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Comparative Efficiency of some Chemicals against Cotton Mealybug and their Side Effects on Associated Predators under Field Condition

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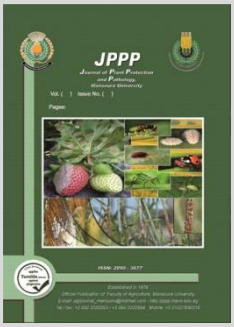

ABSTRACT

Field experiments were carried out at Sidi-Salem district, Kafr El-Sheikh Governorate, Egypt during seasons 2017 and 2018 to evaluate the efficacy of nine chemical compounds *viz.*, thiamethoxam, acetamiprid, flonicamid, emamectin benzoate, methomyl, alpha-cypermethrin, profenofos, Kz-oil, and detergent soap against the cotton mealybug, *Phenacoccus solenopsis* Tinsley. The side effects of the tested compounds on the associated predators were studied as well. The obtained results revealed that profenofos and thiamethoxam were the most affective against cotton mealybug recording 82 and 79.4 % reduction respectively as mean of effect during 10 days experiment period in 2017. In 2018, thiamethoxam was the most potent followed by flonicamid and profenofos causing mean of reduction percentage in mealybug population by 78, 76 and 74, respectively. Whereas, emamectin benzoate, Kz-oil, and detergent soap had the lowest activity against mealybug in both seasons of study. The other tested compounds indicated a moderate toxicity. Concerning the side effects on the associated predators, profenofos, alpha-cypermethrin, thiamethoxam and flonicamid were the most harmful to *Chrysoperla carnea* Steph., and *Coccinella undecimpunctata* Linnaeus, recording more than 50 % mean of reduction. On the other hand, emamectin benzoate, Kz-oil, and detergent proved to be the most harmless to both predators having less than 25 % mean of reduction in the predators population.

Keywords: Cotton, mealybug, chemical control, predators.

INTRODUCTION

Cotton crop is considered the most commercial important crop in the agricultural strategy of Egypt. Cotton exports are a major source of foreign currency and encourage national industries particularly ginning, textiles and seed oil expellers. It produces potential multi products such as, hulls, Lint, oil and food for animal (Ozyigit et al., 2007).

Cotton is suitable reproductive host for many pests, especially sucking pests, such as aphids *Aphis gossypii* Glover, spider mites *Tetranychus urticae* Koch., whitefly *Bemisia tabaci*, Gennadius and mealybugs, *Phenacoccus solenopsis* Tinsley. Cotton infestation with those pests causes deterioration in lint quality and high losses in crop production (Gahukar, 2006).

The cotton mealybug, *p. solenopsis* Tinsley (Hemiptera: Pseudococcidae) is an invasive polyphagous pest causing sever economic damage to wide range of agricultural crops, including vegetables and fruit trees worldwide (Mostafa *et al*., 2018). In Egypt, cotton mealybug was recorded firstly in weeds (Abd-Rabou *et al*., 2010) and on tomato plants as a new pest (Ibrahim *et al*., 2015). Also it causes economic damage mainly to cotton, Eggplant, okra, tomato, sesame and others by depleting the sap from all plant parts such as roots, root crowns, stems, twigs leaves, flowers and fruits. They can occasionally inject toxins, transmit viruses or excrete large amounts of honeydew stimulating the growth of sooty mould (BenDov,1994) and produce a fewer and smaller size bolls and the deformed leaves turn yellow then dry up, and eventually falloff (Saddiq *et al*., 2014; Kousar *et al*.,2016; Mostafa *et al*.,2018).

During the last three decades, the biological control played a major role in controlling the insect pests. The predators are scattered in about 167 families of 14 orders of class insect. Biological control of insect pests is either natural control for better efficiency main is exploiting this or commercially by rearing these predators and release to the agricultural fields. Also biological control, involving predators, played an important role in suppressing mealybug insect on economically important crops. Coccinellids and chrysopids are thought to be major and important predators of *p. solenopsis* (Joshi *et al*., 2010; Fand and Suroshe, 2015).

Control measurements are one of most necessary and costly practices to produce cotton crop. Although pesticides are essential component of pest control in crop protection systems repeated applications of conventional insecticides are often used when they do not give required results in many issuers as disadvantages. These disadvantages including the appearance of insect resistance to such insecticides, built up of population of secondary insects, the outbreak of main insects, reducing predators populations, environmental pollution or contamination and human health effects.

All available effective techniques must be applied in integration to pest control as a part of production systems. Thus integrated pest management (IPM) in such systems is mainly encompasses monitoring, economic and injury thresholds, crop-rotation, resistance crop varieties, cultural control and biological control. All must be integrated to minimize problems caused by cotton insect pests. The cultural control enhances the quality of plant which results in making the plant unsuitable for infestation (Norris *et al*., 2002). Also, biological control involving predators played an important role in suppressing aphid and mealybug pests on economically important crops. (pedigo, 2004). The

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effective use of insecticides needs to apply when economic losses could be arising. This will lead to minimizing the costs of production.

Furthermore, it is necessary to assess the efficacy of some various insecticides (synthesis and biocides) against cotton sucking pests and their side effects on some certain associated predators to know the highly effective insecticides for pests and the less toxic to for predators.

This study was designed to evaluate the efficacy of certain insecticides against on cotton mealybug and their side effects on the associated predators to determine the insecticides that could be used in integrated management for the cotton mealybug.

MATERIALS AND METHODS

The experiments were carried out at Sidi-Salem district, Kafr El-Sheikh Governorate, Egypt during 2017 and 2018 seasons. An area of 4200 m^2 planted with cotton Giza 86 and infested with mealybug *P. solenopsis* was divided into plots 42m^2 for each. This area did not receive any insecticidal treatments before the start of the experiment. Ten treatments (9 insecticides + control) were tested in a randomized complete block design with four replications. The tested insecticides were applied using a Knapsack-sprayer Cp3.

The *P. solenopsis* populations on the top ten inches of a plants terminal portion including stems, leaves, and fruiting buds were counted. The chosen plants were examined before spraying and 3, 7 and 10 days post spray. The mean numbers of mealybug per cotton plant was recorded reduction percentage in mealybug population among treatments in relation to control was estimated. Associated predators, *C. carnea* (larvae) and *C. undecimpunctata* (larvae and adults) were counted on 20 cotton plant from each treatment (five cotton plants were chosen from each replicate) reduction percentage in the populations of studied insects were estimated according to Henderson and Tilton (1955) as follows:

$$\% \text{ Reduction} = 100 \left(1 - \frac{A' \times B}{A \times B'}\right)$$

A`= No. of insects in control samples before spray.
A = No. of insects in control samples after spray.
B = No. of insects in treated samples after spray.
B`= No. of insects in treated samples before spray.

Statistical analysis

Data of mealybugs and its associated predators were subjected to analysis of variance (ANOVA) and the means were compared for significance by Duncans multiple range test (Duncan, 1955) at 0.05 probability level.

Tested chemicals:

Data in Table (1), clarified the nine tested chemical compounds

Table 1. The tested chemicals; trade name, common name, chemical group, % active ingredient and rate of application.

Common name	Trade name	Chemical group	% of active Ingredient	Rate of application ml /100 L
Thiamethoxam	Actara	Neonicotinoid	25 % WG	40 mg /100 L
Flonicamid	Flonicamid	Pyridinecarbox –amide	50 % WG	50 mg /100 L
Emamectin benzoate	Proclaim	Avermectin	5 % SG	40 mg /100 L
Methomyl	Neomyl	Carbamate	90 % WP	150 mg/100 L
Alpha-cypermethrin	Alpha-zd	Synthetic pyrethroid	10 % EC	250 mL/100 L
Profenofos	Teliton	Organophosphoarus	72 % EC	350 mL /100 L
Acetamiprid	Mospilan	Neonicotnoid	20 % mg	50 mg /100 L
Kz- oil	Kz – oil	Mineral oils	95 % EC	500 mL /100 L
Detergent	Detergent	Soap	10 %	500 mL /100 L

RESULTS AND DISCUSSION

The efficiency of nine products from different groups with different mode of action, *i.e*. two neonicotinoid (thiamethoxam and acetamiprid), one pyridinecarbox-amide (flonicamid), one avermectin (emamectin benzoate), one carbamate (methomyl), one pyrethroid (alpha-cypermethrin) one organophospharus (profenofos), one mineral oil (Kz-oil), and one soap (detergent).were examined on cotton field against mealybug and their side effects were evaluated also on *C. carnea* and *C. undecimpunctata* as well.

Efficacy on mealybug

Results presented in Table (2), indicated that, the tested insecticides varied in their efficiency against mealybug depending on the type group to which the product is belonging and the day after application. Thiamethoxam and profenofos were significantly and highly effective in comparison with other insecticides against mealybug (3 day after spray) causing 80.9 and 71.4 % reduction, while both of methomyl and flonicmide produced a moderate% reduction, 59.5 and 57.8%, respectively, with no significant differences between them. The other five tested insecticides were the least effective recorded % reduction ranged between from 11.2 to 26.9 % after 3 days of spray.

On the other side, the general means percentage for both of thiamethoxam and profenofos were in the highest and significant reduction against mealybug 79.4 and 82, respectively with no significant differences between them. While flonicmide and methomyl showed a moderate or more percentages of general mean 63.9 and 55.6% with significant differences in between. Whereas acetamiprid, alpha-cypermethrin, emamectin benzoate, Kz-oil and detergent were recorded relatively poor in the efficiency against mealybug populations with general means % reduction of 41, 35.1, 30.5, 29.7 and 27.7%, respectively, with significant differences in between. Concerning season 2018 and from data presented in Table (2) mealybugs were influenced by the tested insecticides where the highest values of reduction percentages at 3 days from application were recorded (79 and 78.6 %) for both thiamethoxam and profenofos, respectively with insignificant difference in between.

The second effect level of reduction percentages, three days after application was (71.9 and 67.6 %) for flonicmide and methomyl, respectively with significant difference between them and with significant differences with the first group. While the third groups of tested insecticides were showed the lowest effects of (3 days) reduction %, (37, 29, 24.4, 22.9 and 22.8) as descending order for detergent, acetamiprid, alpha-cypermethrin, emamectin benzoate and Kz-oil respectively, with significant difference in between and with significant difference with both groups mentioned above. As for general means percentages effect of tested insecticides on mealybug population densities, the results in Table (2) cleared that, thiamethoxam, flonicmide, profenofos and methomyl showed highest percentages of general means effects 78, 76.8, 74 and 65.9 % respectively with significant difference in between. While acetamiprid, alpha-

cypermethrin and Kz-oil recorded moderate percentages of general means effects 48.9, 47.7 and 40.1 % respectively with significant and insignificant difference in between and with significant difference with first group. emamectin benzoate and soap were relatively poor or less effective against mealybug population with general means effect of 30.4 and 23.7%, respectively with significant difference in between.

Abd El-Mageed *et al.,* (2018) concluded that chlorpyrifos was significantly the most effective in reducing the cotton mealybug population followed by imidacloprid, emamectin benzoate and buprofezin with average reduction between (96, 24 and 43.99%). Our results were in agreement with the result obtained by El-Zahi *et al.,* (2016) where they studied the efficacy of eight toxic products belonging to different chemical groups against mealybug *P. solenopsis* on cotton under field conditions and found that methomyl imidacloprid, thiamethoxam and chlorpyrifos had the highest efficacy against *P. solenopsis* recording 92.3 to 80.4 reduction of the insect population. flonicmide, emamectin benzoate and Kz-oil recorded the lowest control for *P. solenopsis*.

Table 2. Number of mealybug, *phenacoccus solenopsis* Tinsley. / 20 plant and % reduction of tested insecticides at different days post spray during 2017and 2018 seasons.

Seasons	Treatment	Rate ml /100 L	No. of population per plant and percent reduction of *P. solenopsis*							
			Pre-spray	After Spray at days			% reduction			Mean of %reduction
				3 days	7days	10 days	3 days	7days	10 days	
2017	Thiamethoxam	40 mg /100 L	1710	300	311	398	80.9a	82a	75.3b	79.4a
	Flonicamid	50 mg /100 L	2150	830	725	483	57.8b	66.8b	67.1b	63.9b
	Emamectin benzoate	40 mg /100 L	2350	1675	1675	1350	22.3de	29.8d	39.5d	30.5ef
	Methomyl	150 mg /100 L	2675	1000	925	1500	59.5b	66.1b	41.3d	55.6c
	Alpha-cypermethrin	125 mL /100 L	2225	1820	1650	700	11.2e	27.2d	66.9c	35.1de
	Profenofos	350 mL /100 L	2650	698	388	275	71.4a	85.6a	89.1a	82. a
	Acetamiprid	25 mg /100 L	1725	1275	1025	588	18.2de	41.4c	63.3c	41d
	Kz-oil	500 mL /100 L	1760	1175	1340	1050	26.9d	24.9d	37.2d	29.7ef
	Soap	500 mL /100 L	1450	990	970	1260	25.3d	34.6d	8.2e	22.7f
	Control	-	1875	1725	1912	1788	-	-	-	-
2018	Thiamethoxam	40 mg /100 L	1238	247	310	253	79a	74.8a	80.1a	78a
	Flonicamid	50 mg /100 L	1782	468	410	287	71.9b	75.4a	83a	76.8a
	Emamectin benzoate	40 mg /100 L	1382	993	958	889	22.9f	29.7d	38.5e	30.4f
	Methomyl	150 mg /100 L	1225	384	283	583	67.6c	76.8a	45.3d	65.9c
	Alpha-cypermethrin	125 mL /100 L	1244	885	659	347	24.4e	46.4c	72.6b	47.7e
	Profenofos	350 mL /100 L	1574	315	361	530	78.6a	76.6a	68.4b	74.5b
	Acetamiprid	25 mg /100 L	1662	1090	808	575	29d	50.7b	66.9b	48.9d
	Kz-oil	500 mL /100 L	1819	1249	938	962	22.8f	47.6c	50c	40.1e
	Soap	500 mL /100 L	1938	1150	1495	1750	37d	22.2d	12.3f	23.7g
	Control	-	2015	1989	1998	2072	-	-	-	-

The recommended insecticide *viz.* chlorpyrifos and methomyl have been the good products for mealybug control (Saeed *et al.,* 2007). Aheer *et al.,* (2009) and Suresh *et al.,* (2010) represented the neonicotinoid insecticides, imidacloprid and thiamethoxam as effective control measures against mealybug. Ahmad *et al.,* (2011) reported that, the non-insecticidal treatment did not notably lower the cotton mealybug population

The results of this study are in agreement with the results of some investigators. Rizui *et al.*,(2015), concluded that, the highest mortality was observed after 72 h of application by moventoenergy (92.9 %) followed by confidor, actara , tobacco extract and neem by 57.2,51.32,45.03 and 29.76 %, respectively on cotton mealybug, and save the nature enemies compared to the synthetic insecticide lampada-cyhalothrin 4.91 SC, chlorpyrifos 20 % EC imidacloprid 80 WG, imidacloprid 30.5 SC, thiocloprid 24 % SC may be recommended for effective management of cotton mealybug (Seni and Naik, 2017 and Mustafa and Lamiaa, 2019) evaluated the influence of some chemicals, non-chemical insecticide, mineral oil and plant oil against nymphs and adult of *p. solenopsis* on cotton leaves under laboratory conations. Their results revealed that, chemical insecticides were highly toxic against mealybug on cotton plants while the plant oil and mineral oil showed the lowest effect and they were unsuitable to control this pest.

Also the nymphs of mealybug were more susceptible to all tested chemical than the adult females. Nidheesh *et al.*, (2020) studied the bio efficacy of some new insecticide against cotton mealybug with three different dosages: below recommended, recommended and above recommended dosages. The mortality of the mealybug was found to be more in the treatment with recommended dosage when compared to below recommend. Neonicotinoinds such as thiamethoxame and dinotefuran were found the most effective in reducing the mealybug population at below recommended dose and above recommended dosages recorded 97.78 and 90.56 %, respectively.

Side effects of the tested products on some associated predators.

Season 2017.

The beneficial insects play an important role in cotton IPM program, because they are one of the most limiting factors regulating and balancing with their host pests which are mainly harmful pests. Among the most effective predators commonly found in cotton fields are *Coccinella undecimpunctata* Linnaeus, True spider, *Paederus alfieri* Koch., *Chrysoperla carnea* Steph., and others.

One aim of these studies is to evaluate the side effect of nine products, which tested on mealybugs on *C. carnea* and *C. undecimpunctata* under fields condition. The initial and residual activity of the nine different tested compounds a aside effects were evaluated against the larval stages of both *C. carnea* and C. *undecimpunctata* under field conditions during 2017 and 2018 seasons. Only the larval stages were taken into consideration because they are the only predacious stages of chosen predators and also their movements between treated plots were very limit.

1- Side effect on *Chrysoperla carnea* Steph.

The obtained results were cleared in Table (3). For the 3 days after spray, profenofos was the most harmful to *C. carnea* recorded 77.4 % reduction, whereas methomyl, flonicmide, alpha-cypermethrin and thiamethoxam resulted in reduction percentages ranged from 70.3 to 64 % with high effect in a descending order respectively with

insignificant differences in between and with significant differences with emamectin benzoate and acetamiprid were less harmful causing 19.5 and 19.9 %, reduction (3 day after spray) with insignificant differences in between. While Kz-oil and detergent were the most safe or harmless to *C. carnea* recoding 8.5 and 7.1 % reduction respectively at 3 day after spray with insignificant differences in between and significant different with all the products mentioned above.

Also the same trend was recorded for the general mean of effect profenofos, alpha-cypermethrin, thiamethoxam and flonicmide, as they recorded high percentages of general mean of effect with 73.8, 68.4, 57.1 and 56.5 %, respectively with significant differences in between. While the other five tested insecticides, methomyl, acetamiprid, Kz-oil, emamectin benzoate and detergent resulted in weak and very weak effect with general means 34.2, 21.7, 15.7, 14.9 and 6.4% respectively in descending order with significant differences in between.

2 - Side effect on *C. undecimpunctata*.

From data recorded in Table (4) and based on the percent reduction at 3 days after spray, methomyl, profenofos, thiamethoxam, flonicamid and alpha-cypermethrin were the most toxic to *C. undecimpunctata* recording 71.9, 71.8, 63.6, 63.1 and 60.1 %, respectively with insignificant different between them. While other four products acetamiprid, emamectin benzoate, Kz-oil and detergent) showed lower of reduction percentages 3day after application with 26.1, 17.5, 10.7 and 7.8 %, respectively with significant different in between. On the other side, profenofos and alpha-cypermethrin recorded high percentages of mean effect and recorded 71.2 and 68.8 %, respectively with insignificant difference. While thiamethoxam and flonicamid showed the same trend of effect 57.3 and 58.3 %, respectively for general means with insignificant difference in between. Acetamiprid and emamectin benzoate recorded a moderate general means effect 28.9 and 14.1 %, respectively with significant differences in between. The other two compounds; Kz-oil and detergent showed weak general means affect 20.6 and 7.7 %, respectively with significant differences in between. Generally, in case of toxicity of insecticides to predators (Chrysoperla and Coccinellids) the bio insecticides, mineral oil, natural insecticides and detergent were found safer to predators. While chemical insecticides showed a moderate to high toxicity against predators.

Table 3. Number of *Chrysoperla carnea* Steph. / 20 cotton plant and % reduction (as a side) effect for tested insecticide at different days post spray during seasons 2017 and 2018.

Seasons	Treatment	Rate ml /100 L	No. of *Chrysoperla carnea* Steph. / 20 cotton plant							
			Pre-spray	After Spray at days			% reduction			Mean of %reduction
				3 days	7days	10 days	3 days	7days	10 days	
2017	Thiamethoxam	40 mg /100 L	49	19	21	23	64a	57.5ab	49.6b	57.1b
	Flonicamid	50 mg /100 L	43	15	18	22	67.9a	57.8ab	43.7b	56.5b
	Emamectin benzoate	40 mg /100 L	44	37	36	37	19.5b	16.7b	8.6c	14.9d
	Methomyl	150 mg/100 L	44	14	34	36	70.3a	22.9b	10.9c	34.7c
	Alpha-cypermethrin	125 mL/100 L	49	18	16	12	65.2a	66.8a	73.3a	68.4a
	Profenofos	350 mL/100 L	38	9	10	10	77.4a	73.1a	70.8a	73.8a
	Acetamiprid	25 mg /100 L	38	33	28	29	19.9b	26.7b	18.4c	21.7d
	Kz-oil	500 mL/100 L	53	54	43	39	8.5c	18.4b	20.2c	15.7d
	Soap	500 mL/100 L	40	40	37	35	7.1c	7.8c	4.3d	6.4e
	Control	-	43	47	43	40	-	-	-	-
2018	Thiamethoxam	40 mg /100 L	24	9	8	10	64.5b	62.5ab	51.7ab	59.6b
	Flonicamid	50 mg /100 L	21	9	8	8	64.5b	63.7ab	59.6a	62.6b
	Emamectin benzoate	40 mg /100 L	22	18	18	16	19.2c	13.5c	14.1c	15.6bc
	Methomyl	150 mg/100 L	21	7	14	15	73.9a	31.3c	24.7bc	42.8b
	Alpha-cypermethrin	125 mL/100 L	23	8	7	9	69ab	69.6a	61.5a	66.7b
	Profenofos	350 mL/100 L	17	3	3	6	82.1a	76a	58.6a	72.2a
	Acetamiprid	25 mg /100 L	18	18	15	13	21c	23bc	29bc	24.3c
	Kz-oil	500 mL/100 L	26	26	16	14	10d	36.8b	42.6b	29.6c
	Soap	500 mL/100 L	19	19	16	16	9d	15c	7c	10.2d
	Control	-	22	25	21	20	-	-	-	-

Season 2018.

The obtained results of season 2018 were cleared in Tables (3, and 4). It is obvious that at 3days after spray detergent, Kz-oil, emamectin benzoate and acetamiprid were the most harmless to the studied predators recording 9, 10, 19, 2 and 21 for *C. carnea* and 13.8, 19, 21.8 and 22.1 %, for *C. undecimpunctata*, respectively. These four products remained the most harmless until to the end of the experiment causing 10.2, 29.6, 15.6 and 24.3 % reduction as mean of effect on *C. carnea* and 9.3, 36.7, 20.7, 26.4 % reduction against *C. undecimpunctata*, respectively. On the other side, profenofos and methomyl, profenofos and thiamethoxam proved to be the most harmful to the studied predators and showed 82.1, 73.9, 71.5 and 70.1% reduction at 3 days after spray for *C. carnea* and *C. undecimpunctata*, respectively. While alpha-cypermethrin, thiamethoxam, flonicamid and profenofos recorded relatively high reduction percentage at 3 days after spray recording 69.0, 64.5, 64.5 and 82.1%, respectively against *C. carnea* and 64.5, 70.1 ,65.2, and 71.5 % for *C. undecimpunctata* with insignificant differences in between. Also, the same trend was recorded as general means of effect of treatments. profenofos and alpha-cypermethrin recorded high percentage of mean effect 72.2 and 66.7 % for *C. carnea* and 72.3 and 68.4 % for *C. undecimpunctata* respectively with significant difference in between of both predators. While the other tested products, thiamethoxam, flonicamid and methomyl resulted in relatively moderate effect producing 59.6, 62.6 and 42.8 % for *C. carnea*. Generally the five compounds as detergent, Kz-oil, acetamiprid methomyl and emamectin benzoate remained the most harmless products till the end of the experiment. While profenofos, alpha-cypermethrin, flonicamid and thiamethoxam proved to be the most harmful as general means % reduction to both of studied predators. Ghelani *et al.*, (2014). concluded that in case of toxicity of insecticides to *C. undecimpunctata* and *C. carnea*, all the bio pesticides were safer to predators, while chemical pesticides were moderate to higher toxic to predator on cotton. Ahmed *et al.*, (2014) reported that imidacloprid (Neonicotinoids) was safer to beneficial insects and toxic for sucking pests than profenofos and bifenthrin.2, 61, and 36.6 % for *C. undecimpunctata*, respectively with significant differences in between.

Table 4. Number of *Coccinella undecimpunctata* Linnaeus /20 cotton plant and % reduction (as a side) effect for tested insecticide at different days post spray during seasons 2017and 2018.

Seasons	Treatment	Rate ml /100 L	No. of *Coccinella undecimpunctata* Linnaeus / 20 cotton plant							
			Pre-spray	After Spray at days			% reduction			Mean of %reduction
				3 days	7days	10 days	3 days	7days	10 days	
2017	Thiamethoxam	40 mg /100 L	51	19	22	24	63.6a	58.7ab	49.7b	57.3ab
	Flonicamid	50 mg /100 L	45	17	18	21	63.1a	61.5b	50.3b	58.3ab
	Emamectin benzoate	40 mg /100 L	46	38	40	39	17.5bc	15.3d	9.6d	14.1e
	Methomyl	150 mg /100 L	43	12	31	31	71.9a	30.9c	23.2c	42c
	Alpha-cypermethrin	125 mL /100 L	49	20	15	11	60.1a	70.3a	76.1a	68.8a
	Profenofos	350 mL /100 L	42	12	12	12	71.8a	72.4a	69.5a	71.2a
	Acetamiprid	25 mg /100 L	44	33	31	29	26.1b	31.1c	29.6c	28.9d
	Kz-oil	500 mL /100 L	53	48	41	38	10.7d	26.1c	24.9c	20.6d
	Soap	500 mL /100 L	46	43	42	41	7.8d	11.9d	3.6d	7.7e
	Control	-	53	54	55	50	-	-	-	-
2018	Thiamethoxam	40 mg /100 L	29	8	10	13	70.1a	62.1a	64a	62b
	Flonicamid	50 mg /100 L	28	9	11	12	65.2a	59.2b	56.6bc	61b
	Emamectin benzoate	40 mg /100 L	30	21	21	25	21.8b	21.9c	19c	20.7c
	Methomyl	150 mg /100 L	25	8	16	21	64.9a	31bc	14.4	36.6c
	Alpha-cypermethrin	125 mL /100 L	32	10	10	8	64.5a	65.9a	74.8a	68.4a
	Profenofos	350 mL /100 L	37	7	6	8	71.5a	73.7a	71.8a	72.3a
	Acetamiprid	25 mg /100 L	26	17	16	18	22.1b	29.5c	27.8c	26.4c
	Kz-oil	500 mL /100 L	32	23	17	16	19b	41bc	50.7bc	36.7c
	Soap	500 mL /100 L	27	21	21	25	13.8b	10.6d	3.7d	9.3d
	Control	-	36	32	33	36	-	-	-	-

In addition to the effect on associated predators, results of tested insecticides showed either harmfulness or slightly harmfulness to *C. undecimpunctata* and *C. carnea*, also, both predators were more sensitive to chemical one day post treatment than the Neonicotinoide insecticides. Similar results indicated that neonicotinoide insecticides were highly effective against cotton aphid under field conditions **(**Shi *et al.*, 2011; El-Naggar and Zidan, 2013).

Our results are in agreement with the results obtained by El-Zahi and Aref (2011**)** who found that imidacloprid and thiamethoxam were harmless to insect predators. They also found that organophosphorus (profenophos) and carbamate (methomyl) were the most toxic ones to the predators. Previous studies indicated that pirimicarb is harmless to several natural enemies. (Jansen, 2000; Cabral *et al.*, 2008; Jansen *et al.*, 2011; Baccil *et al.*, 2012).

Cabral *et al*., (2008) found that pirimicarb was harmless to several natural enemies for example ladybirds and lacewing under laboratory and field condition. However imidacloprid and thiamethoxam were classified a moderately harmful while acetamiprid and dinotefran were the least toxic to *C. carnea*.

Furthermore, thiamethoxam caused 86.7 % mortality of the *C. carnaa* larvae and found to be a moderate harmful after 24 hr and harmful after 48 hours of exposure in semifield and field testes (Nasreen *et al*., 2005).

El-Sherbeni *et al*., (2018) reported that, flonicamid, emamectin-benzoate, imidacloprid and thiamethoxam were the least harmful to the associated predators causing less than 50% mortality.

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مقارنة كفاءة بعض المبيدات على تعداد البق الدقيقى على نبات القطن فى الحقل وتأثيرها الجانبى على بعض المفترسات المرتبطة

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الملخص

أجريت هذه التجربه الحقليه بمركز سيدى سالم , محافظة كفرالشيخ , مصر خلال موسمى 2017 , 2018 لتقيم فاعلية 9 مركبات كيماوية وهى ثيامثوكسام وأسيتامبريد وفلونيكاميد وإيماكتين بنزوات وميثوميل وألفاسيرمثرين وبروفينوفوس وزيت ك زد وصابون منظف ضد بق القطن الدقيقى. بالإضافه إلى دراسة الأثر الجانبى لهذه المركبات على المفترسات المصاحبه للبق الدقيقى. وأظهرت النتائج أن البروفينوفوس والثيامثوكسام كانت الأكثر فاعليه ضد بق القطن الدقيقى فى 2017 مسجلين 82 و 79,4٪ متوسط نسبة خفض خلال فتره التجربه التى أمتدت لعشرة أيام. فى 2018 كان ثيامثوكسام هو الأكثر فاعليه يليه الفلونيكاميد والبروفينوفوس مسببين نسبة خفض فى تعداد البق الدقيقى 78 و 76 و 74٪ على الترتيب. وكان إيمامكتين بنزوات وزيت ك زد والصابون المنظف هم الأقل فاعليه على بق القطن الدقيقى خلال موسمى الدراسة. وقد أظهرت المركبات المختبره الأخرى فاعليه متوسطة. وكان التأثير الجانبى على المفترسات المصاحبه لمركبات بروفينوفوس وألفاسيرميثرين وثيامثوكسام وفلونيكاميد هى الأكثر ضرراً على أسد المن وأبوالعيد 11 نقطة مسجلين أكثر من نسبه خفض على هذه المفترسات. على الجانب الأخر كان إيمامكتين بنزوات وزيت ك زد والصابون المنظف الأكثر أماناً على كلا من المفترسين محدثة أقل من 25٪ خفض فى تعداد كل من المفترسين.