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LIFE SPAN AND FECUNDITY OF THE CONICAL SNAIL, *COCHLICELLA ACUTA* UNDER LABORATORY CONDITIONS

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ABSTRACT: ***Experiments were conducted under laboratory conditions in Mansoura Research Unit, Plant Protection Research Institute, to determine life cycle, life span and the effect of soil application of mineral salts at the rate of 1 % on fecundity and life span of conical snail, Cochlicella acuta .***

Data showed that number of clutches laid by one pair of C.acuta was 10 ± 0.31 clutches, clutch size was 22.3 ± 0.93 eggs. The mean number of total eggs were 223 ± 18.3 eggs / pair and clutches of the snail was laid under moist soil to a depth of about 2.5cm ± 0.32. While incubation period,life cycle, oviposition period, post-oviposition period and life span of C.acuta were (11±1.3, 335.6±12.4, 96.2 ± 1.65, 128.1 ± 1.96 and 559.9 ± 6.4) days under laboratory conditions, respectively. On the other hand, the effect of di phosphate sodium on fecundity of C. acuta land snail, gave the highest values for all parameters except number of clutches. Regarding to sodium chloride application, snail didn`t give any eggs and lived 120 ± 20.6 days only, compared with control (559.9 ± 16.4 days).

Key words: ***Conical snail, Cochlicella acuta , Biology, Control.***

INTRODUCTION

Land snails and slugs are consider one of the extremely injurious pests to ornamental plants, shrubs, a wide variety of vegetables, agronomic, and citrus in most areas (Miller, *et al*.1988) causing great damage to all plant parts including fruits. The injured plants may intensely recompile the damaged parts and the yield of crops seems not to be affected, but at least the quality was reduced so that the vegetable crops got poorer marketing ratings and was reduced in value (El-Okda, 1980).

Land snails have been concentrated mainly in northern Governorates of Delta region and now, it spread in upper Egypt too on several host plants. These animals are active along the year months in some localities (gardens, nurseries), their activities increase in spring and autumn seasons. (Mortada,2004). Little information are available about biology of conical snail *Cochlicella acuta*. It is clearly known that successful control methods of a pest are largely depend on the available data concerning biology of this pest.

Therefore, the present study aims to gain some basic information about the biological aspects of *C. acuta*. So, some experiments were conducted under laboratory condition in Mansoura Research Unit, Plant Protection Research Institute.

MATERIALS AND METHODS

Laboratory experiments had been conducted to obtain basic information about some biological aspects of land snails *Cochlicella acuta* (Muller).

1. Life Cycle and Life Span of *Cochlicella acut*a (Muller).

Fifty adults of *C.acuta* were handly collected from highly infested fruit orchards of orange and lemon in Aga district. The snails were kept in glass boxes (70 × 40 × 40cm) contained moist soil to a depth of 10cm. They were fed on fresh washed leaves of lettuce. The soil was remoistening as required, and the remained diet was replaced every two days. Box was covered with muslin cloth and secured with rubber band to prevent snails from escaping (Baker and Hawke, 1991). The soil within box was searched for clutches of eggs. The newly deposited clutches were singly removed and time of oviposition was recorded. Ten eggs were arranged in culture dish of 9cm diameter on wet filter paper (Daxl, 1970, Mortada, 2002 and Daoud, 2004).

Ten culture dishes were replicated and kept under laboratory conditions. Eggs were observed daily to calculate the incubation period. Average of temperature as well as relative humidity during the test were (16.4 - 28.2 °C) and (48.2 - 62.3 % R.H) respectively. Thirty newly hatched juvenile snails were transferred into 15 small plastic boxes (17×13×13cm), individuals were paired. Each box contained moist clay soil to depth of about 5 cm. The snails were fed daily on fresh washed leaves of lettuce. The soil moisture was adjacent at 75 - 85% RH. After one month, each boxes were examined daily to determine newly deposited clutches, then, counted and removed, depth of deposited eggs was measured. Also life cycle, oviposition period, post- oviposition period and life span was determined. The obtained data were statistically analyzed using F test and standard error.

2. Effect of the soil application of mineral salts on fecundity of *C. acuta* .

Four mineral salts were applied to soil culture to evaluate its effect on fecundity of *C. acuta i.e*. calcium carbonate (Ca_2CO_3), diphosphate sodium (Na_2HPO_4), magnesium oxide (MgO) and sodium chloride (NaCl) with rate of 1% (1g / 100 gm soil), under laboratory conditions during the period from December 2006 – July 2008.

Fifty adults of *C. acuta* were collected from certain infested fields in Aga and El-Mansoura district. Snails were kept in glass boxes (70× 40× 40 cm) contained moist clay soil to depth of about 10 cm. and fed on fresh washed

leaves of lettuce. Boxes were covered with muslin cloth and secured with rubber band, to prevent snails from escaping (Baker and Hawke, 1991). The soil within each box was searched for clutches of eggs. The newly deposited clutches were singly removed. Ten eggs were arranged in a culture dish of 9 cm diameter on wet filter paper (Daxl, 1970).

Ten culture dishes were replicated and placed on the bench under laboratory conditions. Eggs were observed daily to calculate the incubation period, (Mortada, 2002). Twenty newly hatched juveniles of *C. acuta* were transferred into small plastic boxes. Each pair was placed in plastic boxes of (17× 13× 13cm) after the addition of calcium, phosphorous, magnesium and sodium separately. Ten replicates were done. Another treatment (three replicates) without additives was left as control. The soil humidity was adjacent to 75-85 %. Average of minimum and maximum temperature as well as relative humidity during the tested were (26.2 ± 2.4 °C with range of 16 – 31°C) and (61.1 % ± 3.9 with range of 46 – 71% R.H).

The snails were fed daily on fresh washed leaves of lettuce. The soil within each box was examined to determine the number of clutches / pair, total number of eggs / pair and clutch size. Also, oviposition period, post oviposition period was registered to calculate the life span. The obtained data were statistically analyzed using F test and standard error.

RESULTS AND DISCUSSION

1z. Number of Clutches, Clutch Size and Total Number of Eggs Laid by Pair of *C. acuta* Land Snails.

Pairs of *C.acuta* land snail were placed in plastic boxes contained moist soil, 15 replicates were used for this purpose. Clutches were removed; number of eggs and depth of eggs were counted and measured. Data in Table (1) show that number of clutches laid by one pair of *C.acuta* was 10 ± 0.31 clutches. On the other hand, clutch size was 22.3 ± 0.93 eggs. The mean number of total eggs deposited by one pair of conical snail were 223 ± 18.3 eggs / pair. Clutches of the snail was laid under moist soil to a depth of about 2.5 ± 0.32 cm.

Table (1): Number of clutches, clutch size and total number of eggs laid by pair of *C. acuta* under laboratory conditions.

Parameter	Mean ± S.E
Number of clutches / pair	10 ± 0.31
Clutch size	22.3 ± 0.93
Total No. of eggs / pair	223 ± 18.3
Depth of eggs (cm)	2.5 ± 0.32

2. Life cycle and life span of *C.acuta* land snail under laboratory conditions.

Data in Table (2) show the incubation period, life cycle, oviposition period, post-oviposition period and life span of *C.acuta* under laboratory conditions. Incubation period, newly deposited eggs were placed on moist filter paper and left under laboratory conditions until hatching. Means ± S.E of Incubation period was 11±1.3days. While the mean ± S.E of Life cycle was 335.6±12.4days under average of temperature and relative humidity 20.1± 1.60 °C and 56.0 ± 2.6 % R.H, during the experimental period.

Table (2): Life cycle and life span of *Cochlicella acuta* under laboratory conditions.

Developmental period (days)	Mean ± S.E (Days)	Temperature (°C)		Relative humidity	
		mean	Range	mean	Range
Incubation	11 ± 1.3	18.20 ± 0.51	16 – 23	54.0 ± 1.97	46 - 61
Juvenile stage	324.6 ± 11.2	20.1 ± 1.60	17 – 24	56.0 ± 2.6	45 – 63
Life cycle	335.6 ± 12.4				
Oviposition	96.2 ± 1.65	25.6 ± 1.3	18 – 31	49.7 ± 2.8	39 – 60
Post-oviposition	128.1 ± 1.96	26.7 ± 1.9	19 – 32	61.1 ± 3.9	37 – 71
Longevity	224.3 ± 3.2				
Life span	559.9 ± 6.4	25.9 ± 2.1	16 – 32	62.3 ± 4.3	39 – 71

Oviposition period is the period from the beginning of egg laying until the last egg was deposited. Mean ± S.E of oviposition period was 96.2 ± 1.65 days. Average of temperature and relative humidity were 25.6 ± 1.3 °C and 49.7 ± 2.6 % R.H. Post oviposition period means the time elapsed from the last deposited egg until death of adult. Mean ± S.E of post-oviposition was 128.1 ± 1.96 days under average of temperature and relative humidity of 26.7 ± 1.9 °C and 61.1 ± 3.9 % R.H. Finally life span refers to the period from the

egg deposited and hatching until death of its adult. It was 559.9 ± 6.4 days under average of temperature and relative humidity of 25.9 ± 2.1 °C and 62.3 ± 4.3 % R.H.

These results are in agreement with Baker and Hawke (1991) who studied life cycle of *C.acuta*, and assured that adult of the conical snail laid eggs from autumn to spring season with 372.6 eggs / pair, average of 9.2 clutches. The breeding season lasted from autumn to spring season. Snails were most abundant in spring and summer season, especially near the edges of the fields.

3. Effect of the soil application of mineral salts on fecundity of *C. acuta*.

The experiments were carried out during the period from December 2006 to end of July 2008 in El-Mansoura Unit Plant Protection Institute, to evaluate the effect of soil additives at the rate of 1 % on snail fecundity and its life span.

Data in Table (3) show the effect of soil additives on fecundity of *C. acuta* land snail. The gained table clear that the mean number of clutches / pair, clutch size, total number of eggs / pair and life span values were (10.0 ± 0.50 clutches, 22.2 ± 0.85 eggs, 226 ± 16.2 eggs and 559.9 ± 16.4 days), (11.3 ± 0.63 clutches, 21.72 ± 0.73 eggs, 245.3 ± 19.4 eggs and 558.7 ± 19.6 days), (10.6 ± 0.73 clutches, 23.60 ± 0.89 eggs, 249.6 ± 17.2 eggs and 559.3 ± 20.4 days), (10.3 ± 0.31, 21.4 ± 0.80, 221.0 ± 19.7 and 551.1 ± 23.2 days) for control, calcium carbonate, di-phosphate sodium, and magnesium oxide and sodium chloride, respectively. Di-phosphate sodium had the highest value for all parameters except number of clutches. Sodium chloride treatment didn`t give any eggs and *C.acuta* was lived 120 ± 20.6 days only, compared with control (559.9 ± 16.4 days).

The obtained results are in harmony with those reported by many authors who studied effect of some additives on terrestrial snail species. Oosterhoff (1977) reported that calcium carbonate was a very important supplement to the diet of snails and slugs for egg production. Mohamed (1999) studied the biology of *Eobania vermiculata* land snails and *limax flavus*, under different levels of calcium 0.5, 1.0, 1.5, 2.0 and 2.5 g and found that 1.0 g of calcium was the most favorable level for rearing of snail and slug. Abd El-Karim (2000) studied the effect of calcium carbonate on growth of two land snails *E.vermiculata* and *M.obstructa* and found significant effects on growth rate, weight and shell diameter of the snail compared with control treayment

Table (3): Effect of the soil application of mineral salts on fecundity of *C. acuta* . under laboratory conditions.

Species / Parameters	Mean numbers ± S.E.				
	Control	Calcium carbonate (Ca_2Co_3)	Di-phasphate Sodium ($NaHPo_4$)	Magnesium Oxide (MgO)	Sodium Chloride (Na Cl)
No. of clutches / pair	10.0 ± 0.50	11.3 ± 0.63	10.6 ± 0.73	10.3 ± 0.31	-
Clutch size	22.2 ± 0.85	21.72 ± 0.73	23.60 ± 0.89	21.4 ± 0.80	-
Total No., of eggs / pair	226 ± 16.2	245.3 ± 19.4	249.6 ± 17.2	221.0 ± 19.7	-
Life span (day)	559.9 ± 16.4	558.7 ± 19.6	559.3 ± 20.4	551.1 ± 23.2	120 ± 20.6

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تاريخ الحياه والخصوبة لقوقع النخيل *Cochlicella acuta* تحت الظروف المعملية.

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الملخص العربى

أجريت تجارب بفرع معهد بحوث وقاية النباتات بالمنصورة لتحديد تاريخ الحياه ودورة الحياه وتأثير بعض الاضافات الى تربة التربية بنسبة ١% على خصوبة قوقع النخيل *Cochlicella acuta* . وتلخصت النتائج فيما يلى:

١- عدد كتل البيض لكل زوج من الأفراد كانت ١٠ ± ٠,٣١ كتلة ، عدد البيض لكل كتلة كان ٢٢,٣ ± ٠,٩٣ بيضة ، ومتوسط العدد الكلى للبيض ٢٢٣ ± ١٨,٣ بيضة / زوج ، وكذلك فان عمق وضع البيض كان ٢,٥ ± ٠,٣٢ سم

٢- فترة الحضانة ، دورة الحياه ، فترة وضع البيض ، فترة مابعد وضع البيض و تاريخ الحياه كانت (١١ ± ١,٣ ، ٣٣٥,٦ ± ١٢,٤ ، ٩٦,٢ ± ١,٦٥ ، ١٢٨,١ ± ١,٩٦ و ٥٥٩,٩ ± ٦,٤ يوم) على الترتيب.

٣- أما بالنسبة لتأثير اضافات الكالسيوم والماغنسيوم والفوسفور والصوديوم فقد أوضحت النتائج ان اضافة الفوسفور بنسبة ١% أعطت أعلى النتائج لكل المقاييس ماعدا عدد كتل البيض فكانت فى الكالسيوم أعلى ، وبالنسبة لكلوريد الصوديوم لم يعط القوقع أى بيض وكان تاريخ الحياه ١٢٠ ± ٢٠,٦ يوم قصير جدا بالمقارنة بالطبيعى (بدون اضافات) فكانت ٥٥٩,٩ ± ١٦,٤ يوم .

Table 3. Effect of *Bacillus subtlis* (BS) as a soil treatment on some growth parameters of carrot in both seasons (S) under treated waste water irrigation.

Treatment (T)	Plant length (cm)			No of leaves / plant			Plant fresh weight (g)			Plant dry weight (g)		
	1	2	Mean	1	2	Mean	1	2	Mean	1	2	Mean
Control	51.3	49.9	50.6	7.6	8.1	7.9	87.0	88.1	87.55 b	12.3	12.9	12.6
BS	49.8	51.0	50.4	8.0	8.3	8.2	92.6	94.2	93.4 a	13.5	11.0	12.3
Mean S	50.6	50.5		7.8	8.2		89.8	91.2		12.9	12.0	
MSD T 5%			NS			NS			1.51			NS
MSD S 5%			NS			NS			NS			NS

Treatment (T)	Storage root length (cm)			Storage root thickness (cm^3)			Storage root fresh weight (g)			Storage root dry weight (g)		
	1	2	Mean	1	2	Mean	1	2	Mean	1	2	Mean
Control	15.4	14.3	14.9	2.2	2.2	2.2	69.6	66.6	68.1 b	14.1	10.5	12.3
BS	14.6	14.7	14.7	2.6	2.5	2.6	71.6	82.2	76.9 a	12.1	14.4	13.3
Mean S	15.0	14.5		2.4	2.4		70.6	74.4		13.1	12.5	
MSD T 5%			NS			NS			2.62			NS
MSD S 5%			NS			NS			NS			NS

1 = first season 2 = second season

Table 4. Effect of super phosphate calcium (SPC 1 & 2) as a soil treatment on some growth parameters of carrot in both seasons (S) under treated waste water irrigation.

Treatment (T)	Plant length (cm)			No of leaves / plant			Plant fresh weight (g)			Plant dry weight (g)		
	1	2	Mean	1	2	Mean	1	2	Mean	1	2	Mean
Control	49.4	51.3	50.4	7.6	8.1	7.9	87.0	88.1	87.55 ab	12.3	12.9	12.6
SPC1	52.3	48.4	50.4	7.4	7.8	7.6	102.8	82.7	92.75 a	12.4	13.1	12.8
SPC2	48.4	52.3	50.4	7.4	7.6	7.5	78.2	85.5	81.85 b	12.6	12.3	12.5
Mean S	50.0	50.7		7.5	7.8		89.3	85.4		12.4	12.8	
MSD T 5%			NS			NS			10.23			NS
MSD S 5%			NS			NS			NS			NS

Treatment (T)	Storage root length (cm)			Storage root thickness (cm^3)			Storage root fresh weight (g)			Storage root dry weight (g)		
	1	2	Mean	1	2	Mean	1	2	Mean	1	2	Mean
Control	15.4	14.3	14.9	2.2	2.2	2.2	66.6	69.6	68.1	14.1	10.5	12.3
SPC1	14.0	15.8	14.9	2.3	2.6	2.5	69.0	60.1	64.6	12.7	12.7	12.7
SPC2	14.0	15.0	14.5	2.1	2.5	2.3	60.2	67.0	63.6	13.2	13.9	13.6
Mean S	14.5	15.0		2.2	2.4		65.3	65.6		13.3	12.4	
MSD T 5%			NS			NS			NS			NS
MSD S 5%			NS			NS			NS			NS

1 = first season 2 = second season

SPC1 = 250 Kg / fed SPC2 = 500 Kg / fed

Table 5. Effect of polyacrylamide hydrogel (PAMG) as a soil treatment on some growth parameters of carrot in both seasons (S) under treated waste water irrigation.

Treatment (T)	Plant length (cm)			No of leaves / plant			Plant fresh weight (g)			Plant dry weight (g)		
	1	2	Mean	1	2	Mean	1	2	Mean	1	2	Mean
Control	49.9	51.3	50.6	7.6	8.1	7.9	87.0	88.1	87.55 b	12.9	12.3	12.6
PAMG	50.7	47.0	48.9	7.1	7.8	7.5	94.7	99.6	97.15 a	11.3	13.2	12.3
Mean S	50.3	49.2		7.4	8.0		90.9	93.9		12.1	12.8	
MSD T 5%			NS			NS			2.76			NS
MSD S 5%			NS			NS			NS			NS

Treatment (T)	Storage root length (cm)			Storage root thickness (cm^3)			Storage root fresh weight (g)			Storage root dry weight (g)		
	1	2	Mean	1	2	Mean	1	2	Mean	1	2	Mean
Control	15.4	14.3	14.9	2.2	2.2	2.2	69.6	66.6	68.1 a	14.1	10.5	12.3
PAMG	14.5	13.5	14.0	2.2	2.4	2.3	59.3	65.3	62.3 b	13.0	14.1	13.6
Mean S	15.0	13.9		2.2	2.3		64.5	66.0		13.6	12.3	
MSD T 5%			NS			NS			3.53			NS
MSD S 5%			NS			NS			NS			NS

1 = first season 2 = second season