INTEGRATED MITS MANAGEMENT II- DETERMINATION OF SUBLETHAL DOSES OF SOME COMPOUNDS AGAINST THE TWO SPOTTED SPIDER MITE, *TETRANYCHUS URTICAE* AND THEIR EFFECTS ON ITS BIOLOGICAL ASPECTS WITH RESPECT TO PREDATORS *AMBLYSEIUS FALLACIS AND PHTODEIULUS PERSIMILIS*

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ABSTRACT

The effect of sublethal doses of six compounds, three acaricides (abamectin, ethion and chlorfenapyr), one pyrethroid (cyhalothin), one mineral oil (Nat1), and one plant extract (black cumin) on some biological and behavioral characteristics of the two spotted spider mite, *Tetranychus urticae* (Koch) and adult females of two predator mite, *Amblyseius fallacies* (Garman) *and Phtodeiulus persimilis* (Athias-Henriot)was examined. The results indicated that, cyhalothrin is the most effective compound tested on egg deposition, which is beneficial for some IPM programs away from predators employments. Black cumin extract has the least effect on egg deposition that confer a chance to produce eggs enough for predation including egg mite, the preferable stage, for some predators. Ethion and abamectin are considered ideal from the biological point of view since they decreased egg deposition to a suitable level and this character is needed for any integrated mite management program. Chlorfenapyr and Nat1 are the best compounds that have a moderate effect on egg deposition of spider mite which give these compounds special importance in integrated mite management. Nat1 and black cumin extract exhibited the least effective ovicidal action. The ovicidal effect of ethion and abamectin were about the same against the egg stages of spider mite. Cyhalothrin was highly toxic compound that caused the drastic drop in egg hatchability.

Cyhalothrin and abamectin are the most effective on prey egg consumption, predator egg production, prey consumption and predatory egg deposition. Ethion occupies the next position in prey egg consumption. All compounds exhibited different effects on predator's egg hatchability of the predatory mite *A.fallacis*. Cyhalothrin and abamectin were highly toxic to predator's eggs that caused high decrease in egg hatchability comparable to the control treatment. All compounds exhibited different effects on predator's egg hatchability of the predatory mite *P.persimilis*. Cyhalothrin

and abamectin were highly toxic to predator's egg that caused high decrease in egg hatchability comparable to the control treatment.

INTRODUCTION

Phytophagous mites represent a special importance in our modern agriculture. Scarcely an agricultural crop without a mite problem could be found. Mite control using many of specific chemicals known as acaricides on agricultural crops was and still in some cases, a routine practice by farmers all over the world. The continuous application of these acaricides and other chemicals for controlling mites in field crop, led to development of the resistance problem. The rise of resistance among mite population implies necessitates for alternating these chemicals from a group of certain mode of action to another one that has different mode of actions.

The predatory mites *A. fallacies* and *P. persimilis* are the most abundant of the natural enemies associated with spider mites on several crops. These species play an important role in suppressing populations of phytophagous mites and must be safeguanded .Many laboratory and field investigations concluded that *A. fallacies* and *P. persimilis* are an efficient predators of tetranychid mites (Nicolov *et al.*, 1983; Rather, 1983 and Ahmed- and Ahmed, 1988). The integrated chemical and biological control of two-spotted spider mite (tetranychids) is possible through the combined effect of selective pesticides and the action of various beneficial arthropods.

The petroleum (Mineral) oils are used in large quantities as herbicides and for other crop protection purposes. They are of low chemical reactivty (physical poisons) and may be used as miticides, ovicides and as emulsifiable carriess of pesticides. Botanical pesticides in general possess low mammalian toxicity and their use in an agroecosystem is now emerging as one of the prime means to protect crop produce and the environment from pesticidal pollution, and there is no risk of developing pest resistance to these products, when used in natural forms (Hoseny *et al.*, 2003 and Magouz and Saadoon 2005).

Due to the above different chemicals that may be used against phytophagous mites and different biological control agents that may be combined with pesticidal control that lead to minimize the environmental pollution. There is a renewed interest in the use of integration between chemicals of different mode of action in combination with the use of perdatary mites in tetranychid mite control.

The present study was carried out to examine the effect sublethal doses of six tested compounds on some biological aspects of spider mite *T. urticae* and their predatory mites *A. fallacies* and *P. persimilis*, fecundity

and hatchabilty of eggs for prey, feeding behavior, fecundity and hatchabilty for the two predator.

MATERIALS AND METHODS

Prey Cultures:

The two-spotted spider mite, *T. urticae* (Koch) (Acarina: Tetranychidae), colonies were obtained from castor bean plants from Kafr El-Sheikh Governorate and reared under laboratory conditions according to Dittrich (1962). The prey culture was kept at 25 ± 2°C under 16 hour's photoperiod to encourage plant growth, and 70 ± 5 R.H.

Predator culture:

Two predators were used in this study namely *A. fallacis* and *P. persimilis*. *A. fallacies* **(Garman)** (Acarina: Photoseiidae), was collected and described by **Garman (1948)**. The predator was reared on pollen rains of castor bean (*Ricinus communis*) plants as described by **Overmeer *et al.* (1982).**

Chemicals used:

Six compounds were used. All tested compounds were in the formulated form and the dosages were calculated on the basis of ppm of active ingredient. The chemical names for the tested compounds are as follows:

1- **Abamectin** (1.80% EC) a mixture containing a minimum of 80% avermectin B_1a (5-0 demethyl avermecin A_1a) and a maximum of 20% avermectin B_1 b [5-0-demethyl – 25 –de (1 methyl – propyl)– 25- (1-methyl ethy) avermectin A_1 a].
2- **Ethion** (50% EC) 0,0,0,0-tetraethyl s,s-methylene bis (phosphorodithioate).
3- **Lambda-cyhalothrin** (5% EC): A reaction product comprising equal quantities of (S) -2-cyano-3 phenoxybenzy1 (z)-(1R3R)3-(2-chloro-3,3,3-trifluoro propeny1) -2,2 dimethyl cyclopropane carboxylate and (R) -a- cyno-phenoxybenzyl (Z) -(1S, 3S)-3-(2 chloro-3,3,3-trifluropropenyl)-2,2-dimethyl cyclopropane-carboxylate.
4- **Chlorfenapyr** (36% SC): 4-Bromo-2-(chlorophenyl)(ethoxymethyl)-5-(trifluoro-methyl)-1H- pyrrole -3-carbonitrile; 4-Bromo -2-(4-chlorophenyl)-1-(ethoxymethyl) -5-(trifluoromethyl) pyrrole -3-carbonitrile.

5- **Mineral oils** (Nat 1: (96 % E.C) was provided by Centeral Agricultural Pesticides Laboratory-Natural oil was applied at rate of 1L / fedan.

6- **Plant extracts** (Black cumin extract: An amount of 5g of black cumin seeds powder (*Nigella sativum* Linn.,Family: Ranunculaceae) were extracted in 100 ml of absolute ethanol (75%). Extraction runs over night followed by filtration.

Experimental techniques:

1-Effect of tested compounds residues on *T. urticae* egg laying and its hatchability

The residual effect of each tested chemical at LC_{25} level on adult prey mites was evaluated according to Keratum *et al.*, (1994).

2-Effect of compounds residues on egg consumption and egg laying and its hatchability by predatory mites *A. fallacies* and *P. persimilis*

The method which was adopted by Keratum *et al.*, (1994) was used to evaluate the effect of tested compound residues on egg consumption and egg laying and its hatchability by the predatory mites *A. fallacies* and *P. persimilis*.

RESULTS AND DISCUSSION

1- Effect of compound's residues on egg deposition by the adult females of *T. urticae*:

The effect of sublethal concentrations of the tested compounds (LC_{25}) on egg deposited by the adult female mites of *T.urticae* was studied. Five adult female mites were allowed to oviposite on different compounds-treated plants for a period of 5 days. The deposited eggs were counted daily for five days. Each treatment was replicated four times. The data shown in Table (1) indicated that cyhalothrin was the most effective compound on egg deposition followed by ethion and abamectin. While chlorfenapyr, Nat1 and black cumin extract had a moderate effect on that character and were about similarly effective ein reducing mite fecundity. In general the effect of different compounds can be arranged descendingly as follows:

cyhalothrin > ethion > abamectin > chlorfenapyr > Nat1 > black cumin extract > control.

Several studies were carried out on the effect of different compounds on mite biology indicated that these compounds always showed positive effect on egg deposition of the prey.

Table (1): Effect of different compound residues on egg deposition and hatchability of *T.urticae*:

Compounds	Mean no of eggs deposited in days	Mean of unhatched egg at days	% H.
Control	30.6±0.96a	6.0±0.73^{g}	76.00
Abamectin	17.75±0.36e	15.25±0.41^{c}	39.00
Ethion	13.95±0.74f	17.80±1.14^{b}	28.80
Chlorfenapyr	20.9±0.53d	13.75±0.53^{d}	45.00
Cyhalothrin	10.95±.24g	19.7±0.20^{a}	21.20
Nat1	22.35±0.80c	10.30±1.10^{e}	58.80
Black cumin	25.95±0.59b	8.65±0.25^{f}	65.40

*%H. = % Hatchability

Stafford and Fukushima (1970) indicated that oviposition of *T.pacificus* decreased with increasing concentration of the acaricide, fungicide benomyl. The low number of eggs deposited on plants immediately after its treatment with the pesticide is prospective due to another factor which is the relative low toxic effect of the compounds against the adult, the factor that expected to loss its effect on adults with passing time after treatment of the plants which prepared for oviposition. One of the principle aspects on which successful biological control depend, is the rate of prey egg production relative to that of its predator. There is no doubt that low levels of chemicals which do not cause mortality can influence this character. The present laboratory treatments simulate field conditions where the mites will exposed to chemical residues on plant leaves by contact or as stomach action through feeding on contaminated cell contents. Nakashima and Croft (1974) suggested that the reduction in egg deposition in predaceous mite *A.fallacis* fed on benomyl treated prey may be due to inhibition of mitoses by a breakdown product of the pesticide known to affect cell division in fungi where benomyl is of fungicidal effect. Direct interference with the division and growth of egg cells may be responsible for the suppression of egg laying in two-spotted spider mite exposed to the antibiotic cyclohiximidine (Harries, 1961 and 1963).

The results of the present study probably have a similar explanation. The oviposition in mites is known to be related to feeding and the antifeeding properties of some pesticides especially the pyrethroids that will indirectly affect egg laying. Fenvalerate deposit reduced oviposition in *T.urticae* due to the antifeeding properties of pyrethroid residues (Keratum, 1993). The obtained results are also in agreement with that recorded by Ayyappath *et al.* (1997) and Hosny *et al.* (1998). Derbalah (1999) showed

that fecundity was highly reduced by bromopropylate followed by fenpyroximate and dicofol and no significant differences among them in their effects were observed. It is interesting to note that the results of sterilizing effect which had shown by Hosny *et al.* (1977) on *T.cinnabrinus* is apparent in the present results. Sterilization means one or both of two aspects, few eggs and/or less hatchability. Tedion treated discs showed fewer oviposition than showed on untreated discs (4.6 and 6.5 eggs/day/female), respectively. Temporary or partial sterilization for adult mites exposed to pyrethroids treated discs could be responsible for low number of eggs laid/female/day in spite of their intermediate effect on egg hatchability. So the same two effects could be characterized by a sterilizing effect. The same conclusion was showed by Spadafora and Lindquist (1973) who indicated that benomyl at 0.03 % a.i. depressed egg hatchability of *T.urticae* (Koch) they found that viability was reduced by direct application to the eggs through ingestion of treated plant tissue by gravid females. On the other hand, Singer *et al.* (1988) suggested that oviposition preference and larval performance may be correlated within populations and may vary among individuals such that females prefer the plant species on which their larvae should have the greatest chance of surviving during their first 10 days of growth.

2- Effect of compounds residues on eggs hatchability of *T. urticae*

This experiment was carried out to determine the toxic effect of the tested compounds at LC_{25} level on mite eggs of *T. urticae*. Hatchability was counted 72 hours after egg laying for successive five days. Each treatment was replicated four times.

The data were shown in Table (1) indicated that cyhalothrin, ethion and abamectin were highly toxic compounds, while chlorfenapyr, Natl and black cumin extract were the least effective on egg hatchability. In general, the effect of different compounds (Table 1) can be arranged descendingly as follows: cyhalothrin > ethion > chlorfenapyr > Natl > black cumin extract > control. Based on the percent hatchability as shown in (Table 1), results suggested that cyhalothrin was the most effective compound on egg hatchability (21.2%) followed by ethion and abamectin (28.8 and 39%). While chlorfenapyr had a moderate effect on that character (45%). Natl and black cumin extract were the least effective in egg hatchability (58.8 and 65.4%).

Saadoon (2006) and Ismail (2007) indicated that cypermethrin was highly toxic compound that caused the highest decreased in egg hatchability

on leaf discs against egg stage of *T.urticae* but etoxazole and worm wood extract were the least effective ovicidal action.

3- Effect of compound's residues on the biology of Predatory mites:

Several workers reported pesticidal effect on predatory mites. It is well known that the role of the predaceous mite deals with the feeding capacity on prey mite and oviposition capacity of predatory mite to produce enough number to minimize the phytophagous mite population to tide economic injury level beside other control agents. So, the spider mite *T.urticae* eggs were introduced on pesticidal treated leaf discs to adult predaceous mites *A.fallacis* and *P. persimlis* to record the effect of chemical residues on prey egg consumption by adult females of predaceous mites. The oviposition capacity of the predatory mites and its hatchability were also recorded.

3-1. Predatory mite *A. fallacies*

3-1.1 Effect of compound's residues on feeding capacity of predatory mite *A. fallacis*

The chemical treatments were applied for the plants before egg laying of the prey mite. The discs were dipped in LC_{25} concentration of each tested compound, then left to dry. 10 adult females *T.urticae* of known age were transferred to each disc to oviposite for 24 hours. Then adult females were removed and the oviposited eggs were counted with equal number of eggs of prey mite *T.urticae* on each disc.One adult females of predator mite was transferred to each treated disc. Each treatment was replicated four times. The numbers of prey eggs eaten were recorded after 24 and 48 hours.

The data presented in Table (2) indicated that cyhalothrin and abamectin were the most effective compounds that reduced the prey egg consumption (2.75 eggs/adult/day) for cyhalothrin and 3.0 eggs/adult/day for abamectin comparable to control of 10.5 eggs/adult/day, followed by ethion (4.0 eggs/adult/day) and chlorfenapyr (5.38 eggs/adult/day). Natl and black cumin extract were the least effective compounds in this respect (7.50 eggs/adult/day and 9.0 eggs/adult/day) respectively.

The presence of a pollutant (chemical) and morphological features of the host plant may disturb the searching activities of the predator to find its food material (egg stage). In spite of the egg stage of spider mite is the main food for the predator *A.fallacis*, the leaf surface may have negative or positive chemical stimuli that determine or evaluate the contact process. Renwich and Redke (1988) stated that visual stimuli may play a role in

landing process on plant leaves. This step may also decide, for a certain extent, the rate of prey-egg consumption by the predator.

Table (2): Effect of different compound residues on number of consumed *T. urticae* eggs, number of laid eggs and number of hatched eggs by the predatory mite *A. fallacies*

Compounds	Average no of consumed eggs/adult/day	Average deposited eggs/adult/day	Average predator unhatch eggs	% H.
Control	10.50 ± 0.91^{a}	3.38 ± 0.48^{a}	0.25 ± 0.29^{e}	97.5
Abamectin	3.00 ± 0.70^{f}	0.88 ± 0.25^{c}	8.25 ± 0.65^{a}	17.5
Ethion	4.00 ± 0.40^{e}	1.63 ± 0.25^{b}	7.25 ± 0.50^{b}	27.5
Chlorfenapyr	5.38 ± 0.63^{d}	1.88 ± 0.25^{b}	6.25 ± 0.65^{c}	37.5
Cyhalothrin	2.75 ± 0.50^{f}	1.00 ± 0.40^{c}	9.00 ± 0.70^{a}	10.0
Nat 1	7.50 ± 0.58^{c}	2.63 ± 0.25^{a}	5.50 ± 0.58^{c}	45.0
Black camin cxtract	9.00 ± 0.40^{b}	3.00 ± 0.40^{a}	4.00 ± 0.40^{b}	60.0

*%H. = % Hatchability

3-1.2. Effect of compound's residues on oviposition capacity of predatory mite *A. fallacis*

The studies that investigate the correlation between egg consumption and egg production indicated a positive correlation under normal condition. The deposited eggs by the adult female's predator under the effect of the tested compound's residues were studied through two successive days.

The data in Table (2) indicated that abamectin and cyhalothrin were the most effective chemicals which caused a decrease in eggs deposited by adult females of predatory mite comparable to control (0.88 and 1.00 eggs/day), respectively comparable to control treatment of 3.38 eggs/day, followed by ethion and chlorfenapyr which have a moderate effect (1.63 and 1.88 eggs/day, respectively) while Nat1 and black cumin extract have a little effect on egg deposition by predatory mite comparable to other tested compounds (2.63 and 3.0 eggs/day), respectively and was not significantly different from control.

It is well known that there is a positive correlation between the prey egg consumption and predator oviposition. This relation may take the linear

appearance if it was free from any disruptive factors. The presence of chemicals on leaf discs which is considered a disruptive factor may be coincide with the unsuitable structures of the host plant leaves to increase the above mentioned disruption leading to disturbed relation between egg consumption and predator egg deposition.

3-1.3. Effect of compounds residues on number of hatched eggs of the predatory mite *A. fallacis*

Hatchability of eggs laid by predatory mite *A.fallacis* was recorded 4 and 5 days after egg laying. The hatchability of predator eggs was shown in Table (2) and exhibited that the most safe compounds were black cumin extract and Nat1 (60.0 and 45%) that allowed the predator's eggs to hatch to produce the next stages necessary to complete the biological agent to minimize prey populations. The data in Table (2) also indicate that cyhalothrin and abamectin were the most effective compounds on hatching of eggs produced by the predator mite (10.0 and 17.5%) comparable to control treatment (97.5%). Ethion and chlorfenapyr were of moderate effect on predator's egg hatchability (27.5 and 37.5%).

3-2. Predatory mite *P. persimlis*

3-2.1 Effect of compound's residues on feeding capacity of predatory mite *P. persimlis*

The data presented in Table (3) showed that, cyhalothrin and abamectin were the most effective compounds that reduced the prey egg consumption (4.63 eggs/adult/day) for cyhalothrin and (6.25 eggs/adult/day) for abamectin comparable to control of 17.88 eggs/adult/day, followed by ethion and chlorfenapyr (7.38 eggs/adult/day) and (8.38 eggs/adult/day) respectively.

3-2.2. Effect of compound's residues on oviposition capacity of predatory mite *P. persimlis*

The data in Table (3) indicated that the predator's egg deposited under the chemical effect through the first and second days was less than that deposited under normal conditions (untreated). The average number of predator egg production through two successive days indicate that cyhalothrin and abamectin were the most effective chemicals which caused a decrease in egg deposited by adult females of predatory mite comparable to control (0.63 and 0.88 eggs/day, respectively) comparable to control treatment of 4.124 eggs/day) , followed by ethion and chlorfenapyr which have a moderate effect (1.50 and 1.75 eggs/day, respectively), while Nat1

and black cumin extract have a little effect on egg deposition by the predator comparable to other tested compounds (2.25 and 2.63 eggs/day) and were significantly different from control.

Table (3): Effect of different compound residues on number of consumed *T. urticae* eggs, number of laid eggs and number of hatched eggs by the predatory mite *P. persimilis*.

Compounds	Average no of consumed eggs/adult/day	Average deposited eggs/adult/day	Average predator unhatch eggs	% H.
Control	17.88 ± 0.48^{a}	4.125 ± 0.25^{a}	0.50 ± 0.40^{f}	95.0
Abamectin	6.25 ± 0.29^{f}	0.88 ± 0.48^{c}	7.75 ± 0.29^{b}	22.5
Ethion	7.38 ± 0.48^{e}	1.5 ± 0.01^{c}	7.00 ± 0.01^{c}	30.0
Chlorfenapyr	8.38 ± 0.25^{d}	1.75 ± 0.29^{c}	6.63 ± 0.25^{c}	33.7
Cyhalothrin	4.63 ± 0.48^{f}	0.63 ± 0.25^{c}	9.13 ± 0.63^{a}	8.70
Nat 1	9.25 ± 0.29^{c}	2.25 ± 0.29^{b}	5.50 ± 0.40^{d}	45.0
Black camin extract	10.0 ± 0.40^{b}	2.63 ± 0.25^{a}	4.38 ± 0.25^{e}	56.2

*%H. = % Hatchability

3-2.3. Effect of compound's residues on number of eggs hatched of the predatory mite *P. persimlis*

The hatchability of predator eggs was shown in Table (3) and exhibited that the most safe compounds were black cumin extract and Nat1 (56.2 and 45.0 %) that allowed the predator's eggs to hatch to produce the next stages necessary to complete the biological agent to minimize prey populations.

The data in Table (3) also indicated that cyhalothrin and abamectin were the most effective compounds on hatching of eggs produced by the predator mite (8.7 and 22.5 %) comparable to control treatment of 95.0 %, followed by ethion and chlorfenapyr which were of moderate effect on predator's egg hatchability (30.0 and 33.7 %) and were about of the same in their effects in this respect.

P.persimilis was successefully introduced throughout the world for two-spotted spider mite control for many years. It is a voracious predator which typically reduces two-spotted spider mite to extremely low levels and then rapidly disperses to locate new colonies. It does not appear to have

many alternate food sources as it's numbers decline rapidly once high levels of two-spotted mite have been controlled *P.persimilis*, a predaceous mite, is one of the integrated pest management programs for control of spider mites.This species is a specialized predator of spider mites. In fact, *P.persimilis* feeds, reproduces and completes development only mites (family: Tetranychidae), although it also feeds on young thrips and can be cannibalistic when spider mite prey is unavailable (Sabelis, 1981).

The obtained results were in agreement with that recorded by many investigators. Discussing the foregoing results, it could be noticed that successful biological control depends upon several factors concerning the predator's biology. One of these important factors is the rate of prey consumption. Certainly low concentration level of chemicals such as LC_{25} for adult mites which do not cause enough mortality can affect other responses such as functional response, and this is why the prey egg consumption was recorded under chemical treatments. The decrease in feeding capacity by *S.gilvifrons* exposed to chemicals contaminated eggs on leaf discs could arise a non toxic influence of a change in the nature of the surface on which predator fed. It is interesting to know that the deposited eggs were not in a relation with the eaten ones.

The existence of relationship between feeding and oviposition and mite activity and connection between the levels of these elements and the nature of the surface on which mites were placed suggest that disturbances in all these patterns of behavior could be triggered by the effects of sensory detection of the chemical on the surface. Mite activity can be influenced by the nature of the substrate of the surface (Blommers *et al.* 1977 and Everson, 1979 and 1980). The activity pattern of *S.glivifrons* which was not measured in the present study may be responsible for the non correlated relation between feeding and oviposition in the predatory. The presence of chemicals in low levels, on the leaf surface may be irritant enough to make the adult females predator in contact with the contaminated prey eggs accordingly the consumed eggs seemed to be almost at the same level of untreated control. The suffering adult females are expected to stop oviposition in spite of the stored food (prey eggs eaten) that was enough for oviposition process in a normal number of eggs. The relationship between the number of eggs eaten and laid by *A.fallacis* was found by Barritt (1984) linear, and when she calculated an expected value for egg production using Giboney's regression equation (1981) she found a good agreement between observed and expected oviposition when feeding was affected by bupirimate. Sabelis (1981) suggested that adult female predator lay a constant number of eggs and that if the rate of oviposition was rapid, the

oviposition period would be short, conversely if eggs were laid slowly the predator will, continue to oviposit for a longer time until it deposits full complement. Hosny and Keratum (1995) found decreased feeding and oviposition in *A.fallacis* when deltamethrin was used on prey *T.urticae*. Abou- Awad and El-Benhawy (1985) found an increased mortality of *A.gossipi* as a daily consumption of prey *T.urticae* treated with the pyrethroid cypermethrin or cyfluthrin.

Osman *et al.* (1979) studied some biological aspects of predatory mite *A.gossipi* (El-Badry) affected by different acaricides Curacron and dicofol with two concentrations (LC_{50} and LC_{25}). The egg laying capacity and percentage hatch had decreased but larval and nymphal duration increased. Kim and Paik (1996a) found that fenpyroximate did not affect the hatchability of *A.womersleyi* eggs or the developmental time of immature predators. Survival of immature predators significantly decreased with increasing fenpyroximate concentration. On the other hand, the hydrocarbon oil used in the present study was of moderate effect concerning the egg consumption and egg production and predator egg hatchability. The obtained results are in agreement with these recorded by many investigators, and they showed high effect of biological nature of chemical on predatory mite. Abou- Awad and El- Banhawy (1985) found that residues of the synthetic pyrethroids (cypermethrin, flucythrinate, fenvalerate and cyfluthrin) even at a nontoxic level to predaceous mite *A.gossipi* interrupted oviposition of prey *T.urticae* treated with cypermethrin caused an increased mortality at high prey density.

Keratum (1989) reported that chemically treated surface with deltamethrin, *A.fallacis* showed decreased feeding and oviposition compared with control. Also, Ford *et al.* (1989) found that there was a reduction in the decrease in the predator's oviposition. Zhang and Sanderson (1990) found that abamectin did not affect the hatch of eggs of *Phytoseiulus persimilis* at 1-16 ppm using leaf disc-dip technique. Keratum and Hosny (1994) found that, the effect of sub- lethal concentration of cypermethrin (EC) on the feeding and oviposition of the predatory mite *P.persimilis* using a modified leaf disc technique caused significant reduction in feeding and oviposition. Also they found that very low concentration of cypermethrin and deltamethrin caused marked reduction in feeding with a further more gradual decline with higher concentration. There was a highly significant linear relationship between feeding and egg laying. It is concluded that female predators were dipped in a 0.6 – 0.12 ppm solution, their reproduction was not affected, but at 6 ppm it decreased by 35%. Also Kim and Paik (1996a) found that reproduction was not

significantly reduced of adult females as at 6.25 – 50 ppm fenpyroximate did not affect the hatchability of *A.womerselyi* eggs. Hosny *et al.* (2003) found that cypermethrin was one of the most effective compounds on prey consumption by the predator *A.gossipi*, while Biofly was one of the safest compounds that allowed the predator to consume the contaminated prey eggs. Also Hosny *et al.* (2003) indicated that abamectin was one of the safer compounds that allow the predator *A.gossipi* to consume contaminated eggs and slightly affected predator egg production. Ismail *et al.* (2006) indicated that the pyrethroid compound cypermethrin and the acaricide abamectin are the most effective that decreased prey egg consumption, decreased predator egg production and caused high decrease in egg hatchability of the predator *A.gossipi*. Ismail (2007) indicated that abamectin and cypermethrin were the most effective chemicals that caused a decrease in prey egg consumption of the predator *Stethorus gilvifrons* comparable to the control treatment, while etoxazole had the least effect. Cypermethrin was the most effective chemical which caused a decrease in egg deposited by the predator, while etoxazole and worm wood extract were the safest compounds that allowed the predator's egg to hatch producing the next stages necessary as biological agent that minimize prey populations.

The success of any integrated pest management depends on the judicious use of chemicals applied to control key pests and diseases. The importance of avoiding adverse effects on predatory species was reflected by the fact that chemicals which might be used on certain crops must be subjected to routine screening to assess their toxicity to beneficial arthropods to select the safer compounds. The rate of development of resistance to insecticides in the predaceous mites would be another important evaluation, which must be taken in consideration IPM programmers.

The world safe must be understood relative to the subject under discussion. The safe compound (chemical or biological) means, according to authers look for the present study has the following features:

1- Moderate toxicity to the prey egg stage.
2- Selective toxicity that keep the predator alive necessary for biological control.
3- Keep the predator appetite normal enough to consume prey eggs (the preferable stage for adult predator mite).
4- Allow the predator to translate the egg consumption to egg production to keep the predator populations in numbers enough to play their role in integrated pest management program.
5- Keep the predator egg viability at its maximum rate.

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الملخص العربي

المعالجة المتكاملة للاكاروس.

٢-تقدير التأثيرات الجانبية بالتركيزات تحت المميته لبعض المركبات على العنكبوت الاحمر (تترانيكس أورتيكا) والاكاروسات المفترسه (امبليسيس فالاسيس، فيتوسيلس بيرسيميلس).

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التاثيرات الجانبية للجرعات تحت المميته لستة مركبات من مجاميع مختلفه ، ثلاثة مركبات اكاروسية (ابامكتن، اثيون، كلورفينابير) ومركب بيروثرويدى (سيهالوثرين) وزيت معدنى واحد (نات واحد) والمستخلص النباتى زيت حبة البركة على بعض الصفات البيولوجيه للاكاروس النباتى(تترانيكس أورتيكا) على انتاجية البيض والخصوبه والاكاروسات المفترسه (امبليسيس فالاسيس، فيتوسيلس بيرسيميلس) على سلوكيات التغذيه وانتاجية البيض والخصوبه.

ولقد اوضحت النتائج ان السيهالوثرين كان المركب الاكثر تاثيرا على وضع البيض للاكاروس النباتى والذى يجعله نافعا فى برامج المعالجه المتكامله بينما المستخلص النباتى كان له التاثير الاخير فى عملية وضع البيض وذلك يتيح الفرصه لانتاج عدد وجيز من البيض اللازم لتغذية المفترسات.

مركب اثيون ، ابامكتين يمكن اخذها فى الاعتبار عند نقطة المكافحة الحيوية نظرا لخفضها معدل وضع البيض لمستوى مناسب يكون له اهمية فى برامج المعالجة المتكامله. كلورفينابير، والنات واحد كانا افضل المركبات والتى لها تاثير متوسط على عملية وضع البيض للاكاروس النباتى والذى يجعل له اهمية خاصة فى برامج المعالجة المتكامله.

وكان الزيت المعدنى والمستخلص النباتى اقل المركبات فى فعاليتها كمبيدات بيض. بينما اثيون، وابامكتين كانا لهما نفس التاثير كمبيدات بيض على الاكاروس النباتى بينما السيهالوثرين كان اعلى المركبات سمية والتى تسبب انخفاض عالى فى عملية فقس البيض.

السيهالوثرين، الابامكتين كانا اكثر المركبات تاثيرا على معدل استهلاك بيض الفريسه بواسطة المفترس وكذلك وضع البيض للمفترسات. بينما اثيون فى الوضع التالى فى التاثير على معدل استهلاك بيض الفريسه ووضع البيض للمفترس.

اظهرت كل المركبات المختبره تاثيرات منخفضة على عملية فقس البيض للمفترسات وكان السيهالوثرين، والابامكتين ذات تاثير سام عالى على بيض المفترس والذى سبب انخفاض عالى فى معدل فقس البيض بالمقارنه بالكنترول.