SOME COMPLEMENTARY APPROACHES TO CONTROL APHIDS AND WHITEFLY IN COTTON FIELDS WITH CONSERVATION OF THEIR ASSOCIATED PREDATORS

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Abstract

Laboratory, semi-field and field studies were carried out at Sakha Research station, Kafr El-Sheikh Governorate, Egypt during 2003 and 2004 cotton seasons to evaluate the potency of some control approaches to face the menace of aphids and whitefly to cotton plantations. Under laboratory conditions, by using residual film technique, KZ oil proved to be the most harmless against *Chrysoperla carnea* larvae. Also, Vertimec, Actara and Confidor were categorized harmless. Teliton and Icon were harmful. Under field-cages conditions, the economic decision levels were estimated. The economic threshold of aphids were determined to be 1.84 and 2.83 aphids / cotton leaf and 0.28 and 0.60 whitefly adults / cotton leaf in 2003 and 2004 seasons, respectively. While, the economic injury levels were 2.30 and 3.54 aphids / cotton leaf and were 0.36 and 0.75 whitefly adults / cotton leaf in 2003 and 2004, resp.The results of field studies revealed that Actara and Confidor gave effective control against cotton aphids, and preserve associated predators. Therefore, Actara and Confidor could be used in integrated management of aphids and whitefly on cotton plantations.

INTRODUCTION

Cotton aphids *Aphis gosypii* Glover infests cotton plants at different growth stages. But, late-season populations are the most dangerous because of the ability to contaminate open bolls with excessive honeydew causing problems in picking, ginning and spinning. Cotton is an excellent reproductive host with *Bemisia tabaci* Gennadius, which exhibiting exponential growth rates and doubling every six days in some instances (Buttler et al., 1985). The effective use of insecticides to control such pests and other requires that the compounds be applied only when economic loss could bee occur, so that costs to producer will be minimal and the impact on beneficial insects and the environment will be minimized (Hopkins et al., 1982). Selective pesticides that can be used to control pests, without adversely affecting natural enemies are needed

for modern pest management (Sabir et al., 2000). Estimation of economic decision levels is critical to show the adequate time to apply the chemical control methods. Therefore, the objective of the present work was to control cotton aphids and whitefly at the adequate time with conservation of their associated predators.

MATERIALS AND METODS

Tested pesticides and their application rates were listed in Table 1.
Table 1. Chemical used and their application rates:

Trade name	Common name	Rate of application (recommended rate)
Kz oil*	Mineral oil	1000 ml/100 L
Vertimec*	Abamectin	40 ml/100 L
Actara*	Thiamethoxan	20 gml/100 L
Confidor*	Imidacloprid	75 ml/100 L
Icon*	Lambda-cyhalothrin	80 ml/100 L
Polo*	Diafenthiuron	100 ml/100 L
Cascade*	Flufenoxuron	60 ml/100 L
Teliton**	Profenofos	250 ml/100 L
Tedifol**	(mixture of dicofol+tetradifon)	250 ml/100 L

*Compounds used in Lab. and field experiments.
** Compounds used in Lab. experiments only.

a. Laboratory experiment:

Nine pesticides presented in Table (1) were chosen to test their side effects on *Chrysoperla carnea* (Stephens) larvae. The field recommended rate of each pesticide was used and prepared, using tap water, in 100 ml solution and uniformly distributed on glass plate 25 x 25 cm on one side. After drying of the pesticide residual film, plastic rings cups (6.5 cm of upper diameter, by 5.0 cm of down diameter by 10.5 cm of high) with the bottom cut off were put on glass plates. The inner surfaces of these cups were coated with talcum to prevent *C. carnea* larvae escape. Ten plastic cups were made for each glass plate (i. e. for each pesticide) Two glass plates were treated with tap-water as control. The tests were conducted at 21 _ 1 C and 65 _ 5 relative humidity (Suter and Bigler, 1981) . One second-instars larvae (48-65 hrs old) of *C. carnea* was confined under each cup and left to dose itself by moving on the deposited film. The confined *C. carnea* larvae were fed on eggs of *Corcyra cephalonica* (Stainton) till pupation.

Larval mortality was recorded daily. Percentage of mortality and population were calculated . Standard evaluation categories of International Organization for Biological control (IOBC) were used in classification of tested pesticides.

b. Determining the economic decision levels for *A. gosypii* and *B. tabaci* on cotton under semi-field conditions.

The investigation was conducted at the Experimental farm of Sakha Research Station. One feddan was selected to be sown with cotton var. Giza 86 in March 30, 2003 and March 25, 2004 . Normal cultural practices were followed.

b.1. for *A. gossypii* :

At the beginning of flower structure stage of cotton (formation of first pinhead square), the chosen plants were placed under field-cages measuring 0.50 m long by 0.60 m wide by 1.60 m high covered with mosquito netting. Each cage covered one plant representing one replicate.

The plants were artificially infested with *A. gossypii* adults in five population levels consisting of 5, 10, 20, 40 and 80 aphids / cotton leaf.

Each population level was repeated in four cages at the same time representing four replicate . Four plants under four cages were free from only insect infestation and considered as control.

b.2. for *B. tabaci*

Cotton plants were placed under the cages (had the same measures of those in case of aphids) at the first week of July. The plants under cages were artificially infested with whitefly adults in five population density levels consisted of 1, 2, 5, 10 and 15 insects / leaf. Four replicates were made from each level of infestation, and four without only insect infestation were considered as control . The plants left under cages till picking and the seed-cotton yield in grams / plant was weighted .

b.3. Estimation of the economic decision levels :

The economic damage resulting from an insect infestation is equal to a-y (BA-Angood and Stewart, 1980) which are component of the regression

Equation $Y = a + b x$, where

Y = The estimated yield/area

a = The expected yield without insect infestation

b = yield loss/insect

X = Number of insects/leaf

$$\text{Gain threshold (GT)} = \frac{\text{management costs / hectar}}{\text{market value / kentar}}$$

$$\text{Economic injury level (EIL)} = \frac{\text{Gain threshold}}{\text{Yield loss / insect}}$$

Economic threshold (ET) = 4/5 x EIL (pedgo, 1989)

C. Field experiments:

Six compounds (presented in Table 1) were tested for their effect on *A. gossypii* , *B. tabaci* and some associated predators in cotton fields. The experiments were conducted at the farm of Sakha Agricultural Research Station during 2003 and 2004 seasons.

Four plots (replicates) 87.5 m^2 each were made for every treatment . The recommended rates of the tested compounds were diluted with irrigation water to 300 liters / feddan. A Knapsack sprayer (CP_3) equipped with one nozzle was used. Unplanted corridors (2 m width) were left as barriers between treatments . The complete randomized blocks design was adopted .

Samples of 25 cotton leaves were taken at random from the inner rows of each plot to count the individuals of aphids using lens (5 x) in the field, before spray and at 2, 5, 8, 11 and 14 days after spray . To count nymphal and pupal stages of whitefly, the chosen 25 leaves were taken before spray and at 2, 5, 10 and 15 days after spray, arranged back to back in paper bags then transmitted to the Lab. Where binocular microscope was used in count. The chosen leaves were 2, 1 and 2 from the upper, middle and lower levels of the plant, resp.

Direct count, using lens (5 x), of the associated predators (*C. carnea, Coccinella spp.* and *scymnus spp.*) was carried out on randomly chosen 10 plants / plot before spray and at 2, 5, 8, 11 and 14 days after spray.

The equation of Henderson and Tilton (1955) was used in estimation of reduction percentages in the populations of studied insects and Duncan (1955) was used statistical analysis of reduction percentages .

RESULTS AND DISCUSSION

a. side effects of nine pesticides on *C. carnea* larvae under Lab. Conditions using residual film technique:

The results in Table (2) showed that according to the evaluation categories of IOBC, the mineral oil Kz proved to be the safest one among the tested compounds recording 10% mortality in the predator larvae after 8 days from treatment and 90% pupation, hence it was categorized harmless to *C. carnea.* Vertimec (abamectin), Actara (thiamethoxam) and confidor (imidacloprid) were also harmless resulting in 20, 40 and 40% larval mortality, resp. The chitin synthesis inhibitor, cascade (flufenoxuron), was slightly harmful where gave 70% larva; mortality. While, the other chitin synthesis inhibitor, polo (diafenthiuron), was moderately harmful providing 80% larval mortality. The rest of the tested compounds, i.e., Icon (lambda-cyhalothrin), Tedifol (dicofol+tetradifon) and Teliton (profenofos) were harmful where each of them caused 100% larval mortality.

It is obvious that organophosphorus and pyrethroid insecticides were more toxic to *C. carnea* larvae than all other tested pesticides from different chemical groups, where they killed 100% of predator larvae. On the contrary, mineral oil Kz and biocide (Vertimec) were the less toxic ones, where they killed only 10 and 20% of predator larvae 8 days after treatment. Badawy and Arnaouty (1999) satded that organophosphorus compounds were more toxic to *C. carnea* than carbamates and biocides, while biocides were the less toxic ones under Lab. conditions. Mathirajan and Regupathy (2002) mentioned that Actara (thiamethoxam) at 0.8 gm / L recorded 7.5% eggs mortality, from 10 to 48% larval mortality and from 51.2 to 73.7% pupation in *C. carnea* under Lab. conditions. Guven et al. (2003) found from Lab. tests that Cascade (flufenoxuron) caused 93% mortality in *C. carnea* larvae . While, organophosphorus insecticides caused100% mortality .

b. Estimation of the economic decision levels for *A. gossypii* and *B. tabaci* on cotton plants var. Giza 86.

The relationships between infestation levels with *A. gossypii* or *B. tabaci* and the resulting seed-cotton yield in grams / plant were illustrated in Figures 1, 2, 3 and 4. Also, the economic decision levels for *A.gossypii* and *B. tabaci* were presented in Tables 3 and 4 rasbectively.

b.1. Economic decision levels for *A.gossypii*:

Figures 1 and 2 showed that the relationship between aphids infestation levels and the combined seed-cotton yield was negative and highly significant ($p<0.01$) and very close in 2003 and 2004 season (according to regression analysis of these relations) . The regression equations were $Y= 74.505 - 0.517 x$ and $Y = 79.353 - 0.559 x$, with r^2 values of 0.856 and 0.790 in 2003 and 2004, resp.

Data presented in Table (3) indicated that gain thresholds for *A. gossypii* were 0.50 and 0.83 Kentar / feddan in 2003 and 2004, resp.

Table 2. Side-effect of the tested pesticides on the larval stages of *Chrysoperla carnea* under laboratory conditions .

Pesticides	Conc. Tested (%)	% Larval mortality after exposure to residual film at days			% Pupation	Evaluation category
		2	5	8		
Kz oil	1.00	0	10	10	90	1
Vertimec	0.04	10	20	20	80	1
Actara	0.02	20	30	40	55	1
Confidor	0.075	30	40	40	60	1
Icon	0.08	0	60	100	0	4
Polo	0.10	0	30	80	15	3
Control	--	0	0	0	95	--
Tedifol	0.25	40	100	100	0	4
Teliton	0.25	80	100	100	0	4
Cascade	0.06	10	40	70	30	2
Control	--	0	0	0	100	--

Evaluation categories : 1= harmless (< 50%) , 2 = slightly harmful (50-79%), 3 = moderately harmful (80-99), 4 = harmful (> 99%), mortality according to IOBC (International Organization for Biological Control) Standard.

Table 3. Gain threshold, economic threshold, economic injury level and economic damage of *Aphis gossypii* on cotton plants var. Giza 86 in 2003 and 2004 seasons.

Cotton growing season	Gain threshold in Kentars / feddan	Economic threshold (insect/leaf)	Economic injury level (insect/leaf)	Economic damage (gram/plant)
2003	0.50	1.84	2.30	1.19
2004	0.83	2.83	3.54	1.98

Table 4. Gain threshold , economic threshold , economic injury level and economic damage of *Bemisia tabaci* on cotton plants var. Giza 86 in 2003 and 2004 seasons .

Cotton growing season	Gain threshold in Kentars/feddan	Economic threshold (insect/leaf)	Economic injury level (insect/leaf)	Economic damage (gram/plant)
2003	0.60	0.28	0.36	1.43
2004	1.00	0.60	0.75	2.38

This means that at least 0.50 and 0.83 Kentar of seed-cotton / feddan must be saved with insecticides treatment to achieve the yield that covered the costs management and increases the net return to the farmers to fulfil the economic balance in the agricultural policy . The economic threshold (ET) were 1.84 and 2.83 aphids / leaf in 2003 and 2004 , resp. Stern (1973) informed that the economic threshold is the pest density at which control should be initiated to prevent populations from exceeding the economic injury level. Hence, the application of insecticides should not be lated after the population densities of 1.84 and 2.83 aphids / leaf in 2003 and 2004, resp.

The economic injury for aphids on cotton were 2.30 and 3.54 insects / leaf in 2003 and 2004, resp.. The economic injury level (EIL) is defined as the lowest number of insects that will cause economic damage, or the minimum number of insects that could reduce yield equal to the gain threshold . Also, data in Table (3) showed that the economic damages (ED) were 1.19 and 1.98 grams of seed. cotton yield / plant in 2003 and 2004 , resp. Pediago (1989) defined the economic damage (ED) as the amount of injury that will justify the cost of chemical control measures, and also reported that (ED) occurs when money required for suppressing insect injury is equal to the potential monetary loss from a pest population. The term gain threshold is used to express the beginning point of the (ED).

b.2. Economic decision levels for *B. tabaci.* :

The relationship between infestation levels with cotton whitefly *B. tabaci* and the combined seed-cotton yield in 2003 and 2004 seasons were illustrated in Figures. 3 and 4.The regression analysis indicated that this relationship was negative, and highly significant ($p<0.01$). The regression equations of these relations were $Y = 80.617 - 4.019\ x$ and $Y = 72.590 - 3.160\ x$, with r^2 values of 0.905 and 0.879 in 2003 and 2004 , resp.

It is obvious from data in Table (4) that , the gain thresholds (GT) for *B. tabaci* were 0.60 and 1.00 Kentar of seed-cotton yield / feddan. The economic thresholds (ET) were 0.28 and 0.60 adult whitefly/leaf and the economic injury levels (EIL) were 0.36 and 0.75 adult whitefly / leaf in 2003 and 2004 , resp. The economic damages (ED) , which occurs when the population density of the pest reaches the economic injury level

Considering the yield loss / one pest, were 1.43 and 2.38 grams of seed-cotton / plant.

The economic decision levels of *A.gossypii* and *B. tabaci* were calculated considering the costs of chemical control / feddan (with three sprays during the season to control each of them) were 500 and 600 L.E. for *A. gossypii* and *B.tabaci*, resp. and these costs of control were unchangeable during the two seasons of investigation. While the market price of one kentar of seed –cotton giza 86 changed from 1000 L.E. in 2003 to be 600 L.E. in 2004, this means that more aphids or whitefly. Individuals were to lerable on cotton plants in 2004 than that in 2003 season without causing economic damage .In this respect, Naranjo et al. , (1996) reported that economic injury level declined with increasing cotton pricing and increased as the cost of control increased, in contrast lower effectiveness of insecticides applications being associated with higher injury levels .

Generally, because the economic decision levels, in their values, depend upon many factors, which are very changeable from one part of the world to the other , the EIL and ET values , depend upon many factors , which are very changeable from one part of the world to the other , the EIL and ET values would be highly differentiated around the world . Sukhija et al. (1986) , in India , mentioned that chemical control of *B. tabaci* should be initiated when the pest population reached 6.8 adults / cotton leaf (ET) from mid-July onwards . Dai et al. (1990) , in China , estimated the ET to be 66 aphids / leaves from one cotton plant . Selim and Emam (1993) , in Egypt , revealed that 19.96 in individuals of *A. gossypii* / cotton seedling was less than the economic or damage threshold . Stam et al. (1994) , in Sudan , found that during the period 1987 – 1990 , the control action threshold for *B. tabaci* increased from 200 to 600 adults / 100 cotton leaves . Abdel-Baky et al. (1997) , in Egypt , determined the cotton aphids densities at which control measures should be initiated to be 4.40 and 3.81 insects / cotton leaf at the mid-season infestation in 1991 and 1992 , resp. Slosser et al. (2002) in USA stated that threshold for sticky lint problems occurred when aphids numbers ranged between 11.1 and 50.1 / cotton leaf after bolls open .

c.1. Efficiency against *A. gossypii*:

The population density of aphids before and after application of the tested compounds during 2003 and 2004 seasons was presented in Table (5) . The average number of aphids / cotton leaf before spray

Table 5. Average number of *A. gossypii* individuals (nymphs + adults) / cotton leaf pre and after spraying of the tested compounds under field conditions in 2003 and 2004 seasons .

Tested compounds	Rate of application per 100 L water	2003 season						2004 season					
		Average No. of ophids/cotton leaf						Average No. of aphids/cotton leaf					
		Pre-spray	After spraying at indicated days					Pre-spray	After spraying at indicated days				
			2	5	8	11	14		2	5	8	11	14
Kz oil	1000 ml	27.12	25.54	23.14	14.21	12.56	11.54	11.60	9.79	8.94	6.13	6.67	6.60
Vertimec	40 ml	25.00	15.56	13.56	15.76	15.89	18.02	11.21	6.58	5.16	7.29	8.13	10.50
Actara	20 gm	39.65	7.35	0.29	0.35	0.77	0.96	10.65	2.21	0.60	0.31	0.15	0.19
Confidor	75 ml	20.37	0.71	0.08	0.39	0.23	0.69	9.71	0.31	0.33	0.31	0.44	1.00
Icon	80 ml	36.46	28.73	20.46	16.52	14.46	15.21	10.92	9.02	6.75	4.75	5.14	6.42
Polo	100 ml	25.00	3.42	0.02	0.17	0.14	0.39	12.25	1.87	0.87	0.25	0.65	0.63
Control	--	24.56	25.85	23.67	26.63	25.16	22.46	9.15	9.25	9.48	10.05	11.06	11.13

Table 6. Insecticidal efficacy of the tested compounds against A. gossypii in cotton fields during 2003 and 2004 Seasons.

Tested compounds	Rate of application per 100 L water	2003 season							2004 season						
		% initial kill 2 days after spray	% reduction at days				Mean of % residual effect	General mean % reduction	% initial kill 2 days after spray	% reduction at days				Mean of % residual effect	General mean of % reduction
			5	8	11	14				5	8	11	14		
Kz oil	1000 ml	17.70^{d}	24.76	51.06	52.37	52.89	45.27b	39.76b	23.02d	14.44	50.83	53.52	52.87	42.92c	38.94b
Vertimec	40 ml	41.52^{c}	55.07	39.77	39.19	22.25	39.07c	39.56b	39.60c	55.45	41.95	38.20	20.83	39.11c	39.21b
Actara	20 20 gm	78.29^{b}	94.57	97.39	98.88	98.52	97.34a	93.73a	81.88b	99.26	99.17	98.29	97.29	98.50a	95.18a
Confidor	75 ml	96.80^{a}	96.66	97.05	96.26	91.95	95.36a	95.64a	97.11a	99.52	98.54	99.06	96.64	98.44a	98.17a
Icon	80 ml	18.00^{d}	40.53	60.44	61.00	51.72	53.42b	46.34b	24.22d	40.76	57.25	60.09	53.65	52.94b	47.19b
Polo	100 ml	84.88^{b}	87.06	98.10	95.63	95.80	94.65a	92.29a	86.69b	99.90	99.33	99.99	98.22	99.36a	96.83a

In the same column, means followed by a common letter are not significantly different at 5% level by Duncan (1955)

ranged between 20.37 and 39.65 in 2003 . While, it ranged from 9.15 to 12.25 in 2004 season. All tested compounds lowered the aphids number than that in untreated checks, but with different degrees depending upon the group to which the compound is belonging .

Results presented in Table (6) showed the initial and residual activities of the tested compounds on cotton aphids in 2003 and 2004 seasons . In 2003, it is clear that Confidor proved to be the superior to all compounds resulted in 96.8% initial kill after treatment with 2 days and significantly differed from the others . Polo and Actara came in the second order recording 84.88 and 78.29% initial kill, resp. without significant differences in between . Icon and Kz oil were the inferior compounds causing 18.00 and 17.70% initial kill. Taking the mean of residual effect (mean of % reduction at 5, 8, 11 and 14 days post-treatment) into consideration, the tested compounds could be arranged descendingly as follows: Actara (97.34) , Confidor (95.36) , Polo (94.65) , Icon (53.42) , Kz oil (45.27) and Vertimec (39.07%).

According to the general mean of % reduction , Confider, Actara and Polo gave the highest activity recording 95.64 , 93.73 and 92.29 % reduction , resp. with insignificant differences in between.

In 2004 season, the tested compounds showed the same previous trend, Confidor gave the highest initial kill (97.11%) followed by Polo (86.69%) and Actara (81.88%) . Regarding to the mean of residual effect , Polo , Actara and Confider caused 99.36 , 98.50 and 98.44% reduction resp. without significant differences in between followed by Icon (52.94) . While, Kz oil and Vertimec showed the lowest means of residual effect amounted (42.92 and 39.11%) respectivily . Concerning to the general mean of % reduction , the tested compounds could be arranged into two groups ; the first one comprises Confidor , Polo and Actara which caused from 98.17 to 95.18 % reduction in aphids population. The second one comprises Icon , Kz oil and Vertimec which caused % reduction ranged between 47.19 and 38.94. The compounds in each group did not significantly differ in between.

The obtained results agreed with that of many investigators ; Selim and Emam (1993) stated that Confidor was highly effective against *A gossypii* on cotton recording from 83.72 to 98.80 % reduction as general mean of activity after 21 days of treatment. Hayder et al. (1996) found that Kz oil and Supermisrona gave an intermediate activity against *A. gossypii* with LC_{50} values 207.5 and 2086 ppm , resp. , while primiphos-

ethyl and monocrotophos gave LC_{50} values 98.5 and 302.4 ppm, resp. Layton et al. (1996) mentioned that Confidor provided in excess of 90% control of aphids population 2 days after treatment. Scarpellini and Nakamora (1999) stated that Actara at 25 g a.i./ha, Confidor at 50 g a.i./ha and Polo at 250 g a.i./ ha gave 85, 84 and 75% control, resp. against *A. gossyoii* after 2 days of treatment, while after 14 days they gave 79, 77 and 76 % control, resp.

c.2. Efficiency against *B. tabaci*:

Data presented in Table (7) indicated that the population density of immature stages of whitefly (nymphs + pupae) infesting cotton leaves ranged from 12.49 to 33.66 and from 10.00 to 17.05 insects / leaf in 2003 and 2004 seasons , resp. before spray of the tested compounds. All the tested compounds lowered the population of the pest less than that in the control 2 days post treatment, then it began to increase gradually in some treated plots till the last scouting (after spraying with 14 days) specially in 2003 season.

Results presented in Table (8) reflected the initial and residual activities of the tested compounds against immature stages of whitefly infesting cotton plants in 2003 and 2004 seasons . In 2003 season , Polo proved to be the superior to all compounds followed by Confidor causing 82.09 and 77.01 % initial kill , 95.32 and 87.58 % mean of residual effect and 92.01 and 84.94 % reductions as general mean of effect , resp. Actara gave the lowest initial kill (35.50%) , but its potency increased by time to induce 86.36% reduction as mean residual effect and 73.64% reduction as general mean of effect.

The rest compounds resulted in from 56.15 to 71.11% initial kill, from 70.56 to 77.99% of residual effect and from 66.96 to 76.28% reduction as general mean.

In 2004 season, with exception of Vertimec, all the tested compounds induced less efficacy than that of 2003 season. The compounds could be arranged descendingly according to their initial kill percentages as the following , Polo (77.83), Vertimec (70.59), Confidor (59.53), Kz oil (45.79), Icon (44.62) and Actara (27.12) . Insignificant differences were detected between Polo and Vertimec and also between Icon and Kz oil. With respect to mean of residual effect, all the tested compounds showed good activity against immatures whitefly where the percent reduction ranged between 68.48 and 88.12% . The obtained results were in full agreement with that of many investigators; Kandil et al. (1991) reported that Polo and Confidor caused 90.57

and 84.63% reduction of both mature and immature stages of B. tabaci . El-Adl et al. (1998) found that Admiral, Kz oil and Polo were very effective for controlling the nymphs of B. tabaci . Helal et al. (2003) mentioned that Confidor and Applaud showed the highest initial and residual activities against both adults and immature stages of whitefly, while mineral oils showed less activity. Also, Ferman et al. (2004) stated that Confidor was the most efficient in controlling the cotton whitefly.

c.3. Side-effects of the tested compounds on larval stages of *C. carnea* , *Coccinella spp.* and *scymnus spp.* In cotton fields:

It is obvious from data in Table (9) that the predatory insects were more abundant in 2004 than in 2003 season , where the maximum average numbers of them / 5cotton plants pre-spray were 13.2 in 2003 and 35.7 in 2004 season .

Based on initial kill percentages (Table 10) , Vertimec, Actara and Kz oil were the most harmless to the studied predators causing 15.38, 17.50 and 25.56 hn 2003 and 17.64, 13.07 and 27.65% in 2004 initial kill resp. These three compounds remained the safest till the end of experiment recording 21.79, 33.65 and 38.87% reduction as general mean of effect in 2003 season and 20.11, 29.91 and 35.24% in 2004 for Vertimec, Kz oil and Actara, resp.

On the contrary, Icon and Polo proved to be the most harmful to the studied predators, where gave 84.29 and 72.50 initial kill in 2003 & 93.23 and 74.60% initial kill in 2004 respectively . The toxicity of Icon decreased by time progress to give 65.18 and 73.98% reduction as general mean of effect in 2003 and 2004 respectively . While, Polo showed the opposite, where its toxicity increased by time to give 80.64 and 83.25% reduction as general mean of effect in 2003 and 2004 respectively. Confidor showed intermediate case comparing to the others providing 45.00 and 61.13% initial kill and 52.04 and 50.43% reduction as general mean in 2003 and 2004 , resp. Cole et al. (1997) found that Icon caused a transient reduction in the natural enemies population, which recovered within 10 days post treatment in cotton-field trials. Cai et al. (1997) stated that when *Coccinella septempunctata* was treated with Vertimec at 40 mg/L in cotton fields the percent mortality was 43.28% . El-Adl et al. (1998) mentioned that mineral oil (Kz) gave slight reduction in *Orius spp.* population . While , *C. carnea* was the most resist predator to all tested materials .

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Table 7. Average number of individuals of *B. tabaci* immature stages/cotton leaf pre and after spraying of the tested compounds under field conditions in 2003 and 2004 seasons.

Tested compounds	Rate of application per 100 L water	2003 season					2004 season				
		Average No. of *B. tabaci* immature stages/cotton leaf					Average No. of *B. tabaci* immature stages/cotton leaf				
		Pre-spray	After No. of B. tabaci immature stages/cotton leaf				Pre-spray	After spraying at indicated days			
			2	5	10	15		2	5	10	15
Kz oil	1000 ml	33.66	20.00	16.57	39.63	38.73	15.19	11.48	5.08	8.06	10.59
Vertimec	40 kl	20.45	13.88	18.97	27.53	25.99	14.77	5.83	8.17	7.13	8.71
Actara	20 gm	23.19	33.35	24.21	9.82	4.65	14.48	14.29	6.98	3.88	3.42
Confidor	75 ml	14.86	7.57	9.74	8.90	5.33	13.25	9.83	5.44	3.54	2.10
Icon	80 ml	14.53	15.65	12.93	19.95	23.23	14.92	11.00	7.21	5.84	6.86
Polo	100 ml	24.23	9.75	11.70	0.55	0.76	17.05	5.21	5.92	3.00	1.36
Control	--	12.49	27.85	47.20	62.47	51.87	10.00	13.79	16.25	17.06	16.42

Table 8. Insecticidal efficacy of the tested compounds against *B. tabaci* immature stages in cotton fields during 2003 and 2004 seasons.

Tested compounds	Rate of application per 100 L water	2003 season						2004 season					
		% initial kill 2 days after spray	% reduction at days			Mean of % residual effect	General mean of % reduction	Initial kill 2 days after spray	% reduction at days			Mean of % residual effect	General mean of % reduction
			5	10	15				5	10	15		
Kz oil	1000 ml	71.11b	86.91	76.71	70.35	77.99c	76.28b	45.79c	80.92	68.16	56.53	68.54c	62.85c
Vertimec	40 ml	68.12b	74.37	73.06	68.74	72.06c	71.07b	70.59a	68.78	71.50	65.16	68.48c	69.01bc
Actara	20 gm	35.50d	72.37	91.53	95.17	86.36b	73.64b	27.12d	67.16	85.08	84.30	78.85b	65.92c
Confidor	75 ml	77.01ab	82.63	88.63	91.48	87.58b	84.94a	59.53b	76.99	83.94	90.23	83.72a	77.67b
Icon	80 ml	56.15c	76.76	73.38	61.55	70.56.c	66.96b	44.62c	70.22	74.80	69.08	71.36bc	64.68c
Polo	100 ml	82.09a	87.16	99.65	99.23	95.32a	92.01a	77.83a	79.75	89.48	95.13	88.12a	85.55a

In the same column , means followed by a common letter are not significantly different at 5% level by Duncan (1955).

Table 9. Average number of (*C. carnea, Coccinella spp.* and *Scymnus spp.*) larvae / 5 cotton plants

Tested compounds	Rate of application per 100 L water	2003 season						*2004 season*					
		Average No. of (*C. carnea, Coccinella spp.* and *Scymnus spp.*) larvae/5 cotton plants						*Average No. of (*C. carnea, Coccinella spp. *and* Scymnus spp.*) larvae/5 cotton plants*					
		Pre-spray	After spraying at indicated days					Pre-spray	*After spraying at indicated days*				
			2	5	8	11	14		2	5	8	11	*14*
Kz oil	*1000 ml*	*9.3*	*6.1*	*4.4*	*4.6*	*3.9*	*4.4*	*35.7*	*14.1*	*16.9*	*14.3*	*15.9*	*16.8*
Vertimec	*40 ml*	*13.2*	*10.2*	*8.1*	*8.4*	*6.2*	*7.3*	*19.4*	*14.2*	*10.3*	*9.2*	*9.3*	*10.2*
Actara	*20 gm*	*8.2*	*6.4*	*3.1*	*4.1*	*3.2*	*3.3*	*18.5*	*14.3*	*7.2*	*6.1*	*6.0*	*8.2*
Confidor	*75 ml*	*6.7*	*3.1*	*3.2*	*2.1*	*2.0*	*1.2*	*23.8*	*8.5*	*8.7*	*9.0*	*7.1*	*6.3*
Icon	*80 ml*	*7.1*	*1.1*	*2.1*	*2.2*	*2.2*	*2.3*	*33.6*	*2.1*	*5.2*	*5.3*	*6.2*	*10.0*
Polo	*100 ml*	*8.1*	*2.1*	*1.1*	*1.2*	*1.0*	*1.1*	*22.3*	*5.2*	*4.3*	*2.1*	*1.1*	*1.0*
Control	--	*11.9*	*10.4*	*8.5*	*9.6*	*7.7*	*8.6*	*19.2*	*10.5*	*12.1*	*11.9*	*12.1*	*13.4*

Table 10. Side-effect of the tested compounds on (*C. carnea, Coccinella spp.* and *Scymnus spp.*) larvae in cotton fields during 2003 and 2004 seasons .

Tested compounds	Rate of application per 100 L water	2003 season							2004 season						
		% initial kill 2 days after spray	% reduction at days				Mean of % residual effect	General mean % reduction	% initial kill 2 days after spray	% reduction at days				Mean of % residual effect	General mean of % reduction
			5	8	11	14				5	8	11	14		
Kz oil	1000 ml	25.65d	34.17	39.26	35.08	34.17	35.76c	33.65d	27.65d	24.76	35.45	29.29	32.42	30.48d	29.91d
Vertimec	40 ml	15.38d	15.38	24.79	27.47	25.96	23.40d	21.79e	17.64e	16.67	18.18	25.00	23.08	20.73d	20.11e
Actara	20 gm	17.50d	48.44	38.89	41.07	48.44	44.21c	38.87d	13.07e	38.43	42.42	47.22	35.04	40.78c	35.24d
Confidor	75 ml	45.00c	31.25	59.26	47.62	77.08	53.80b	52.04c	61.13c	44.93	32.41	51.81	61.87	47.76c	50.43c
Icon	80 ml	84.29a	60.71	65.08	55.10	60.71	60.39b	65.18b	93.23a	76.01	73.83	71.21	55.71	69.19b	73.98b
Polo	100 ml	72.50b	82.81	84.72	80.36	82.81	82.68a	80.64a	74.60b	71.21	84.30	92.80	93.36	85.42a	83.25a

In the same column, means followed by a common letter are not significantly different at 5% level by Duncan (1955).

بعض الطرق المتكاملة لمكافحة المن و الذبابة البيضاء في حقول القطن مع الحفاظ علي المفترسات المرتبطة بها

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أجريت دراسات معملية و نصف حقلية و حقلية في محطة البحوث الزراعية بسخا محافظة كفر الشيخ خلال موسمي ٢٠٠٣ ، ٢٠٠٤ م لتقييم فعالية بعض الطرق لمواجهة خطر المن و الذبابة البيضاء علي نباتات القطن .

تحت الظروف المعملية و باستخدام طريقة الفلم المتبقي اثبت زيت ك زد أنه الأمن علي يرقات أسد المن . كذلك كانت مركبات فيرتيميك ، أكتارا ، كونفيدور غير ضارة بيرقات المفترس . كانت مركبات تلتون ، أيكون ضارة بالمفترس تحت الأقفاص في الحقل تم تقدير مستويات الضرر الإقتصادي . فكان الحد الإقتصادي الحرج للمن ١,٨٤ ، ٢,٨٣ حشرة من / ورقة قطن و كان للذبابة البيضاء ٠,٢٨ ، ٠,٦ حشرة كاملة / ورقة قطن خلال موسمي ٢٠٠٣ ، ٢٠٠٤ علي الترتيب . بينما كان مستوي الضرر الاقتصادي للمن ٢,٣ ، ٣,٥٤ حشرة / ورقة و كان للذبابة البيضاء ٠,٣٦ ، ٠,٧٥ حشرة كاملة / ورقة في الموسمين علي الترتيب . أوضحت نتائج الدراسة الحقلية أن مركبات أكتارا ، كونفيدور الأكفاء في مكافحة المن مع الحفاظ علي المفترسات المصاحبة .

بينما أثبت كونفيدور فعالية عالية علي الذبابة البيضاء و بدون تأثيرات ضارة علي المفترسات المصاحبة. لذلك يمكن أن تستخدم مركبات أكتارا ، كونفيدور في المكافحة المتكاملة للمن و الذبابة البيضاء في زراعات القطن .