JKAU: Met., Env. & Arid Land Agric. Sci., **vol. 11,** pp. 39-46 (1420 A.H. / 2000 A.D.)

Efficacy of *Megaselia scalaris* (Loew) (Diptera: Phoridae) Against the Common Terrestrial Snail Species in Northern Egypt

HAMDY B. EL-WAKIL
Department of Agricultural Animal Pests, Plant Protection Research Institute, Baccous. El-Sobahia, 21616, Alexandria, Egypt.

ABSTRACT. Six of terrestrial snail species were exposed to *Megaselia scalaris* (Loew). The mean number of live snails and the percentage of snail mortalities were calculated after 1, 2, 3, and 4 weeks. The results illustrate that, there are significant differences in the percentage of snail mortalities between different snail species. Also between different time intervals post exposure.Some of the exposed snails such as *Eobania vermiculata, Theba pisana, Helicella vestalis* and *Eremina desertorum* were almost parasatized, after 4 weeks. On the other hand, other exposed snails such as *Rumina decollata* and *Cochlicella acuta* were totally unparasatized, where zero % mortality was recorded. Results indicate that, the newly listed insect in the Egyptian fauna *M. scalaris* (Loew) could be used in snail pests biocontrol programmes in Egypt. While it will be safer for the predatory snail species.

KEY WORDS: Phoridae terrestrial snails, biological control, parasitic flies.

Introduction

There is a much wider and economically more serious impact by terrestrial snails on man's agricultural activities. Whereas, vegetables, ornamentals and other main crops are destructed by different terrestrial snail species, Kassab and Daoud (1964); Barry (1969); Judge (1969); Godan, (1983); Baker (1989); El-Okda *et al,* (1989); El-Wakil and Radwan, (1991); Radwan and El-Wakil, (1991); El-Wakil *et al.* (1992); Radwan *et al.* (1992); Kassem and Abdullah, (1992); El-Wakil and Mesbah (1995); Abdallah *et al*. (1998a); Abdallah *et al*. (1998b) El-Wakil (1999), El-Wakil and Attia (1999).

As a matter of fact, not all the terrestrial snail species, are considered as pests, but some of them play a good role as predators against snail species. In this *Rumina decollata* which is found predating on the common pest snail species, Godan (1983) and Olkowski *et al.* (1991).

Different control measures have been used for controling the pest snail species such as biological, physical and chemical measures. However, chemical control is consider to be the most effective measure against terrestrial snails. Meanwhile, extensive application of the different pesticides had led to pollution of the environment and cause high toxicity for man and his domestic animals, Godan (1983).

Different biotic mortality agents are associated with these pests, such as: Calliphorid, Sarcophagid, Sciomyzid flies, Carbid, Staphylinid, Siliphid, Cautharid and Lampyrid beetles, predatory molluscs, reptiles, birds and mammals, (Godan 1983; Baker, 1989, Grossman and Olkowski, 1990 and El-Wakil 1994).

El-Wakil (1994) recorded for the first time in Egypt that, *Megaselia scalaris* (Loew) parasatized on the most common terrestrial snails, *Eobania vermiculata* and *Theba pisana;* where the average mortality percentage of exposed snails were 98.59% and 95.35%, respectively. *Megaselia scalaris* belongs to the family Phoridae which is a large family of flies with some 3000 world species, they breed on a very wide variety of decaying organic materials. In addition some of them are parasitizes and others develop in fungi (Smith, 1986). There are approximately 220 valid genera on this family, but more than half of the known species are included in the large genus Megaselia. Species of the the latter are abundunt in all Zoogeographic regions and found in a wide range of habitates (Robinson, 1971).

The aim of this work is to study the efficacy of *M. scalaris* against different terrestrial pest snail species and also against *R. decollata* snail which are considered as biological agents against pest snail species. This study, will be valuable to contribute to the assessment of the possible success of the snail control programme. Moreover, to through a light on the importance of the natural enemies against terrestrial snails to avoid the pollution of the environment and health hazards due to the extensive use of pesticides in this respect.

Materials and Methods

Experimental Animal

Six species of terrestrial snails namely *Eobania vermiculata* (Müller), *Theba pisana* (Müller), *Helicella vestalis* (Pfeiffer), *Eremina desertorum* (Forskall), *Romena decollata* (Linneaus) and *Cochlicella acuta* (Müller) were collected

from Citrus trees in El-Bhiera and Alexandria governorates and transferred and reared under laboratory conditions for one month.

Experimental Insect

Newly emerged flies of *Megaselia scalaris* (Loew) breed under laboratory condition were used where female and males inserted each in separate glass jar for one week before exposing to the aforementioned snail species. Identification of the used flies was previously obtained from Insect Collection, Comstock Hall, Department of Entomology, Cornell University, Ithaca, N.Y., USA (El-Wakil, 1994).

Experiments

150 of healthy snails from each of the aforementioned snail species were chosen and divided in 3 glass jars of 3 litre capacity with 50 snails/jar. Then two males and two females were inserted in each jar and snails were fed daily with fresh lettuce leaves *ad libtum.* After 1, 2, 3, and 4 weeks jars were checked and the mean number of dead snails were calculated. The percentage of snail mortalities were calculated. Dead snails were detected by watching brownish liquid and maggots inside the aperture of the snails shells. Similar groups of the aforementioned snails were kept without flies as control groups to find out mortality of other causes than flies.

All snails and flies were maintained under laboratory conditions of 25ºC ± 1.

Statistical Analysis

Statistical analysis for the obtained data were made by using General Linear Model procedure (GLM) and least significant difference (L.S.D) at 0.05 as a level of significance, SAS (1987).

Results and Discussion

In this study, it was observed that, snails which were exposed to *Megaselia scalaris* (Loew) such as *E. vermiculata, T. pisana , H.vestalis* and *E. desertorum* were totally parasatized, while *R. decollata* and *C. acuta* were totally unparasatized.

The activity of infested snails went slow down and the maggots invaded the snails showed parasitic behaviour during their first instar. In the second Larval instar, the maggots showed predatory habits, while the well developed last instar larva was saprophagous. These observations agreed with the findings of (Godan 1983 and El-Wakil 1994).

The results presented in Table (1) illustrate that, there are significant differences at ($P<0.01$) between different exposed snail species. Also, between different time intervals post exposure. The decrease in the mean numbers of the alive exposed snails to *M. scalaris* were very obvious in *E. vermiculata, T. pisana, H.vestalis* and *E.desertorum.* Whereas, the total mean numbers of live snails among 4 weeks post exposure were 25, 28.4, 30.2 and 20.6, respectively. On the other hand, *R. decollata* and *C. acuta* were not affected, where the *M. scalaris* flies did not succeed to parazatize the exposed snails.

The results also indicate that, the percent mortalities of the exposed snails to *M. scalaris* were very obvious in *E. vermiculata, T.pisana, H.vestalis* and *E. desertorum,* among different time intervals after exposure to *M. scalaris.* Whereas, the highest % mortalities were recorded after 4 week post exposure where 100%, 100%, 70% and 100% were exhibited, respectively. On the other hand the percent mortalities in both exposed *R. decollata* and *C. acuta* snails exhibited zero % mortality each. The control groups of the aforementioned snail species were survived during the period of the experiments with no records of natural mortalities.

M. scalaris had been recorded from numerous hosts, including terrestrial snails *Achatina fulca* (Müller) by Robinson (1971). It was also reported by Godan (1983) that, there were some Phoridae which pray on living molluscs in the larval stage. In addition, *Megaselia acqualis* (Wood), can greatly reduce the number of a population of slugs while *M. scalaris* fed on terrestrial snails.

In Egypt it was recorded for the first time that, *M. scalaris* (Loew) parasatized on *E. vermiculata* and *Theba pisana* snails, where as 95.33% and 98.59 % mortalities were recorded respectively (El-Wakil 1994).

It was also noticed by Smith (1986) that, the larvae of Phorids like wise showed many different habitat preferences, they were known from seed capsules, feces, molluscs and various other gastropods. Flies in the family Phoridae (humpbacked flies) were known to prey upon snails and slugs (Grossman and Olkowski, 1990).

The present study indicates that, the newly listed insect in the Egyptian fauna *Megaselia scalaris* (Loew) could be used in snail pests biocontrol programmes in Egypt. On the other hand, it will be much safer for the useful snails such as the predatory snail *R. decollata*. Moreover, the results give some encouragement to further studies on *M. scalaris* to facilitate its mass production in the laboratory to be used in an integrated programme against snails pests in agroesystems where the terrestrial snails are found. Further efforts are still in need for clarify, the relationship between *M. scalaris* snails and other hosts, as well as biology and the ecophysiology of the *M. scalaris* flies.

TABLE 1. % Mortality of six terrestrial snail species parasatized by a Phorid fly, *Megaselia scalaris* (Loew) under laboratory condition for 4 weeks.

Time interval post exposure (weeks)	% Mortality of exposed snail species.												*Total mean*	
	Eobania vermiculata		*Theba pisana*		*Helicella vestalis*		*Eremina desertorum*		*Cochlicella acuta*		*Rumina decoltata*			
	Mean no. of alive snails	Average mortality (%)	Mean no. of alive snails	Average mortality (%)	Mean no. of alive snails	Average mortality (%)	Mean no. of alive snails	Average mortality (%)	Mean no. of alive snails	Average mortality (%)	Mean no of alive snails	Average mortality (%)	Alive snails	Mortality (%)
0	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0	50	0.0	0.0	0.0^{e}
1	41	18	44	12	44	42	12	17	50	0.0	50	0.0	45.15	9.83^{d}
2	31	38	28	45	40	20	36	28	50	0.0	50	0.0	39.17	21.83^{c}
3	23	55	20	60	32	36	25	50	50	0.0	50	0.0	33.33	33.50^{b}
4	0.0	100	0.0	100	15	70	0.0	100	50	0.0	50	0.0	19.17	61.67^{a}
Total mean	25	42.20^{a}	28.40	43.40^{a}	30.20	27.60^{c}	20.60	39^{b}	50	0.0^{d}	50	0.0^{d}	27.37	25.37

Mean in a column not sharing the same superscript are significantly different at ($P < 0.01$).

$L.S.D_{(0.05)}$ (Between snails species) = 4.757.

$L.S.D_{(0.05)}$ (Between time interval post exposure) = 4.342.

Acknowledgments

I wish to acknowledge my appreciation to Prof. Dr. A.A. Ashmawy Prof. of Biostatistics Facutly of Agric., Ain Shams Univ., Egypt, for his statistical analysis of the results.

References

Abdallah, E.A.M., Kassem F.A., El-Wakil, H.B. and **Abo-Baker, Y.** (1998a) Molluscicidal potentiality of certain pesticides against brown and white terrestrial snails. *7th Conference of Agriculture Development Research, Faculty of Agriculture, Ain Shams University, Cairo, Dec. 15-17, Annals of Agricultural Science,* **3:** 1089-1102.

Abdallah, E. A. M., El-Wakil, H.B., Kassem, F.A., El-Agamy, E.I. and **Abo-Baker, Y.** (1998b) Impact of aldicarb and metaldehyde exposure of different molluscan enzyme activities and stress protein response. *7th Conference of Agriculture Development Research, Faculty of Agriculture, Ain Shams University, Cairo, Dec. Annals of Agricultural Science,* **3:** 1103-1117.

Baker, G.H. (1989) Damage, population dynamics, movement and control of pest helicid snails in southern Australia. *In, "Slug and Snails in World Agriculture".* **ed . Henderson, I.,** pp. 175-185. British Crop Protection Council. U.K.

Barry, B.D. (1969) Evaluation of chemicals for control of slugs on field corn in Ohio. *Journal of Economic Entomology,* **62**(6): 1277-1279.

El-Okda, M.M., Emara, M.M. and **Selim, A.M.** (1989)The response of the harmful and useful terrestrial mollusca towards several toxicants: I. Efficacy of six toxicants under laboratory conditions. *Alexandria Science Exchange,* **10**(3): 375-384.

El-Wakil, H.B. (1994) A new record of *Megaselia scalaris* (Loew) (Diptera: Phoridae) in Egypt associated with certain terrestrial snails. *Egyptian Journal of Applied Science,* **9**(11): 619-628.

El-Wakil, H.B. (1999) Molluscicidal activity and repellency of some inorganic fertilizers against terrestrial snail, *Theba pisana* (Müller), infesting citrus trees in Northern areas, Egypt. *Journal of King Abdulaziz University, Science,* **11:** 15-26.

El-Wakil, H.B. and **Attia, A.M.** (1999) Effect of selected insecticides on terrestrial snails *Eobania vermiculata* (Müller) and *Theba pisana* (Müller) with respect to some morphological changes in Egypt. *Journal of Environmental Science & Health,* **B34**(1): 47-60.

El-Wakil, H.B. and **Mesbah, H.A.** (1995) Effect of spraying copper sulfate solution on the infestation rate of the terrestrial snail *Theba pisana* (Müller) and the productivity of *Vicia faba* (L). *Communication in Science and Developing Research,* No. 786, **52:** 81-88.

El-Wakil, H.B. and **Radwan, M.A.** (1991) Biochemical studies on the terrestrial snails *Eobania vermiculata* (Müller) treated with some pesticides. *Journal of Environmental Science & Health,* **B26**(5&6): 479-489.

El-Wakil, H.B., Radwan, M.A. and **Osman, K.A.** (1992) Interaction of some oxime carbamate pesticides with terrestrial *Helix aspersa* snails enzyme systems. *Alexandria Science Exchange* **13**(3): 497-515.

Godan, D. (1983) *Pest Slugs and Snails, Biology and Control.* N.Y. Springer-Verlag, Berlin p. 447.

Gorssman, J. and **Olkowski, H.** (1990) Stopping slugs and snails. *Common Sense Pest Control Quarterly,* **6**(1): 7-18.

Judge, F.D. (1969) Preliminary screening of candidate molluscicides. *Journal Economic Entomology,* **62**(6): 1393-1397.

Kassab, A. and **Daoud, H.** (1964) Notes on the biology and control of land snails of economic importance in UAR. *Agriculture Research Review, Ministry of Agriculture, UAR,* **42:** 77-98.

Kassem, F.A. and **Abdallah, E.A.M.** (1992) Toxicity of certain pesticides against terrestrial snails, *Eobania vermiculata* and *Theba* sp. *Alexandria Science Exchange,* **13**(4): 775-786.

Olkowski, W., Daar, S. and **Olkowski, H.** (1991) *Common-Sense Pest Control*. The Taunton Press. Inc. U.S.A.

Radwan, M.A. and **El-Wakil, H.B.** (1991) Impact of certain carbamate and synthetic pyrethroids on the non-target terrestrial snail *Eobania vermiculata. Alexandria Science Exchange,* **12** (2): 305-316.

Radwan, M.A., El-Wakil, H.B. and **Osman, K.A. (**1992) Toxicity and biochemical impact of oxime carbamate pesticides against terrestrial snail, *Theba pisana* (Müller). *Journal of Environmental Science & Health,* **B27** (6): 759-773.

Robinson, W.H. (1971) Old and new biologies of *Megaselia* species (Diptera, Phoridae). *Studia Entomologica,* **14:** 321-348.

SAS (1987) *State User's Guide.* SAS Institute. Inc., SAS Circle, P.O.Box 80000, CARY, NC 27512-8000, USA.

Smith, K.G.V. (1986) *A Manual of Forensic Entomology.* British Museum (Natural History) and Comstock Publishing Associates, a Division of Cornell University Press, Ithaca, N.Y., U.S.A.

فعالية حشرة الميجاسلياسكالاريس (لوي) من رتبة ذات الجناحين ، عائلة (فوريدي) ضد أكثر أنواع القواقع الأرضية شيوعًا في شمال مصر

حمدي بديع محمد الوكيل

قسم بحوث الحيوانات الضارة بالزراعة ، معهد بحوث وقاية النبات ، الصبحية باكوس ، الإسكندرية – مصر

المستخلص . في هذه الدراسة تم تعريض ستة أنواع من القواقع الأرضية لحشرة الميجاسلياسكالاريس (لوي) ، وتم حساب متوسط عدد القواقع الحية والنسبة المئوية لعدد الموتى في القواقع بعد ١ ، ٢ ، ٣ ، ٤ أسابيع . وأوضحت النتائج أن هناك اختلافات معنوية في النسب المئوية لعدد الموتى بين مختلف أنواع القواقع ، وأيضًا بين مختلف الأوقات بعد التعريض . بعض أنواع القواقع التي تم تعريضها للحشرة مثل قواقع الأيوبانيا فيرميكيولاتا والثيبابيسانا والهيلايسيلا فيستاليس وأريمنا ديزرتورم قد تم التطفل عليها بالكامل ، حيث كانت النسبة المئوية لموت القواقع بعد أربعة أسابيع من التعريض هي ١٠٠٪ ، ١٠٠٪ ، ٧٠٪ ، ١٠٠٪ على التوالي . وعلى جانب آخر ، فإن القواقع المعرضة الأخرى مثال الرومينا ديكولاتا والكوشيلسيلا أكيوتا لم يتم التطفل عليها إطلاقًا ، حيث كانت النسبة المئوية لعدد الموتى في هذه القواقع هي صفر٪ . هذا وقد أوضحت النتائج أن حشرة الميجاسلياسكالاريس (لوي) المسجلة في البيئة المصرية حديثًا يمكن أن تستعمل في برامج المكافحة الحيوية للقواقع الضارة في مصر ، بينما سوف تكون هذه الحشرة غير ضارة بأنواع القواقع النافعة والتي تقوم بافتراس أنواع القواقع الضارة .