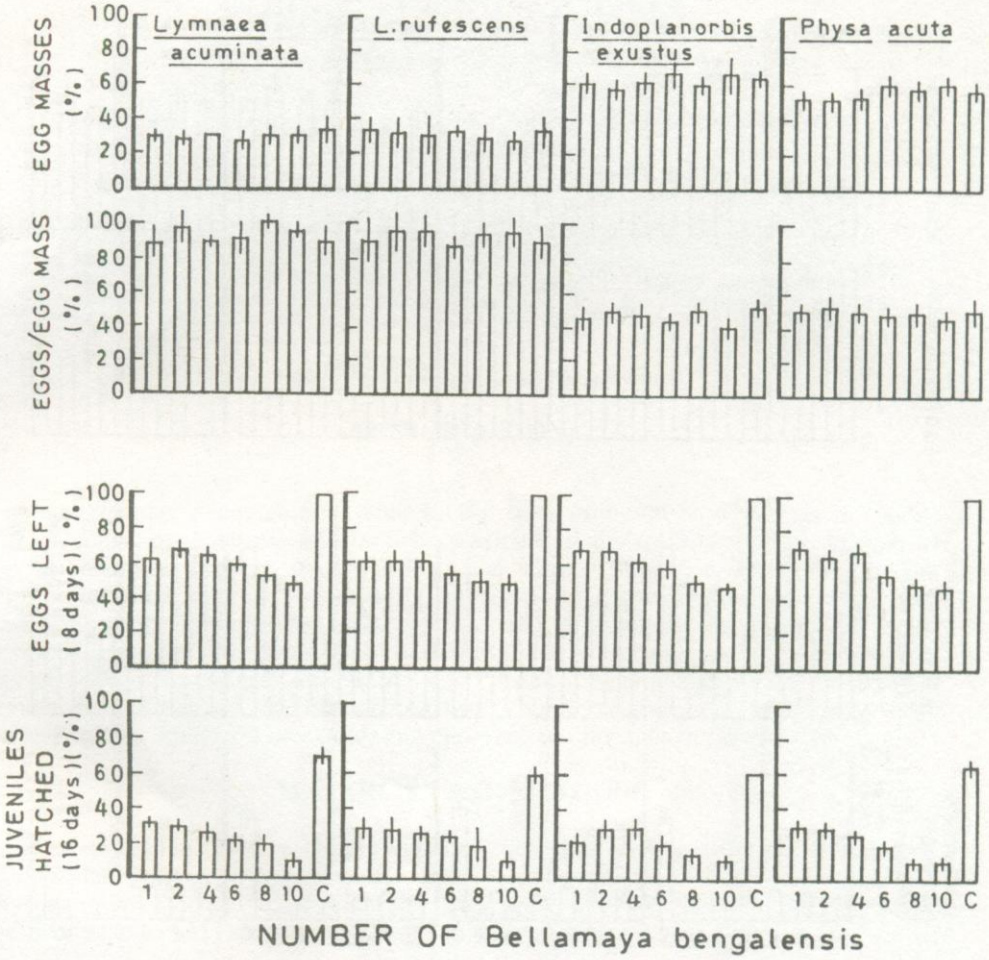

Fig. 1. Fate of eggs of *Lymnaea acuminata*. *L. rufescens*, *Indoplanorbis axustus* and *Physa acuta* in the presence of well fed adult *Bellamaya bengalensis*. Values given are mean±S.D. of two replicates of each group for 16 days.

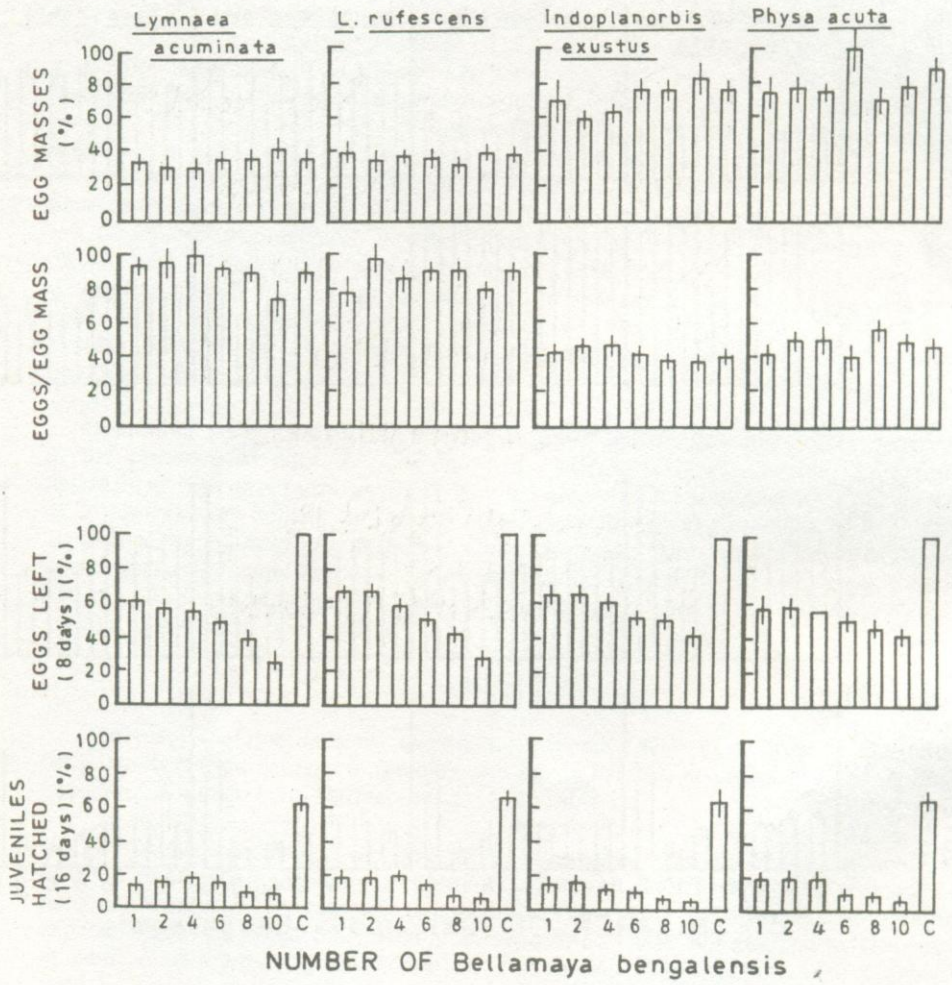

Fig. 2. Fate of eggs of *Lymnaea acuminata*. *L. rufescens*, *Indoplanorbis axustus* and *Physa acuta* in the presence of unfed adult *Bellamaya bengalensis*. Values given are mean±S.D. of two replicates of each group for 16 days. .

Table 1. **Fate of eggs of *Lymnaea acuminata*, *L. rufescens*, *Indoplanorbis exustus*, and *Physa acuta* in the presence of juvenile *Bellamaya bengalensis*. Values given are mean ± S.D. of two replicates. Food supplied is indicated by + and food not supplied by - .**

Eggs	Juveniles	Food	Total No. of egg masses	Total No. of eggs	Eggs left after 8 days (%)	Total No. of juveniles	Juveniles left (%)
L. acuminata	*B. bengalensis*	+	6.5±0.707	421.5±10.60	56.67±12.16	20.0	92.5±3.53
L. acuminata	*B. bengalensis*	-	5.5±0.707	371.5±4.95	7.79±2.18	20.0	85.0±7.07
L. acuminata	-	+	7.0±0.0	435.0±7.07	98.45±0.90	-	-
L. acuminata	-	-	6.5±0.707	451.5±12.02	88.55±5.33	-	-
-	*B. bengalensis*	+	-	-	-	20.0	100.0±0
-	*B. bengalensis*	-	-	-	-	20.0	92.5±3.53
L. rufescens	*B. bengalensis*	+	5.5±0.707	315.0±7.07	61.18±6.53	20.0	97.5±3.53
L. rufescens 4	*B. bengalensis*	-	6.5±0.707	460.0±1.14	7.82±3.05	20.0	80.0±14.1
L. rufescens	-	+	6.5±0.707	394.5±6.36	97.72±0.35	-	-
L. rufescens	-	-	5.5±0.707	465.0±21.21	88.26±4.02	4.02	- -
-	*B. bengalensis*	+	-	-	-	20.0	97.5±3.53
-	*B. bengalensis*	-	-	-	-	20.0	92.5±3.53
L. exustus	*B. bengalensis*	+	9.5±0.707	331.0±14.14	53.82±9.35	20.0	97.5±3.53
L. exustus	*B. bengalensis*	-	8.5±0.707	374.5±7.78	8.58±3.58	20.0	92.5±3.53
L. exustus	-	+	10.5±0.707	360.0±0	97.13±1.74	-	-
L. exustus	-	-	9.5±0.707	399.5±13.43	95.29±3.03	-	-
-	*B. bengalensis*	+	-	-	-	20.0	97.5±3.53
-	*B. bengalensis*	-	-	-	-	20.0	92.5±3.53
P. acuta	*B. bengalensis*	+	11.0±1.41	364.5±21.92	53.41±2.99	20.0	100.0±0
P. acuta 1	*B. bengalensis*	-	12.5±0.707	359.0±14.14	26.1±2.80	20.0	92.5±10.6
P. acuta	-	+	12.5±0.707	377.0±4.24	98.01±0.92	-	-
P. acuta	-	-	11.0±1.41	352±12.02	90.03±3.51	-	-
-	*B. bengalensis*	+	-	-	-	20.0	97.5±3.51
-	*B. bengalensis*	-	-	-	-	20.0	97.5±3.51

for those in which food was provided while the similar values were 15-21 % for the groups in which food was not provided, while the other values lie between these two extremes. Having a look on Table I it is clear that juvenile *B. bengalensis* caused damage to the egg masses of *L. acuminata*, *L. rufescens*, *I. exustus* and *P. acuta* (during the 8 days) the snails left in the pots were between 50-62 % when the food was supplied in maximum. However, these values reduced to 8-27 % when food was not supplied. Among the four starved, competing snails maximum reduction took place for *L. acuminata* and *L. rufescens*, then *I. exustus* and minimum reduction took place for *P. acuta* eggs (Table I). Juveile and adult *L. acuminata*, *L. rufescens*, *I. exustus* and *P. acuta* showed no tendency to destroy their own egg masses or juveiles, even in the absence of food. The negligible mortality faced by these groups was due to mechanical interference which they made in search of food. However, when the time for hatching of juvenile (from the eggs) of the competing snail species was noted, and compared with the control groups, there was found no difference.

DISCUSSION

The main objective behind this study was to observe the fate of eggs and juveniles of medically important pulmonate snail species in the presence of gradually increasing number of well fed and starved *B. bengalensis*.

As for as the fate of egg masses of *L. acuminata*, *L. rufescens*, *I. exustus* and *P. acuta* is concerned it was noted that not only the egg masses of these snail species were predated or destroyed by adult and juvenile *B. bengalensis* but the detrimental effect of *B. bebgalensis* was also evident on the newly hatched juveniles of the above snail species. While the effect of these snail specied (Lymnaeid, Planorbid and Physid) on the juvenile and adult *B. bengalensis* was not found. Almost similar findings have also been reported by other workers like Abdallah and Nasr (1973) showed the effect of *Helisoma duryi* on *B. glabrata*, Madsen (1979b) showed the effect of *Pomacea* spp. on *B. glabrata*, Malek and Malek (1978) explained the effect of *H. duryi* on *Biomphalaria cumerunensis*). It was further observed during the present investigation that this predation increased when food was in short supply and egg masses thus seem to be used as an alternate food source. The absence of food probably increases the searching activity of snails thereby making the incidental passage over egg masses more frequent. Storey (1971) was of the opinion that the rate of movement of *L. peregra* was three times faster on surface without food than on surface with food, when no alternative food source (*i.e.* algal growth on the sides of the plastic bowls) was available for the snails.

It was also noted that *B. bengalensis* did not effect its own juveniles by its presence in the absence of food. This may be due to the fact that juveniles of *B. bengalensis* can escape any predatory activity by actively moving away from the adult snails, while the egg masses of *L. acuminata*, *L. rufescens*, *I. exustus* and *P. acuta* are helpless creatures so they have to face the mechanical injuries caused by the movement of adult snails. It is also evident from Table I that in the control groups of competing snail species less than 70 % eggs develop into juveniles while others died or destroyed due to unknown reasons. The predation on egg masses was considered to be a solid reason for the suppression of reproductive potential of *B. camerunensis* in the experimental aquaria

(Madsen and Frandsen, 1979; Madsen, 1979)). They furter reported that water pollution (*i.e.* metabolic waste products from snails and bacterial activity and various chemical substances leaching from lettuce or other food sources was also held responsible as an important inhibitor for the development of egg masses in older balanced aquaria.

Mandahl-Barth (1970), Abdallah and Nasr (1973) and Malek and Malek (1978) suggested that excretions or secretions from Helisomes also affect the reproductive potential of *B. glabrata* but finding of Madsen (1979) did not provide evidence of inhibitory substances secreted by *H. duryi*. However, during the present investigation chances of fouling the aquaria were negligible because of the carefully routinized schedule of food and water change every day.

In view of above mentioned results, although prosobranch snail *B. bengalensis* suppresses the population of pulmonate snails by predating their egg masses and juveniles (under laboratory conditions) however, the significance of such predation for the competitive relationship between *B. bengalensis* and medically important pulmonate snails under field conditions in not known because in the field it is important whether food is a limiting facter for these snails or not and also upon specific trophic level of the species involved. It is also precautionary to note that the results of laboratory experiments should not always be indicative of what happens in natural habitat.

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