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## Toxicity of Certain Chemical Compounds Against Aphids, Leafhoppers AND Related Predators on Faba Bean Fields

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### ABSTRACT

Faba bean, *Vicia faba* L., is a main nutritive source for human beings and their domestic animals. Many insect pests have been recorded on *Vicia faba* such as aphids, leafhoppers which are the most harmful insects, causing a considerable loss in yield. The current study was conducted at the experimental farm of the Sakha Agricultural Research Station, Kafr El- Sheikh Governorate, to evaluate the chemical compounds against aphids, leafhoppers and the common associated predators during 2021/2022 and 2022/2023 growing seasons. The tested insecticides were neonicotinoids (Gamorid, Actara and Oshin), carbamates (Marshal), avermectin (Proveplus) and the Biocide (*Beauveria bassiana*). Marshal induced the highest effect against aphids (91.46 to 93.48 % reduction) followed closely by Actara (87.28 to 91.48% reduction) during the two seasons of study. *Beauveria bassiana* induced the lowest reduction in aphid's population (53.34 to 40.40% reduction) Similarly, Marshal and Actara induced the highest initial effect against leafhoppers followed closely by Gamorid and Marshal (87.23 to 87.11% reduction), while *B. bassiana* induced the lowest reduction (64.96 to 57.82 % reduction). The rest insecticides exhibited moderate initial effect. Regarding the side effect on the associated predators, Marshal, Actara, and Oshin induced the highest initial kill to predator's population in two seasons, while, *B. bassiana* induced the lowest reduction. These results indicated that Marshal, Actara and Oshin could be included in IPM program on faba bean fields.

**Keywords:** leafhoppers, neonicotinoids, carbamates, avermectin, biocides.

### INTRODUCTION

In Egypt, faba bean, *Vicia faba* L., is a main legumes nutritive source for human beings and their domestic animals, as its seeds contain 22% protein and 58% carbohydrates (Nopke and Nemeck, 2010) in addition to many vitamins and other nutrients (Mohammed *et al.*, 1996). It is the most important legume crop not only due to its uses, but also due to its important role in the crop rotation. Faba bean is the oldest cultivated legume crop in winter season in Egypt (Nuessly *et al.*, 2004). Egypt, Morocco and Ethiopia, among 58 countries, are the main producing countries around the world (Bascur, 1993.; El-Mahi, 2004; Nuessly *et al.*, 2004; Singh *et al.*, 2013). Many pests have been recorded on *Vicia faba* such as aphids, leafhoppers and the serpentine leaf miners, which considered the most harmful insects of faba bean, causing a considerable loss in yield (El-Sarand *et al.*, 2019). Aphid infestation makes a huge damaged on faba bean. *Aphis craccivora* and *Aphis faba* are the most important insects which affect the plant growth of faba bean and caused yield losses depending on the intensity of infestation (El-Dessouki *et al.*, 2014). Both nymphs and adults of leafhoppers inject a toxin in the foliage during feeding causing down-curling of leaf edges, which turn yellow at first, then become brown and die (Nielson, 1995; El-Gindy, 2002). The leafhoppers also transmit pathogenic organisms: spiroplasma, viruses, mycoplasma, and bacteria.

Bioinsecticides and insecticides as a way of integrated faba bean management indicated that the least

effective compound against aphid was Bio-Power (*Beauveria bassiana*) which caused reduction in aphid populations as potential bio-control agent could be used for the management of all aphid species such as *A. craccivora* and *Aphis faba* (Abd El-Salam *et al.*, 2012; Muhammad *et al.*, 2013; Choudhary *et al.*, 2017; Eisawy *et al.*, 2022). Neonicotinoid insecticides (imidacloprid, acetamiprid, thiamethoxam and dinotefuran) were highly effective against *Aphis craccivora* Koch. and leafhoppers under field and laboratory conditions. Abd-Ella (2014), Yadav *et al.* (2015) and Patil *et al.* (2017) noted that Diafenthiuron was found to be next best after thiamethoxam and superior than dimethoate. Diafenthiuron acts specifically on piercing-sucking pests such as aphids.

Family Coccinellidae plays an important role in the biological control (El-Heneidy *et al.*, 2008) but insecticides have a harmful effect on the bio-agents in environmental field (Carmo *et al.*, 2010 a; Fernandes *et al.*, 2010; Bueno *et al.*, 2017). Barrania and Abou-Taleb (2014) showed that admire recorded a highly significant effect on both *Coccinella undecimpunctata* and *Chrysoperla carnea*. Karas *et al.*, (2017) studied the side effect of Radiant and two bio-pesticides; Biovar and Andros on *C. undecimpunctata* under laboratory condition. They recommended that use of Radiant caused a high mortality on predator compete with the bio-pesticides. Also, *C. undecimpunctata* and *C. septempunctata* showed a highly reduction after use of Baicao and Neemix pesticides (Gameel, 2013). The aim of this study was to determine the

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impact of used insecticide against aphids, *A. craccivora*, *A. faba* and the common associated predators (*C. carnea* Steph., *Paederus alfieri* Koch., *C. undecimpunctata* L. and *Scymnus* spp.) on faba bean fields.

## MATERIALS AND METHODS

### Chemicals used

The chemical compounds used in this study and their details are presented in the following Table(A)

**Table A. The chemical compounds used in this study and their details**

Kind of pesticides	Common name	Trae name	Chemical group	Formulation	Manufacturer company	Rate of application
1. Synthetic Insecticides	Imidacloprid	Gamorid	Neonicotinoids	20% SC	Bayer Crop Science,Japan	0.75ml L <sup>-1</sup>
	Thiamethoxam	Actara	Neonicotinoids	25% WG	Syngenta Agrosociences. Switzerland	0.25 g L <sup>-1</sup>
	Dinotefuran	Oshin	Neonicotinoids	20% SG	Syngenta Agrosociences. Switzerland	0.25 g L <sup>-1</sup>
	Emamectin-benzoate	Proveplus	Avermectin	5.7%SG	Syngenta Agrosociences. Switzerland.	0.3 gm L <sup>-1</sup>
	Carbosulfan	Marshal	Carbamates	20% EC	Syngenta Agrosociences. Switzerland	0.25 g L <sup>-1</sup>
2. Biological insecticides	<i>Beauveria bassiana</i>	Biovar	Bioinsecticide	WP 2.5% (1*10 <sup>8</sup> CFU/s/ gm)	Plant Protection Research Institute, Egypt.	2.5gL <sup>-1</sup>

### Experiment layout

Field experiments were conducted at the farm of the Sakha Agricultural Research Station, Kafr El- Sheikh Governorate. An area of about one half feddan was divided into 21 equal plots. This area did not receive any insecticidal treatments before the start of the experiment. Seven treatments (six insecticides and the control) were arranged in a complete randomized block design, with three replicates. Faba bean variety Sakha 3 was sown during the first week of November during both seasons; 2021/2022 and 2022/2023. The treatments were carried out in the second week of December. The tested insecticides were applied using a Knapsack sprayer, CP3(Cooper Pegler Co. Ltd.,Northumberland, England).

To evaluate the effect of different treatments against *Empoasca* spp, *Aphis* spp and predators. Samples of 20 leaflets representing upper, middle and lower level of the plant branches was randomly chosen to count leafhoppers but for Aphides and predators, 10 branches were taken for examination directly in the filed by the aid of a suitable lens. The numbers of aphids (nymphs and adults), leafhoppers (nymphs and adults) and predators (nymphs and adults) were counted on leaf samples just before chemical application as well as 2, 5, 8, 11 and 14 days after treatments. Percentages of insect reductions were calculated 2, 5, 8, 11 and 14 days post treatments according to Henderson and Tilton (1955) as follows:

$$\% \text{ Population reduction} = \left( 1 - \frac{T_a \times C_b}{T_b \times C_a} \right) \times 100$$

Where: T<sub>a</sub>= the number of insects in treated plots after spray

**Table 1. Mean number of aphids on faba bean before and after treatment with certain compounds during 2021/2022 season at Kafr El-Sheikh**

Compound	Rate /L.	Mean number /10 branches at indicated days					Mean	
		Before treatment	After treatment with					
			2 days	5 days	8 days	11 days		14 days
<i>Beauveria Bassiana</i>	2.5g	28.80	18.40	20.60	21.20	22.80	26.00	21.08
Carbosulfan	0.25g	48.60	6.00	8.20	10.00	10.80	15.40	10.08
Dinotefuran	0.25g	29.00	6.00	6.00	7.04	9.00	12.20	8.12
Thiamethoxam	0.25g	36.80	6.00	7.40	8.60	10.40	15.40	9.65
Emamectin- Benbenzoate	0.30g	40.20	17.80	19.00	21.00	23.60	27.40	21.76
Imidacloprid	0.75ml	32.80	6.40	7.40	9.60	11.60	12.40	9.48
Untreated		36.00	51.00	49.20	51.00	52.20	56.40	51.96

**Table 2. Reduction percentage in aphid population on treated faba bean with certain compounds during 2021/2022 season at Kafr El-Sheikh**

Compound	Rate /L.	% Reduction in population at indicated days					%Mean residual effect
		%Initial effect (2days)	Residual effect after treatment with				
			5 days	8 days	11 days	14 days	
<i>Beauveria Bassiana</i>	2.5g	53.34cd	42.87	46.83	44.78	39.67	43.54c
Carbosulfan	0.25g	91.46a	86.80	85.57	84.65	79.85	84.22a
Dinotefuran	0.25g	85.43 a	84.30	80.64	76.19	71.49	78.15ab
Thiamethoxam	0.25g	87.28ab	83.86	78.67	73.77	70.92	76.80ab
Emamectin- benzoate	0.30g	67.45c	60.68	61.92	56.19	53.98	58.19bc
Imidacloprid	0.75ml	84.63b	80.79	78.42	75.62	72.96	76.95ab

In a column, means followed by the same letter is not significantly different at 5% level

T<sub>b</sub> = the number of insects in treated plots before spray

C<sub>a</sub> = the number of insects in the control plots after spray

C<sub>b</sub> = the number of insects in the control plots before spray

### Statistical Analysis

Data were subjected to the one-way analysis of variance test (ANOVA) and completely randomized design. The least significant differences (LSD) at 0.05% level were determined according to computer program COASTST and Duncan's Multiple Range (1995) test.

## RESULTS AND DISCUSSION

### Effect of the tested compounds on aphids

The results in Tables 1 and 3 showed the population of aphid on faba bean plants untreated and treated with the tested insecticides. The aphid numbers before treatment ranged from 28.80 to 48.60 and from 30.40 to 45.80 insects/ 10 branches in the first and second seasons, respectively. All the tested insecticides were superior over the control in reducing the aphid population. carbosulfan and thiamethoxam caused a noticeable decrease in the population density of aphids, while *B. bassiana* had low effect on the population.

The results presented in Tables 2 and 4 indicated that Marshal induced the highest effect against aphids (91.46 and 93.48 % reduction in first and second seasons, respectively) after 2 days of treatment (initial effect) followed closely by Actara (87.28 and 91.48% reduction in first and second seasons, respectively).

**Table 3. Mean number of aphid on faba bean branches before and after treatment with certain compounds during 2022/ 2023 season at Kafr El-Sheikh**

Compound	Rate/L.	Mean number /10 branches at indicated days					mean	
		Before Treatment	After treatment					
			2 days	5 days	8 days	11days		14days
<i>Beauveria Bassiana</i>	2.5g	40.40	18.60	19.60	22.20	24.40	25.20	22.00
Carbosulfan	0.25g	45.80	3.40	8.10	9.40	9.20	13.20	8.66
Dinotefuran	0.25g	30.40	4.00	5.40	7.80	10.00	12.00	7.84
Thiamethoxam	0.25g	31.80	3.20	8.00	8.20	10.40	14.00	8.76
Emamectin- benzoate	0.30g	30.80	12.60	14.00	15.20	15.00	17.40	14.84
Imidacloprid	0.75ml/L.	34.40	4.00	6.80	8.00	11.20	14.00	8.80
Untreated		36.80	44.00	46.40	45.20	49.60	55.00	48.04

**Table 4. Reduction percentage in aphid population on treated faba bean branches with certain compounds during 2022/2023 season at Kafr El-Sheikh**

Compound	Rate /L.	% Reduction in population at indicated days				%Mean residual effect	
		%Initial effect (2days)	After treatment				
			5 days	8 days	11days		14days
<i>Beauveria Bassiana</i>	2.5g	57.69d	55.36	50.64	47.92	50.67	51.15cd
Carbosulfan	0.25g	93.48a	86.32	83.48	84.14	80.48	83.61a
Dinotefuran	0.25g	88.93b	84.20	77.63	74.37	71.04	76.81ab
Thiamethoxam	0.25g	91.72a	80.59	78.19	73.98	69.07	75.46ab
Emamectin- benzoate	0.30g	62.03c	60.18	57.07	56.65	54.46	57.09c
Imidacloprid	0.75ml	90.12a	81.84	78.95	74.41	69.55	76.19a

In a column, means followed by the same letter is not significantly at 5% level

*B. bassiana* induced the lowest reduction in this respect (less than 54 % reduction in the two seasons). The rest insecticides exhibited initial effect ranged from 67.45 to 85.4% and from 62.03 to 88.93 % reductions in the population of the first and second seasons, respectively.

The residual effect of the tested insecticides (mean reduction after 5, 8, 11 and 14 days of treatment) reveled that Marshal was the most effective compound, as it recorded 84.22 and 83.61 % reduction in the first and second seasons, respectively in the population followed by Oshin, which induced 78.15 and 76.81% reduction. On the other hand, *B. bassiana* and Proveplus were the least effective compounds recording 43.54 and 58.19 & 51.15and 57.09 % reductions in the first and second seasons, respectively. The other insecticides caused reduction ranged between 76.80 and 76.95 % &75.46 and 76.19%in both seasons, respectively.

In the first season, analysis revealed insignificant differences among Marshal, Gamorid, Actara, and Oshin, in initial effect, and in residual effect of Marshal, Oshin and Actara only. The rest insecticides including *B. bassiana* exhibited significant differences. The results of the second season confirmed the results of the first season.

The current results are in agreement with those of the Abd El-Salam *et al.* (2012) who indicated that the least effective was *Beauveria bassiana* (Bals) which caused 45.5% reduction in aphid populations after two sprayings at 15- days interval Muhammad *et al.* (2013) demonstrated that, *Beauveria bassiana* (Bals) as a potential bio-control agent could be used for the management of all aphid species such as *A. fabae* and *A. craccivora*. Also, the obtained results are in agreement with those of Abd-Elah (2014) who indicated that neonicotinoid insecticide thiamethoxam was highly effective against aphid under field and laboratory conditions. These results agree with those of Abdu-Allah *et al.* (2017). They evaluated the protective ability of three neonicotinoid insecticides as seed treatment (acetamiprid, imidacloprid, and thiamethoxam) against aphid damage in faba bean. The neonicotinoid treatments significantly protected faba bean plants against cowpea aphid infestation for 48 days after planting. The protective ratios with imidacloprid, acetamiprid and thiamethoxam were 87.67, 54.08 and 81.05 %, respectively.

These results agree with Sujatha and Bharpoda (2017) who reported that thiamethoxam 25WG (0.01%) was found to be more effective against the sucking pests by recording the lowest population of 0.38 aphids and 0.08 whiteflies.

Omer *et al.* (2019) indicated that the effect of *B. bassiana* on the population of aphids was measured. The high concentration (108 spores/ml) where 80% mortality was obtained with *B. bassiana* in day 3 with local variety; then mortality increased after 5, 7, and 14 days of measuring the population of the adults. Mortality declined with the decrease in concentrations. Kandil *et al.* (2022) showed that different neonicotinoid pesticides had different LC<sub>50</sub> values against the cowpea aphid. Dinotefuran showed the greatest efficiency (0.89g/mL), followed by acetamiprid (0.95g/mL), and thiamethoxam showed the least harmful effect (3.82g/mL).

Eisawy *et al* (2022) showed that the lowest and highest % reduction of numbers of aphid, *A. craccivora* were 14.15 % and 62.63 % at 3<sup>rd</sup>and 14<sup>th</sup> day, respectively after application with recommended rate of Biovar (2.3 × 106 cells *Beauveria bassiana* /ml).

**Effect of the tested compounds on leafhoppers, *Empoasca spp***

The results in Tables 5 and 7 show the population of leafhoppers on faba bean plants treated with the tested insecticides. The leafhoppers numbers before treatment ranged between 7.20 and 15.60 & 11.20 and 16.20 insects/30 leaflets in the first and second seasons, respectively. All the tested insecticides were superior over control in reducing the leafhoppers population. Marshal and Gamorid caused significant decrease in the population density of leafhoppers, while *B. bassiana* had low effect.

The results presented in Tables 6 and 8 indicated that Marshal and Actara induced the highest effect on leafhoppers (87.30 and 89.93 % reduction in first and second seasons, respectively) after 2 days of treatment (initial effect) followed closely by Gamorid and Marshal (87.23 and 87.11% reduction in first and second one, while *B. bassiana* induced the lowest reduction in this respect (64.96 and 57.82 % reduction in the two seasons, respectively). The rest insecticides exhibited moderate initial effect mounted from

72.94 to 85.63% and from 74.11 to 83.08% reductions in the population in both seasons, respectively.

The residual effect of the tested insecticides (mean reduction after 5, 8, 11 and 14 days of treatment) revealed that Marshal was the most effective compound, as it recorded 80.02 and 81.57 % reduction in the two seasons, respectively on the population followed by Actara, which induced 80.89 and 79.48% reduction, while *B. bassiana* and Proveplus were the least effective compounds recording 47.61 and 64.04 & 50.41 and 67.84 % reductions in the first and second seasons, respectively. The other insecticides caused reduction between 76.80 and 76.95 % &75.46 and 76.19% in both seasons, respectively.

on the other hand, the first season data analysis revealed insignificant differences between Marshal, Oshin, Actara and Gamorid in initial and residual effect with exception of *B. bassiana* effect. The results of the second season confirmed the results of the first season.

**Table 5. Mean number of *Empoasca spp.*, on faba bean before and after treatment with certain compounds during 2021/ 2022 season at Kafr El-Sheikh**

Compound	Rate /L.	Mean number/20 leaflets ainticated days	Mean numbers /20 leaflets at indicated days days					Grand mean
			2 days	5 days	8 days	11 days	14 days	
<i>Beauvaria Bassiana</i>	2.5g	14.40	6.20	8.80	10.80	8.80	7.80	8.48
Carbosulfan	0.25g	14.40	2.20	2.20	3.60	3.40	3.60	3.00
Dinotefuran	0.25g	15.60	2.80	3.80	5.00	3.40	3.80	3.76
Thiamethoxam	0.25g	8.00	1.30	1.60	2.20	1.80	1.60	1.70
Emamectin- benzoate	0.30g	7.20	2.40	3.40	3.60	2.80	2.60	2.96
Imidacloprid	0.75ml	13.00	2.40	3.20	3.80	3.40	3.00	3.16
Untreated		12.80	16.00	17.60	19.20	14.40	13.20	16.08

**Table 6. Reduction percentage in *Empoasca spp.*, population on treated faba bean with certain compounds during 2021/2022 season at Kafr El-Sheikh**

Compound	Rate /L.	% Reduction in population at indicated days					% Mean residual effect
		%Initial effect (2days)	5 days	8 days	11 days	14 days	
<i>Beauvaria Basiana</i>	2.5g	64.96d	51.56	49.58	44.48	44.61	47.56c
Carbosulfan	0.25g	87.30a	83.86	82.83	78.98	74.41	80.02a
Dinotefuran	0.25g	83.30ab	81.80	78.55	79.28	73.28	78.23ab
Thiamethoxam	0.25g	85.36ab	85.16	79.52	80.84	78.04	80.89a
Emamectin- benzoate	0.30g	72.94c	64.23	63.56	65.66	62.84	64.07bc
Imidacloprid	0.75ml	87.23a	81.34	80.29	75.02	76.18	78.21b

In a column, means followed by the same letter is not significantly at 5% level

**Table 7. Mean number of *Empoasca spp.*, on faba bean branches before and after treatment with certain compounds during 2022/ 2023 season at Kafr El-Sheikh**

Compound	Rate/L.	Before Treatment	Mean number /20 leaflets at indicated days					mean
			2 days	5 days	8 days	11 days	14 days	
<i>Beauvaria Basiana</i>	2.5g	11.20	5.40	4.80	6.00	4.60	4.80	5.12
Carbosulfan	0.25g	10.90	1.80	1.50	1.80	1.80	1.80	1.74
Dinotefuran	0.25g	14.40	2.40	2.60	3.00	3.40	2.60	2.80
Thiamethoxam	0.25g	16.00	1.80	3.20	3.20	3.20	2.80	2.84
Emamectin- benzoate	0.30g	14.40	4.20	3.60	5.40	4.40	3.80	4.28
Imidacloprid	0.75ml	16.20	3.00	2.80	3.70	4.20	3.20	3.38
Untreated		16.00	19.20	16.20	16.80	16.40	12.80	16.28

**Table 8. Reduction percentage in *Empoasca spp.*, population on treated faba bean with certain compounds during 2022/2023 season at Kafr El-Sheikh**

Compound	Rate /L.	% Reduction in population at indicated days					% %Mean residual effect
		%Initial effect (2days)	5 days	8 days	11 days	14 days	
<i>Beauvaria Basiana</i>	2.5g	57.82c	54.80	49.05	52.47	45.31	50.41c
Carbosulfan	0.25g	87.11a	81.22	84.01	81.28	79.77	81.57a
Dinotefuran	0.25g	85.99a	82.98	79.74	75.67	77.13	78.88ab
Thiamethoxam	0.25g	89.93 a	82.08	79.93	78.34	77.57	79.48ab
Emamectin- benzoate	0.30g	74.11bc	75.27	64.14	66.73	65.21	67.84b
Imidacloprid	0.75ml	83.08b	81.31	77.77	72.51	75.25	76.71ab

In a column, means followed by the same letter is not significantly at 5% level

**Side effects on the associated predators**

The results in Tables 9 and 11 show the population of predators (*C. carnea*, *C. undecimpunctata*, *P. alfieri* and *Scymnus* spp) on faba bean plants untreated and treated with

the tested insecticides. The predators' numbers before treatment ranged from 5.40 to 12.20 and 8.80 to 16.00 predators/10 branches in the first and second season, respectively. All the tested insecticides were superior over

control in reducing the predator's population. Marshal and Actara caused a noticeable decrease in the population of predators, while *Beauveria bassiana* had low effect on the population.

The results presented in Tables 10 and 12 indicated that Marshal and Actara & Marshal and Oshin in first and second seasons, respectively induced the highest toxicity to predators (70.47 and 65.57 & 73.78 and 69.22 % reduction in first and second seasons) after 2 days of treatment (initial effect) followed closely by Oshin and Actara (65.57 and 68.13% reduction first and second seasons), while, *B. bassiana* induced the lowest reduction in this respect (42.54 and 46.18 % reduction in the two season, respectively.

The efficiency of the residual effect of the tested insecticides (mean reduction after 5, 8, 11 and 14 days of treatment) appeared that Oshin was the most harmful compound, as it recorded 70.40 and 71.79 % reduction in the two seasons, respectively in the population followed by Marshal, which induced 68.92 and 70.99% reduction in two seasons, while *B.bassiana* was the least toxic compound recording 46.66 and 57.75 % reduction first and second one, respectively. The other insecticides caused reduction

between 64.66 to 66.34 % and 62.51 to 70.92 % in both seasons, respectively.

On the other hand, in first season data analysis appeared insignificant differences between Marshal, Oshin, Actara and Gamorid in initial effect, Also, in residual effect of Oshin, Marshal, proveplus and Gamorid only comparing to *Beauveria bassiana*. The results in second season were similar the results in first season.

These results agree with these of Huerta *et al.* (2003) who showed that imidacloprid was determined to be extremely harmful to *C. carnea*, third instar larvae, and inhibited adult emergence as well as killed a high proportion of newly emerged adults

These results agree with these of Nasreen *et al.* (2005) thiamethoxam caused 86.7% mortality of the *C. carnea* larvae and found to be a moderately harmful after 24 hours and harmful after 48 hours of exposure for semifield and field tests.

Also, Ormond *et al.* (2007) reported that the fungus, *Beauveria bassiana* was relatively injurious to the ladybird beetle, *C.septempunctata*.

**Table 9. Mean number of the total of associated predators in faba bean field before and after treatment with certain compounds during 2021/ 2022 season at Kafr El-Sheikh**

Compound	Rate /L.	Mean number /10 branches at indicated days						mean
		Before treatment	After treatment					
			2 days	5 days	8 days	11 days	14 days	
<i>Beauveria Bassiana</i>	2.5g	5.40	3.40	3.20	3.20	3.60	2.40	3.16
Carbosulfan	0.25g	10.40	3.20	3.60	3.00	3.80	2.60	3.24
Dinotefuran	0.25g	12.20	4.40	4.20	3.70	5.00	3.00	4.06
Thiamethoxam	0.25g	7.60	2.80	3.40	2.80	3.60	2.40	3.00
Emamectin- benzoate	0.30g	10.40	5.30	4.80	4.40	3.80	2.60	4.18
Imidacloprid	0.75ml	10.20	3.20	4.40	3.40	4.60	3.40	3.88
Untreated		9.00	11.20	12.20	9.80	11.40	8.80	10.68

**Table 10. Reduction percentage in population of the total predators in faba bean field treated with certain compounds during 2021/2022 season at Kafr El-Sheikh**

Compound	Rate /L.	%Reduction in population at indicated days					% %Mean residual effect
		%Initial effect (2days)	After treatment				
			5 days	8 days	11 days	14 days	
<i>Beauveria Basiana</i>	2.5g	42.54c	50.26	47.57	41.59	46.02	46.36bc
Carbosulfan	0.25g	70.47a	71.30	62.73	69.21	72.43	68.92a
Dinotefuran	0.25g	65.57a	73.62	69.36	66.50	72.12	70.40a
Thiamethoxam	0.25g	66.01a	64.39	61.41	56.03	62.23	61.02ab
Emamectin- benzoate	0.30g	55.64b	63.54	60.16	69.21	72.43	66.34a
Imidacloprid	0.75ml	64.63a	66.11	67.99	61.89	62.65	64.66a

In a column, means followed by the same letter is not significantly at 5% level

**Table 11. Mean number of the total of associated predators on faba bean field before and after treatment with certain compounds during 2022/ 2023 season at Kafr El-Sheikh**

Compound	Rate /L.	Mean number / 10 branches at indicated days						Grand mean
		Before Treatment	After treatment					
			2 days	5 days	8 days	11 days	14 days	
<i>Beauveria bassiana</i> Basiana	2.5g	8.80	5.40	5.40	4.00	3.60	3.60	4.40
Carbosulfan	0.25g	13.20	3.70	4.20	4.40	4.20	4.20	4.14
Dinotefuran	0.25g	13.00	4.20	4.40	4.40	4.00	3.60	4.12
Thiamethoxam	0.25g	16.00	6.00	6.40	7.40	5.60	5.40	6.16
Emamectin- benzoate	0.30g	14.20	6.20	6.80	6.60	5.20	4.60	5.88
Imidacloprid	0.75ml	16.00	5.70	6.00	5.80	5.00	4.60	5.42
Untreated		12.00	14.80	14.80	14.40	15.20	14.00	14.64

**Table 12. Reduction percentage in population of the total predators in Faba bean field treated with certain compounds during 2022/2023 season at Kafr El-Sheikh**

Compound	Rate/L	% Reduction in population at indicated days					%Residual effect
		%Initial effect (2days)	After treatment				
			5 days	8 days	11 days	14 days	
<i>Beauveria bassiana</i>	2.5g	46.18c	50.48	58.86	58.94	62.74	57.75c
Carbosulfan	0.25g	73.78a	70.80	72.00	69.44	71.69	70.99a
Dinotefuran	0.25g	69.22a	71.69	69.29	71.37	74.81	71.79a
Thiamethoxam	0.25g	68.13a	66.25	61.51	65.88	69.11	65.69ab
Emamectin- benzoate	0.30g	58.56c	54.14	59.05	65.78	71.09	62.51b
Imidacloprid	0.75ml	67.51a	66.25	69.23	73.39	74.80	70.92a

In a column, means followed by the same letter is not significantly at 5% level

Al-Shannaf (2010) studied the side effect of some insecticides on *C. undecimpunctata* and *C. carnea*. Date indicated that there was a highly decrease in the predator's numbers on *faba bean* plants. That results were similar to Ali *et al.* (2015) they showed that the tested compounds did not completely eliminate the beneficial arthropods. The superiority of thiamethoxam as systemic insecticides activities than non-systemic insecticides in their selectivity to *C. undecimpunctata* and *Scymnus spp* after 3,7 and 15 days in Cauliflower field. These results were agreement with Thakar *et al.* (2023) who showed that relatively safer as compared with the other pesticides on the basis of natural enemies. Based on PCBR, the highest return was obtained with the treatment of thiamethoxam 25 WG 0.01 % as compared with the other pesticide

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## سمية بعض المركبات الكيميائية ضد حشرات المن ونطاطات الأوراق والمفترسات المرتبطة بها في حقول الفول البلدى

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### المخلص

يعتبر الفول البلدى *Vicia faba* مصدرًا رئيسيًا للعناصر الغذائية بالنسبة للإنسان وحيواناته الأليفة. وفي هذه الدراسة تم فحص الإصابة ببعض الأقات الحشرية مثل المن ونطاطات الأوراق وتعتبر من الحشرات الأكثر ضررًا على نباتات الفول البلدى. أجريت هذه الدراسة في محطة البحوث الزراعية بسخا - كفر الشيخ لتقييم ستة مبيدات حشرية تتبع مجموعة النيونيكوتينويد (أوشين أكتارا، جاموريد) و مجموعة الكريامات (مارشال) و مجموعة أفرومكتين (بروف بلس) و مجموعة المبيدات الحيوية (بيوفاريا بسيانا). تم استخدام هذه المركبات للسيطرة على المن ونطاطات على الفول البلدى واثرها على المفترسات المتواجدة على نباتات الفول خلال موسمى الدراسة. أوضحت النتائج تأثير المبيدات على Aphids حيث أن مبيد المارشال أكثر ابداء فورية بنسبة 93.48%، 91.46% ثم مبيد الأكتارا، وكان أقلهم تأثيرًا هو بيوفاريا بسيانا خلال الموسمن، بينما سجلت باقى المبيدات تأثيرًا متوسطًا. بالنسبة لتأثير المبيدات على *Empoasca* spp أظهرت النتائج أعلى نسبة ابداء فورية في حالة المعاملة بمبيد المارشال والأكتارا ثم الجاموريد والمارشال في الموسمين. بينما سجلت البيوفاريا بسيانا أقل نسبة ابداء فورية. أما بالنسبة لباقى المبيدات فسجلت خفضًا في التعداد خلال الموسمين. أوضحت النتائج أن المارشال، الأكتارا والأوشين أكثر سمية حيث حققت أعلى نسبة ابداء فورية على المفترسات في الموسم الأول والثانى، ثم الأوشين والأكتارا بنسبة، بينما سجلت البيوفاريا بسيانا أقل نسبة ابداء فورية و أثر باقى. بناءً على النتائج المتحصل عليها من هذه الدراسة يمكن التوصية باستخدام المبيدات الحشرية (المارشال، الأكتارا، الأوشين) في برنامج المكافحة المتكاملة لخفض التعداد لكل من المن و نطاطات الأوراق في حقول الفول البلدى.