https://dx.doi.org/10.4314/ejppri.v7i2.2

Egypt. J. Plant Prot. Res. Inst. (2024), 7 (2): 199–205

Egyptian Journal of Plant Protection Research Institute

www.ejppri.eg.net

Mechanical and agricultural process for controlling *Eobania vermiculata* (Gastropoda: Helicidae) in citrus orchards in Qalubia Governorate, Egypt

Eman, Kamel Khidr

Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza, Egypt.

ARTICLE INFO

Article History

Received: 1/4/2024

Accepted: 10/6/2024

Keywords

Eobania vermiculata, terrestrial snail, mechanical and agricultural control and Egypt.

Abstract

The effect of some mechanical and agricultural control methods has been evaluated against Eobania vermiculata (Müller) (Gastropoda: Helicidae), snail under field conditions. Outcomes revealed that hand collection of some points at mid-autumn to early wintry weather gave a reduction percentage of 60.43% in the long run in four weeks with a general mean of 73.99%. Therefore, the number of snails laying eggs decreased. Also, a ploughing process in February and March duration gave reduction percentages of 57.8% at the end of the four weeks, while at the same time general mean was 69.29%. As a result, the number of snails and hatchable eggs decreased while hand collection during mid-April and May and gave a reduction percentage of 23.27% in the long run of the four weeks whereas the general mean was 44.507%. The impact of some trap types for land snails such as wet Sacking, Plastic Sheets, and molasses+ wheat was used as snail-appealing material that will compare their suitability for attracting snails in traps. It's far apparent that the very best recorded numbers of snails have been sheltered under portions of wetted Sacking+ molasses + wheat which gave (108), Plastic sheets+ molasses + wheat (17) while recorded (40) and (10) for sacking and plastic sheets (Without any attractive), respectively after 72 hrs. of remedy so it can be recommended that ploughing, wetted Sacking best (Attractive) and hand collection were the best processes for E. vermiculata snail population reduction in citrus orchards.

Introduction

Snails and slugs (Molluscs) are hermaphrodites, however, there is a reciprocal change in spermatozoa as they mature earlier than the improvement of eggs (Routray and Dey, 2016). Molluscs are the second biggest phylum of the animal kingdom. Their name is derived from the Latin word “Mollus” meaning “Smooth”, which is generally blanketed using a difficult calcium-containing shell (Zala *et al*., 2018). Due to their excessive reproductive ability, multiply in the field and it's far very tough to control their population; however, during daytime, those creatures are observed within shelters, moist shady places;

however, at some stage at night, they come out from the shelter and damages different crops which cause financial loss (Economic loss). Numerous species of snails and slugs are considered notorious pests in agro-environment in exceptional part of the world, due to their rasping feeding behaviors (Das *et al*., 2020). Land molluscs are very harmful pests to vegetables, ornamental plants, fruit trees, and the environment (Ecosystem) (Godan, 1983 and Carlsson *et al*., 2004). Crops are damaged by molluscs gastropods due to feeding and contamination of harvested plants with their bodies, eggs, slime, or feces, leading to the deterioration within the exceptional of harvest quality and financial loss (South,1992).

Molluscs are characterized by holes and slimy trails over the foliage of plants (Cauliflower) (Adeline et al., 2018). Invasive gastropods are pests of the quality of agriculture and horticulture in North the USA with many species feeding directly and decreasing the yield and first-rate agricultural products and decreasing the rating of an extensive range of plants (Byers, 2002 and Sakovich, 2002). In India, 1,500 species of land snails are observed. Among those, nine species of snails and 12 species of slugs are said to a pests of field crops, ornamentals plants, fruit, and vegetables (Routray and Dey, 2016). Corn and soybean corn crops have been subjected to 90-50% yield loss because of rapid harm through slugs (Askary *et al*., 2012). There are numerous species of terrestrial slugs dispensed throughout the world living in a range of habitats from temperate (Barker, 2001).

The study of Post and Post (1986) mentioned that slugs reason harm to vegetation both above and below the ground, in arable plants; it has the greatest impact established, main to a thin crop stand or in excessive cases to complete germination failure as the result of grain hollowing. Terrestrial snails attack vegetables, seedlings, seeds, and tuber plants and depart unsightly slimy tracks on the injured components (El-Okda, 1980).

The study aims to throw light on some mechanical and agricultural control of terrestrial snail *E. vermiculata* infecting some citrus orchards in Qalubia Governorate.

Materials and methods

The present study was conducted in a citrus orchard in Banha district, Qalubia Governorate.

1. Mechanical control:

1.1. Hand collection (Mechanical control process):

The effect of hand collection was evaluated on reducing the abundances of E. vermiculata snails during November and December 2023 and April and May 2024. An experiment was conducted in Banha district, Qalubia Governorate. This work was carried out in citrus orchard infestation with *E. vermiculata* land snail. An area of was chosen for this purpose. This area was divided into two plots.

One plot was subjected to hand collection application during the daytime (Day hours). a week after irrigation, while the others were left without collection. Snails were counted in a randomly quadrate size sample of 50×50 cm under the trees and on the lower portion `of the trunk about one meter height before and after one day and then intervals over four weeks during December 2023. The percent reduction in abundance of each snail was calculated according to Handerson and Tilton Formula (1955).

Reduction percentage

$$= 1 - \frac{(C_1 \text{ x } T_2)}{(C_2 \text{x } T_1)} \text{ x } 100$$

C_1 = Number of snails in control before application,

C_2= Number of snails in control after application,
T_1 = Number of snails in treatment before application,
T_2= Number of snails in treatment after application,

2. Ploughing process soil:

The impact of ploughing soil was evaluated as natural control methods in reducing abundances of *E. vermiculata* snail infesting citrus trees during February and March 2024. An experiment was conducted in Banha district, Qalubia Governorate. An area chosen and divided into two treatments, the first one was subjected to ploughing and the second to was left without any treatment as control . Ten replicates from treatment were carried out. Individuals of the land snail *E. vermiculata* counted in the early morning in a quadrate of 50×50cm under trees and on the lower portion in the trunk of some tree to about one meter height in treated and untreated area. Population counts were entailed 24 hrs. before ploughing and after one day then at weekly intervals during five weeks beginning in February and March 2024.The reduction percentages were calculated according to Henderson and Tilton Formula (1955).

Trap types of Pieces of Plastic sheets, wetted sacking with molasses + wheat was studied in reducing abundances of snails. Land snails usually can escape in different dark shelters as soil gravel or in grass to avoid unsuitable conditions, in this respect, Okka (1998) technique was adopted with slight modification. Pieces of wetted sacking (1×0.75 m each), Plastic sheets (1×0. 5 m each (, 5 ml molasses + 95 gm wheat was used as snail attractive material to evaluate their suitability for attracting snails for traps. The effect of some trap Types for land snail *E. vermiculata* in reducing the abundance of snails was studied in April 2024.

Two traps were used, wetted sacking, plastic sheets, 5 ml molasses + 95 gm wheat was used as snail attractive material. Four replicates of each type of tested trap material were placed, and the distance between each trap and the other was three meters. The traps were moistened with water, and small dishes containing bran with an attractant were placed under each land snail trap. Four replicates of each trap of tested without any baits or attractive material were used as control, and the number of snails per trap was recorded after 24, 48, and 72 hrs. individuals were handily collected from all parts of traps and soil under it and counted in plastic cases at middle-sun. The number of animals under traps was considered as a daily catch index per one square meter. The collected snails were killed.

3. Statistical analysis:

Data were analyzed by using SAS statistical program software (SAS Institute, 1999) with Duncan multiple rang teste (Duncan, 1955) at a 5% probability level for comparing the differences means.

Results and discussion

The effect of hand collection was evaluated on reducing the abundance of *E. vermiculata* snail during November and December 2023. Adult snails are collected during the months of November and December, as the number of snails during this period is small, and thus the number of snails that lay eggs is reduced. The attained data in Table (1) clearly that hand collection obviously dropped the population of *E. vermiculata* since one-day post-treatment, the mean number of land snails dropped after one day from 11.4 to 1.2 snail/sample size, while after 5, 10, 15, 21 and 28 days post-treatment were dropped from (12.8, 12.7, 12.7, 13.4 and 13) to (2.1, 2.8, 3.9, 4.8 and 5.1 snails per samples size), respectively.

Table (1): Effect of mechanical control process on abundances reduction of *Eobania vermiculata* infesting citrus trees during the period from November and December 2023 in Qalubia Governorate.

Days after hand collection	Mean number of snalis		
	Untreated area	treated area	Reduction%
Before treatment	.118	11.7	
1	11.4	1.2	89.38
5	12.8	2.1	83.45
10	12.7	2.8	77.76
15	12.7	3.9	69.029
21	13.4	4.8	63.87
28	13	5.1	60.43
Total	**87.8**	**31.6**	443.919
General Mean	**14.63**	**5.27**	**73.99**

These experiments were carried out in Banha region, Qalubia Governorate on citrus trees to investigate the effect of ploughing in reducing *E. vermiculata* population density. Data in Table (2) indicate that ploughing process reduced snails population with reduction percent (78.60, 77.37, 74.50, 66.509, 60.97 and 57.8%) snails/sample after 1, 5, 10, 15, 21 and 28 days in compared with that of (Without any treatment) control (32.78) during February and March 2024, respectively. From values of mean reduction, it was stated that ploughing processes soil reduced snail population ploughing where the percentage mean reduction values were 69.29 % snail /sample.

Table (2): Effect of ploughing process on abundances reduction of *Eobania vermiculata* infesting citrus trees during February and March 2024 at Qalubia Governorate.

Days after Stirring the soil	Mean number of snalis		
	Untreated area	treated area	Reduction%
Before treatment	28	27	
1	25.2	5.2	78.60
5	22	4.8	77.37
10	30.1	7.4	74.50
15	35.3	11.4	66.51
21	27.1	10.2	60.97
28	29	11.8	57.8
Total	**196.7**	**77.8**	415.749
General Mean	**28.1**	**11.11**	69.29

These results agree with those obtained by Woulters (1970) who stated that the rough ploughing process of the soil before sowing of wheat protected seeds from damage caused by terrestrial snails. Moreover, El-Masry (1997) stated that the ploughing dropped a number of the terrestrial snail *Helicella vestalis* (Prieffer) after one day post ploughing while the loftiest reduction percentage after 15 days post ploughing was 91.6% (Salem *et al*., 2007 and Shetaia, 2010) mentioned that ploughing dropped the population of *M. cartusiana* and *E. vermiculata* snail species. Since general means of percent reduction in population *E. vermiculata* and *M. cartusiana* during six weeks after ploughing.

The effect of hand collection as a mechanical control method was evaluated in reducing the abundance of *E. vermiculata* snails in infesting orange trees. The obtained data in Table (3) clearly that hand collection obviously decreased population of *E.*

vermiculata since one-day post-treatment, the mean number of land snails was decreased after one day from 27.4 to 8.2 snail/sample size, while after 5, 10, 15, 21 and 28 days post-treatment were decreased from (31.2, 27.2, 25.7, 29.4 and 29.8) to (11.2, 13.6, 15.8, 18.4 and 21.2 snails per samples size), respectively. Regarding percentage reduction of land snails after 5, 10, 15, 21, and 28 days post-treatment were (61.28, 46.07, 36.21,32.49 and 23.27%), respectively.

Table (3): Effect of mechanical control (hand collection) method on abundances reduction of *Eobania vermiculata* infesting citrus trees during the period from April to May 2024 at Qalubia Governorate.

Days after hand collection	Mean number of snalis		Reduction%
	Untreated area	treated area	
Before treatment	30.2	28	
1	27.4	8.2	67.72
5	31.2	11.2	61.28
10	27.2	13.6.	46.07
15	25.7	15.8	36.21
21	29.4	18.4	32.49
28	29.8	21.2	23.27
Total	200.9	116.4	267.04
General Mean	28.7	16.63	44.507

On the other hand, the percentage reduction after one day was 67.72%. Eventually, the hand collection method had a significant effect on the percent reduction for *E.vermiculata* recorded 44.51% as a mean during the experimental period. The hand-collection method was investigated for controlling terrestrial snails by many authors i.e. Carman (1965); Bishara *et al*. (1968); El-Deeb *et al*. (2003 and Shetaia, 2010).

Effect of some trap types for land snail *Eobania vermiculata* reducing was studied during April 2024:

The obtained data in Table (4) among the *E. vermiculata* trapping methods tested, wetted Sacking + molass traps had many terrestrial snails (108), which was significantly greater than the terrestrial snails captured in Sacking traps (40), but significantly different than for Plastic sheets+ molass traps (17), Plastic sheets (10), after 72 hrs. of treatment. Generally, it could be recommended that ploughing process as an agrarian control method gave a high reduction in the population density of terrestrial snails. The traps wetted Sacking + molasses (Baites attractive) and hand collection were the best mechanical control methods in reducing the abundance of land snails in citrus orchards.

Table (4): Efficacy of some trap types for land snail.

Types trap	Aver. number during			Total	Mean±S.E
	24 hrs.	48 hrs.	72 hrs.		
Wetted Sacking+molass	85[a]	118.25[a]	108[a]	311.25	103.75[a]±0.302
Sacking	28[b]	82[b]	40[b]	170	50[b]±0.112
Plastic sheets+molass	14[c]	72[c]	17**c**	103	34.33[b]±0.513
Plastic sheets	5[d]	26.5[d]	10[c]	41.5	13.83[b]±0.412
General Mean	33	74.688	43.75		
F.Value	0.000***	0.000***	0.000***		0.0094**
L.S. D	6.723	2.7142	7.472		45.0198

** **Highly significant at P>0.01**

*** **Very highly significant at P > 0.001**

Numbers of the same letters have no significant difference.

References

Adeline, S. J.; Chakravarthi, R.; Khamis, N. H.; Harum, M. and Yeow, Y. K. (2018): Sound based identification of snail pest in agriculture. International Journal of Engineering and Technology, 7(4.25): 267-270.

Askary, T. H.; Khan, A. A.; Waliullah, M. I. S.; Banday, S. A.; Iqbal, U. and Mir, M. M. (2012): Slug pest management through nematodes in agricultural and horticultural crops. In: Boeri F. Chung JA (eds.) Nematodes. Nova Science Publisher, 197-212.

Barker, G. M. (2001): Gastropods on land: phylogeny, diversity and adaptive morphology. In: Barker GM, editor. The Biology of Terrestrial Molluscs. CABI Publishing, Wallingford. Oxford. UK: pp. 1-145.

Bishara,S.I.; Hassan, M. S. and Kalliny, A. S. (1968): Studies on some land snails injurious to agriculture in U, A, R, Rev. Zool, Bot, Afr., 77 (3-4):239-252.

Byers, R. A. (2002): Agriolimacidae and Arionidae as pests in luceme and other legumes in forage systems of northeastem North America. In: Barker GM, ed. Molluscs as Crop Pest. UK: CAB International, Wallingford, pp. 325-336.

Carlsson, N. O. L.; Bronmark, C. and Hansson, L. A. (2004): Invading herbivory: The golden apple snailalters ecosystem functioning in Asian wetlands. Ecology, 85: 1575-1580.

Carman, G. E. (1965): Electrical trapping device for land snail, J,Econ. , Entomol.,58: 786-787.

Das, P. P. G.; Bhattacharyya, B.; Bhagawnti, S.; Dev, E. B.; Manpoong, N. S. and Bhairavi, K. S. (2020): Slug: An emerging menace in agriculture: A review. Journal of Entomology and Zoology Studies, 8(4): 01-06.

Duncan, D.B. (1955): Multiple Ranges and multiple F. tests. Biometrics, 11: 1-42.

El-Deeb, H. I.; Sobeih, A. K.; Foud, M. M. and Asran, F. D. A. (2003): Utilization of some mechanical and cultural control measures against terrestrial snail, Zagazig. J, Agric, Res., 30 (6): 2321-2335.

El-Masry, S. A. (1997): Studies on control of some land snails infesting certain fruit trees. Ph,D, Thesis, Fac. Of Agric., Zagazig University.

El-Okda, M. K. (1980): Land snails of economic importance on vegetable at Alexandria and heighboring region. J. Agric. Res. Review, 58: 79-85.

Godan, D. (1983): Pest Slugs and Snails; Springer-Verlag: Berlin, Germany, pp. 445.

Henderson, C. F. and Tilton, E. W. (1955): Test with acaricides against the brown wheat mite, J. Econ. Entomol., 48:157-161.

Okka, M. A. (1998): Land traps as a mechanical method for controlling land snail, *Monacha cantiana* (Montagu) under field conditions. J. Agric. Sci. Mansoura Univ., 23(9): 4011-4017.

Post, C. M. and Post, G. R. (1986): The biology and behaviour of slugs in relation to crop damage and control. Agricultural Zoology Reviews, 1: 253-299.

Routray, S. and Dey, D. (2016): Snails and slugs as crop pests. *Rashtriya Krishi*, 11(1): 40-41.

Sakovich, N. J. (2002): Integrated Management of *Cantareus asperses* (Muller) (Helicidae) as

a pest of citrus in California. In: Barker GM, ed. Molluscs as Crop Pests. UK: CAB International, Wallungford, pp. 353-360.

Salem, A. A.; Mahrous, M. E.; Ibrahim, M.H. and Abd El-Aal, S. M. (2007): Different control measures for controlling certain land snail in Sharkia Governorate. Zagazig J. Agric. Res., 34(2): 291-305.

SAS Institute (1999): SAS/STAT User's guide, SAS Institute Inc. Cary, North Carolina.

Shetaia, S. Z. S. (2010): Mechanical and cultural control methods for land snail *Monacha cartusiana* (Müller) inhabiting some orchards at Sharkia Governorate J. Plant Prot. and Path., Mansoura Univ., 1 (11): 869 - 875.

South, A. (1992): Terrestrial slugs. Biology, Ecology, Control. London: Chapman and hall Ltd.

Woulters, L. (1970): Schneckenbc kampfung in oost flevoland pflanzen schutz, nachr, Bayer, 23: 173-177.

Zala, M. B.; Sipai, S. A.; Bharpoda, T. M. and Patel, B. N. (2018): Molluscan pests and their management: A review. AGRES- An International e. Journal, 7(2): 126-132.