Efficacy of Insecticides Against the Tortoise Beetle, *Cassida vittata* Vill (Coleoptera: Chrysomelidae) and the Side Effects on Predators in Sugar Beet Fields

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ABSTRACT: Sugar beet crop has recently become the first source of sugar production in Egypt, followed by sugar cane. The tortoise beetle, *Cassida vittata* Vill is an important insect pest infesting sugar beet plants, and causing considerable yield losses. The current study was carried out at , Kafr El-Sheikh region during 2020/ 2021 and 2021/ 2022 seasons to evaluate the efficacy of some insecticides against *C. vittata* and their side effects on some arthropod predators. Carbosulfan was the most potent insecticide against the beetle one day after treatment; 90.68 and 93.35% larval insect reduction in the first and second seasons, respectively. Ten days after treatment, these reductions reached 98.55 and 99.78% in the first and second seasons, respectively. acetamiprid+biferthrin reduced *C. vittata* larval population by 98.55 and 98.87%, while the bioinsecticide, spinetoram reduced the insect population by 86.62 and 87.32% ten days after treatments in 2020/ 2021 and 2021/ 2022 seasons, respectively. The evaluated insecticides induced high harmful side effects on some predators occurring in sugar beet fields. Overall reduction in *Coccinella undecimpunctata* due to acetamiprid+biferthrin was 99.13-99.24%, due to and was 97.15-99.19%. The corresponding values of the two insecticides on *Paederus alfierii* were 84.65-93.26 and 70.59-93.44%.The spider populations were reduced by 83.15-92.13 and 86.75 – 89.15% for the first and second insecticides, respectively. However, the bioinsecticide, spinetoram was the safest on predators, which induced 28.03 - 28.83, 41.79 - 45.04 and 32.59 – 36.82% in the populations of *C. undecimpunctata*, *P. alfierii* and spiders respectively.

Keywords: *Cassida vittata, predators, acetamiprid+biferthrin insectcides, spinetoram, sugar beet*

INTRODUCTION

Sugar beet, *Beta vulgaris* L. (Chenopodiaceae) is an industrial economic, and a main source of Egypt's sugar supply (El-Fergani, 2019). This crop is attacked by many insect pests, one of which is the tortoise beetle, *Cassida*. *vittata* Vill.(Coleoptera: Chrysomelidae), which has become a notorious pest of sugar beet in Egypt (Saleh et al., 2009).

Both tortoise beetle larvae and adults feed on the lower side of the sugar beet leaves, where they feed on the lower epidermis and inner tissues, but the upper epidermis remain intact looking like a glass. In addition, adults feed on leaf tissues, causing regular circular holes (Abo El-Ftooh, 1995). Crop loss occurs due to the leaf-feeding behavior which causes a reduction in the sugar content of the infested plants (Aly et al. 1993).

Profenofos and carbosulfan are efficient compounds against all stages of the tortoise beetle (AL-Habashy 2013 and El-khouly and Omar 2002). However, chlorfenapyr demonstrated a moderate toxic effect against the insect.Unfortunately, Shaheen et al. (2011) reported that profenofos, carbosulfan and chlortenapyr showed toxic effects to the predator, *Coccinella undecimpunctata*. Anter et al. 2020 tested the effect of three pesticides; Selecron (profenofos), Marshal (carbosulfan) and Radiant (spinetoram) against larvae and adults of the tortoise beetle, *Cassida vittata* (Vill.) inhabiting sugar beet plants. Selecron and Marshal were highly effective against larvae and adults of the pest. However, Radiant (spinetoram) demonstrated a moderate toxic effect. The adult stage of *C. undecimpunctata*, has been observed in considerable numbers and for a long time in sugar beet field (Askar 2016). (El-Khayat et al., 2012 and Sadanandane et. al., 2012). Reported that, The use of insecticides, caused severe harm to the natural balance between pests and their enemies.

The current work has been carried out for the evaluation of insecticides against *C. vittata* infesting sugar beet plants and their side effects on some predators in sugar beet fields, at Kafr El-Sheikh Governorate, Egypt, during two consecutive planting seasons, 2020/ 2021 and 2021/ 2022.

MATERIAL AND METHODS

1. Sugar beet sowing

This experiment was conducted at El-Hamedia village, Kafr El-Sheikh Governorat, with the Gloria sugar beet variety as susceptible to the tortoise beetle, *Cassida vittata* Vill. An area of about 500 m^2 was divided into 12 plots, arranged in complete randomized block design, with three replicates Each plot measured 42 m^2. seeds of Gloria variety were sown on October 15th and 17th in 2020/ 2021 and 2021/ 2022 seasons, respectively. All agricultural practices were followed with the exception of pesticides, rather than the insecticides tested.

2. Tested Insecticides

The field recommended rates of the following insecticides were used against *C. vittata* using a commercial formulation of each.

- Spinetoram (Radiant 12% SC) (100 cm3/ fed), Daw Agro Sciences Co.
- Acetamiprid 22.7% + Biferthrin 27.3% (Rubek extra WP 5%) (25g /1oo
L water), Shoura Chemical Co.
- Carbosulfan (Marshal 20 % Ec) (250 cm3 / fed). Delta Chemical Co.

3. Insecticide applications

The three insecticide treatments were performed on April 9th (about six months after sugar beet sowing), and the check plots were sprayed with only water. Knapsack sprayes (20 L volume) was used.

4. Evaluation of insecticide efficiency

From each plot, ten sugar beet plants were selected randomly one, seven, and ten days after Rubek and Marshal application. The numbers of larvae of *C. vittata* were counted in the 10 sugar beet plants. In addition, numbers of *Coccinella undecimpunctata*, *Paederus alferii* and spiders were recorded on ten plants. Numbers of both tortoise beetle and its associated predators were counted just before treatments, and as abovementioned days after treatments.

5. Statistical analysis

The percentage reduction in the *C. vittata* larvae population, as well as the associated predators for all treatments in the two growing seasons, were calculated using Henderson and Tilton's formula (1955) as follows:

Reduction (%)=

$$1-\left(\frac{\text{No.in control before treatment}}{\text{No.in control after treatment}} X \frac{\text{No.in treatment after } treatment}{\text{No.in treatment before } treatment}\right) \times 100$$

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RESULTS AND DISCUSSION

1. Insecticide efficiency

1.1. Against *C. vittata* Larvae

Data in **Tables (1 and 2)** present the reduction percentage of *C. Vittata* larvae population in sugar beet fields after treatment with the tested insecticides. In both seasons, spinetoram was effective against the insect population in sugar beet fields. It was noticed that spinetoram was effective against the *C. Vittata* larvae population three days post-treatment compared to untreated areas, causing 86.62 and 87.32% reductions in larval populations in 2020/2021 and 2021/ 2022 seasons, respectively, compared to the untreated sugar beet plants. However, the highest larval reductions 95.49 and 96.16% in the first and second seasons, after 10 dayes respectively. The initial larval killing (one day post – treatment) values due to acetamiprid + biferthrin treatment were 91.13 and 92.87% in the first and second seasons, respectively, and reached 98.55 and 98.87% reductions , in the first and second seasons, after 10 dayes respectively, compared to the check (untreated). High reduction percentages were assessed ten days post-treatment (98.55 and 99.78). Concerning the overall means of reductions in *C. Vittata* larvae, as presented in **Tables (1&2)**. These reductions averaged 91.04, 95.44 and 95.01% due to spinetoram, acetamiprid + biferthrin and carbosulfan, respectively in 2020/2021season. The corresponding values in 2021/2022 season, were 91.23, 96.01 and 96.93%.

Thus, it could be reported that the three compounds performed well (achieving more than 90% larval reduction) against *C. Vittata*.

1.2. Against *Coccinella undecimpunctata*

The efficacies of tested insecticides against larvae and adults of *C. undecimpunctata* are presented in **Table (3&4)**.

In both seasons, the bioinsecticide, spinetoram was safer against the predator, *C. undecimpunctata* compared to the two other insecticides. The overall means of predator reduction were 28.83, 99.24 and 99.19% due to the applications of spinetoram, acetamiprid + biferthrin and carbosulfan, respectively in the first season **(Table 3)**. The corresponding reduction values in the second season **(Table 4)** were 28.03. 99.13 and 97.15%. Thus, spinetoram was less toxic to the coccinellid compared to the evaluated conventional insecticides.

Table (1): Reduction percentage of *Cassida vittata* larvae in sugar beet fields due to insecticide applications, 2020/ 2021 season

Treatment	Mean No. before treatment	Days after treatments								Overall mean of reduction (%)
		1 Day (initial)		3 Days		7 Days		10 Days		
		Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	
Spinetoram	110.75	NR	NR	15.75	86.62	10.75	91.00	5.50	95.49	91.04
Acetamiprid+ Biferthrin	110.25	10.00	91.13	NR	NR	4.00	96.63	1.75	98.55	95.44
Carbosulfan	110.25	10.5	90.68	NR	NR	5.00	95.79	1.75	98.55	95.01
Untreated	111.00	113.5	-	118.00	-	119.75	-	122.25	-	-

NR: No recorded data

Table (2): Reduction percentage of *Cassida vittata* larvae in sugar beet fields due to insecticide applications, , 2021/ 2022 season

Treatment	Mean No. before treatment	Days after treatments								Overall mean of reduction (%)
		1 Day (initial)		3 Days		7 Days		10 Days		
		Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	
Spinetoram	100.00	NR	NR	13.25	87.32	10.50	90.21	4.25	96.16	91.23
Acetamiprid+ Biferthrin	100.25	7.25	92.87	NR	NR	4.00	96.28	1.25	98.87	96.01
Carbosulfan	100.00	6.75	93.35	NR	NR	2.50	97.67	0.25	99.78	96.93
Untreated	100.00	101.5	-	104.5	-	107.25	-	110.75	-	-

NR: No recorded data

Table (3): Side effect of insecticides on *Coccinella undecimpunctata* L. (adults & larvae) at sugar beet fields, , 2020/ 2021 season

Treatment	Mean No. before treatment	Days after treatments								Overall mean of reduction (%)
		1 Day (initial)		3 Days		7 Days		10 Days		
		Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	
Spinetoram	7.50	NR	NR	6.75	28.82	7.00	25.34	7.25	32.34	28.83
Acetamiprid+ Biferthrin	7.75	0.00	100.00	NR	NR	0.00	100.00	0.25	97.74	99.24
Carbosulfan	7.25	0.00	100.00	NR	NR	0.00	100.00	0.25	97.58	99.19
Untreated	7.00	7.50	-	8.85	-	8.75	-	10.00	-	-

NR: No recorded data

Table (4): Side effect of insecticides on *Coccinella undecimpunctata* L. (adults & larvae) at sugar beet fields, , 2021/ 2022 season

Treatment	Mean No. before treatment	Days after treatments								Overall mean of reduction (%)
		1 Day (initial)		3 Days		7 Days		10 Days		
		Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	
Spinetoram	7.25	NR	NR	6.50	24.37	6.75	30.18	7.00	29.55	28.03
Acetamiprid+ Biferthrin	7.00	0.00	100.00	0.00	NR	NR	100.00	0.25	97.39	99.13
Carbosulfan	7.25	0.00	100.00	0.00	NR	NR	100.00	0.85	91.46	97.15
Untreated	6.75	7.50	-	8.00	-	9.00	-	9.25		-

NR: No recorded data

1.3. Against *Paederus alfierii*

Data presented in Tables (5&6) exhibit the side effects of insecticides, applied against *C. vittata* in sugar beet fields, on the population densities of the insect predator, *Paederus alfierii* adults.

In the first season (2020/2021), both acetamiprid + biferthrin and carbosulfan sharply reduced the populations of *P. alfierii*. The initial killing of acetamiprid + biferthrin against the predator was very high (90.51% reduction), followed by that at seven days post- treatment (83.17% reduction) and then by that at ten days post-treatment (80.26% reduction). As for carbosulfan, the *P. alfierii* population reductions were 36.36, 88.38 and 87.02% at one, seven and ten days post-treatments respectively.

Concerning the side effect of the bioinsecticide, spinetoram, the reductions in *P. alfierii* populations were 41.56, 43.69 and 49.87% three, seven and ten days after treatments, respectively.

However, the overall means of predator reduction due to spinetoram was 45.04% compared to 84.65% due to acetamiprid + biferthrin and 70.59% due to carbosulfan.

In the second season (2021/2022) (Table 4) adeverse effects of evaluated insecticides against *P. alfierii* adults were higher than those of the first season. Initial killings of acetamiprid + biferthrin and carbosulfan were very high; 95.48 and 100% reductions, respectively. The residual effects of both insecticides were 93.11 and 92.73% insect predator reductions, respectively.

The bioinsecticide, spinetoram was obviously safer against *P. alfierii* adults throughout the experimental period. The overall means of insect predator reductions were 41.79, 93.26 and 93.44% for spinetoram, acetamiprid + biferthrin and carbosulfan, respectively.

It could be concluded that spinetoram could be applied against *C. vittata* infestation in sugar beet fields, particularly when the tortoise beetle populations are moderate, not too heavy. This strategy keeps, to a great extent the populations of the beneficial predator, *P. alfierii* high.

1.4. Against spiders

In 2020/2021 sugar beet season (Table 7), the overall mean reduction in spider population due to the application of insecticides showed that bioinsecticide, spinetoram was the safest against the spiders. The overall reduction due to this formulation was 35.59%, while acetamiprid + biferthrin and carbosulfan reduced the spider populations by 83.51 and 86.75%, respectively.

Data of the second season (2021/ 2022) were similar to those of the first one, as Also, the bioinsecticide was the safest. (36.82% spider population reduction) compared to 92.13 and 89.15% reductions in case of acetamiprid + biferthrin and carbosulfan, respectively.

The obtained results are in line with those of El-Khouly and omar (2002) Shaheen et al (2011) and Al-Habashi (2013) who found that carbosulfan was, in most cases, highly effective against the tortoise beetle, *C. vittat.* Also, El-Fergani et al (2022) reported the high toxicity of the organophosphorous insecticide, chlorpyrifos against most of sugar beet insect pests, but unfortunately, was highly toxic to most natural enemies, particularly *Coccinella undecimpunctata*. The low mortality of the bioinsecticide, spinetoram, in the current investigation was also found by shaheen et al (2011) for the same compound, and by Anter et al (2020) for another formulation (Radiant) of the bioinsecticide.

CONCLUSION

From the results of the current investigation, both conventional insecticides were effective against *C. vittata***,** but in the same time, they had adverse side effects on natural enemies, dominant in sugar beet fields. However, in case of moderate population densities of harmful insects in sugar beet fields, it could be recommended to use the bioinsecticide, spinetoram, which achieves a moderate insect control, but at the same time is safer against natural enemies.

Table (5): Side effect of different insecticides on *Paederus alfierii* Koch adults at sugar beet fields, 2020/ 2021 season

Treatment	Mean No. before treatment	Days after treatments								Overall mean of reduction (%)
		1 Day (initial)		3 Days		7 Days		10 Days		
		Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	
Spinetoram	5.50	NR	NR	3.75	41.56	4.00	43.69	4.25	49.87	45.04
Acetamiprid+ Biferthrin	5.75	0.5	90.51	NR	NR	1.25	83.17	1.75	80.26	84.65
Carbosulfan	5.00	6.25	36.36	NR	NR	0.75	88.38	1	87.02	70.59
Untreated	6.00	5.5	-	7.00	-	7.75	-	9.25	-	-

NR: No recorded data

Table (6): Side effect of different insecticides on *Paederus alfierii* Koch adults at sugar beet fields, 2021/ 2022 season

Treatment	Mean No. before treatment	Days after treatments								Overall mean of reduction (%)
		1 Day (initial)		3 Days		7 Days		10 Days		
		Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	
Spinetoram	4.75	NR	NR	4.00	34.00	4.25	41.39	4.25	49.98	41.79
Acetamiprid+ Biferthrin	4.75	0.25	95.48	NR	NR	0.50	93.11	0.75	91.18	93.26
Carbosulfan	4.5	0.00	100.00	NR	NR	0.50	92.73	1.00	87.58	93.44
Untreated	4.75	5.50	-	6.00	-	7.25	-	8.50	-	-

NR: No recorded data

Table (7): Side effect of different insecticides on spiders at sugar beet fields, 2020/ 2021season

Treatment	Mean No. before treatment	Days after treatments								Overall mean of reduction (%)
		1 Day (initial)		3 Days		7 Days		10 Days		
		Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	
Spinetoram	8.25	NR	NR	7.25	25.99	7.50	30.73	7.75	41.05	32.59
Acetamiprid+ Biferthrin	8.25	0.50	94.29	NR	NR	1.50	86.14	2.75	79.09	83.51
Carbosulfan	7.50	0.25	96.86	NR	NR	1.75	82.22	2.25	81.17	86.75
Untreated	8.00	8.50	-	9.50		10.50	-	12.75	-	-

NR: No recorded data

Table (8): Side effect of different insecticides on spiders at sugar beet fields , 2021/ 2022 season

Treatment	Mean No. before treatment	Days after treatments								Overall mean of reduction (%)
		1 Day (initial)		3 Days		7 Days		10 Days		
		Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	Mean	Reduction%	
Spinetoram	9.00	NR	NR	7.75	25.91	8.00	36.75	8.00	47.79	36.82
Acetamiprid+ Biferthrin	9.00	0.25	97.36	NR	NR	1.00	92.09	2.00	86.95	92.13
Carbosulfan	9.25	0.50	94.87	NR	NR	1.50	88.46	2.50	84.13	89.15
Untreated	9.25	9.75	-	10.75	-	13.00	-	15.75	-	-

NR: No recorded data

REFERENCES

Abo El-Ftooh, A. A. 1995. Studies on the sugar beet insect *Cassida vittata* Vill. (Coleoptera : Chrysomelidae). M. Sc. Thesis, Plant Protection Dept., Faculty of Agriculture, Saba Basha, Alexandria Univ., Egypt. 170 pp.

Al-Habashy, A.Z.N. 2013. The economic injury level of *Cassida vittata* (Vill.) on sugar beet plants. Egyptian Academic Journal of Biological Sciences, A. Entomology, 6(2): 159-168.

Aly, F. A., M. M. A. Mahgoub, S. I. El-Deib and M. A. El-Hamaky 1993. Ecological studies on the tortoise beetle, *Cassida vittata* Vill and the efficacy of certain chemicals in controlling this insect in sugar beet plants. J Agric Sci, Mansoura Univ, Egypt 18(6):1813–1824.

Anter, M. A., M. Mahmoud, M. El-Hassawy, S. A. Abou-Donia and A. E. Abdelmonem 2020. Comparison between the effectiveness of certain insecticides and entomopathogenic nematodes against tortoise beetle, Cassida vittata (Vill.) in sugar beet fields and their side effects on Coccinella undecimpunctata. Egyptian Academic Journal of Biological Sciences, F. Toxicology & Pest Control, 12:(2) 227-287.

Askar, S. I. 2016. Population density of the tortoise beetle, *Cassida vittata*, Vill. (Coleoptera: Chrysomelidae) and the role of predators on sugar beet at El-Beheira Governorate. Journal of Plant Protection and Pathology, Mansoura Univ., 7 (4): 265 – 272.

El-Fergani, Y. A. 2019. Field evaluation of selected oxadiazine insecticide and bacterial bio-insecticides against cotton leafworm, *Spodoptera littoralis* (Boisduval) (Lepidoptera: Noctuidae) infesting Sugar beet (Beta vulgaris l). Egypt. J. Agric. Res., 97 (1), 137-145.

El-Khayat, E. F.; W.M.H. Desuky ; M.M. Azab and M.M.A. Khedr 2012. Toxic impact of some insect growth regulators and biocides in relative to chlorpyrifos to cotton leafworm, *Spodoptera littoralis* (BOISD). Egypt. J. Agric. Res., 90 (1): 55-56.

El-khouly, M. I. and B. A. Omar 2002. The efficiency of some insecticides on tortoise beetle, *Cassida vittata* Vill. inhabiting sugar beet fields. Egyptian Journal of Agricultural Research, 80(2):697-708.

Fergani, Y. A., Y. A. EL Sayed, and E. A. Refaei 2022. Field evaluation of organophosphorus insecticides, chlorpyrifos and fungal bio-pesticide, *Beauveria bassiana* towards the sugar beet moth *Scrobipalpa ocellatella* (Lepidoptera: Gelechiidae) and studying their effect on the population size of the associated arthropod predators in the Egyptian sugar beet fields. Journal of Plant Protection and Pathology, Mansoura Univ., 13 (8):191 – 194.

Henderson, C.F. and E.W. Tilton. 1955. Test with acaricides against the brown wheat mite. J. Econ. Entomol., 84: 157-161.

Sadanandane C; P. S. Boopathi Doss and P. Jambulingam 2012. Efficacy of three formulations of diflubenzuron, an insect growth regulator, against Culex quinquefasciatus Say, the vector of Bancroftian filariasis in India. Indian J Med Res., 136(5):783- 791.

Saleh, M. M. E., K.A.A.Draz, M. A. Mansour, M. A. Hussein and M. F. M. Zawrah 2009. Controlling the sugar beet beetle Cassida vittata with entomopathogenic nematodes. Journal of Pest Science 82: 289–294.

Shaheen F. A. H., A. A. A. Said, E. A. H. Sherief and H. A. M. Fouad 2011. Effect of certain insecticides against sugar beet beetle Cassida vittata (VILL.) (Coleoptera: Chrysomelidae) inhabiting sugar beet fields. Journal of Plant Protection and Pathology, 2:(6) 597-607.

الملخص العربي

تقييم بعض المبيدات الحشرية ضد خنفساء البنجر السلحفائية والمفترسات المرتبطة بها فى حقول بنجر السكر

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أجريت هذه الدراسة بقرية الحميدية بمحافظة كفر الشيخ بمصر خلال موسمي 2020/ 2021 ، 2022/2021 لتقييم تأثير بعض المبيدات ضد خنفساء البنجر السلحفائية التي تسبب خسارة كبيرة لأوراق بنجر السكر والمفترسات المرتبطة بها. عند تقييم التأثير السام لبعض المبيدات الحشرية على خنفساء البنجر السلحفائية كان Carbosulfan أكثر المبيدات الحشرية سمية بعد يوم واحد من المعاملة مقارنة بالقطع غير المعاملة مما تسبب فى حدوث نسبة موت حوالى 90،68 ، 93،35% خلال الموسمين الأول والثاني على التوالي . كما لوحظ نقص واضح في تعداد الحشرة وصل إلى 98،55 ، 99،78% بعد 10 أيام على التوالي ، أظهر مبيد Acetamiprid + Biferthrin نسبة خفض عالية في يرقات الحشرة بعد عشرة أيام من المعاملة (98،55، 98،87% على التوالي) بينما كان Spinetoram هو الأقل سمية بنسبة 86،62% ، 87،32 % بعد ثلاثة أيام من المعاملة مقارنة بالقطع غير المعاملة خلال موسمي 2021 ، 2022. كان للمبيدات المستخدمة تأثيرً جانبي ضاراً على الحشرات المفترسة، حيث كانت النسبة العامة لخفض تعداد حشرة أبو العيد نتيجة استخدام Acetamiprid + Biferthrin هي 99،13-99،24% كما كانت نسبة الخفض 97،15- 99،19% لمبيد Carbosulfan. وكانت القيم المناظرة لهذين المبيدين هما 84،65- 93،26% ، 70،59- 93،44% على الحشرة الرواغة ، كما كانت نسبة الخفض في تعداد العناكب 83،15- 92،13% ، 86،75- 89،15% لكل من المبيدين على التوالي . كان المبيد Spinetoram هو الأكثر أمانا على جميع المفترسات موضوع الدراسة ، حيث كانت نسبة الخفض 28،03- 28،83% في أعداد أبو العيد ، 41،79- 45،04% في أعداد الرواغة ، 32،59- 36،82% في أعداد العناكب.