

Effect of Limiting Irrigation Periods on the Population Density of Certain Land Snail and Slug Species in Egyptian Clover Fields at Damietta Governorate

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Abstract:

The effect of irrigation periods on population density and egg laying of land snails

Monacha cartusiana (Müller, 1774), *Monacha cantiana* (Montagu, 1803) and land slugs *limax maximus* (Linnaeus, 1758) *Deroceras reticulatum* (Müller, 1774), was measured in fields of Egyptian clover at Sharabas village, Faraskour district and Mit El-Khouly Abdulla village, El-zarqa district at Damietta governorate. This study was conducted on two types of soil which are loamy and heavy soils during winter and spring seasons of 2010-2011.

The results showed that the efficacy of irrigation period, as cultural control method depends on irrigation period and soil type. In loamy soil, irrigation after 10 and 15 days caused a rapid decrease in the population percentage of snail and slug. In heavy soil, the reduction in population percentage showed a slow response. The decline of population percentage was faster with the prolongation of post irrigation periods for 10, 15 and 20 days in heavy soil. Therefore, reduction percentages of population density increased during spring months as compared to population density during winter months. Also, the number of

clutches laid in loamy and heavy soils was significantly influenced by tested animals. On the other hand, the present data indicated that the two slugs,

L.maximus, *D. reticulatum*, were sensitive toward the irrigation period in comparison to the two snails, *M. cantiana* and *M. cartusiana*.

Keywords: land snails, *Monacha cartusiana*, *Monacha cantiana* and land slugs *limax maximus*, *Deroceras reticulatum*, Egyptian clover, cultural control method, irrigation periods and soil type.

Introduction:

In recent years, land snails and slugs increased as dangerous pests on field crops, vegetables and fruits causing an economical damage to these crops not only in quantity but also in quality. In addition, they acted as intermediate hosts for many diseases that spread to plant, man, farm animals and birds; such as fasciola, lungworms and many viral diseases Bishara *et al.* (1968) and Godan (1983).

These pests increased in the northern part of Delta especially in field crops such as Egyptian clover and leafy vegetables, which is considered as suitable shelters for these animals, providing them with protection and

relative humidity El-Okda (1980, 1984 and El-Okda et al., 1990).

The use of specific molluscicides and other candidate insecticides with high concentrations has a toxic effect on man and livestock and causes environmental pollution El-wakil (1994) and Wronski and Hausdort (2008).

Therefore, this study is planned to find out safe means for controlling these pests by using the ecological factors such as different irrigation period affecting their activities, population dynamic and egg clutches.

Materials and Methods

Two experiments were carried out during winter and spring of 2010 – 2011 in two different habitats i.e. loamy and heavy clay soils cultivated with Egyptian clover at Sharabas village, Faraskour district and Mit El-Khouly Abdulla village, El-zarqa district at Damietta governorate.

Population density and egg clutch lying of snails *M. cartusiana*, *M. cantiana* and slugs *L.*

maximus, *D. reticulatum*

were recorded before and after different irrigation periods.

An area of about one feddan was selected for each heavy and loamy clay soils. Five replicates of quadrat sample size (1 x 1 m²) from Egyptian clover fields were randomly chosen, then left far from any pesticide contamination Asran, (2001). These fields were irrigated by two different levels of irrigation for 10

and 15 days with loamy soil. Three different levels of irrigation period were used for 10, 15 and 20 days with heavy soil, during two seasons of winter and spring. Five replicates in addition to another one for comparison were used for each irrigation period. The number of snails, slugs and egg clutches of the tested quadrat were counted in the field before and after irrigation period.

Sampling was carried out during the morning in the absence of rain and sunrise **Staikou and Lazanidou-Dimitriadou, (1990)**. Tested snails, slugs and egg clutches were counted once every two weeks **Baker, (1988)**. Averages of temperature and relative humidity were recorded after two weeks. The reduction percentages of the samples were calculated according to the formula of **Abbott (1925)**, and statistically analysed using F-test (L.S.D).

$$\% \text{ Reduction} = \frac{\text{Control-infested} - \text{Control}}{\text{Control}} \times 100$$

Results and Discussion

The experiment was carried out during winter and spring 2010 – 2011 in two different soils i.e. loamy and heavy soils to investigate the efficiency of irrigation period on population density of snail and slug that infesting Egyptian clover and to determine their egg clutches at Sharabas village, Faraskour district and Mit El-Khouly Abdulla

village, El-zarqa district at Damietta governorate.

1- Population density on loamy soil:

Data in Table (1) reveal that the irrigation period showed high efficacy on the population of the land snail *M. cartusiana* and *M. cantiana* and slug *L. maximus* and *D. reticulatum* in Egyptian clover fields.

The reduction percentage of two slugs was significantly higher at 10 and 15 days after irrigation than of the two snails. Also, the number of egg clutches of land snail and slug was significantly more sensitive to the loamy soil than the another soil. On the other hand, the mean of percent reduction in population of *M. cartusiana* reached 11.3 and 48.7% in winter and 14.5 and 49.8% in spring at Sharabas village, Faraskour district after 10 and 15 days of irrigation respectively. Yet, it was 11.4 and 49.8% in winter and 15.2 and 57.4% in spring respectively at Mit El-Khouly Abdulla village, El-zarqa district. The means of percentage reduction were high in case of the egg clutches representing 4.5 and 54.5%, 34.3 and 68.7%, 9.1 and 59.1% and 33.3 and 100% in winter and spring at the same two districts, respectively.

Percent reduction in the population of *M. cantiana* was

6.7, 43.6% and 10.1, 45.6% in winter and spring after 10 and 15 days of irrigation, respectively at Sharabas village, Faraskour district, while the percentage reduction of egg clutches was the highest (22.8 and 54.2%, 47.6 and 64.2%) in winter and spring at the same district respectively, followed by Mit El-Khouly Abdulla village, El-zarqa district, where it was 7.7, 45.1% and 13.2, 55.8%. Also the percentage reduction was high for the egg clutches (28.5, 71.4% and 68.7, 96.8%) at 10 and 15 days after irrigation, during the same two seasons, respectively.

From this investigation, it is clear that the two slugs *L. maximus* and *D. reticulatum* were sensitive after 10 and 15 days of irrigation in winter and spring at two districts. The percentage reduction was 4.0, 61.5% and 22.4, 62.3% and 19.7, 65.5% and 29.5, 78.9% in *L. maximus*, and 21.3, 63.2% and 28.6, 72.4% and 47.2, 76.8% and 54.4, 84.7% in *D. reticulatum*, in winter and spring respectively. Therefore reduction percentage of the number of egg clutches was 31.5, 68.4% and 85.7, 95.2% and 77.2, 86.3% and 90.9, 100% for *L. maximus*, while it was 47.6, 100% and 85.7, 100% and 69.6, 100% and 91.1, 100% in case of *D. reticulatum* during the same seasons, respectively.

Table (1): Effect of irrigation periods on land snail and slug population and on their egg clutches laid in loamy soil of Faraskour and El-zarqa districts during winter and spring seasons of 2010 – 2011 at Damietta governorate.

District	Season	Period (days)	Effect of irrigation period on																Mean of temperature and relative humidity	
			Land snails								Land slugs									
			<i>M. cartusiana</i>				<i>M. cantiana</i>				<i>L. maximus</i>				<i>D. reticulatum</i>					
No. snail	R%	No. clutch	R%	No. snail	R%	No. clutch	R%	No. slug	R%	No. clutch	R%	No. slug	R%	No. clutch	R%	°C	R.H.%			
Faraskour	Winter	10	80.2	11.3	2.1	4.5	80.4	6.7	2.7	22.8	40.4	4.0	1.3	31.5	60.1	21.3	2.2	47.6	12.4	72.2
		15	46.4	48.7	1.0	54.5	48.6	43.6	1.6	54.2	16.2	61.5	0.6	68.4	28.1	63.2	0.0	100	14.4	51.4
		Control	90.5		2.2		86.2		3.5		42.1		1.9		76.4		4.2		14.2	76.6
		L.S.D	3.28		0.31		6.80		0.48		4.37		0.37		4.55		0.26			
	Spring	10	65.2	14.5	2.1	34.3	83.0	10.1	2.2	47.6	28.6	22.4	0.3	85.7	52.2	28.6	0.6	85.7	15.4	62.2
		15	38.3	49.8	1.0	68.7	51.2	45.6	1.5	64.2	13.9	62.3	0.1	95.2	20.2	72.4	0.0	100	18.6	48.4
		Control	76.3		3.2		92.3		4.2		36.9		2.1		73.2		4.2		18.8	74.4
		L.S.D	5.26		0.37		3.78		0.25		4.49		0.21		3.09		0.36			
El-zarqa	Winter	10	60.2	11.4	2.0	9.1	78.3	7.7	2.5	28.5	28.4	19.7	0.5	77.2	42.4	47.2	1.0	69.6	14.2	74.2
		15	34.1	49.8	0.9	59.1	46.6	45.1	1.0	71.4	12.2	65.5	0.3	86.3	18.6	76.8	0.0	100	16.4	52.4
		Control	68.0		2.2		84.9		4.0		35.4		2.2		80.4		3.3		16.2	76.6
		L.S.D	5.01		0.45		3.09		0.31		3.09		0.31		3.09		0.16			
	Spring	10	68.0	15.2	1.4	33.3	79.6	13.2	1.0	68.7	34.1	29.5	0.2	90.9	28.6	54.4	0.3	91.1	18.4	66.4
		15	34.1	57.4	0.0	100	40.5	55.8	0.1	96.8	10.2	78.9	0.0	100	9.6	84.7	0.0	100	16.6	48.2
		Control	80.2		2.1		91.8		3.2		48.4		2.2		62.8		3.4		18.8	72.4
		L.S.D	5.21		0.16		4.89		0.39		4.61		0.19		2.82		0.26			

R% = Reduction percentage

2- Population density on heavy soil:

Data in Table (2) show that means of percentage reduction of snails and slugs in Egyptian clover fields were significantly higher after 20 days of irrigation at Sharabas village, Faraskour district and Mit El-Khouly *M. cartusiana*, *M. cantiana* and land slugs *L. maximus*, *D. reticulatum* Abdulla village, El-zarqa district, representing 62.0, 69.1, 55.8, 65.5, 79.9, 84.5, 82.2 and 83.7% in winter, while they were 65.4, 71.1, 62.2, 76.2, 80.0, 87.0, 85.0 and 87.3% in spring for snails *M. cartusiana*, *M. cantiana* and slugs *L. maximus*, *D. reticulatum*, respectively. However, reduction percentage reached 43.4, 47.5, 40.4, 53.2, 54.3, 63.4, 58.1 and 60.2% in winter and 51.7, 55.5, 45.2, 59.1, 57.7, 65.5, 63.0 and 63.7% in spring after 15 days of irrigation for the same snails and slugs, respectively. The percentage of reduction was lowest 5.9, 8.7, 3.6, 11.1, 3.9, 5.5, 9.5 and 16.3% in winter and 12.4, 20.5, 6.0, 14.6, 11.3, 24.2, 17.8 and 23.3% in spring after 10 days of irrigation for the land snails *M. cartusiana*, *M. cantiana* and land slugs *L. maximus*, *D. reticulatum*, respectively. Also, in contrast to the snails and slugs the present data indicated that the clutches were comparatively sensitive to irrigation times. Percentage of reductions egg clutches after 10, 15 and 20 days of irrigation were 4.0, 34.0, 76.0, 17.5, 47.5, 80.0, 2.5, 35.0, 60.0, 15.5, 35.5, and 64.4% in winter, respectively, it was 14.5, 37.5, 79.2, 33.3, 52.4, 83.3, 16.6, 40.5, 73.8, 17.4, 52.2 and 76.1 % in

spring for the two snails at Sharabas village, Faraskour district and Mit El-Khouly Abdulla village, El-zarqa district, respectively.

The same trend was observed for the two slugs on Egyptian clover plants. Data in Table (2) illustrated generally that the irrigation period had initial effect on the number of egg clutches of the two slugs after 10, 15 and 20 days of irrigation and reduction percentage increased gradually until the end of experiments. Reduction percentages reached in egg clutches of *L. maximus* and *D. reticulatum*, at Faraskour and El-zarqa districts reached 20.0, 70.0, 80.0, 28.1, 71.8, 87.5, 30.0, 73.3, 90.0, 44.7, 76.3 and 92.1% in winter, respectively, while, it was 36.8, 78.9, 89.4, 47.6, 80.9, 92.8, 41.5, 75.6, 95.1, 65.7, 80.0 and 97.1 % in spring, respectively.

These results agree with those reported by El-Masry (1997) who mentioned that the plough process decreased the population of *Helicella vestalis* immediately after one day. El-Deeb *et al* (2003), reported that the efficacy of tillage process was more effective against the land snails with reduction the population density in percentages after tillage. Also, hand collection of the land snails was an efficient practice as cultural control with reduction percentages of 61.54 & 72.6% for *E. vermiculata* and *M. obstructa* respectively. The Lettuce plant used as trap nearly bated the snail population of both species up to the half.

Table (2): Effect of irrigation periods on land snail and slug population and on their egg clutches, laid in heavy soil of Faraskour and El-zarqa districts during winter and spring seasons of 2010 – 2011 at Damietta governorate.

District	Season	Periods (days)	Effect of irrigation period on																Mean of temperature and relative humidity	
			Land snails								Land slugs									
			<i>M. cartusiana</i>				<i>M. cantiana</i>				<i>L. maximus</i>				<i>D. reticulatum</i>				°C	R.H.%
			No. snail	R%	No. clutch	R%	No. snail	R%	No. clutch	R%	No. slug	R%	No. clutch	R%	No. slug	R%	No. clutch	R%		
Faraskour	Winter	10	100.1	5.9	4.8	4.0	106.2	3.6	3.9	2.5	46.0	3.9	3.2	20.0	70.8	9.5	2.1	30.0	14.2	74.4
		15	60.2	43.4	3.3	34.0	65.6	40.4	2.6	35.0	21.9	54.3	1.2	70.0	32.8	58.1	0.8	73.3	16.4	52.2
		20	40.4	62.0	1.2	76.0	44.2	55.8	1.6	60.0	9.6	79.9	0.8	80.0	13.9	82.2	0.3	90.0	14.4	76.6
		Control	106.4		5.0		110.2		4.0		47.9		4.0		78.2		3.0		18.2	84.2
		L.S.D	7.79		0.59		8.37		0.77		3.91		1.30		4.17		0.95			
	Spring	10	84.2	12.4	4.1	14.5	90.4	6.0	3.5	16.6	50.2	11.3	2.4	36.8	68.0	17.8	2.4	41.5	20.4	78.2
		15	46.4	51.7	3.0	37.5	52.7	45.2	2.5	40.5	23.9	57.7	0.8	78.9	30.6	63.0	1.0	75.6	18.2	74.6
		20	33.2	65.4	1.0	79.2	36.4	62.2	1.1	73.8	11.3	80.0	0.4	89.4	12.4	85.0	0.2	95.1	18.4	48.2
		Control	96.2		4.8		96.2		4.2		56.6		3.8		82.8		4.1		20.2	76.4
		L.S.D	5.59		0.57		5.36		0.90		3.82		0.63		4.25		0.51			
El-zarqa	Winter	10	75.2	8.7	3.3	17.5	78.4	11.1	3.8	15.5	59.9	5.5	2.3	28.1	63.5	16.3	2.1	44.7	14.8	72.2
		15	43.2	47.5	2.1	47.5	41.3	53.2	2.9	35.5	23.2	63.4	0.9	71.8	30.2	60.2	0.9	76.3	16.2	54.2
		20	25.4	69.1	0.8	80.0	30.4	65.5	1.6	64.4	9.8	84.5	0.4	87.5	12.3	83.7	0.3	92.1	16.2	54.4
		Control	82.4		4.0		88.2		4.5		63.4		3.2		75.9		3.8		14.4	74.2
		L.S.D	5.27		0.53		4.92		0.60		4.05		0.63		4.96		0.55			
	Spring	10	82.6	20.5	2.8	33.3	89.6	14.6	3.8	17.4	46.1	24.2	2.0	47.6	66.0	23.3	1.2	65.7	18.8	76.2
		15	46.2	55.5	2.0	52.4	42.9	59.1	2.2	52.2	21.0	65.5	0.8	80.9	31.2	63.7	0.7	80.0	18.2	64.4
		20	30.0	71.1	0.7	83.3	25.0	76.2	1.1	76.1	7.9	87.0	0.3	92.8	10.9	87.3	0.1	97.1	16.4	48.2
		Control	104		4.2		105.0		4.6		60.8		4.2		86.0		3.5		18.8	78.2
		L.S.D	6.11		0.71		4.20		0.64		3.33		0.58		4.09		0.50			

R% = Reduction percentage

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تأثير فترات الري علي تعداد القواقع والبزاقات الأرضية في حقول البرسيم في محافظة دمياط

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تمت هذه الدراسة على نوعين من التربة، الأولى تربة خفيفة والثانية تربة ثقيلة في كل من قرية شرباص، مركز فارسكور، وقرية ميت الخولي عبدالله، مركز الزرقا، بمحافظة دمياط خلال موسمي الشتاء والربيع لعامي 2010/2011 على نوعين من القواقع والبزاقات.

فكانت النتائج كالآتي:

أولاً :- أظهرت التربة الخفيفة في كل من قرية شرباص، وقرية ميت الخولي عبدالله استجابة سريعة لطول المدة بين فترات الري حيث أدت إلى انخفاض كبير في أعداد القواقع والبزاقات الأرضية وكذلك في أعداد كتل البيض لكل منهما حيث أن زيادة الفترة بين الريتين من 10 إلى 15 يوماً أدى إلى حدوث انخفاض يتراوح بين 6.7 إلى 49.8 % في أعداد القواقع الأرضية خلال فصل الشتاء و10.1 إلى 57.4 % خلال فصل الربيع وتراوحت نسبة الانخفاض في أعداد كتل البيض ما بين 4.5 إلى 100 % في كل الفصليين ، أما نسبة الانخفاض في أعداد البزاقات الأرضية فأظهرت اختلافات كبيره حيث كانت 4.0 - 76.8 % في الشتاء و22.4 - 84.7 % في الربيع ، كذلك كانت نسبة الانخفاض في أعداد كتل البيض 31.5 - 100 % في كل من الفصليين.

ثانياً :- التربة الثقيلة أو الطينية أظهرت استجابة بطيئة لطول الفترة بين الريتين إذا ما قورنت بنسبة الانخفاض في أعداد القواقع والبزاقات الأرضية في الأرض الخفيفة عندما كانت المدة بين الريتين من 10 - 15 يوم وعندما تم زيادة الفترة بين الريتين في الأراضي الطينية إلي 20 يوم أدى ذلك إلى زيادة نسبة الانخفاض في أعداد الرخويات إلى 62.0 و69.1 % في الشتاء و65.4 و71.1 % في الربيع للقوقع *M. cartusiana* وكانت 76.0 و80.0 % في الشتاء و79.2 و83.3 % في الربيع للقوقع *M. cantiana* في المنطقتين محل الدراسة على التوالي، وكانت نسبة الانخفاض 79.9 و84.5 % في الشتاء للبقاقه *L. maximus* و80.0 و87.0 % في الربيع لنفس البزاقه، كما بلغت هذه النسبة 82.2 و83.7 % في الشتاء و85.0 و87.3 % في الربيع للبقاقه *D. reticulatum* لكلا المنطقتين على التوالي.

أما عند زيادة الفترة بين نوبات الري إلى 20 يوم كانت نسبة الانخفاض في أعداد كتل البيض اقل منها في حالة الأرض الخفيفة عندما كانت المدة بين فترات الري 10 و15 يوم لكل من القواقع والبزاقات في منطقتي الدراسة ويرجع ذلك إلى قدرة الأرض الثقيلة على الاحتفاظ بالرطوبة الأرضية لمدة طويلة.

تتميز هذه الدراسة بأنها دراسة تطبيقية تمكنا من تقليل أعداد القواقع والبزاقات الأرضية وأعداد كتل البيض في حقول البرسيم دون اللجوء إلي المبيدات وذلك تفادياً للآثر الضار للمبيدات مهما كانت درجة انخفاض سميتها حيث لا يمكن استخدام أي مبيد علي البرسيم كمحصول علف لما له من تأثير سيئ علي صحة الحيوان بالإضافة إلى توفير كميته كبيره من ماء الري.