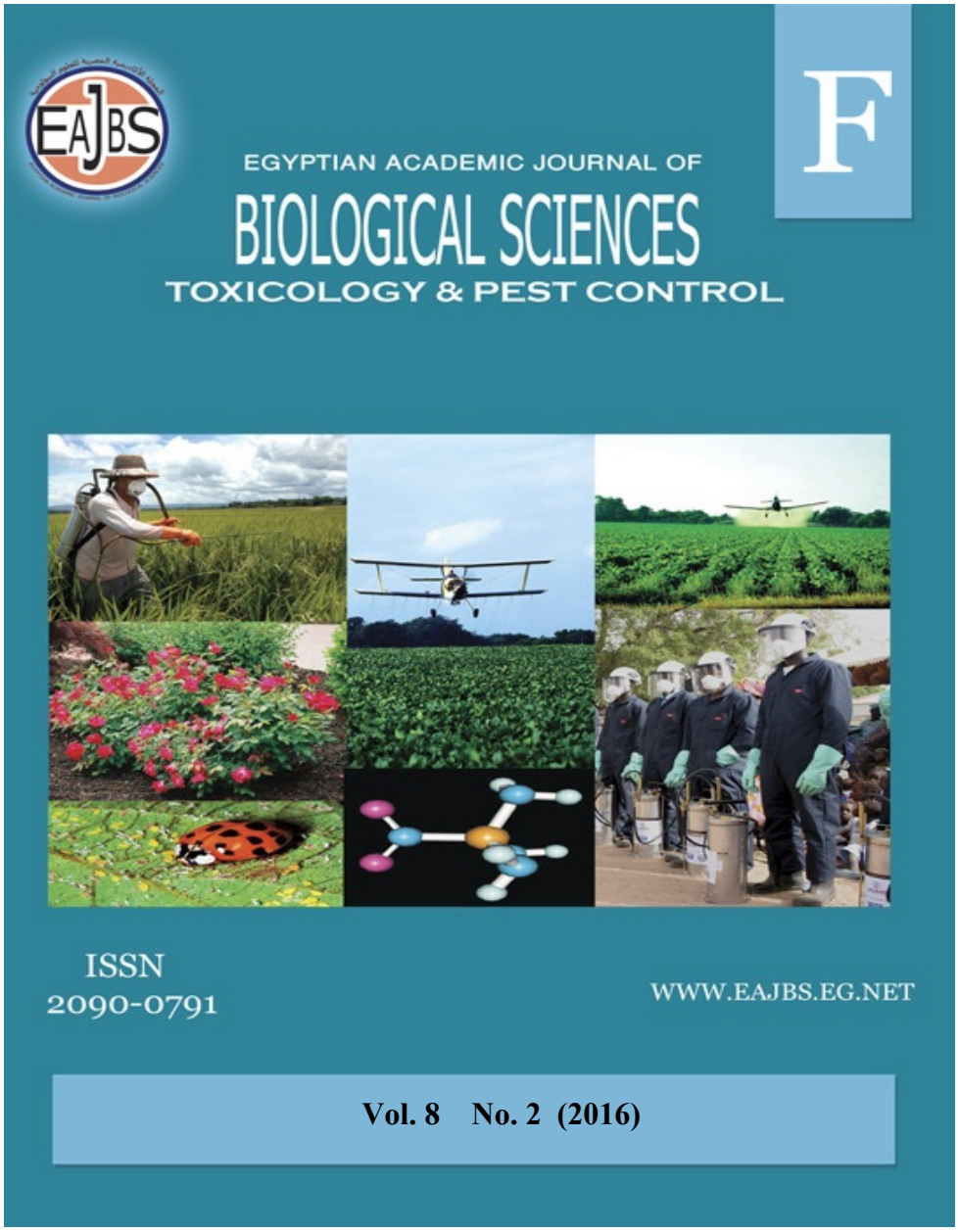

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Population Density and Effect of Some Toxic Compounds on *Aphis gosspyii* Glover and their Predators, Parasitoids and Major Elements in Okra Plants

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ABSTRACT

Field experiments were conducted during 2014 and 2015 seasons at El-Riad, Kafr El-Sheikh governorate, to study the population density of *Aphis gosspyii* Glover, predators and parasitoids on different okra varieties; white velvet, Sakha1 and balady. Also, efficiencies of certain compounds; Imidacloprid, Primicarb, Acetamipirid, Primiphos-methyl and Azadirachtin in reducing the population density of *A. gosspyii* and their side effects on predators and parasitoids were evaluated. In addition, chlorophyll content and major elements; potassium (K), nitrogen (N) and phosphorous (P) in okra leaves were assessed. The population densities of *A. gosspyii* and chlorophyll content were higher on balady cultivar than on other cultivars. Significant differences were found among three cultivars on population density of *A. gosspyii.* Population densities of predators were lower on Balady than on other cultivars in the two seasons, except syrphids in 2015 season. Syrphids induced high significant reduction in aphid population in 2014 and *Aphidoletes aphidimyza* (Rondami) in 2015. The population density of *A. gosspyii*, parasitism (mummification), parasitoid *Lysiphlebus fabarum* (Marshall) and hyperparasitoid, *Pachyneuron aphidis* (Bouché) were recorded in May, June and July on white velvet and Sakha 1, while no parasitism was detected on Balady cv. All the tested compounds showed a high effect, in reducing the population *A. gossypii*. Also, Pirimi adwia and Etox induced a high effect on predators followed by Volley and Egydoor that were of moderate effect, while the other compounds induced the lowest. In addition, Pirimi adwia and Cezar were the highest harmful compound in reducing the parasitoid, *L. fabarum* population followed by Etox and Egydoor, while Volley and Safe oil was the least effects. Chlorophyll content and elements (K, N and P %) significant differences were found with the treatments. Chlorophyll content increased significantly by Pirimi adwia, Cezar and Volley treatments, while it was the least with Confidate treatment on leaves okra. Also, K% had the highest with safe oil followed by Etox and Pirimi adwia treatments, while it was the least with Cezar and Volley. In addition, N% had the lowest with safe oil and Confidate treatment, while it was the highest with Pirimi adwia treatment. P% had the highest with safe oil.

INTRODUCTION

Okra, *Abelmoschus esculentus* L. (Moench), family Malvaceae is an economically important vegetable crop grown in tropical and sub-tropical parts of the world (Nwangburuka *et al.,* 2011).

This crop is suitable for cultivation as a garden crop as well as on large commercial farms. Among insect pests, aphids especially *Aphis gossypii* (Glov.) is considered one of the most important pests of okra (Dhaliwal, 2004).

Predators; coccinellids, chrysopids, syrphids and spiders were detected at variable levels, attacking mainly *A. gossypii* on okra (Abdalla *et al.*, 2012 and Saljoqi *et al.*, 2013). Several aphid parasitoid species (Hymenoptera: Brachonidae: Aphidiinae) have been tested for their usefulness as biological control agent based on population growth rates, searching capacity and host preferences (Barahoei *et al.*, 2011 and Prado *et al.*, 2015). The genus *Lysiphlebus* is a moderately diverse group of aphidiines with about 20 described species (excluding Adialytus) attacking different host aphids in various habitats (Starý *et al.,* 2010). *Lysiphlebus fabarum* associated with many host aphid species, such as *A. gossypii* (Barahoei *et al.*, 2011).

Relying upon predators and parasitoids (Prado *et al.*, 2015) and certain compounds; Azadirachtin, blue gum, orange oil, imidacloprid, malathion and emamectin benzoate were used to control aphids (El-Fakharany, 2005, Thulasiram *et al.,* 2014 and *et al.,* 2015). Nitrogen (N) or deficiency of potassium (K) can lead to higher accumulation of amino acids in plants and a higher degree of attack by aphids, such as *A. gossypii* (Chau *et al.*, 2005). The effects of leaf N and K levels in okra on aphid population were not detected due to the small variation of these nutrients in okra leaves (Leite *et al.,* 2007). Essential mineral elements are required in optimum amounts; nitrogen (N), phosphorus (P), and potassium (K) and they have great effects in plant growth and chlorophyll content (Sanchita *et al.,* 2014).

The objective of this study was to investigate population density of *Aphis gosspyii* as affected by predators and parasitoids on different okra varieties white velvet, Sakha1 and balady. Also, efficiencies of certain compounds; Imidacloprid, Primicarb, Acetamipirid, Primiphos-methyl and Azadirachtin in reducing the population density of *A. gosspyii*, and their side effects on predators and parasitoids were evaluated. In addition, chlorophyll content and elements potassium (K), nitrogen (N) and phosphorus (P) in okra leaves.

MATERIALS AND METHODS

The present study was undertaken during 2014 and 2015 seasons at El-Riad District, Kafr El-Sheikh governorate, and laboratory experiments were conducted at Vegetable Pest Research Department, Sakha Agricultural Research Station.

Population density of aphid and its predators in okra plantations:

Population density of aphids and predators were investigated. Okra seeds were sown on April 2nd in both seasons. An area of about one quarter feddan was divided into four equal plots (considered as four replicates). Inspection started 30 days after sowing, and continued weekly till the end of the crop season. Numbers of aphids (nymphs and adults) were counted on 30 leaves taken from ten plants/replicate (leaves picked up from lower, middle and upper levels). Also, predators were counted on ten plants/replicate in the field.

Population density of aphid parasitoid and hyperparasitoid:

The collected aphids from aphid-infested okra plants were kept in petri–dishes under laboratory conditions of 25±2°c and 65±5% R.H. The dishes were continually monitored till aphid

mummifications and/or emergence of the parasitoid and/or hyperparasitoid. Depending on number of mummies and emerging parasitoids, the parasitism percentage was calculated, according to the technique described by Rakhshani *et al.* (2013).

Toxicity of the tested compounds against aphids, predators and parasitoids:

The efficiency of seven compounds and control against *A. gosspyii* was evaluated in an experimental area divided into 32 plots, 50 m^2 each. The treatments were arranged in a randomized complete block design with four replicates. The tested compounds were applied at recommended rates using a knapsack motor sprayer. These compounds were sprayed on June 4th and 7th in 2014 and 2015 seasons, respectively at El-Riad District, Kafr El-Sheikh governorate. The tested compounds (treatments) and rate application were:

A. Insecticides:

1- Imidacloprid

- (Confidate 35% SC) at 75 ml/100 l water.
- (Egydoor 70 % WS) at 40g/100 l water.

2- Primicarb

- (Etox 50 % WP) at 200g/ feddan

3- Acetamipirid

- (Volley 20 % SP) at 25g/100 l water.
- (Cezar 20% SP) at 25g/100 l water.

4- Primiphos-methyl

- (Pirimi adwia 50% EC) at 375 ml/100 l water.

A- Plant oil: -Azadirachtin (Safe-oil 0.03% EC) at 500 ml/100 l water.

Counts of *A. gosspyii* (nymphs and adults) were recorded just before spraying on 120 okra leaves and predators were also counted on 40 okra plants. Counts were also recorded 2,5,7, 10 and 14 days after applications. Percentage of population reductions were calculated according to Henderson and Telton (1955) equation.

Pieces of okra leaves infested with aphids were cut and introduced into petri dishes (9 cm diam). The pieces were daily monitored, and the emerging parasitoids were calculated. The parasitism as affected by compound applications was recorded throughout the experimental period, according to the technique described by Omar *et al.* (1996).

Chlorophyll content of okra leaves:

After 60, 90, and 135 days from sowing, chlorophyll content of okra leaves was measured in SPAD with a portable leaf chlorophyll meter (Minolta) (Marquard and Timpton, 1987) on the recently fully expanded leaf.

Also, clorophyll content of okra leaves was measured in SPAD, 2, 5, 7, 10 and 14 days after application (tested compounds).

Effect of tested compounds on N, P and K% in okra leaves:

Leaf samples were oven dried, crushed and digested using sulphoric+ perchloric acid method according to Cottenie *et al.* (1982). Nitrogen in the digested leaves was determined by micro-kjeldahl method according to Jackson (1958), while phosphorous (P) as described by Peterburgski (1968). The available potassium (K) was determined from NH4OAc. (PH, 7.0) extract as described by Jackson (1967).

RESULTS AND DISCUSSION

Population density of *Aphis gosspyii* and its predators on okra plants and relationship between predators and pest:

Data presented in Table (1) show that population densities of *Aphis gosspyii* were higher on balady cultivar than on white velvet 746.86 & 863.82 and Sakha1 691.36 & 749.64 in 2014 and 2015, respectively at El-Riad district. Significant differences among three cultivars on population density of *Aphis gosspyii* were recorded.

Also, population densities of predators were lower on balady than on white velvet and Sakha1cv. in the two seasons, except syrphids in 2015

(Table,1). Significant differences were found among cultivars on population density of *Chrysoperla carnea,* syrphids in 2015 and *Scymnus* sp. in the two seasons.

Also, data in Table (1) showed that syrphids induced high significant positive effect in the three cultivars and *Scymnus* sp. was significant negative effect on white velvet and Sakha1, while it was high significant negative effect on balady on *A. gosspyii* in 2014 at El-Riad. *Aphidoletes aphidimyza* had high significant positive in the three cultivars and *C. carnea* high significant on white velvet and Sakha1 on *A. gosspyii* while, syrphids had significant positive on white velvet in 2015 season.

In general, combined effect (percentage of explained variance, Table 1) of the six predators on *A. gosspyii* was relatively higher in 2014 than 2015. These interactions induced high effects against *A. gosspyii*; 75, 75.30 and 73.80 % in 2014 and 70.60, 72.5 and 63.70 % in 2015 on white velvet, Sakha1and balady, respectively.

A. gossypii was observed attacking mainly the leaves of okra (Obeng-Ofori and Sackey, 2003). Ladybird beetle as a natural enemy of aphids is one of the most important factors contributing to the aphid population reduction (Leite *et al.*, 2007). Abdalla *et al.* (2012) detected coccinellids, chrysopids, syrphids, and spiders at variable levels, attacking mainly *A. gossypii* on okra in northern Sudan, and *C. carnea* was the most prevalent species in okra fields. BenchaSri (2013) found that *A. gossypii* was more abundant from June to October. Saljoqi *et al.* (2013) found that the lowest mean infestation was recorded on Hybrid Nirali, while Sarhad Green which were mainly attacked by *A. gossypii*. Also, the population of ladybird beetle and syrphid fly were lowest in Hybrid Nirali, while Sarhad Green afforded the highest numbers. Khan and Akbar (2015) revealed that overall mean density of *C. septumpunctata* was significantly higher on Malay and lower on Local Peshawri. Khan *et al.* (2015) found that mean density of Ladybird beetles and syrphid flies were non-significantly different among the cultivars.

Table 1: Population density of *Aphis gosspyii* and its predators on okra plants at El-Riad district, Kafr El-Sheikh Governorate

Arthropod	Seasonal mean and partial correlation (r)					
	White velvet	r	Sakha1	r	Balady	r
2014						
Aphis gosspyii	746.86^{b}	-	691.36^{c}	-	945.41^{a}	-
Aphidoletes aphidimyza	18.14^{a}	-0.025	17.27^{a}	-0.033	13.95^{a}	0.398
Chrysoperla carnea	26.32^{a}	0.234	25.27^{a}	0.146	26.73^{a}	0.797
Coccinella undecimpunctata	49.82^{a}	0.390	45.77^{a}	0.199	34.73^{a}	-0.246
Syrphids	19.09^{a}	0.602**	17.55^{a}	0.644**	18.82^{a}	0.719**
Scymnus sp.	47.18^{a}	-0.505*	41.82^{b}	-0.496*	40.23^{c}	-0.413
Spiders	46.00^{a}	-0.130	48.05^{a}	-0.088	40.14^{a}	-0.224
E.V$^{\square}$%	-	75.00	-	75.30	-	73.80
2015						
Aphis gosspyii	863.82^{b}	-	749.64^{c}	-	895.59^{a}	-
Aphidoletes aphidimyza	17.50^{a}	0.627**	16.73^{a}	0.682**	17.68^{a}	0.669**
Chrysoperla carnea	15.18^{b}	0.691**	15.32^{a}	0.742**	15.14^{c}	0.385
Coccinella undecimpunctata	43.91^{a}	0.189	39.73^{a}	0.173	37.50^{a}	0.106
Syrphids	24.59^{b}	0.476*	22.59^{c}	0.413	25.86^{a}	0.304
Scymnus sp.	35.77^{a}	-0.307	34.05^{b}	-0.358	33.23^{c}	0.027
Spiders	57.05^{a}	0.121	52.27^{a}	0.085	50.77^{a}	0.349
E.V$^{\square}$%	-	70.60	-	72.5	-	63.70

Mean followed by a row letter are not significantly different at the 5% level by DMRT (1955)

$^{\square}$ Explained variance.

Population density of parasitoid and hyperparasitoid:

The data pertaining to aphid parasitisation are presented in Tables (2&3). The population density of *A. gosspyii*, parasitism (mummification) and *Lysiphlebus fabarum* (Marshall) and hyperparasitoid**,** *Pachyneuron aphidis* were recorded in May, June and July. The population on density of *L. fabarum* parasitism (mummification) and *L. fabarum* was recorded in May as 52.43 &46.51% on white velvet and 56.48 & 47.06% on Sakha1 in 2014 and 53.91&40 % on white velvet and 55.70&41.82% on Sakha1 in 2015 at El-Riad, respectively. The seasonal parasitism efficiency % of *L. fabarum* was 31.60 & 27.69 % on white velvet and 36.63& 32.66% on Sakha1 in 2014 and 2015, respectively (Table 2&3).

Table 2: Parasitism status of *Lysiphlebus fabarum* and *Pachyneuron aphidis* on *Aphis gossypii* infesting okra white velvet cv. plants at El-Riad Kafr El-Sheikh Governorate

Month/year	Aphid (No.)	Mummy (No.)	Parasitism %	Parasitoids (No.) (Emerging)	Parasitism efficiency %	Hyper-parasitoid (No.)	Hyper-parasitism efficiency %
2014							
May 2014	410.0	215.0	52.43	100.0	46.51	21.0	9.77
Jun.	962.0	340.0	35.34	98.0	28.82	45.0	14.71
Jul.	1000.0	100.0	10.0	9.0	9.0	30.0	30.0
Aug.	400.0	0.0	0.0	0.0	0.0	0.0	0.0
Sept.	210.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	596.40	131.00	19.55	41.40	16.87	19.20	10.90
Seasonal parasitism %	-	-	21.97	-	31.60	-	14.66
2015							
May 2015	371.0	200.0	53.91	80.0	40.0	20.0	10.0
Jun.	1011.0	350.0	34.62	90.0	25.71	48.0	13.71
Jul.	1200.0	100.0	8.33	10.0	10.0	25.0	25.0
Aug.	360.0	0.0	0.0	0.0	0.0	0.0	0.0
Sept.	620.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	712.4	130.0	19.37	36.00	15.14	18.6	9.74
Seasonal parasitism %	-	-	18.25	-	27.69	-	14.31

Table 3: Parasitism status of *Lysiphlebus fabarum* and *Pachyneuron aphidis* on *Aphis gossypii* infesting okra Sakha1 cv. plants at El-Riad Kafr El-Sheikh Governorate

Month/year	Aphid (No.)	Mummy (No.)	Parasitism %	Parasitoids (No.) (Emerging)	Parasitism efficiency %	Hyper-parasitoid (No.)	Hyper-parasitism efficiency %
2014							
May 2014	602.0	340.0	56.48	160.0	47.06	35.0	10.29
Jun.	1200.0	550.0	45.83	200.0	36.36	83.0	15.09
Jul.	1400.0	120.0	8.57	10.0	8.33	38.0	31.67
Aug.	750.0	0.0	0.0	0.0	0.0	0.0	0.0
Sept.	205.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	831.40	202.00	22.18	74.40	18.35	31.2	11.41
Seasonal parasitism %	-	-	24.30	-	36.63	-	15.45
2015							
May 2015	395.0	220.0	55.70	92.0	41.82	17.0	7.73
Jun.	890.0	370.0	41.57	125.0	33.78	50.0	13.51
Jul.	1000.0	99.0	9.9	8.0	8.08	28.0	28.28
Aug.	800.0	0.0	0.0	0.0	0.0	0.0	0.0
Sept.	400.0	0.0	0.0	0.0	0.0	0.0	0.0
Average	697.00	137.80	21.43	45.00	16.74	19.0	9.90
Seasonal parasitism %	-	-	19.77	-	32.66	-	13.87

The seasonal parasitism efficiency % of hyperparasitoid, *P. aphidis* were 14.66 & 14.31% on white velvet and 15.45 & 13.87% on Sakha1 for *L. fabarum* in 2014 and 2015, respectively.

Barahoei *et al.* (2011) found that *L. fabarum* associated with five host aphid species, such as, *A. gossypii*. Barahoei *et al.* (2011), Khan *et al.* (2015) and Rakhshani *et al.* (2015) also reported parasitisation of aphids by *Aphidius* spp. and *L. fabarum* under field conditions. Talebi *et al.* (2009) and Satar *et al.* (2014), also reported parasitisation of parasitoids aphids by the hyperparasitoid, *P. aphidis*.

Chlorophyll content in okra leaves:

Data presented in Table (4) show that balady cv. had the highest chlorophyll content than that of white velvet and Sakha1cv. in leaves okra. Also, chlorophyll content were higher in leaves after 90 day of the sowing than that after 60 and 135 days. Significant differences were found among three cultivars on grand average chlorophyll content. A positive significant correlation was evident between the population density of *A. gosspyii* and chlorophyll content.

Table 4: Mean of chlorophyll content in okra leaves at El-Riad, Kafr El-Sheikh Governorate

Cultivars	Chlorophyll content (SPAD) unit			
	After 60 day	After 90 day	After 135 day	Grand average
White velvet	38.33	44.80	40.70	41.28[b]
Sakha1	36.28	42.70	39.98	39.65[c]
Balady	44.77	50.63	42.53	45.98[a]
Aphis gossypii (r) value				0.99*

Efficiency of compounds on *Aphis gosspyii* :

The effect of the tested compounds on *A. gossypii* infesting okra plants, white velvet cv. at El-Riad District, Kafr El-Sheikh governorate in 2014 and 2015 is presented in Table (5). Data revealed that all tested compounds were effective, in reducing the population of *A. gossypii* in the two seasons.

Table 5: Potency of tested compounds in reducing *Aphis gosspyii* populations on okra plants, white velvet cv. at El-Riad, Kafr El-Sheikh Governorate

Compound	Rate/ 100 liter of water	Aver. No. pre- treat. /30 leaves	% Reduction						
			Initial effect %	Residual effect after indicated days				Residual effect average	Grand average
				5	7	10	14		
2014									
Confidate	75 ml	606.25	98.81	100.0	100.0	99.98	99.89	99.97	99.74
Egydoor	40 g	500.0	99.56	100.0	99.92	99.94	99.74	99.90	99.83
Etox	100g	687.5	99.36	100.0	99.94	99.98	99.94	99.97	99.84
Volley	25g	562.5	97.67	99.92	100.0	99.95	99.92	99.95	99.49
Cezar	25g	437.5	96.67	100.0	99.90	100.0	99.80	99.93	99.27
Pirimi adwia	375 ml	250.0	98.25	100.0	100.0	100.0	99.91	99.98	99.63
Safe oil	500 ml	350.0	75.42	92.71	97.94	97.86	93.75	95.57	91.54
Untreated (No.)	-	131.25	225.0	293.75	387.5	1162.5	750.0	-	-
2015									
Confidate	75 ml	750.0	98.89	100.0	100.0	99.90	99.80	99.93	99.72
Egydoor	40 g	601.5	99.31	100.0	99.86	99.99	99.79	99.88	99.77
Etox	100 g	800.0	98.96	100.0	99.69	99.87	99.69	99.81	99.64
Volley	25g	500.0	97.50	99.78	100.0	99.86	99.69	99.83	99.37
Cezar	25g	310.0	95.97	100.0	99.47	100.0	99.20	99.67	98.93
Pirimi adwia	375 ml	450.25	98.15	100.0	100.0	100.0	99.45	99.86	99.52
Safe oil	500 ml	375.0	75.56	91.11	96.70	96.86	89.44	93.53	89.93
Untreated (No.)	-	250.0	300.0	450.0	606.25	700.0	1010..5	-	-

Ahmed (2000) found that Azadirachtin succeeded in the significant reduction of *A. gossypii* population on okra. Omar *et al.* (2001) found that imidacloprid was most potent in reducing *A. gossypii* population followed by malathion. Obeng-Ofori and Sackey (2003) found that Actellic and neem seed extract significantly reduced the population and damage caused by *A. gossypii* of okra recorded at Legon, Ghana compared to the untreated. Actellic and aqueous neem seed extracts were equally effective against the aphids of okra and caused a significant reduction in insect damage. El-Fakharany (2005) found that fenitrothion was the most toxic compound followed by baladi mandarin oil extract on *A. gossypii*. Said *et al.* (2015) found that treatments, 2% oil of *Azadirachta indica* and 2.5% extract of *A. indica* seed exhibited better results in comparison with other botanicals and un-treated plot.

Side toxic effects of tested compounds on predators inhabiting okra plantations:

Data presented in Table (6) revealed that Pirimi adwia and Etox induced a high effect on predators [*A. aphidimyza*, syrphidae and spiders] with reduction of 66.82 & 63.93% and 59.95&55.63% in 2014 and 2015 at El-Riad, respectively. Volley and Egydoor were moderate effect on predators, while the others compounds induced the lowest (Table 6).

Table 6: Effect of tested compounds in reducing predator¤ populations on okra plants at El- Riad, Kafr El-Sheikh Governorate.

Compound	Rate/ 100 liter of water	Aver. No. pre-treat. /10 plants	% Reduction						
			Initial effect %	Residual effect after indicated days				Residual effect average	Grand average
				5	7	10	14		
2014									
Confidate	75 ml	15.75	22.22	67.74	47.62	0.0	0.0	28.84	27.52
Egydoor	40 g	20.25	39.51	69.89	48.15	9.94	0.0	32.0	33.50
Etox	100 g	24.75	64.65	89.74	69.70	43.06	32.62	58.78	59.95
Volley	25 g	24.75	1.01	79.47	54.55	33.00	17.65	46.17	37.14
Cezar	25g	11.25	22.22	81.94	40	4.21	0.0	31.54	29.67
Pirimi adwia	375 ml	29.25	88.03	82.63	71.79	51.82	39.82	61.52	66.82
Safe oil	500 ml	9.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Untreated (No.)	-	15.75	20.25	69.75	47.25	42.75	38.25	-	-
2015									
Confidate	75 ml	22.5	27.27	69.95	44.86	0.0	0.0	28.70	28.42
Egydoor	40 g	30.25	39.89	72.06	46.26	4.70	0.0	30.76	32.58
Etox	100 g	21.5	61.95	89.52	64.18	36.31	26.17	54.05	55.63
Volley	25 g	22.0	9.09	79.51	47.50	26.29	11.98	41.32	34.87
Cezar	25g	13.5	25.93	81.22	36.62	3.90	0.0	30.44	29.53
Pirimi adwia	375 ml	25.0	89.09	83.10	69.20	48.11	30.16	57.64	63.93
Safe oil	500 ml	14.75	0.0	0.0	1.39	0.0	0.0	0.35	0.28
Untreated (No.)	-	20.0	22.0	35.5	46.75	55.50	63.0	-	-

¤ where predators : Syrphids, *Aphidoletes aphidmyza* and spiders.

Omar *et al.* (2001) found that malathion was harmful to *C. undecimpunctata* and *C. carnea* which significantly reduced the numbers of predators especially in plots treated three times. El-Fakharany (2005) found that fenitrothion was the most harmful on *Syrphus corollae* and spiders, while sour orange and acidless orange oil extracts were the least toxic. Thulasiram *et al.* (2014) found that the populations of spiders were higher in the untreated

check (4.62/plant) while a low population was recorded in the treatment with bifenthrin,160 g a.i./ha (0.31/plant). It was also found that, the population was higher in the treatment with cypermethrin, 70 g a.i./ha (1.02 and 0.92/plant in kharif and rabi respectively) compared to the other treatments.

Side toxic effects of tested compounds on the emergence of parasitoid, *Lysiphlebus fabarum* from aphids on okra plantations:

The data in Table (7) show the parasitism status of *L. fabarum* on *A. gossypii*, white velvet cv. in plants treated with the considered compounds. Pirimi adwia and Cezar were the highest harmful compounds on the parasitoid populations reducing its numbers by 84.28 & 85.62 % and 68.70 & 71.74 % in 2014 and 2015 seasons, at El-Riad, respectively followed by Etox and Egydoor. Also, Confidate was of a moderate effect, while, Volley and Safe oil was the least toxic compounds on *L. fabarum* population in the two seasons (Table 7).

Leena and Hazem (2011) reported that cypermethrin showed a high survival percentage for *Aphidius colemani* on *A. gossypii* when introduced 72 hr after spraying; while chlorpyrifos was severely harmful to the parasitoid adults and parasitoid pupae in aphid mummies at all post-spraying introducing periods. Sabahi *et al.* (2011) found that abamectin, imidacloprid, and pymetrozine caused 44.8, 58.5, and 14.5% mortality of aphid mummies, respectively. Insecticides applied to broad bean foliage resulted in 52.5, 90.0 and 57.0% mortality to abamectin, imidacloprid, and pymetrozine one day after treatment and 28.1, 77.0 and 18.6% mortality five days after treatment. Also, Sixteen day-old residues produced 8.8, 22.4 and 13.6% mortality and 0.0, 3.2 and 1.1% mortality 30 days after treatment.

Table 7: Effect of tested compounds in reducing emergence of the parasitoid, *Lysiphlebus fabarum* from *Aphis gossypii* on okra plants at El-Riad, Kafr El-Sheikh Governorate

Compound	Rate/ 100 liter of water	% Emergence pre- treat.	% Reduction emergence					
			Initial effect %	Residual effect after indicated days			Residual effect average	Grand average
				5	7	10		
2014								
Confidate	75 ml	50.00	61.24	62.53	40.23	45.73	49.50	52.43
Egydoor	40 g	40.00	63.66	79.92	45.67	49.12	58.24	59.59
Etox	100 g	41.38	100.0	54.72	56.67	57.84	56.41	67.31
Volley	25 g	42.50	21.83	11.82	53.12	36.15	33.70	30.73
Cezar	25 g	38.16	79.58	77.52	68.92	47.08	64.51	68.70
Pirimi adwia	375 ml	54.55	68.66	100.0	100.0	70.15	90.05	84.28
Safe oil	500 ml	54.00	28.22	30.60	26.20	24.62	27.14	27.41
Untreated*	-	47.22	81.82	84.0	79.0	58.0	-	-
2015								
Confidate	75 ml	55.00	62.60	63.40	38.37	42.15	47.97	51.63
Egydoor	40 g	44.50	63.34	78.11	43.63	46.88	56.21	57.99
Etox	100 g	37.00	96.17	56.12	52.36	55.77	54.75	65.11
Volley	25g	60.00	20.80	12.34	51.41	34.85	32.87	29.85
Cezar	25g	47.50	76.11	76.76	64.32	44.50	70.29	71.74
Pirimi adwia	375 ml	57.16	72.70	100.0	100.0	69.78	89.93	85.62
Safe oil	500 ml	49.50	26.93	29.16	24.67	22.87	25.57	25.91
Untreated*	-	50.00	70.50	77.0	73.75	55.0	-	-

* % emergence

Effect of tested compounds on chlorophyll content in okra leaves:

Results in Table (8) showed that chlorophyll content were found significant differences due to compound applications. The chlorophyll content grand average increased significantly by Pirimi adwia, Cezar and Volley treatments, while it was the least with Confidate treatment on leaves okra. The other tested compounds had moderate effects.

Table 8: Effect of tested compounds on chlorophyll content in okra leaves at El-Riad, Kafr El-Sheikh Governorate

Compound	Rate/100 liter of water	Chlorophyll content (SPAD) unit effect after indicated days					
		2	5	7	10	14	Grand average
Confidate	75 ml	42.57^{a}	40.80^{de}	44.6^{bc}	45.97^{d}	38.2^{f}	42.43^{e}
Egydoor	40 g	44.87^{a}	40.33^{ef}	42.57^{de}	46.o7^{d}	42.47^{e}	43.26^{d}
Etox	100 g	44.7^{a}	39.20^{f}	42.5^{de}	46.53^{cd}	44.47^{d}	43.48^{d}
Volley	25 g	45.33^{a}	39.73^{ef}	44.93^{b}	47.73^{ab}	47.53^{ab}	45.05^{b}
Cezar	25 g	44.4^{a}	41.57^{cd}	46.53^{a}	48.43^{a}	48.5^{a}	45.89^{a}
Pirimi adwia	375 ml	45.0^{a}	42.77^{ab}	46.37^{a}	48.5^{a}	48.77^{a}	46.28^{a}
Safe oil	500 ml	42.73^{a}	43.47^{a}	43.37^{cd}	47.47^{abc}	45.6^{cd}	44.53^{be}
Untreated	-	42.13^{a}	41.97^{bc}	41.73^{e}	46.9^{bcd}	46.9^{bc}	43.93^{cd}
LSD_{05}	-	2.885	1.099	1.286	0.980	1.415	10.817

Mean followed by a common letter are not significantly different at the 5% level by DMRT (1955)

Reduction of the chlorophyll content in the current investigation which may be due to the inhibition of their biosynthesis or breakdown of pigments or their precursors as suggested for cowpea seedling under stress by insecticide dimethoate (Mishra *et al.*, 2008). Seth *et al.* (2014) found that the increase in total chlorophyll content due to Neem oil treatment was significantly the same as synthetic pesticide (dimethoate) treated plant.

Effect of tested compounds on elements % in okra leaves:

Results in Table (9) showed that elements % (K, N and P) significant differences due to compound applications. K% average had the highest with safe oil followed by Etox and Pirimi adwia treatments, while it was the least with Cezar and Volley treatment on leaves okra. The other tested compounds had moderate effects on K%. Also, N% average had the lowest with safe oil and Confidate treatment, while it was the highest with Pirimi adwia treatment followed by the other tested compounds. In addition, P% average had the highest with safe oil whereas the other tested compounds had moderate effects (Table 9).

Table 9: Effect of tested compounds on elements% in okra leaves at El-Riad, Kafr El-Sheikh governorate.

Compound	Rate/100 l of water	K%			N%			P%		
		10-day	14-day	Aver.	10-day	14-day	Aver.	10-day	14-day	Aver.
Confidate	75 ml	3.09^{c}	2.52^{e}	2.81^{c}	3.22^{d}	3.64^{c}	3.43^{d}	0.35^{b}	0.025^{d}	0.19^{c}
Egydoor	40 g	3.09^{c}	2.72^{d}	2.91^{bc}	4.62^{a}	3.22^{d}	3.92^{b}	0.35^{b}	0.0125^{e}	0.18^{c}
Etox	100 g	3.09^{c}	3.26^{a}	3.18^{b}	4.62^{a}	3.08^{e}	3.85^{b}	0.015^{f}	0.40^{a}	0.21^{bc}
Volley	25 g	2.35^{f}	2.35^{f}	2.35^{d}	3.22^{d}	4.06^{b}	3.64^{c}	0.225^{e}	0.125^{c}	0.18^{c}
Cezar	25 g	2.52^{e}	2.52^{e}	2.52^{d}	3.5^{c}	3.64^{c}	3.57^{c}	0.275^{c}	0.125^{c}	0.20 ^{bc}
Pirimi adwia	375 ml	3.26^{b}	3.09^{b}	3.18^{b}	3.92^{b}	4.34^{a}	4.13^{a}	0.25^{d}	0.225^{b}	0.24^{b}
Safe oil	500 ml	4.38^{a}	2.91^{c}	3.65^{a}	3.92^{b}	2.8^{f}	3.36^{d}	0.775^{a}	0.015^{e}	0.40^{a}
Untreated	-	2.91^{d}	3.26^{a}	3.09^{b}	3.92^{b}	4.34^{a}	4.13^{a}	0.020^{f}	0.0225^{d}	0.02^{d}
LSD_{05}	-	0.033	0.013	0.216	0.366	0.109	0.088	0.014	0.006	0.044

Mean followed by a common letter are not significantly different at the 5% level by DMRT (1955).

Seth *et al.* (2014) observed there is significant increase in carbohydrate content of mung plant treated with Neem extract whereas decrease in dimethoate treated plant. The result also shows increase in amino acid content in Neem extract treatment was significantly the same as dimethoate treated plant.

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ARABIC SUMMERY

الكثافة العددية وتأثير بعض المركبات السامة على من القطن *Aphis gossypii* Glover ومفترساته وطفيلياته و محتوي الكلورفيل و بعض العناصر الكبرى فى أوراق نباتات الباميا

ثناء قطب مرسى الفخرانى

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تم إجراء هذا البحث بمركز الرياض بمحافظة كفر الشيخ موسمى ٢٠١٤ و ٢٠١٥ لدراسة الكثافة العددية لحشرة من القطن *Aphis gossypii* Glover و مفترساتها و طفيلياتها على أصناف الباميا (بلدى وهوايت فلفيت المعروف بصوابع الست وسخا ١). كما تمت دراسة فاعلية بعض المركبات على من القطن وكذلك دراسة الأثر الجانبى للمركبات المختبرة على مفترساتها و طفيلياتها و أيضا على محتوى الكلورفيل والعناصر الكبرى (البوتاسوم و نتروجين و فوسفور) فى أوراق صنف هوايت فلفيت.حيث سجلت الكثافة العددية لمن القطن و محتوى الكلورفيل فى صنف البلدى أعلى منها فى الصنفين الاخرين. و أيضا توجد فروق معنوية بين الأصناف فى الإصابة بالمن و محتوى الكلورفيل.كانت المفترسات أعلى تعداداً فى هوايت فلفيت و سخا١ عن الصنف البلدى فى الموسمين ما عدا ذبابة السيرفس فى موسم ٢٠١٥. دلت النتائج أن هناك تأثيراً للمفترسات على تعداد الأفة ،حيث كانت ذبابة السيرفس ذات معنوية عالية موجبة على المن فى كل الأصناف فى ٢٠١٤ ولكن *Aphidoletes aphidmyza* فى ٢٠١٥. تم تسجيل طفيل أولى *L. fabarum* على من القطن والاخر ثانوى على طفيل *L. fabarum* و سجلت الكثافة العددية للإثنين فى مايو و يونيو و يوليو فى صنفين هوايت فلفيت و سخا ١. لم يوجد أى تطفيل على من القطن على الباميا فى الصنف البلدي.

أيضا أظهرت النتائج تحت الظروف الحقلية أن كل المركبات المختبرة أدت إلى خفض عالى لتعداد حشرة من القطن على نباتات الباميا مع تفاوت نسب الخفض فى الإصابة . عند دراسة الأثر الجانبى للمركبات المختبرة على المفترسات المصاحبة للآفة ظهر أن بريمى ادويا واتيوكسى كانا أعلاها سمية و تلا ذلك فولى و ايجى دور متوسطة السمية. بينما المركبات الأخرى منخفضة التاثير. كانت مركبات بريمى ادويا و سيزار أكثر المركبات تأثيرا على طفيل *L. fabarum* و تلا ذلك اتيوكسى و ايجى دور.بنيما فولى و سيف أويل أقلها تأثيرا . أوضحت النتائج أيضا أن رش المركبات المختبرة صاحبه وجود اختلافات معنوية فى محتوى الكلورفيل والعناصر الكبرى (البوتاسوم و نتروجين و فوسفور) فى اوراق الباميا فى صنف هوايت فلفيت. ويزيد محتوى الكلورفيل زيادة معنوية مع معاملات بريمى ادويا و سيزار و فولى بينما هو أقل مع معاملة كونفيديت.كان تركيز البوتاسيوم و الفوسفور أعلى مع معاملة سيف أويل و العكس فى حالة النتروجين.