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THE EFFICIENCY OF SOME INSECTICIDES ON TORTOISE BEETLE, *CASSIDA VITTATA* VILL. INHABITING SUGAR BEET FIELDS

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Abstract

The efficiency of profenofos, carbosulfan and chlorfenapyr, was evaluated against eggs, larvae, pupae and adults of the tortoise beetle *Cassida vittata* Vill. inhabiting sugar beet fields in Kafr El-Sheikh Governorate during 1999/2000 and 2000/2001 sugar beet growing seasons. Data obtained revealed that when mortality rates were considered, profenofos and carbosulfan were the most efficient compounds on eggs, larvae, pupae and adults of *C. vittata*. However, chlorfenapyr, demonstrates a moderate toxic effect.

The side effects of the tested insecticides on the associated bioagents, *viz. Coccinella undecimpunctata* Reiche, *Chrysoperla carnea* Steph. and *Paederus alfierii* Koch was studied. Unfortunately, profenofos and carbosulfan demonstrate unacceptable toxic effect. Chlorfenapyr was moderately effective either in controlling the insect pest or in its side effect on the associated predators.

INTRODUCTION

Sugar beet, *Beta vulgaris* L. (Chenopodiaceae), is considered as the second available source of sugar rank next after sugar cane in Egypt. The tortoise beetle, *Cassida vittata* de Viller (Coleoptera : Chrysomelidae), has become a notorious pest of sugar beet in Egypt within the past decade.

Abo-Aiana (1991) mentioned that *C. vittata* reduced both crop quantity and quality. El-Sebae *et al.* (1987) found that lannate alone had no reliable effect against *C. vittata* control, but mixtures of lannate/dimilin or lannate/sir-8514 were the most effective. Saleh (1994), Samy *et al.* (1992) and Hano (1983) stated that, some conventional insecticides, *i.e.* pirimiphos-methyl, monocrotophos, profenofos, methomyl were comparatively more effective against *C. vittata* under field conditions.

The present work was carried out to evaluate certain conventional insecticides against *C. vittata* infesting sugar beet plants at Kafr El-Sheikh Governorate during two successive sugar beet growing seasons. Meanwhile, the side effect of these insecticides on certain predators were also estimated.

MATERIALS AND METHODS

Field studies were conducted at Farag El-Shamy village, kafr El-Sheikh Governorate during 1999/2000 and 2000/2001 seasons, to evaluate the effectiveness of three insecticides for controlling *C. vittata* infesting sugar beet plants.

The experimental area was cultivated with sugar beet (*Beta vulgaris* L.) on 31-9-1999 for the first season and on 15-10-2000 of the second season. Normal agricultural practices were applied. The experimental area was divided into four equal plots of 42 m^2 each, the treated and untreated plots were arranged in a complete randomized block design.

The tested insecticides were :

1. **Profenofos** (Profecron 72 % ec.), O-4-bromo-2-chlorophenyl O-ethyl-S-propyl phosphorothioate at rate of 750 cc/feddan.
2. **Carbosulfan** (Marshal 25 % wp.), 2,3-dihydro-2,2-dimethylbenzofuran-7-yl (dibutylaminothiomethyl carbamate) at the rate of 800 g/feddan.
3. **Chlorfenapyr** (Challenger 36 % sc.), 4-bromo-2 (4-chlorophenyl)-1-(ethoxymethyl)-5- (trifluromethyl) pyrrole -3-carbonitrile at the rate of 180 cc/feddan.

Sugar beet plants were sprayed with the tested insecticides on 5*th* April 2000 for the first season and on 15*th* April 2001 for the second season.

To evaluate the efficiency of the tested insecticides against *C. vittata*, the reduction percentages in the population density were calculated according to the formula given by Henderson and Tilton (1955). Data were analyzed by 1-way analysis of variance (ANOVA). The yielded corrected means were arranged according to Duncan's multiple range test. Reduction percentages were calculated after 2, 3, 5, 10 and 15 days after treatment. The mean reduction percentages were calculated on the overall mean population within 15 days. All insect stages (eggs, larvae, pupae or adults) were count-

ed directly on ten plants/plot. The side effect of the tested insecticides against the associated predators, namely; *Coccinella undecimpunctata* (larvae and adults), *Chrysoperla carnea* (larvae) and *Paederus alfierii* (adults) were also tested by direct counting after 2, 3, 5, 10 and 15 days after treatment.

RESULTS ND DISCUSSION

A. Effectiveness of the tested compounds : The population densities of *C. vittata* (immature and mature stages) were monitored on plant leaves. The mean numbers were about 78, 160, 65 and 53 in 1999/2000 season and 91, 166, 76 and 42 in 2000/2001 season for egg, larva, pupa and adult, respectively, Tables 1-4.

The integration of the data presented in Table 1, revealed that profenofos was the most potent compound in reducing the population size of *C. vittata* eggs on sugar beet plants. After two days from application, reduction percentage was 92.7 % for the 1st season, followed by carbosulfan and chlorfenapyr, which demonstrated reduction percentages of 86.9 and 75.1 %, respectively. After 15 days (period of evaluation), profenofos still showed the highest percent reduction for egg population (89.7 %), followed by carbosulfan and chlorfenapyr, Table 1.

The same trend was observed for the 2*nd* season. Table 1 also showed the general mean percent reduction in egg population of *C. vittata* during the two seasons. The reduction percentages were 86.1, 82.9 and 78.3, respectively. Similar results were obtained by El-Khouly (1998) who found that selecron was successful for controlling egg stage of the tortoise beetle.

Number of larvae of the tortoise beetle and reduction percentages in treated plots after insecticides application during 1999/2000 and 2000/2001 are presented in Table 2. It appears from this table that the initial kill (after 2 days) were 85.7, 77.17 and 69.0 for the 1st season and 87.0, 81.5 and 75.5 % for the 2nd season, for profenofos, carbosulfan and chlorfenapyr, respectively. Profenofos demonstrates after 15 days from application the highest reduction figures in the larval population of *C. vittata* in both seasons. The reduction percentages were 83.4, 77.3 and 70.6 % for profenofos, carbosulfan and chlorfenapyr, respectively. These results confirm those obtained by Saleh (1994) who mentioned that laboratory and field studies revealed that pirimi-

Table 1. Separate effect of three insecticides on eggs of *Cassida vittata* infesting sugar beet plants expressed as corrected mortality percentages in Kafr El-Sheikh Governorate during 1999/2000 and 2000/2001 seasons.

Insecticide (Trade name)	Rate/ fed.	Mean no. of eggs per 10 plants (% Reduction in infestation)*												
		1999/2000						2000/2001						
		Before spray	Days after spray				Mean	Before spray	Days after spray				Mean	General mean
			2	5	10	15			2	5	10	15		
Profenofos (Profecron 72 % EC)	750 cc	77.0	6.3 (92.7)	10.3 (88.8)	11.5 (88.2)	12.3 (89.2)	(89.7)	89.8	11.3 (88.7)	16.5 (86.0)	25.3 (80.0)	32.8 (74.9)	(82.4)	(86.1) a
Carbosulfan (Marshal 25 % WP)	800 gm	77.8	11.3 (86.9)	12.5 (86.6)	13.5 (86.2)	15.3 (86.7)	(86.6)	90.3	16.0 (84.1)	19.0 (84.0)	30.8 (75.8)	35.3 (73.2)	(79.3)	(82.9) a
Chlorfenapyr (Challenger 36% SC)	180 cc	77.5	21.5 (75.1)	15.8 (83.2)	14.8 (84.9)	12.8 (88.8)	(82.9)	87.5	26.8 (72.5)	22.5 (80.5)	34.0 (72.4)	39.3 (69.2)	(73.7)	(78.3) b
Control	water	78.2	87.0	93.3	98.3	115.3	-	91.0	101.5	119.8	128.3	132.8	-	-

* The numbers in parentheses indicate the reduction percentages in the deposited eggs of *C. vittata*.

(F value = 50.6 at 5 % L.S.D. = 3.3 %).

Table 2. Separate effect of three insecticides on larvae of *Cassida vittata* infesting sugar beet plants expressed as corrected mortality percentages in Kafr El-Sheikh Governorate during 1999/2000 and 2000/2001 seasons.

Insecticide (Trade name)	Rate/ fed.	Mean no. of larvae per 10 plants (% Reduction in infestation)*												
		1999/2000						2000/2001						General mean
		Before spray	Days after spray				Mean	Before spray	Days after spray				Mean	
			2	5	10	15			2	5	10	15		
Profenofos (Profecron 72 % EC)	750 cc	155.3	23.3 (85.7)	34.2 (80.8)	33.8 (82.4)	44.5 (77.6)	(81.6)	161.3	22.5 (87.0)	31.0 (83.5)	34.8 (82.2)	23.3 (88.3)	(85.2)	(83.4) a
Carbosulfan (Marshal 25 % WP)	800 gm	157.3	36.8 (77.7)	48.3 (73.4)	51.0 (73.8)	56.5 (71.9)	(74.2)	164.0	32.5 (81.5)	42.3 (77.8)	46.5 (76.6)	29.3 (85.5)	(80.4)	(77.3) ab
Chlorfenapyr (Challenger 36% SC)	180 cc	157.8	50.3 (69.0)	59.3 (66.8)	62.3 (67.5)	73.3 (62.9)	(66.5)	166.5	44.5 (75.5)	49.3 (74.5)	60.3 (70.2)	44.3 (78.5)	(74.7)	(70.6) b
Control	water	159.3	166.8	189.0	197.0	203.5	-	163.0	174.8	189.5	197.8	201.5	-	-

* The numbers in parentheses indicate the reduction percentages in the larval population density of *C. vittata*.

(F value = 32.4 at 5 % L.S.D. = 6.9 %).

phos-methyl and profenofos were the most potent insecticides to the 3*rd* and 5*th* instars larvae of *C. vittata*. El-Khouly (1998) stated that selecron was the most effective insecticide against the immature stages of *C. vittata*.

The field trials data shown in Table 3, revealed that the organophosphorus compound profenofos and the carbamate carbosulfan caused distinct pupal mortality rates during both seasons tested when sprayed on sugar beet plants to control *C. vittata*. The reduction rates expressed as percentages were 87.1, 85.9 %, respectively; the general means of reduction percentages were 84.6 and 82.6 for profenofos and carbosulfan, respectively compared with the insecticide chlorfenapyr, which was less potent. Reduction percentages for pupal population were tabulated in table 3. It appears that profenofos and carbosulfan caused high initial mortalities, while chlorfenapyr was the least in this respect.

Table 4 demonstrates the population of the adult stage of *C. vittata* and percent reduction in its population during 15 days after application of various insecticides in sugar beet field. The organophosphate profenofos, the carbamate carbosulfan and the pyrolle chlorfenapyr a new class of insecticides caused significant percentages of adult mortality. The reduction percentages indicated that profenofos, carbosulfan and chlorfenapyr caused initial mortalities of 95.0, 93.3 and 89.2 % in 1999/2000 season. The same trend was also obtained in 2000/2001 season. After 15 days of treatment, the reduction percentages for *C. vittata* adults were 85.9, 84.1 and 81.1, for profenofos, carbosulfan and chlorfenapyr, respectively. The general means of reduction percentages were 84.9, 80.5 and 77.0 % after spraying on sugar beet plants for both seasons. Organophosphate and carbamate seem to be the most promising for control of *C. vittata* adults. It appears that existence of high adult mortality levels for these compounds is due to the higher sensitivity of adult individuals to organophosphate and carbamate compounds (Saleh, 1994). Successful reduction in adult population by spraying infested sugar beet plants with selecron or marshal was also ascertained by Abo-Aiana (1991) and Ali *et al.* (1993). According to the aforementioned results, it can be concluded that all the tested compounds demonstrate considerable toxic effects on the tortoise beetle stages. Profenofos and carbosulfan were superior for immature and adult stages. On the other hand, unfortunately the results in Table 5 indicate that profenofos and carbosulfan were the most toxic compounds against total predators fol-

Table 3. Separate effect of three insecticides on pupae of *Cassida vittata* infesting sugar beet plants expressed as corrected mortality percentages in Kafr El-Sheikh Governorate during 1999/2000 and 2000/2001 seasons.

Insecticide (Trade name)	Rate/ fed.	Mean no. of pupae per 10 plants (% Reduction in infestation)*												General mean
		1999/2000						2000/2001						
		Before spray	Days after spray				Mean	Before spray	Days after spray				Mean	
			2	5	10	15			2	5	10	15		
Profenofos (Profecron 72 % EC)	750 cc	63.3	6.8 (91.2)	8.3 (90.3	11.8 (83.4)	16.3 (83.6)	(87.1)	75.3	11.0 (87.2)	14.3 (84.5)	16.0 (84.5)	32.0 (72.3)	(82.1)	(84.6) a
Carbosulfan (Marshal 25 % WP)	800 gm	64.5	7.8 (90.1)	12.3 (86.0)	14.3 (85.0)	17.3 (82.9)	(85.9)	76.3	13.5 (84.5)	16.3 (82.5)	19.8 (81.6)	36.8 (68.6)	(79.3)	(82.6) a
Chlorfenapyr (Challenger 36% SC)	180 cc	62.3	11.0 (85.5)	14.8 (82.4)	17.0 (81.5)	20.0 (79.5)	(82.2)	73.5	16.5 (80.4)	19.5 (78.3)	23.8 (77.0)	39.5 (65.0)	(75.2)	(78.7) b
Control	water	62.0	75.5	83.8	91.5	97.3	-	79.8	85.5	91.5	105.3	114.8	-	-

* The numbers in parentheses indicate the reduction percentages in the pupal density of *C. vittata*.

(F value = 32.2 at 5 % L.S.D. = 3.2 %).

Table 4. Separate effect of three insecticides on adults of *Cassida vittata* infesting sugar beet plants expressed as corrected mortality percentages in Kafr El-Sheikh Governorate during 1999/2000 and 2000/2001 seasons.

Insecticide (Trade name)	Rate/ fed.	Mean no. of adults per 10 plants (% Reduction in infestation)*												
		1999/2000						2000/2001						General mean
		Before spray	Days after spray				Mean	Before spray	Days after spray				Mean	
			2	5	10	15			2	5	10	15		
Profenofos (Profecron 72 % EC)	750 cc	50.5	4.3 (95.0)	4.0 (94.1)	17.3 (78.2)	19.8 (76.7)	(85.9)	40.3	8.0 (85.5)	9.3 (84.4)	11.3 (83.4)	13.8 (82.4)	(83.9)	(84.9) a
Carbosulfan (Marshal 25 % WP)	800 gm	53.0	6.0 (93.3)	7.5 (89.5)	18.8 (77.4)	21.3 (76.2)	(84.1)	41.8	10.8 (81.1)	15.0 (75.7)	15.5 (78.0)	22.3 (72.5)	(76.8)	(80.5) a
Chlorfenapyr (Challenger 36% SC)	180 cc	52.3	9.5 (89.2)	10.3 (85.3)	220.3 (75.3)	22.3 (74.7)	(81.1)	42.3	14.0 (75.8)	17.3 (72.3)	19.5 (72.7)	24.3 (70.4)	(72.8)	(77.0) a
Control	water	50.3	59.5	67.5	79.0	84.8	-	41.5	56.8	61.3	70.0	80.5	-	-

* The numbers in parentheses indicate the reduction percentages in the adult population density of *C. vittata*.

(F value = 5.5 at 5 % L.S.D. = 10.3 %).

lowed by chlorfenapyr. These undesirable effects were obvious either for initial or residual toxicities during both seasons. The general means of reductions in the numbers of total predators were 92.8 , 91.3 and 65.6 % for profenofos, carbosulfan and chlorfenapyr, respectively.

In general, it can be concluded that the organophosphate profenofos and the carbamate carbosulfan were the most toxic compounds against the associated predators of the tortoise beetle *C. vittata*. However, they were very effective in controlling the pest, but at the same time they were highly toxic to the associated predators. Chlorfenapyr was effective in controlling the insect pest and had a moderate effect on the predators.

Table 5. Mortality percentages in total predators after insecticidal treatment on sugar beet plants in Kafr El-Sheikh Governorate during 1999/2000 and 2000/2001 seasons.

Insecticide (Trade name)	Rate/ fed.	Mean no. of predators per 10 plants (% Reduction in infestation)*												
		1999/2000						2000/2001						General Mean
		Before spray	Days after spray				Mean	Before spray	Days after spray				Mean	
			2	5	10	15			2	5	10	15		
Profenofos (Profecron 72 % EC)	750 cc	90.4	4.8 (95.7)	8.7 (92.9)	11.2 (91.8)	13.6 (90.6)	(92.7) a	80.4	3.2 (96.6)	6.6 (93.5)	10.2 (90.8)	11.4 (90.7)	(92.8) a	(92.8) a
Carbosulfan (Marshal 25 % WP)	800 gm	80.4	5.2 (94.7)	10.2 (90.7)	13.4 (89.0)	17.5 (86.5)	(90.2) a	76.7	3.2 (96.5)	3.2 (92.7)	9.2 (91.3)	12.4 (89.4)	(92.4) a	(91.3) a
Chlorfenapyr (Challenger 36% SC)	180 cc	75.1	22.0 (76.4)	32.8 (68.1)	40.1 (64.7)	54.6 (54.9)	(66.0) b	79.1	25.1 (73.4)	28.9 (71.4)	44.4 (59.2)	52.1 (56.9)	(65.2) b	(65.6) b
Control	water	86.9	108.0	119.3	131.7	140.2	-	82.3	98.2	105.4	113.5	125.8	-	-
LSD at 0.05 =							(6.2%)						(5.9%)	(3.6%)

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فاعلية بعض المبيدات الحشرية ضد أطوار حشرة خنفساء البنجر السلحفائية فى حقول بنجر السكر

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تم تقييم كفاءة كل من اليروفينوفوس، كربوسلفان، كلورفينابيرعلى أطوار البيضه، اليرقة، العذراء، والحشرة الكاملة لخنفساء البنجر السلحفائية .*Cassida vittata* Vill التى تصيب محصول بنجر السكر فى محافظة كفر الشيخ خلال الموسمين ١٩٩٩/٢٠٠٠ و٢٠٠٠/٢٠٠١ .

أظهرت نتائج البروفينوفوس، الكربوسلفان أنهما من أكثر المركبات كفاءة على الأطوار المختلفة لخنفساء البنجر السلحفائية بينما كان تأثير الكلورفينابير متوسطاً فى مكافحة هذه الأفة الحشرية.

تمت دراسة الأثر الجانبى لهذه المركبات على المفترسات المصاحبه لهذه الأفة وهى حشرات أبو العيد *Coccinella undecimpunctata*، وأسد المن *Chrysoperla carnea*، والرواغة *Paederus alfierii*. أوضحت النتائج أن اليروفينوفوس والكربوسلفان كانا الأكثر فعاليه فى مكافحة خنفساء البنجر *C. vittata*، لكن فى نفس الوقت كان لهما تأثيراً شديداً على المفترسات. وكان تأثير المركب كلورفينابير متوسطا سواء فى مكافحة الأفة الحشرية أو على المفترسات المصاحبة لها.