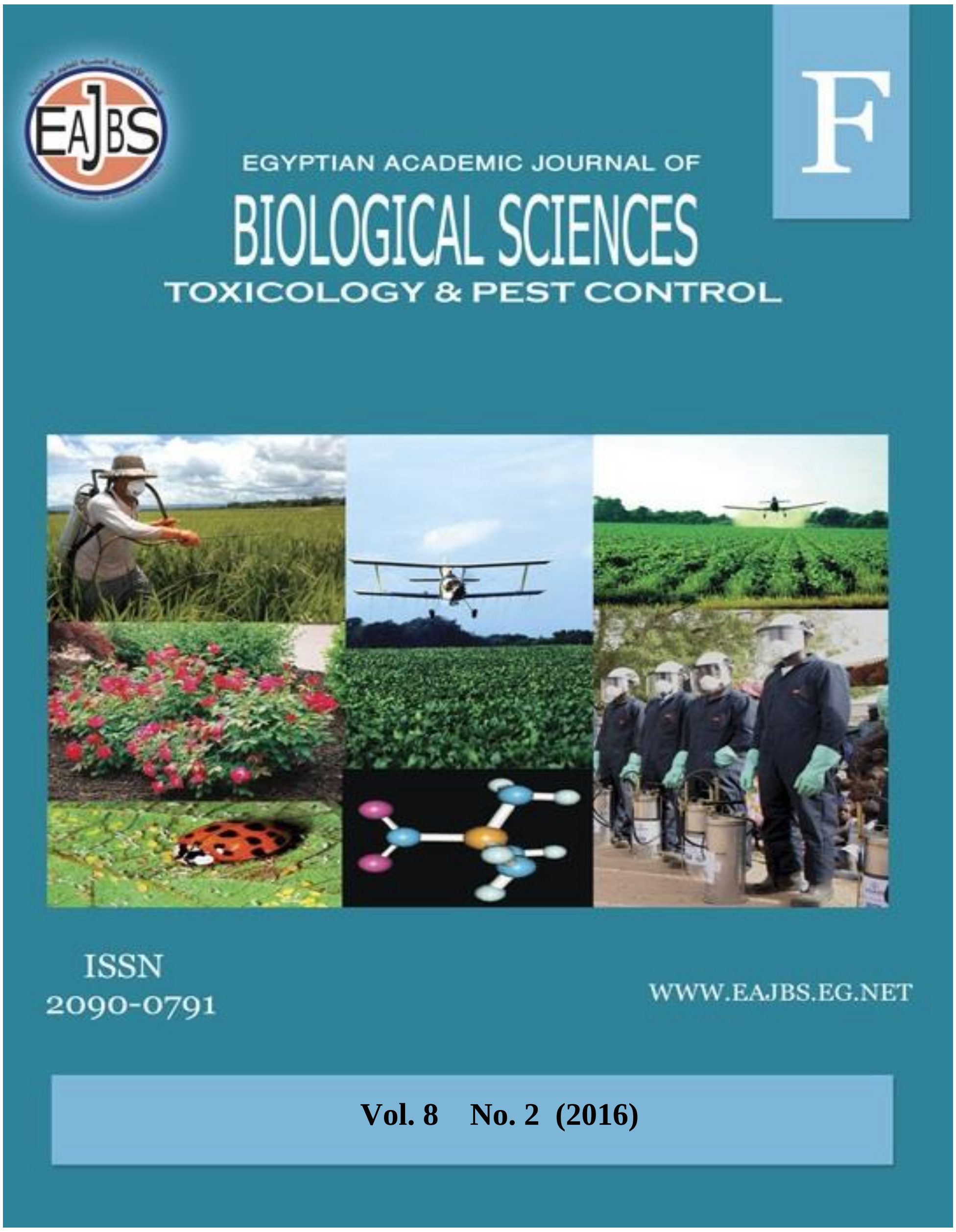

The journal of Toxicology and pest control is one of the series issued twice by the Egyptian Academic Journal of Biological Sciences, and is devoted to publication of original papers related to the interaction between insects and their environment.

The goal of the journal is to advance the scientific understanding of mechanisms of toxicity. Emphasis will be placed on toxic effects observed at relevant exposures, which have direct impact on safety evaluation and risk assessment. The journal therefore welcomes papers on biology ranging from molecular and cell biology, biochemistry and physiology to ecology and environment, also systematics, microbiology, toxicology, hydrobiology, radiobiology and biotechnology.

www.eajbs.eg.net

Citation : *Egypt. Acad. J. Biolog. Sci. (F. Toxicology & Pest control) Vol.8(2)pp. 135- 144(2016)*

Egypt. Acad. J. Biolog. Sci., 8(2): 135 - 144 (2016)

Egyptian Academic Journal of Biological Sciences
F. Toxicology & Pest control
ISSN: 2090 - 0791
www.eajbs.eg.net

Field Efficiency of Certain Neonicotinoids Alone and Their Mixtures With Chlorpyrifos Against, *Aphis gossypii*, *Bemisia tabaci* and Their Predators *Coccinella septempunctata* and *Chrysoperla carnea*

Hassan Fouad Mohammed Abdel-Hamid [1]; El-Sayed Mohammad Soliman Mokbel[2] and Hanan. H. Osman [3]

1- Cotton Pesticides Bioassay Dept, Plant Protection Res. Institute, ARC
2- Standard Rearing Dept., Central Agricultural Pesticides Laboratory, ARC
3- Cotton leaf worm Dept., Plant Protection Res. Institute, ARC

ARTICLE INFO

Article History
Received:30/8/2016
Accepted:1/10/2016

Key words:
Acetamiprid
thiamethoxam
chlorpyrifos ethyl
mixtures
Bemisia tabaci
Aphis gossypii
Coccinella septempunctata
and *Chrysoperla carnea*

ABSTRACT

Cotton aphid, *Aphis gossypii* and whiteflies, *Bemisia tabaci* are an important pests in cotton plants in Egypt. The present work was conducted during two successive seasons 2014 and 2015 in Beni- suef Governorate on the cotton crop by spraying the tested insecticides alone and mixtures of both acetamiprid and thiamethoxam with chloropyrifos to estimate the percentage of reduction of *Aphis gossypii* and *Bemisia tabaci* and their associated predators, *Coccinella septempunctata* and *Chrysoperla carnea*,after different intervals which include (24 hours) to estimate the immediate effect, as well as after 3 ,7 and 14 days to evaluate the latent effect. Results indicated that acetamiprid, thiamethoxam and chloropyrifos alone proved to reduce *Aphis gossypii* and *Bemisia tabaci* populations up to 14 days after treatment throughout both seasons. Whereas, combination of acetamiprid and thiamethoxam with chloropyrifos at half recommended rate showed the high efficiency with reduction percentage reached to 100.0% at same exposure time during the successive seasons 2014 and 2015. In addition, acetamiprid, thiamethoxam and chloropyrifos proved the high reduction percent to the populations of *Coccinella septempunctata* and *C. carnea* when these insecticides were used alone at recommended rate at 24h from treatments. Chlorpyrifos in mixtures with both acetamiprid, and thiamethoxam at half recommended rate showed the high effect with reduction percentage reached to 100.0% reductions for both predators in two seasons. Results suggested that, choosing suitable insecticide to control the tested cotton pests not only depends on its efficiency but also its toxicity to natural enemies. Also, these results indicated that the initial kill and residual effect of these insecticides was highly persistent up to 14 days. The overall results appeared promising in combination with insecticides as result of significant increasing its reduction percent.

INTRODUCTION

Whitefly, *Bemisia tabaci* (Gennadius) and cotton aphid, *Aphis gossypii* (Glover) remain key pests of many fields (Said *et al*., 2005). They affect numerous host plant species, large excretion of honeydew serves as a medium for black sooty mold fungi. In addition, they can transmit numerous types of plant virus (Hunter and Polston, 2001; Berlinger, 1986; Jorge and Mendoza, 1995). Controlling these pests rely mainly on insecticides application; as a result, the extensive use of insecticides has led to several problems, include the reduction of beneficial arthropods caused by non-selective insecticides causing resurgence of new pests and the eruption of secondary pests (Fernandes *et al*., 2010).

Under cotton field conditions, Green lacewing, *Chrysoperla carnea* (Stephens) (Neuroptera: Crysopidae) is a polyphagous predator that prey on a wide range of pest species such as; aphids, scale insects, leafhoppers, whiteflies, psyllids, thrips, psocids, lepidopterans and mites; hence they are very important bio control agents (Remoldi *et al*., 2008). However, they may fail to survive and provide control when environmental conditions are too dry or too moist (Nayar *et al*., 1976). The seven spotted lady beetle, *Coccinella septempunctata* L. (Coleoptera: Coccenillidae), is a widespread ladybird beetle. It is an aphidophagous species and important biological control agent (Hodek & Honěk, 1996, Alexidze & Barjadze, 2006). Pesticides effects on natural enemies include both direct effects such as mortality over a given time period and indirect. Indirect or delayed effects include rise in the costs of pest control and, mainly, the death of natural enemies caused by non-selective insecticides. Reduction of natural enemies may bring serious problems including resurgence of new pests and the eruption of secondary pests to key pest (Cloyd, 2012).

One of the forms to avoid the resurgence of pests is the use of selective insecticides for controlling target pest. In addition, there is growing global concern over the environmental impacts of pesticide use. Hence, it is urgent to develop new groups of insecticides acting selectively on certain insects to combat highly resistant insect pest, and to conserve their efficacy by applying insecticide resistance management strategies (Horowitz *et al.*, 1998). Neonicotinoids are selective insecticides against sucking pests, used intensively since imidacloprid was first introduced in 1991. Neonicotinoids act as a nicotinic acetylcholine receptor and therefore have specific activity against the insect nervous system (Maienfisch *et al*., 2001). They are considerably less toxic to humans than the organophosphorus and carbamate insecticides. Several primary target insect pests for neonicotinoids insecticides have been shown a high potential for resistance development (IRAC 2008).

Insecticide mixtures especially those with different modes of action are usually applied in the field to enhance the spectrum to control multiple pests in the presence of stimulus attack. They are also may possesses certain advantages including, increasing the efficacy to control a single pest, to delay the development of insecticide resistance, improve the efficiency of the application because mixture often used at lower doses than the doses of each component separately and also reduce the side effects of non-target organism and environment (Warnock and Cloyd, 2005)), and to combat current resistance in a pest species. Using mixtures as a countermeasure for resistance management in insect pests has been recommended (Ahmad 2004).The use of a mixture of insecticides is recommended as it would delay the onset of pest resistance in certain insecticides. It would control some types of pests, improve the efficiency of the application because mixture often used at lower doses than the doses of each component separately, and also reduce the side effects of non-target organism and environment (Warnock and Cloyd, 2005).

The objectives of the present study directed to evaluate the efficacy of the tested insecticides alone at the recommended rates and mixtures of tested neonicotinoid members with chlorpyrifos ethyl at the half recommended rates to elucidate the effectiveness of mixtures in order to saves time, money and may preserve neonicotinoids efficacy by combating resistance development.

MATERIALS AND METHODS

Insecticides used

The insecticides tested, are shown in Table1.

Table 1: Details of used insecticides

Active ingredient (common name)	Trade name	Manufacturer	Rate	Chemical group	IRAC MOA[b]
Chloropyrifos-ethyl	Dursban EC 48%EC	A green serve	1L / fed	Organophosphates	Group 1B
Acetamiprid	Mospilan 20%SP	Nippon soda	100gm/ fed	Neonicotinoid	Group 4A
Thiamethoxam	Actara 25%WP	Syngenta agro	200gm/ fed	Neonicotinoid	Group 4A

IRAC MoA Classification Version 8.0, December 2015

Experimental design

The experiments were carried out at Beni- suef Governorate, Egypt during the 2014 and 2015 cotton growing seasons. The experimental area was about 1050 m2, divided into equal parts of 210 m^2. The experimental area was divided into equal parts of about 42 m^2 each. Every treatment as well as the untreated plots was replicated four times in a completely randomized block design.

To evaluate the efficiency of these treatments, 25 cotton leaves per replicate were chosen randomly from the bottom, middle, and the top of the cotton plants (2 + 1 + 2 leaves per plant). The upper and lower leaf surfaces were examined carefully early at the morning and numbers of whiteflies, cotton aphid and associated predators, *Chrysoperla carnea* and *Coccinella septempunctata* counts were recorded. Leaf sampling and insect counting were made just before the spraying and at 24h, 3, 7 and 15 days after the spraying. The reduction percent of the populations was estimated by using Henderson and Tilton’s equation (1955) .

Statistical analysis

Data were analyzed by subjected to analysis of variance (ANOVA). Means were determined for significance at 0.05 using LSD test.

RESULTS

Efficiency of the tested treatments against *Aphis gossypii* and *Bemisia tabaci:*

The insecticidal activity of the neonicotinoids (imidaclopridm, thiame-thoxam) and chlorpyrifos), beside half-recommended rate mixtures of acetamiprid and thiamethoxam with chlorpyrifos were applied against cotton aphid, whitefly and their associated predators, *Coccinella* ssp. and *Chrysoperla carnea* (Stephens) on cotton seedlings and evaluated under field conditions.

Results in Table (2) indicated that full recommended rate application against *Aphis gossypii* showed effective reduction percentage at 24 h. from application. Reduction percentage in the two successive seasons (2014 and 2015) recorded (88.5, 91.6), (84.5, 89. 6) and (87.8, 89. 1) for acetamiprid, thiamethoxam and chlorpyrifos, respectively. Considerable drop in reduction was noticed at 3, 7 and 15-days intervals observations with the tested treatments throughout the two seasons (2014 and 2015). Reduction at 3 days intervals recorded (85.9, 75.4), (75.3, 69.6) and (83.9, 76.7) for acetamiprid, thiamethoxam and chlorpyrifos, respectively. Reduction at 7 days were (62.9, 75.4), (63.4, 69.6) and (65.9, 76.7); at 15 days reduction percent were (54.5, 47. 6), (52.7, 45. 7) and (49.73, 48.6) for acetamiprid, thiamethoxam and chlorpyrifos, respectively.

Mixtures of the tested neonicotinoids with chlorpyrifos were conducted in the two successive seasons (2014 and 2015) with half-recommended rate led to excellent efficacy (100% reduction percent) at 24 h. Reduction percent at 3 day intervals was (74.79, 73.9) and (75.15, 75.2), at 7 day intervals was (60.70, 59.3) and (55.22, 66.6)while at 15-days post-treatments reduction percent was (47.32, 44.27) and (44.27, 48.8) for (Acetamprid + Chlorpyrifos) and (Thiamethoxam + Chlorpyrifos) mixtures,respectively.

Table 2: Reduction percentages of *Aphis gossypii* after field application of different insecticide treatments during 2014 and 2015 growing seasons

2014 season					
Treatment	**Rate/fed.**	**% Reduction after different intervals**			
		24	3-days	7-days	14-day
insecticides					
Acetamprid	100gm/ fed	88.55a	85.89a	62.87a	54.54a
Thiamethoxam	200gm/ fed	84.51b	75.34b	63.41a	52.67b
Chlorpyrifos	1L / fed	87.87c	83.97c	65.95b	49.73c
Mixtures					
Acetamprid + Chlorpyrifos	50gm+500ml/ fed	100.0d	74.79d	60.70c	47.32d
Thiamethoxam + Chlorpyrifos	100gm+500ml/ fed	100.0d	75.15d	55.22d	44.27e
LSD at 5%		2.14	2.12	2.02	1.08
2015 season					
insecticides					
Acetamprid	100gm/ fed	91.6^{a}	75.4^{a}	59. 9a	47. 6a
Thiamethoxam	200gm/ fed	$89.\ 6^{b}$	69.6^{b}	56.6.b	45. 7b
Chlorpyrifos	1L / fed	$89.\ 1^{b}$	76.7^{c}	57.9c	48.6c
Mixtures					
Acetamprid + Chlorpyrifos	50gm+500ml/ fed	100.0^{c}	73.9^{d}	59.3d	46.2d
Thiamethoxam + chlorpyrifos	100gm+500ml/ fed	100.0^{c}	75.2^{e}	66.6e	48.8e
LSD at 5%		1.9	1.8	1.03	1.22

Regarding *Bemisia tabaci*, results in Table (2) indicated that full recommended rate of the tested insecticides alone showed the same aforementioned trend for reduction percentage at 24 h. from application. Reduction percentage recorded (82.51, 89.11), (90.72, 91.12) and (89.11, 92.33) for acetamiprid, thiamethoxam and chlorpyrifos in the two successive seasons (2014 and 2015), respectively. Considerable drop in reduction was noticed at 3, 7 and 15-days intervals of observations as illustrated in Table 3.

Table 3: Reduction percentages of *B. tabaci* after field application of different insecticide treatments during 2014 and 2015 growing seasons

2014 season					
insecticides	**Rate/fed.**	**% Reduction after different intervals**			
		24	3-days	7-days	14-day
Acetamprid	100gm/ fed	82.51a	84.52a	68.38a	58.68a
Thiamethoxam	200gm/ fed	90.72b	84.15a	69.41b	53.15b
Chlorpyrifos	1L / fed	89.11c	87.16c	65.97c	49.18c
Mixtures					
Acetamprid + Chlorpyrifos	50gm+500ml/ fed	100.0d	88.30c	70.10d	48.19c
Thiamethoxam + Chlorpyrifos	100gm+500ml/ fed	100.0d	78.19d	63.17e	38.22d
LSD at 5%		2.3	2.03	1.78	2.54
2015 season					
insecticides					
Acetamprid	100gm/ fed	89.11a	81.5a	67.3a	49.2a
Thiamethoxam	200gm/ fed	91.12b	79.2b	72.3b	53.1b
Chlorpyrifos	1L / fed	92.33c	86.0c	75.6c	44.5c
Mixtures					
Acetamprid + Chlorpyrifos	50gm+500ml/ fed	100.0d	81.9d	54.9d	47.9d
Thiamethoxam + chlorpyrifos	100gm+500ml/ fed	100.0d	72.8e	65.6e	50.0e
LSD at 5%		1.08	1.11	1.23	1.99

Mixtures of acetamiprid or thiamethoxam with chlorpyrifos in the two successive seasons (2014 and 2015) with half-recommended rate at 24 h. showed significant increasing activity against whiteflies, *B. tabaci* leading to excellent efficacy (100% reduction percent).On the other hand, Reduction percent at 3,7 and 15 days intervals tend to be similar to the aforementioned results with aphids.

Efficiency of the tested treatments against *Coccinella septempunctata* and *C. carnea*.

Data in Table 4 indicated that, population density of *Coccinella spp* was reduced after application of acetamiprid, thiamethoxam, and chlorpyrifos compared to untreated plots at different exposure dates during the two seasons. During 2014 season, acetamiprid, thiamethoxam and chlorpyrifos reduced the population of *Coccinella spp* with a reduction 73.33, 79.16 and 92.59 % when these insecticides were used alone at full recommended rate from 24h from treatments. These reduction percent were increased to 100.0 % when thiamethoxam, acetamiprid mixed with chlorpyrifos at half recommended rate at the same time. For 2015 season, results showed that, acetamiprid, thiamethoxam and chlorpyrifos caused a significant reduction in the population of *Coccinella spp* with a reduction percentage 83.60, 85.24 and 100.0 % when these insecticides were used alone at full recommended rate from 24h from treatments. These reduction percent were increased to 100.0 % when thiamethoxam, acetamiprid mixed with chlorpyrifos at half recommended rate at the same time.

Table 4: Reduction percentage and selectivity effects of the tested treatments on *Coccinella septempunctata* during 2014 and 2015 growing seasons

2014 season					
Treatment	**Rate/fed.**	**% Reduction after different intervals**			
		24	3-days	7-days	14-day
insecticides					
Acetamprid	100gm/ fed	73.33a	68.0a	62.66a	58.23a
Thiamethoxam	200gm/ fed	79.16b	72.8b	56.66b	46.66b
Chlorpyrifos	1L / fed	100.0c	100.0c	66.66c	48.82c
Mixtures					
Acetamprid + Chlorpyrifos	50gm+500ml/ fed	100.0c	100.0c	53.33d	42.35d
Thiamethoxam + Chlorpyrifos	100gm+500ml/ fed	.100.0c	.100.0c	53.33e	39.16a
LSD at 5%		2.09	2.3	1.93	2.54
2015 season					
insecticides					
Acetamprid	100gm/ fed	83.60a	66.40a	62.58a	61.11a
Thiamethoxam	200gm/ fed	85.24b	72.65b	64.51b	51.35b
Chlorpyrifos	1L / fed	100.0c	100.0c	62.87c	54.54c
Mixtures					
Acetamprid + Chlorpyrifos	50gm+500ml/ fed	100.0c	100.0c	66.45d	52.43d
Thiamethoxam + Chlorpyrifos	100gm+500ml/ fed	.100.0c	.100.0c	62.58e	45.94e
LSD at 5%		1.09	1.79	1.37	1.2

Results in Table 5 showed a significant reduction on the population of *C. carnea* compared to untreated plots at different exposure dates during the two seasons. Results in Table 5 showed the reduction percentage and selective effects of different insecticides on *C. carnea* at 24, 3, 7 and 14 days during 2014 season. Acetamiprid, thiamethoxam and chlorpyrifos caused a significant reduction in the population of *C. carnea* with a reduction percentage 84.44, 82.77 and 97 % respectively when these insecticides were used alone at full recommended rate from 24h from treatments. These reduction percent were increased to 100.0 % when thiamethoxam, acetamiprid mixed with chlorpyrifos at half recommended rate at the same time. During 2015 season, results showed that acetamiprid, thiamethoxam, and chlorpyrifos caused a significant reduction in the population of *C. carnea* reached to 86.18, 82.77 and 92.12% when these insecticides were used alone at full recommended rate from 24h from treatments. These reduction percent were very increased to 100.0 % when thiamethoxam, acetamiprid mixed with chlorpyrifos at half recommended rate at the same time.

Table 5: Reduction percentage and selectivity effects of the tested treatments on *C. carnea* during 2014 and 2015 growing seasons

2014 season					
Treatment	**Rate/fed.**	**% Reduction after different intervals**			
		24	3-days	7-days	14-day
insecticides					
Acetamprid	100gm/ fed	84.44a	75.93a	59.48a	39.8a
Thiamethoxam	200gm/ fed	82.77b	72.19b	56.92b	40.60a
Chlorpyrifos	1L / fed	100.0c	100.0c	53.84c	41.62a
Mixtures					
Acetamprid + Chlorpyrifos	50gm+500ml/ fed	100.0c	100.0c	50.25d	36.54b
Thiamethoxam + Chlorpyrifos	100gm+500ml/ fed	.100.0 c	.100.0c	55.22e	44.27c
LSD at 5%		1.85	1.13	1.37	1.66
2015 season					
insecticides					
Acetamprid	100gm/ fed	86.18a	74.73a	44.77a	39.30a
Thiamethoxam	200gm/ fed	82.77b	59.48b	40.29b	36.81b
Chlorpyrifos	1L / fed	92..12c	63.41c	55.22c	44.27c
Mixtures					
Acetamprid + Chlorpyrifos	50gm+500ml/ fed	100.0d	100.0d	49.75d	35.32d
Thiamethoxam + Chlorpyrifos	100gm+500ml/ fed	100.0d	100.0d	63.41e	52.67e
LSD at 5%		1.23	1.44	2.11	1.6`

DISCUSSION

Cotton aphid,*Aphis gossypii* and whitefly, *Bemisia tabaci* are a polyphagous pests cause different damage levels; directly or indirectly to several plants, (Jacobson and Croft 1998). Farmers used to control such pest with insecticides, however, populations of this pest have demonstrated the ability to develop resistance to several insecticides (Grafton-Cardwell *et al*.,1992). In this study, aphid and whitefly were susceptible to the examined insecticides treatments and gave high mortality. However, an appropriate management strategy for pesticide resistance should be considered. The tested parasitoids are important in controlling aphid and whitefly naturally and are used in biological control programs of them in diverse crops (Pungerl, 1984).Although biological control is desirable, pests having high reproductive rate and mobility are very difficult to control by biological means only and require selective insecticides acting together with natural control (Stark and Rangus, 1994).

In this study, acetamiprid, thiamethoxam, and chlorpyrifos caused a high significant reduction in cotton aphid and white fly populations. In addition, the efficiency and residual effects of these insecticides persisted up to 15 days against *A. gossypii* and *B. tabaci*. Similar results indicated that neonicotinoid insecticides were highly effective against cotton aphid and reduced the population of this pest (up to 14days) under field conditions (Shi *et al*., 2011; El-Naggar and Zidan, 2013). In addition, when outbreaks occur in cotton aphid populations, insecticides application is the only effective tactic to suppress this pest and consequently insect predators often got killed which resurge the pest again and thus more sprays are needed. That will lead us to use selective insecticides to spare the natural enemies (Preetha *et al*., 2009). Also, our results indicate that all insecticides were effective as leaf treatments at 24h of both insects *Aphis gossypii* and. *Bemisia tabaci* . Other investigators reported that imidacloprid showed satisfactory control of sucking pests (Maienfisch *et al*., 2001; Magalhaes *et al*., 2009). Such a difference in performance between imidacloprid and thiamethoxam has been reported the obtained results are in agreement with those of several investigators. Misra (2002) found that imidacloprid as well as thiamethoxam proved significantly superior in. Also, all insecticides induced a fast initial effect after two weeks of treatment **(**El-Naggar and Zidan 2013). The neonicotinoid, imidacloprid proved to be effective against aphids, jassids, and whitefly. It could reduce the need for foliar sprays by at least four applications (Zhang *et al*., 2014).

Mixtures of various compounds which acting on different sites has been adopted to slow down insecticide resistance evolution, safe and cost effective based on the optimum use of existing compounds (Martin *et al*., 2003). Theoretically, insecticide mixtures can delay the onset of resistance development more effectively than rotation of insecticides if resistance to each compound is independent and rare (Curtis, 1985). Neonicotinoids act agonistically on nicotinic acetylcholine receptors (Elbert *et al*., 2007) and have been shown to have no or less cross-resistance to conventional insecticides (Mokbel 2007; 2013). Then, neonicotinoids and their mixtures have commonly been used in practice against a variety of pests worldwide.

In the present study, the synergistic effect between chlorpyrifos (acetyl choline esterase inhibitors) with acetamiprid and thiamethoxam (neonicotinoids) may be due to either Ops caused accumulation of acetylcholine at the junction of motor nerve and ganglia of the autonomic nerves system leading to enhance the nerve impulse firing in the post synaptic membrane or inhibiting esterase which play a certain role in metabolism of neonicotinoids. Neonicotinoids may work as agonists and exhibit excitatory effect to nicotinic acetylcholine receptors. Therefore, both cholinesterase inhibitors and neonicotinoids have a similar net result on the transmission of nerve impulses

The common green lacewing, *C. carnea,* is the main natural enemy that has been effectively used to control various insect pests in different agro-ecosystems (Athan *et al*., 2004; Tsaganou *et al*., 2004). Our results indicated that chlorpyrifos tend to be highly persistent up to 15 days and reduced the population of *C. carnea* on cotton plants. On the other hand, Elbert *et al*. (1998) reported that exposure of *C. carnea* larvae to imidacloprid resulted in a 40% reduction in the population under field conditions. However, 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 exposure for semifield and field tests (Nasreen *et al*., 2005; Gaber *et al*., 2015).

Also, imidacloprid and thiamethoxam possesses low toxicity to lady beetles than their prey aphids; however, this limited tolerance was insignificant under the high dosage of spraying. Preetha *et al*. (2010) reported that imidacloprid had little impact on the egg parasitoid, *T. Chilonis* and at the recommended dose (25 g a.i. ha_1).

Generally, the present work showed that tested neonicotinoids can be used effectively to control cotton aphid, *A. gossypii* and whiteflies, *Bemisia tabaci* in cotton fields, and proved less toxic to natural enemies in comparison with chloropyrifos. The tested mixtures proved excellent efficacy to both tested pests and associated tested predators. These results could be useful for the selection of suitable insecticides for use in IPM program in cotton plants to control the cotton aphid and whiteflies under field conditions.

REFERENCES

Ahmad, M. 2004. Potentiation/antagonism of deltamethrin and cypermethrins with organophosphate insecticides in the cotton bollworm, Helicoverpa armigera (Lepidoptera: Noctuidae). Pesticide Biochemistry and Physiology 80: 31–42.

Alexidze, G.; Barjadze, Sh. 2006. Natural enemies complexes associated with the Russian wheat aphid (RWA) - *Diuraphis noxia* (Mordvilko) in East Georgia. Proceedings of the Georgian Academy of Sciences, Biological Series B, 4 (4): 67-69.

Anonymous. 2007. Central cotton Research Institute - Annual Research Progress

Report, 2006-07. Pakistan Central Cotton committee, pp. 67-69.

Athan R, Kaydan B, Ozgokce MS, 2004. Feeding activity and life history characteristics of the generalist predator, Chyroperla carnea (Neuroptera: Chrysopidae) at different prey densities. Journal of Pesticide Sciences 77: 17-21

Berlinger, M. J. 1986. Host plant resistance to Bemisia tabaci. Agric. Ecosystems Environ.17: 69-82.

Cloyd, R. A. 2012. Indirect Effects of Pesticides on Natural Enemies. Pesticides – Advances in Chemical and Botanical Pesticides pp 127-149.

Curtis, C.F. 1985. Theoretical models of the use of insecticide mixtures for nagement of resistance. Bull. Entomol. Res. 75:259-265.

El- Naggar, J. B.; Zidan, N. A. 2013. Field evaluation of imidacloprid and thiamethoxm against sucking insects and their side effects on soil fauna. J. of plant protection Res., 53 (4): 375 -385.

Elbert, A.; Haas, M.; Thielert, W.; Nauen, R. 2007. Applied aspects of neonicotinoid uses. In:Proc XVI Internat Plant Prot. Cong. Glasgow, UK, vol. 3, pp. 620-621.

Elbert, A.; Nauen, R.; Leicht, W. 1998. Imidacloprid, a novel chloronicotinyl insecticide: biological activity and agricultural importance. In: Ishaaya I, Degheele D, eds. Insecticides and Novel Mode of Action, Mechanism and Application. pp 50-73. Springer-Verlag, Berlin, Germany.

Fernandes, F. L.; Bacci, L.; Fernandes, M.S. 2010. Impact and Selectivity of Insecticides to Predators and Parasitoids. EntomoBrasilis 3(1): 01-10

Gaber, A. S.; Abd-Ella, A. A. ; Abou-Elhagag1, G. H. ; Abdel-Rahman Y. A.2015. Field efficiency and selectivity effects of selected insecticides on cotton aphid, Aphis gossypii Glover (Homoptera: Aphididea) and its predators. Journal of Phytopathology and Pest Management 2(1): 22-35.

Grafton-Cardwell, E. E.; Leigh, T. F.; Bentley, W. J.; Goodell, P.B. 1992. Cotton aphids have become resistant to commonly used pesticides. Calif. Agric., 46: 4-7.

Henderson, C. F.; Telton, E.W. 1955. Test with acaricides against the brown wheat mite. J. Econ. Entomol, 48:157-161.

Hodek, I.; Honěk, A. 1996. Ecology of Coccinellidae. Kluwer, Dordrecht: 464 pp.

Horowitz, A. R.; Mendelson, Z.; Weintraub, P. G.; Ishaaya, I. 1998. Comparative toxicity of foliar and systemic applications of acetamiprid and imidacloprid against the cotton whitefly, Bemisia tabaci (Homoptera: Aleyrodidae). Bull. Entomol. Res. 88: 437-442.

Hunter, W. B.;. Polston J. E .2001. Development of a continuous whitefly cell line [Homoptera: Aleyrodidae) Bemisia tabaci (Gennadius)] for the study of Begomovirus. J. Invert. Pathol. 77: 33-36.

IRAC. 2008. Guidelines for Resistance Management of Neonicotinoids, Version 1.0:1-4, June 2008. www.irac-online.org

Jacobson, R.J.; Croft, P. 1998. Strategies for the control of *Aphis gossypii* Glover (Hom: Aphididae) with *Aphidius colemani* Viereck (Hym: Brachonidae) in protected cucumbers. Biocontrol Science and Technology, 8(3): 377-387.

Jorge, S.; Mendoza, O. 1995. Biology of the sweet potato whitefly (Homoptera:Aleyrodidae) on tomato. Flor. Entomol. 78:154- 160.

Magalhaes, L.C.; Hunt, T.E.; Siegfried, B.D. 2009. Efficacy of neonicotinoid seed treatments to reduce soybean aphid populations under field and controlled conditions in Nebraska. J. Econ. Entomol. 102, 187-195.

Maiensfisch, P.; Huerlimann, H.; Rindlisbacher, A.; GsellL- Dettwiler, H.; Haettenschwiler, J.; Syeger, E.;

Walti, M. 2001. The discovery of thiamethoxam: a second-generation neonicotinoid. Pest Manag Sci., 57:165–176.

Martin, T.; Ochou, O. G.; Vaissayre, M.; Fournier, D.2003. Organophophorus insecticides synergize pyrethroids in the resistant strain of cotton bollworm, Helicoverpa armigera (Hubner) (Lepidoptera: Noctuidae) from West Africa. J. Econ. Entomol. 96:468:474.

Metecalf,R L.1980.changing roles of insecticides in crop protection. Annual review of entomology25, 219-256.

Misra H.P. 2002. Field evaluation of some newer insecticides against aphids (*Aphis gossypii*) and jassids (*Amrasca biguttula*) on okra. Indian J. Entomol. 64 (1): 80–84.

Mokbel, E. M. S. 2007. Toxicological and biochemical studies for some new and nonconventional insecticides against aphids. MSc. thesis. Fac. of Agric. Zagazig Univ.pp137.

Mokbel, E. M. S. 2013. Further Studies on Insecticides Resistance in the Cowpea Aphid. Ph.D.thesis. Fac. of Agric. Cairo Univ.pp206.

Nasreen A, Mustafa G, Ashfaq M, 2005. Mortality of Chrysoperla carnea (Stephens) (Neuroptera: Chrysopidae) after exposure to some insecticides; laboratory studies. South Pacific Studies 26: 1-6.

Nayar, K.K.; Ananthak, T.N.; David, B.V. 1976. General and applied entomology Tata McGraw Hill publishing company limited, India, 569 pp.

Preetha G, Stanley J, Manoharan T, Chandrasekaran S, Kuttalam S, 2009. Toxicity of imidacloprid and diafenthiuron to Chrysoperla carnea (Stephens) (Neuroptera: Chrysopidae) in the laboratory conditions. Journal of Plant Protection Research 49: 290-296.

Preetha G; Manoharan, T.; Stanley, G.;Kuttalam, S. 2010 impact of chloronicotinyl insecticide, imidacloprid on egg, egg-larval and larval parasitoids under laboratory conditions. J.PI.Protect.Res.50:535-540.

Pungerl, N.B., 1984. Host preferences of Aphidius (Hymenoptera: Aphidiidae) populationsparasitizing pea and cereal aphids (Hemiptera: Aphididae). Bull. Entomol. Res., 74: 153-161.

Rimoldi, F.; Schneider, M.I. ; Ronco, A.E. 2008.Susceptibility of Chrysoperla externa eggs (Neuroptera:Chrysopidae) to conventional and biorational insecticides.Journal of Environmental Entomology, 37 (5):1252–1257.

Said, A. A. A.; F. A. H. Shaheen; A. M. Hamid and E. S. Elzahi (2005). Population dynamic of aphids, whitefly, some predators and seed cotton yield as inflected by cotton sowing date. Egypt. J .Agric. Res. 83 (2): 813-830.

Shi K, Jiang L, Wang H, Oiao K, Wang D, Wang K, 2011. Toxicities and sublethal effects of seven neonicotinoid insecticides on survival, growth and reproduction of imidacloprid resistant cotton aphid, Aphis gossypii. Pest Management Science 67: 1528-1533.

Stark, J. and T. Rangus, 1994. Lethal and sublethal effects of the neem insecticide formulation, Margosan-O, on the pea aphid. Pestic. Sci., 41: 155-160.

Tsaganou FC, Hodgson CJ, Athanassiou CG, Kavallieratos NG, Tomanovié Z, 2004. Effect of Aphis gossypii Glover. Brevicoryne brassicae and Megoura viciae on the development of Harmonia axyridis. Biological Control 31: 138-144.

Warnock, D. F. and R. A. Cloyd. 2005. Effects of pesticide mixtures in controlling western flower thrips (Thysanoptera: Thripidae). Journal of Entomological Science 40: 54-66.

Zhang, X.B.,Wang, K.,Wang, M.,Wang, J.M., Mu, W., 2014. Effects of imidacloprid on population dynamics of Apolygus lucorum under different application modes. Acta Phytophylacica Sin. 41, 93-97 (in Chinese with English summary).

ARABIC SUMMERY

الكفاءه الحقليه لمركبات نيونيكوتينويد معينه منفرده ومخلوطه بالكلوروبيرفوس ضد من القطن والذبابة البيضاء و مفترساتها (ابو العيد واسد المن)

حسن فؤاد محمد عبد الحميد [1] ، السيد محمد سليمان مقبل[2] حنان حسين عثمان [3]

1- معهد بحوث وقاية النباتات –مركز البحوث الزراعية- الجيزة- مصر
2- المعمل المركزي للمبيدات- مركز البحوث الزراعية- الجيزة- مصر
3- قسم دودة القطن – معهد بحوث وقاية النباتات – مركز البحوث الزراعية- الجيزة - مصر

من القطن والذبابة البيضاء من الآفات الهامة علي نباتات القطن في مصر.وقد تم إجراء هذا البحث في موسمين متعاقبين (2014،2015)) لتقدير فاعلية مركبين من مركبات النيونيكوتينويد (الاسيتامبريد و السياميثوكسام) والمركب الفسفوري الكلوربيريفوس منفردة وخليط كل منهما مع الكلوربيريفوس والمفاضلة بينهم في نسبة الخفض لكل من المن والذبابة البيضاء وتأثيراتها علي المفترسات ابو العيد واسد المن و ذلك بتقدير النسب المئويه للخفض بعد الرش فى الحقل بها على فترات مختلفه و مقارنة كفائتها فى المكافحه فى كل فترة من هذه الفترات وقد تمت التجربة فى حقول القطن بمحافظه بنى سويف بمعدلات الاستخدام الموصي بها من الاسيتامبريد و السياميثوكسام ومركب الكلوربيريفوس منفردة .وبالنسبة للمخاليط فتم خلط نصف المعدل الموصي بها من مبيدات نيونيكوتينويد مع نصف المعدل من مركب الكلوربيريفوس وتقدير نسب الخفض لكل من المن والذبابة البيضاء وكذلك حشرة ابو العيد واسد المن حيث تم فحص عينات عشوائية من نباتات القطن قبل الرش مباشرة وبعد 24 ساعة لتقدير الاثر الفورى و3ايام و 7 أيام و14يوم من الرش لتقدير الاثر الباقى . ودلت النتائج علي أن استخدام هذة المبيدات بالمعدلات الموصي به قد اثر على تعداد الاطوار غير الكامله للذبابه البيضاء وكذلك من القطن وقد أعطي نسب خفض مختلفه.أما عند خلط نصف معدلات الاستخدام لمبيدات نيونيكوتينويد مع الكلوربيريفوس فأعطت نتائج تفوق استخدام كل مركب بمفردة. وعلي هذا فإن إستخدام المخاليط المختبرة بنصف معدل الاستخدام زاد من فاعليتها علي من القطن والذبابة البيضاء . اما مبيدي الاسيتامبريد و السياميثوكسام فكان تاثيرها عاليا على المن والذبابة وأقل من الكلوربيروفوس على كل من حشرة ابو العيد واسد المن. ويمكن الإستفادة من نتائج هذة الدراسة في تقليل معدل استخدام هذة المبيدات وبالتالي تقليل التلوث البيئي وتقليل الضغط الإنتخابي لمقاومة الحشرات ضد فعل المبيدات.