

MECHANICAL PROCEDURES AS AN ENVIRONMENTAL CONTROL ALTERNATIVELY WITH CHEMICALS ON LAND SNAILS AND SLUGS ON FRUIT TREES

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ABSTRACT

Experimental studies were conducted under field conditions by adopting methods friendly with the environment at Damietta Governorate represented at Fareskure, El-Zarka and Kafr Saad districts in addition to Sherbeen district in El-Dakahlia Governorate aimed to study the effect of tillage process and agricultural control of land snail of *Monacha theba cartusiana* (Muller) and slug *deroceracac reticulatum* (Muller) infecting some fruit trees such as lemon, orange, guava and peach, during winter and spring seasons, 2007/2008. The tillage process in each treatment was carried out into two levels according to the tillage depth of 15cm and 25cm in comparison with samples treated by Lanit 90 as molluscicides in each district. These three treatments were compared with others un-treated as a control to show the natural population of land snail and slug to tillage on 15cm depth (site1), tillage on 25 cm depth (site 2) and plots which treated with Lanit 90 (site 3). The effect of tillage in site 2 was more effective than site 1 in most samples and was similar to site 3 and sometimes more effective on lemon and guava than in orange and peach, respectively.

INTRODUCTION

In recent years land snail and slugs became injurious pests attacking fields, vegetable crops and fruit trees causing serious economic damages not only in quantity but also in the quality of fruits such as lemon, orange, apple, peach, guava and pear by scraping the cortex layer of these fruits and encourage bacterial and fungal diseases on these fruits causes export rejecting. Land snails and slugs damage plant seeds, seedlings, underground tubers, leaves and fruit. Damage to seedlings often results in the death of the plant, which means major production losses.

In Egypt, such studies carried out on injurious snails to agriculture (Bishara *et al*, 1968), land snails which found at Alexandria caused economic damage and their control (El-Okda, 1979 and 1980) and also in Ismailia Governorate (El-Okda, 1984), Ecological and morphological studies on certain land snails at Sharkia governorate by (Ghamry *et al*, 1993) Seasonal fluctuation in population of the land snails in citrus trees in the northern reclaimed lands was carried out by (Hashem *et al*, 1993) economic importance of land snails on field crops, vegetables and fruits studied by (Kassab and Daoud, 1964) pest snails and slugs, biology and control reported by (Godan, 1983), Davison and (Chibas, 2006) studied the population structure of the mandarin snail species from Japan.

Slugs have involved from snails by losing or greatly reducing the external, hard, calcified shell, enabling them to live in small spaces such as in the soil. Slugs are better able than land snails to survive in cultivated fields.

Since land snails and slugs and their principal natural enemies are soil-dwelling animals, cultivation can cause major changes to their numbers and behavior. These studies showed the influence of tillage systems on snails and slugs numbers and damage in fruit crops and the influence of tillage practices on the abundance of land snails and slugs and their natural enemies

These studies aimed to find the safety suitable and effective mean in controlling these land snails and slugs, where, it found on clover, fruits, leafy vegetables which injuries by chemical control that make these products unsuitable for human or animals, so, the suitable agricultural method was studied to remove the shelter of weeds and limiting the relative humidity in the soil under fruit trees and exposing the soil layers to the sun.

MATERIALS AND METHODS

1- Seasonal fluctuations of land snail *M. T. cartusiana* and slug *D. reticulatum*:

Samples of *M. T. cartusiana* were obtained under field conditions from mixed gardens of fruits located in four districts, three of them were Fareskure, El-Zarka and Kafr Saad in Damietta Governorates while Sherbien district only in Dakahlia Governorate. Snails and slugs collected monthly from the soil under five marked trees for each crop of lemon, orange, guava and peach through two season of year (winter and spring) from November to the end of May as a way used by (Godan 1983 and Hashem et al 1993).

2- Agricultural control by tillage process:

Tillage process was divided into two treatments, the first one with depth of 15cm one pass and collection after 3 days of tillage, the second treatment was perpendicular tilled twice to make two layers of soil with depth of 25cm after 5 days from the first pass, snails and slugs collected after 3 days from the second pass.

3- Lanit 90 (methomyl):

Lanit 90 as recommended pesticides provided by Dupont company used in sort of spray as recommended dose used in land snail control in treatment 3 by five replicates for each collection of land snails and slugs after 3, 5, 10, 15 days

4- Technique used:

The plan of this work was divided into three divisions as follow snails and slugs under mixed fruit trees samples were taken from four districts with four types of fruit trees for each district, each tree sampled by five replicates for each one pass of 15 cm depth, second pass of 25cm depth and lanit 90 treatments (Coate 2003).

Affected individuals were collected five days after one pass of tillage and three days after second pass of tillage and 3 , 5, 10, 15 days after lanit 90 treatment. Reduction percentages were counted according to Hendreson and Tilton (1955) and corrected by Abott (1925).

RESULTS AND DISCUSSION

1- Seasonal fluctuations of land snail *M. T. cartussiana* and slug *D. reticulatum*:

The number of individuals shown in Table 1, indicates that the effect of temperature and relative humidity are very important on snail and slug population and on activity, so, it can be noticed that there is a difference between winter and spring seasons, where the low number was in winter season at Fareskure district. This population differed from a tree to another. The total number of snails and slugs in winter season in Fareskure were (70, 66, 54 and 46) on guava, lemon, orange and finally in peach which shown the lowest number of individuals. While, in spring season at the same district, the number of individuals recorded the highest in guava trees (94) followed by orange (84), lemon (73) and the peach (60). It was noticed that the number of *M. T. cartussiana* recorded highest number under orange and guava by the same of peach (58) individuals in spring more than the winter where recorded (30) individual under orange trees but recorded (36) under guava trees also. It was noticed that the number of *D. reticulatum* showed the nearly similar number in winter and spring seasons (30/33), (24/26), (34/36) and (22/24) on lemon, orange, guava and peach in winter and spring seasons at Fareskure district, respectively. These values agree with that reported by Godan 1983, El-Okda 1982, and Hashim *et al* 1993.

At El-Zarka district of Damietta Governorate, the same fluctuation of snails and slugs were found but less than at Fareskure, in general, which recorded (54, 52, 58, and 40) under lemon, orange, guava and peach respectively in winter season. While recorded (65, 72, 74, and 70) in spring season with the same previous arrangements. It was remarked that the number of *M. T. cartussiana* was significantly differed from winter to spring only under orange, guava and peach which recorded (30/48), (34/48) and (20/44) at El-Zarka district throughout (winter/spring), respectively but under lemon trees the number of individual of *M. T. cartussiana* almost equal or the same number. This result may be due to the shelter of weeds from year to another under lemon trees and also the humus under these trees which mixed with soil and makes it warm all over the year, agreed with that reported by Godan 1983.

Data of Table 1 indicated the number of individuals varied at Sherbien district of Dakahlia Governorate as recorded (86, 84, 72 and 71) in spring season under lemon, guava, orange and peach respectively. While recorded (64, 56, 46 and 39) under lemon, guava, orange and peach in winter season respectively. The highest number of *M. T. cartussiana* under guava (56) followed by lemon (52) while the same number of individuals found under orange and peach through spring season. Also in Kafr-Saad district it was found that the number of individuals differed from spring to winter seasons where recorded (72, 70, 69 and 68) under guava, lemon, orange and peach. The number of *M. T. cartussiana* increased twice in spring than in winter where recorded (50, 48, 46 and 46) in spring while recorded (26, 24, 28 and 27) in winter on guava, orange, lemon and peach, respectively.

From Table 1, data showed clear fluctuation of individuals affected by seasonal climatic factors and agree with that reported by Kassab and Dauood 1964, El-Okda 1979-1980 and Godan 1983. In general, it was observed that there were significant differences between individual of *M. T. Cartusiana* according to season while the number of slug had not affected by this factor or slightly affected.

Table 2. Effect of tillage process on *Manacha T. Cartusiana* and *Deroceras reticulatum* under fruit trees at Fareskoure, El-Zarka, and Kafr-Saad ditructs of Damietta Governorate and Sherbien district of El-Dakahlia Governorate.

Key words, Site 1 = treated by tillage one way with depth of 15cm, Site 2 = treated by tillage two way with depth of 25cm and Site 3 = treated by Lanit 90.

$$\text{Reduction, \%} = \frac{\text{untreated} - \text{treated}}{\text{untreated}} \times 100 \text{ and corrected by Abott, 1925}$$

2- Agricultural control by tillage process:

The essential trend for this work was to protect the horticultural crops and avoid the dangerous effect of pesticides and protect our environment from chemical pollution. So, it is a must to try to find another method to produce products without chemicals.

The present work was conducted to control land snails and slugs by removing the essential habitant which encouraged their distribution and activity, as weeds and shelter of dead and dry weeds save the suitable substrate to these land snails and slugs, where protect them from natural enemies in addition to providing these pests with enough moisture and relative humidity. Tillage process was proceeded to remove these weeds and limiting the relative humidity according to reports of Godan, 1983, El-Okda, 1979 and Bishara, *et al.*, 1986.

A- Effect of tillage on *M.theba. Cartisenia*:

Data obtained from Table 3 stated that tillage had a great effect in most tested samples which conducted at three districts of Damietta Governorate and the district of El-Dakahlia. There was no significant differences between reduction percentages of tillage and that of using Lanit 90 but in some sites was more effective than Lanit 90.

Fareskure district showed equal results for tillage and Lanit 90 under lemon trees, where the reduction percentage was 73% for both. While at El-Zarka Lanit 90 was more effective (80%) than first tillage (66%) and second tillage (75%) and also Kafr Saad district, had efficiency of Lanit 90 (76%) more than first tillage and second tillage (70%) and similar to Sheirben district of Dakahlia Governorate which presented equal effect with first and second tillage (69%) less than Lanit 90 (73%) .

Under orange trees, it was noticed that the reduction of individuals resulting from (80%) was more effective than the second tillage (71%) and Lanit 90 (52%). Also, under guava trees, there was no difference between three tested treatments in each of Fareskure, El-Zarka and Sheirbein but at Kafr Saad there was significant variation between tillage and Lanit 90 since tillage was more effective (80% and 83%) for first and second tillage, respectively but Lanit 90, 73% reduction in peach reduction resulting from second tillage 75% more effective than that with first tillage (69%) and Lanit 90 (60 %) the same result with Sherbien district and Kafr Saad in converse with El-Zarka district which showed that Lanit 90 was more effective (67%) than in first tillage (31%) and second tillage (49%).

B- Effect of tillage on *D. reticulatum*

At Faraskour district the second tillage was more effective on *D. reticulatum* under lemon, orange and guava (92, 89, and 92%), respectively than the effect of Lanit 90 which represented (89, 82, and 88 %) on lemon, orange and guava similar to that of orange and guava at El-Zarka district which recorded 88, 91% respectively. Also, in peach at Sherbien and Kafr Saad districts which recorded 82 and 81% respectively in converse with that in lemon and peach at El-Zarka 88 and 87% for Lanit 90 more effective than that with the first and second tillage 73 and 82 %, respectively.

CONCLUSION

From the previous results it can be concluded that the agricultural control could be throw some light on safe and healthy method, healthy for product, animal, plant, soil and human in addition its costs which was cheaper than pesticides in addition to increasing production quantity and quality through weed control and avoiding the great damage resulting from competition of these weeds to the main plant. Also, tillage destroyed pre hatched snails and egg clusters by mechanical effect and limiting soil moisture and relative humidity which is the essential factor for land snails and slugs' distribution and activity.

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استبدال طرق مكافحة الكيمائية بوسائل ميكانيكية كوسيلة صديقة للبيئة لمكافحة القواقع والبزاقات في أشجار الفاكهة

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تتنمى القواقع والبزاقات الأرضية إلى قبيلة الرخويات وهي عبارة عن حيوانات ذات أجسام رخوة غير مقسمة إلى حلقات وتسمى هذه الحيوانات بالبطن قدميات وتتميز القواقع عن البزاقات بوجود صدفة جيرية على الظهر أما البزاقات فهي عارية. وتنتشر القواقع والبزاقات الأرضية حالياً بمصر بشكل وبائي في الحقول الزراعية ومزارع الفاكهة وذلك بمعظم محافظات الوجه البحري حيث درجات الحرارة المعتدلة والرطوبة العالية ومع التوسع الزراعي وما صاحبه من نقل الشتلات المصابة أدى ذلك إلى تواجد العديد من أنواع هذه الحيوانات بشكل وبائي كما أن الإهمال في العمليات الزراعية وترك الأرض بدون زراعات بين المواسم الزراعية المختلفة ساعد علي وجود بيئات مناسبة لنمو وتكاثر القواقع والبزاقات وانتشارها بشكل وبائي. وتقوم الحيوانات الصغيرة من هذه الأنواع بالتغذية تحت سطح التربة علي الشعيرات الجذرية لأشجار الفاكهة خاصة للشتلات ثم تنتقل بعد ذلك للتغذية على قلف الأشجار حيث تتواجد الحيوانات بأعداد كبيرة علي جذوع الأشجار والأفرع الجانبية متغذية علي القمم النامية ثم تنتقل بعد ذلك الإصابة بالقواقع علي الأوراق والثمار

- مما يؤدي إلي تساقطها كما أن قيام هذه الحيوانات بنشر الثمار يؤدي إلي تعرضها للإصابة بالأمراض الفطرية وتعفنها مما يقلل من قيمتها التسويقية.
- وقد أجري هذا البحث في محافظتي دمياط والدقهلية ممثلة في ثلاث مواقع (فارسكور والزرقا وكفر سعد في محافظة دمياط) وشربين بمحافظة الدقهلية وذلك لدراسة تأثير الحرق - كمقاومة ميكانيكية- على أعماق ١٥ سم و ٢٥ سم واستخدام Lanit 90 على نشاط القواقع والبيزاقات *Manacha T. cartusiana* and slug *Deroceas reticulatum* على بعض محاصيل الفاكهة (الليمون والبرتقال والجوافة والمشمش) بالمقارنة بأشجار فاكهة لم يتم معاملتها تحت نفس الظروف بهدف إمكانية الاستغناء تدريجياً عن المعاملة الكيميائية باستخدام المبيدات التي تسبب ضرراً بالغاً لصحة الإنسان والحيوان والنبات وكذلك البيئة بشكل عام وبالتالي إنتاج محصول جيد خالي من التلوث قادر علي المنافسة عالمياً. وعموماً يمكن إجمال النتائج فيما يلي:
- كان تأثير الحرق على عمق ٢٥ سم في المعاملة الثانية مشابه تماماً لتأثير استخدام lanit 90 في المعاملة الثالثة وكان التأثير منخفض في المعاملة الأولى على عمق ١٥ سم.
 - كان تأثير المعاملات بالحرق و Lanit 90 على الليمون والجوافة أكبر منه على البرتقال والمشمش.
 - تفيد عملية الحرق والعزيق في القضاء علي القواقع والبيزاقات نتيجة الضرر الميكانيكي الناتج عنه وتقليل رطوبة التربة وزيادة تهويتها وتعرضها للشمس يفقد أفراد القواقع والبيزاقات وزنها وقدرتها علي الحياة.
 - وتنمى لما سبق من المقاومة الميكانيكية فإن الدراسة توصي بما يلي:
 - جمع القواقع المتواجدة تحت الأشجار وعلي الجذوع والأفرع يدوياً وحرقها .
 - وضع أكوام من السماد البلدي في أركان الحقول المصابة لتتجذب القواقع إليها ثم جمعها وحرقها .
 - وضع أجولة من الخس المبلل أو أوراق الجرائد المبلل بالماء تحت الأشجار لتتجمع تحتها القواقع ثم حرقها.
 - وضع طعوم جذابة مثل خليط الردة والعسل ٩٥,٥ جزء أو البطاطس أو البطاطا المسلوقة وهرسها في أواني فخارية توضع علي القني والبتون والتربة مع غروب الشمس ثم المرور عليها صباحاً لجمع القواقع منها وحرقها.
 - حش البرسيم قبل غروب الشمس وتوزيعه علي هيئة أكوام صغيرة مع رفع هذه الأكوام في الصباح التالي وجمع القواقع التي تحتها وحرقها.

Table 1. Number of individuals of *Monacha theba cartusiana* and *Deroceras reticulatum* under fruit trees at Faraskoure, El-Zarka, Sherbien and Kafr-Saad ditructs through the two seasons of 2006.

District		Number of individuals on																Climatic factors	
		Lemon				Orange				Guava				Peach					
Season		M.	D.	T	Mean	M.	D.	T	Mean	M.	D.	T	Mean	M.	D.	T	Mean	C°	RH,%
Fareskoure	W	36	30	66	33	30	24	54	27	36	34	70	35	24	22	46	23	18	58
	S	40	33	73	36.5	58	26	84	42	58	36	94	47	36	24	60	30	24	56
Total		76	63	139	69.5	88	50	138	66	94	70	164	82	60	46	106	53		
Mean		38	31.5	69.5		44	25	69		27	35	82		30	23	53			
El-Zarka	W	32	22	54	27	30	22	52	26	34	24	58	29	20	20	40	20	17	54
	S	38	24	62	31	48	24	72	36	48	26	58	29	44	26	70	35	26	56
Total		70	46	116	58	78	46	124	62	82	50	116	58	64	46	110	55		
Mean		35	23	58		39	23	62		41	25	58		32	23	55			
Sherbien	W	34	30	64	32	20	26	46	23	30	26	56	28	18	21	39	19.5	19	54
	S	52	34	86	43	44	28	72	36	58	28	84	42	45	26	71	35.5	26	58
Total		86	64	150	75	64	54	118	59	88	54	140	70	63	47.5	110	55		
Mean		43	32	75		32	27	59		44	27	70		31.5	23.5	55			
Kafr-Saad	W	28	20	48	24	24	18	42	21	26	20	46	23	22	20	42	21	19	56
	S	46	24	70	35	48	21	69	34.5	50	22	72	36	46	22	68	34	28	58
Total		74	44	118	59	72	39	111	55.5	68	42	110	55	68	42	110	55		
Mean		37	22	59		36	19.5	55.5		34	21	55		34	21	55			

LSD 5% = 4.46

M = *Monacha theba cartusiana*

Win. = Winter

D = *Deroceras reticulatum*

Sp. = Spring

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Table 2. Effect of tillage process on *Manacha T. Cartusiana* and *Deroceras reticulatum* under fruit trees at Fareskoure, El-Zarka, and Kafr-Saad ditructs of Damietta Governorate and Sherbien district of El-Dakahlia Governorate

Key words, Site 1 = treated by tillage one way with depth of 15cm, Site 2 = treated by tillage two way with depth of 25cm and Site 3 = treated by Lanit 90.

Reduction, % = $\frac{\text{untreated} - \text{treated}}{\text{untreated}} \times 100$ and corrected by Abott, 1925

Table 3. Effect of tillage process on *Manacha theba. cartusiana* and *Deroceras reticulatum* under fruit trees at Fareskoure, El-Zarka, and Kafr-Saad districts of Damietta Governorate and Sherbien district of El-Dakahlia Governorate.

District	Sites	Number of affected individuals on															
		<i>M. theba. cartusiana</i>								<i>D. reticulatum</i>							
		lemon		orange		Guava		peach		lemon		orange		guava		peach	
No.	Red.%	No.	Red.%	No.	Red.%	No.	Red.%	No.	Red.%	No.	Red.%	No.	Red.%	No.	Red.%	No.	Red.%
Faras-kour	Site1	27.6	73 AB	22.0	73 B	33.6	70 C	11.6	64 C	22.0	79 C	18.4	77 D	30.6	86 AB	18.0	75 BC
	Site2	29.2	73 AB	23.6	74 B	36.8	68CD	18.0	75 A	30.2	92 A	23.0	89 A	31.4	92 A	15.2	84 B
	Site3	26.4	73 AB	20.0	71 BC	29.8	71 C	13.2	60 C	26.6	89 AB	19.6	82 BC	30.0	88 AB	18.6	85 B
El-Zarka	Site1	21.2	66 D	17.6	80 A	31.0	74 B	5.00	31 F	13.8	77 C	15.0	83 BC	19.4	89 AB	18.4	77 BC
	Site2	28.4	75 B	20.0	71 BC	41.0	79 B	10.8	49 E	16.0	73CD	16.0	88 A	23.6	91 A	18.0	82 B
	Site3	28.8	80 A	10.4	52 D	28.8	72 BC	17.4	67 BC	16.0	88 B	16.2	85 B	21.2	88 AB	22.4	87 A
Sher-bien	Site1	23.4	69 C	15.2	63 C	21.0	66 C	14.0	58 D	25.2	79 BC	22.2	86 B	21.6	83 BC	18.6	77 BC
	Site2	28.8	69 C	20.4	64 C	30.0	75 B	21.0	75 A	28.2	83 C	24.8	81 C	24.6	88 AB	21.2	82 B
	Site3	27.8	73 B	17.6	62 C	24.4	68CD	14.4	60 C	25.8	81 C	21.8	81 C	23.4	87 AB	18.4	77 BC
Kafr Saad	Site1	26.4	70 BC	34.4	75 B	30.4	80 A	15.6	71B	14.8	74 D	13.0	81 C	12.0	75 C	14.2	71 D
	Site2	29.2	70 BC	34.0	71 BC	34.8	83 A	18.8	72 B	14.2	79 C	15.4	86 B	13.8	77 C	17.0	81 B
	Site3	27.2	76 A	29.0	74 B	26.4	73 BC	14.2	59 C	18.0	82 C	18.2	90 A	15.4	77 C	17.2	78 BC

No.= Number of affected individuals

Site 1: Tillage one pass with depth of 15 cm , Site 2: Tillage two passes with depth of 25 cm

Site 3: Lanit 90 as pesticides and, R% = Reduction in land snails or slugs number

A = Significant , B = n.s , C = n.s D = n.s, E = n.s and, F = n.s

