

BIOLOGICAL STUDIES OF TWO LAND SNAIL SPECIES AT MINUFIYA GOVERNORATE

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ABSTRACT: *Some biological aspects of both Monacha cartusiana and Eobania vermiculata were studied under laboratory conditions, Life span of M. cartusiana was 580±8.4 days compared with 921.4±8.9days for E. vermiculata. The incubation period lasted 19.3±1.6 days and 12 days for M. cartusiana and E. vermiculata, respectively. Juvnile period of M. cartusiana prolonged for 112±4.2 days, while this period prolonged 117.6±4.5 days for E. vermiculata. Oviposition period was 91±2 and 354.2±6.04 days for M. cartusiana and E. vermiculata respectively. The effect of four temperature degrees on incubation period and hatchability of M. cartusiana and E. vermiculata were studied. The highest hatchability was recorded when snails reared on 20°C (95 and 80% for M. cartusiana and E. vermiculata). When three moisture levels were tested, the highest hatchability and the shortest incubation period recorded at 80% R.H. Rearing snails on 1 clay: 1 sand soil gave moderate incubation period (19 & 18 days) and the highest hatchability was 87.5 and 92.5% for M. cartusiana and E. vermiculata, respectively. When snails egg exposed to long light period (12 hours) no hatching was occurred, while six hours was the most suitable for hatchability (92.5 and 97.5%) and shorted the incubation period (14,12 days) for M. cartusiana and E. vermiculata, respectively. The effect of five food types on E. vermiculata consumption was tested for seven days, data cleared that Lettuce leaves were the most preferable food type followed by Cabbage and Clover leaves.*

Key words: *Monacha cartusiana, Eobania vermiculata, Biology, land snails.*

INTRODUCTION

In recent years, the importance of land snails as agricultural pest was increased, Biological data have great effect in controlling pests. The average number of clutches/snail were 0.4 ± 0.0 , 0.8 ± 0.4 clutches with 19 ± 0.0 , 922.8 ± 4.6 eggs/ clutch for *Eobania* sp and *Monacha* sp respectively (Arafa,1997). The snail *E.vermiculata* incubation period was 21.2 days at 20°C, the life span averaged 1265.4 days hatchability percentages were approximately 88.4% (Mohamed 1999). Life cycle of *M.cartusiana* lasted three months from December to February, the majority of individuals aestivated during the period from May to August (Mahrous et al 2002). The optimum temperature degrees of *M. cartusiana* and *E. vermiculata* were from 17 to

20°C (Mahmoud,1994). The highest hatchability percentages were observed at 25°C and 75% R.H. for *E.vermiculata* (Eshra,1997 , Ismail, 1997). The effect of temperature on the survival of *M. cartusiana* and *E.vermiculata* was decreased by increasing relative humidity from 25 and 50 to 75% , *M. cartusiana* was more sensitive to the change of temperature in all cases of relative humidity followed by *E. vermiculata* (Lokma and Zafran 1999) .The effect of soil type on egg numbers of *M. cartusiana* was observed by Ismail,1997 and noticed that 1 clay : 1 sand soil gave the highest egg numbers. The most preferred food for both *M. cartusiana* and *E. vermiculata* was fig leaves, orange leaves (Asran,1994), grape leaves (Mohamed 1994), while lettuce leaves was the most preferred food among vegetable leaves followed by cabbage (Arafa 1997, El- Deeb et al 2001). This study aimed to determine some biological aspects, and the effect of some physical factors on *M. cartusiana* and *E. vermiculata*, in addition to the food preference of *E. vermiculata*.

MATERIALS AND METHODS

To investigate life span of *Monacha cartusiana* and *Eobania vermiculata* snails, fifty adults of tested snails were handly collected from certain highly infested nursery cultivated with ornamental plants in Shebin El-Kom during October 2004. The snails were kept in glass boxes (70 x 40 x 40 cm) contained moist clay soil to a depth of 10 cm., and fed every two days on fresh washed leaves of lettuce or cabbage. Boxes were covered with muslin and secured with rubber band to prevent snails from escaping (Baker and Hawke, 1990). The soil within each box was searched for cluches of eggs. The newly deposited cluches were singly removed. Ten eggs were arranged in culture dish of 9 cm diameter on wet filter paper. Biological aspects data under study were analyzed by counting the average (\pm) standered error. Ten culture dishes were used as replicates and kept under laboratory conditions. To study the effect of some physical factors on incubation period and egg hatching of *E. vermiculata* and *M. cartusiana*, newly deposited cluches were collected washed and cleaned. Ten eggs were placed singly on wet filter paper on a sponge slice as transparent plastic cup, each treatment was replicated 4 times and incubated at 15, 20, 25 and 30°C \pm 0.5 °C. After five days, replicates were examined daily to calculate the incubation period and hatching percentages R.H. was 95-100%. Three soil moisture levels i.e. 70, 80 and 90% R.H. were tested. Each treatment was replicated 4 times and examined daily. Air temperature was about 25°C \pm 0.5 °C during the experimental period. To study the effect of soil type, adult snails were collected and reared in containers (70 x 10 x 40 cm³) which contained clay & sandy & 1 clay: 1 sand soil, each soil type was replicated 4 times with 95 - 100% R.H. and 25°C. To study the effect of light period, three different levels of daily light period were tested (6, 9, 12 hours) where light was add in to the

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incubator for the required period. To study the effect of food preference on *E. vermiculata*, healthy snails were kept individually in plastic box (24 x 10 x 12 cm) contain clay soil and fed on fresh slices of lettuce for two weeks under laboratory conditions (25 °C and 80% R.H.) Snails were starved for 48 hours before starting the experiments (Miller *et al.* 1988). Five food materials were tested: lettuce, cabbage, Egyptian clover, guava and orange leaves, 10 grams of each food material were offered daily to each tested snail for seven successive days. Total and daily consumption was recorded for each food type.

RESULTS AND DISCUSSION

Monacha cartusiana and *Eobania vermiculata* are the most abundant and harmful land snails attack crops, therefore biological studies of these species are important to design successful control programs.

1- Life table of *Monacha cartusiana* under laboratory conditions:

Data in table (1) indicate that when *M. cartusiana* eggs were incubated under laboratory conditions, the average mean of incubation period was 19.3 ± 1.6 days, also the period which egg clutches took place to complete hatching was about 2.5 days. Regarding to the juvenile period of *M. cartusiana*, it was prolonged for 112 ± 4.2 days at 21-29 °C and 42-57%R.H. Mature individuals registered 232.7 ± 4.8 days as preoviposition period, while oviposition period continued for 91 ± 2 days at 19-27 °C and 45-60%R.H. Life cycle of *M. cartusiana* snails was 346 ± 4.1 days. Calculated life span was 580 ± 8.4 days.

Table (1): Life table of *Monacha carustiana* land snail under laboratory conditions.

Biological aspect	days \pm SE	°C		R.H%	
		mean	range	mean	range
Incubation period	19.3 ± 1.6	21	20-22	53	47-60
Juvenile period	112 ± 4.2	25	21-29	50	42-57
Preoviposition period	232.7 ± 4.8	25	22-28	50	43-56
Life cycle	364 ± 4.1	24	20-29	51	42-60
Oviposition period	91 ± 2	23	19-27	53	45-60
Postoviposition period	125 ± 8.2	28	25-31	51	43-58
Life span	580 ± 8.4	26	19-31	51	42-60

2- Life table of *Eobania vermiculata* under laboratory conditions:

Data in Table (2) show that the incubation period of *E. vermiculata* eggs was 12 days at 21-23 °C and 49-62% R.H. Hatching period of eggs in clutches took

2 days to complete the process. Juvenile period was 117.6 ± 4.5 days at 22-30°C and 44-59 % R.H. Preoviposition period of *E. vermiculata* was 249.8 ± 5.88 days. Life cycle was 379.4 ± 5.19 days at 21-30 °C and 44-62% R.H. It was observed that life cycle of *E. vermiculata* is longer than that obtained with *M. cartusiana* where it recorded 364 ± 4.1 days. Oviposition period and postoviposition period of *E. vermiculata* were 354.2 ± 6.04 days and 177.6 ± 9.74 days, respectively. Finally, life span of *E. vermiculata* was estimated by 921.4 ± 8.9 days, while it was only 580 ± 8.4 days for *M. cartusiana*, that owing to the long oviposition period of *E. vermiculata*.

Table (2): Life table of *Eobania vermiculata* snails under laboratory conditions.

Biological aspect	(days \pm SE)	°C		R.H%	
		mean	range	mean	range
Incubation period	12 ± 0.0	22	21-23	55	49-62
Juvenile period	117.6 ± 4.5	26	22-30	51	44-59
Preoviposition period	249.8 ± 5.88	26	24-29	52	46-58
Life cycle	379.4 ± 5.19	26	21-30	53	44-62
Oviposition period	354.2 ± 6.04	24	20-27	53	46-60
Postoviposition period	177.6 ± 9.74	25	27-23	52	44-59
Life span	921.4 ± 8.9	25	21-30	53	44-62

3- The effect of some physical factors on the incubation period and hatchability of *Eobania vermiculata* and *Monacha cartusiana*.

3-1 Effect of temperature degrees:

Data presented in table (3) show the effect of four different temperature degrees (15,20,25 and 30 °C) on the incubation period and hatching of both *E. vermiculata* and *M. cartusiana* at $75 \pm 5\%$ soil humidity. The shortest incubation period was recorded at the treatment of 25°C where it recorded 10&14 days ,and the longest period was observed at the treatment of 15 °C with 21 & 22 days for *E. vermiculata* and *M. cartusiana*, respectively. It was noticed that eggs failed to hatch at 30 °C for both snail species under study, while the hatchability percentages were the highest at 20 °C (80 and 95% for *E. vermiculata* and *M. cartusiana*, respectively) and the lowest hatchability was recorded at 15 °C for *E. vermiculata* (57.5%), while the same percentage was recorded with the snail *M. cartusiana* at 25 °C. Generally, 20 °C was the most suitable degree for hatching process for both snails.

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3-2 Effect of soil moisture:

The effect of some different levels of soil moisture on the incubation period and the hatching process of both *E. vermiculata* and *M. cartusiana* was recorded in Table (3) . It was observed that, when eggs were incubated at 70% soil moisture level, the hatching process of both *E. vermiculata* and *M. cartusiana* was occurred 14 days after inoculation resulting 40 and 70% hatchability percentages, respectively. On the other hand, when eggs were incubated at 80% soil moisture level, the hatching process of both *E. vermiculata* and *M. cartusiana* were decreased to 12 days after inoculation resulting 90 and 82.5% hatchability percentages, respectively.

Table (3): The effect of some physical factors on the hatchability and incubation period of *Eobania vermiculata* and *Monacha carustiana* eggs.

Physical factor	<i>Eobania vermiculata</i>			<i>Monacha carustiana</i>		
	Incubation period (day)	No of hatched eggs(40)	Hatchability %	Incubation period (day)	No of hatched eggs(40)	Hatchability %
Temperature						
15 °C	21	23	57.5	22	24	60
20 °C	12	32	80	19	38	95
25 °C	10	28	70	14	23	57.5
30 °C	-	0	0	-	0	0
Moisture level						
70 %	14	16	40	14	28	70
80 %	12	36	90	12	33	82.5
90 %	10	27	67.5	11	18	45
Soil type						
clay	22	28	70	24	23	57.5
sandy	12	12	30	14	8	20
1 clay :1 sand	18	37	92.5	19	35	87.5
Light period						
6 hours	12	39	97.5	14	37	92.5
9 hours	18	16	40	19	19	47.5
12 hours	-	0	0	-	0	0

These results are in harmony with those obtained by Eshra (1997), Ismail (1997), Lokma and Zafran (1999) and Al-Akra (2005) who reported that the hatching process of both *E. vermiculata* and *M. cartusiana* at 90% soil moisture level were occurred 10 & 11 days after inoculation with 67.5 and 45% hatchability percentages, respectively.

3-3 Effect of soil type:

Three soil types: clay, sandy and 1 sandy: 1 clay were tested their effect on the incubation period and the percentages of hatchability of both *E. vermiculata* and *M. cartusiana* under laboratory conditions (25 ± 2 °C and $75 \pm 5\%$ soil humidity). Regarding to the effect of soil types on the incubation period of *E. vermiculata* and *M. cartusiana* eggs Table (3), it was found that the shortest incubation period was recorded in sandy soil (12 and 18 days for both snails) followed by 1 clay : 1 sand soil (18 and 19 days for both snail), while the longest incubation period were registered with sandy soil 22 and 23 days for both snail, respectively. Also data cleared that 1 sand : 1 clay soil type exhibited the suitable environment for hatchability process of *E. vermiculata* and *M. cartusiana* eggs , the percentages of hatchability of both snails eggs were 92.5 and 87.5 %, respectively. Regarding to the effect of clay soil type on the percentages of hatchability, it was found that these percentages were decreased to 70 and 57.5 % for the two tested snails, respectively. As for the effect of sandy soil type it was found that the hatchability percentages for *E. vermiculata* and *M. cartusiana* were greatly reduced recording 30 and 20 %, respectively. These finding are in agreement with those obtained by Eshra (1997) , Ismail (1997), Mortada(2002),and Al-Akra (2005).

3-4 Effect of light period:

The effect of light period on the incubation period and the percentages of hatchability process of the eggs of both *E. vermiculata* and *M. carustiana* were tested under laboratory conditions (25 ± 2 °C and $75 \pm 5\%$ soil humidity) by exposing eggs to period of 6,9, or 12 daily light hours.

As for the effect of daily light periods on the incubation period of *E. vermiculata* and *M. carustiana*, it could be observed that the treatments of 6 and 9 daily light hours periods prolonged the incubation period which was 12,18 days for *E. vermiculata* eggs and registered 14,19 days for *M. carustiana* eggs , respectively , where the treatment of 12 daily light hours period led to complete failure of hatching process (Table 3). Data revealed that eggs of both snail species were failed to hatch when exposed to 12 hours light period, while diminishing the light period to 6 hours was the most suitable light period for egg hatchability giving 97.5 and 92.5 % for *E. vermiculata* and *M. carustiana*, respectively. Exposing eggs of the two snails

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under study for daily 9 hours light period gave 40 and 47.5 % egg hatching for *E. vermiculata* and *M. carustiana*, respectively.

4- Food preference of *Eobania vermiculata* :

Food preference of *E. vermiculata* to fresh leaves of different host leaves (Lettuce, cabbage, clover, orange and guava) was studied and recorded in Table (4) by determining the daily food consumption of 10 snails for one-week period. Lettuce leaves were the most preferred food for *E. vermiculata* with significant difference followed by cabbage and clover leaves with daily mean rate of 7.43, 4.84 and 3.9 gm/10 individuals, while leaves of fruit trees were not suitable for the snail feeding; recorded 2.83 and 0.92 gm/10 individuals for guava and orange, respectively. Statistical analyses showed no significant differences between the mean of cabbage, clover and guava consumption, while there are significant differences between lettuce and other food types. These data are in agreement with that obtained by Arafa (1997) , Eshra (1997) , Wilson *et al.* (1999) .

Table (4): The effect of food type on food consumption of *Eobania vermiculata* .

Food type (leaves)	The daily consumed food (g) / 10 individuals								
	1 st day	2 nd day	3 rd day	4 th day	5 th day	6 th day	7 th day	Total	Mean
Lettuce	10	7	5.25	8.33	4.94	8.47	8	51.99	7.43 a
Cabbage	7.85	6.06	3.3	7.19	2.64	2.76	4.1	33.9	4.84 b
Clover	5.97	3.27	1.8	1.65	6.89	5.65	2.09	27.32	3.90 b
Guava	3.57	3.7	5	1.87	2.5	1	2.17	19.81	2.83 bc
Orange	1.31	2.91	00	0.35	1.85	00	00	6.42	0.92 c

Means followed by same letter(s) are not significantly different.

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دراسات بيولوجية على نوعين من القواقع الأرضية في محافظة المنوفية

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المخلص العربى:

أجريت هذه الدراسة البيولوجية على نوعين من القواقع قوقع البرسيم الزجاجى *Monacha cartusiana* وقوقع الحدائق البنى ذو الشفة *Eobania vermiculata*، وأوضحت النتائج أن مدة الحياه لقوقع البرسيم الزجاجى استغرقت $8,40 \pm 580$ يوم بينما كانت $9,8 \pm 921,4$ يوم بالنسبة لقوقع الحدائق البنى ذو الشفة *E. vermiculata*.

تم دراسة تأثير كل من درجة الحرارة ، الرطوبة ، نوع التربة ، فترة الإضاءة على فترة حضانة البيض ونسبة الفقس لكلا القوقعين حيث ظهر أن درجة حرارة 20°C أعطت أعلى نسبة فقس $80,95\%$ لكل من *E. vermiculate*, *M. cartusiana*

لم يحدث فقس للبيض في كلا النوعين عند درجة حرارة 30°C . أما درجة الرطوبة فقد أعطت درجة رطوبة 80% أعلى نسبة فقس $82,5$ ، 90% لكلا القوقعين على الترتيب ، أما درجة رطوبة 90% فأعطت أقل فترة حضانة للفقس البيض لكلا النوعين وعند دراسة تأثير نوع التربة وجد أن استخدام التربة بنسبة 1 طينية : 1 رملية أعطت أعلى نسبة فقس للبيض $87,5$ ، $92,52\%$ بينما كانت أقل فترة حضانة عند استخدام التربة الرملية يليها الطينية .

أما عن فترة الإضاءة فعند تعريض البيض لفترة إضاءة 12 ساعة لم يحدث فقس أما عند 6 ساعات إضاءة فتم الفقس بعد 14 ، 12 يوم لكل من قوقع *E. vermiculata*, *M. cartusiana* وكانت أعلى نسبة فقس عند تعريض القواقع لست ساعات إضاءة ($92,5$ ، $97,5\%$) نكل من *E. vermiculata*, *M. cartusiana* على التوالي .

عند دراسة تأثير أنواع التغذية على أوراق من العوائل النباتية وهى الخس والكرنب والبرسيم والبرتقال والجوافة على كمية الغذاء المستهلك وجد أن أعلى استهلاك لقوقع *E. vermiculata* كان بمتوسط $7,43$ جم/ 10 قواقع من أوراق الخس يليها $4,84$ جم/ 10 قواقع من أوراق الكرنب وأقل استهلاك تم تسجيله عند استخدام أوراق البرتقال ($0,92$ جم/ 10 قواقع) .