



DETERMINATION AND REMOVAL OF LAMBADA-CYHALOTHRIN RESIDUES AFTER TOMATO FIELD SPRAYING FOR *BEMISIA TABACI* (GENN) CONTROL

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ABSTRACT

Effect of recommended dosage of Lambda -cyhalothrin against different stages of whitefly, *Bemisia tabaci* (Genn), on late summer tomato crop was evaluated. The results showed that Lambda -cyhalothrin reduced the whitefly infestation percentages by 823,83.1 and 83.8 in season 2006 and 83.7,82.0 and 82.8 in season 2007 for adult, immature and egg stages, respectively 7 days after treatment. Lambda -cyhalothrin residues in tomato fruit reached 0.002 rag/kg. This amount of residues was found below the tolerance level (0.005 mg/kg) and no hazardous effects are expected when tomato fruit are consumed. It was found that the tested washing solutions such as potassium permanganate (0.02%), detergent 2%, sodium chloride 2% and acetic acid 2% removed Lambda -cyhalothrin residues on and in tomato fruit to reach below tolerance level. The concentrations and removal percentage of Lambda -cyhalothrin residue were found to be 0.03 mg/kg and 98.6% for potassium permanganate solution 0.017 mg/kg and 99.2% for detergent solution 0.011 mg/kg and 99.5% for sodium chloride solution and 0.019 mg/kg and 99.1% for acetic acid solution (2%).

Key words: Lambda-cyhalothrin residues; Tomato; *B. tabaci*; Food safety.

INTRODUCTION

Egyptian food stuffs, tomato (*Lycopersicon esculentum* L.) is one of the most important vegetable crops. The tomato belongs to the Solanaceae family and is an important vegetable crop worldwide Maia *et. al* (2009). Tomato is a rapidly growing crop with a growing period of 90-150 days. It is a day length neutral plant. Hence, this crop is gaining importance both in developing and developed countries and efforts are being made for the quality and quantity production of this commodity (Mahajan & Singh, 2006). It is infested in the field by several diseases and insects. The importance of whitefly, *B. tabaci* as economic pest seems to expand continually. These homopteran insects damage crops by extracting large quantities of phloem sap, which may cause more than 50 % yield reduction Maia *et. al* (2009).

However, the whitefly insect is one of the major pests attacking vegetable crops, especially tomato during summer season (July-September). Besides the direct damage by sucking of plant sap and honey excretion interfere with the photosynthetic process reducing crop development and decreasing yield, adults also, transmit viral diseases (Hyder *et. al*, 1995) such as tomato yellow leaf curl virus (TYLCV)-

Lambda -cyhalothrin is a third generation of pyrethroid, with contact, residual and stomach-poisoning action coupled with repellent property Ripley *et. al*, (2001). For several years now, it has been used to control a wide range of arthropod pests on field and plantation crops.

Lambda -cyhalothrin is stable to light and stable, also in storage for more than 6 months at 15-

25°C. It acts on the nervous system of insects and disturbs the function of neurons by interaction with the sodium channel

It is non-systemic insecticide with contact and stomach action and repellent properties. It gives knockdown and long residual activity. It is used to control a wide spectrum of insect pests; e.g., aphids, Colorado beetles, trips, lepidoptera and coleoptera larvae and adults on cereals, hops, ornamentals, potatoes, vegetables, cotton and other crops. It provides good control of insect-borne plant viruses at 2-5 kg/ha. Also, it is used for control of insect pests in public health Maia *et. al* (2009). Application of pesticides, such as Lambda -cyhalothrin on tomato foliage is attempted to protect plants from the damage by pests and to increase the yield reduction. So, Lambda -cyhalothrin is being used for controlling whitefly, *B. tabaci* (Genn) which occurs in most countries cultivating tomato. Therefore, the present study was carried out to find out the action of spraying Lambda -cyhalothrin in tomato field on infestation by *B. tabaci* stages and to determine the pesticide residues on and in tomato fruit and the possibility of removing these residues.

MATERIALS AND METHODS

1. Insecticide:

One insecticide was assayed against the different stages of whitefly, *B. tabaci* (Genn). This compound is Lambda -cyhalothrin (lambda 5% EC) [la-(S'')], 3a

(Z)-(+)-cyano-(3-phenoxyphenyl)-2,2-dimethylcyclopropane carboxylate 5% EC was produced by Chema Industries Company, Egypt Recommended rate is 50 cm/100 liters of water.

2. Evaluation of insecticide efficiency on tomato plants:

Tomato *L. esculentum* L (Castle-Rock variety) was cultivated at Zarzoura Station in Etay El-Baroud (Beheira governorate) June 2006 and June 2007 seasons. The experimental area was divided according to a complete randomized block design including four replicates for each treatment and the whole land area was 10 kehrate. A knapsack sprayer was used in applying the insecticide five times. A sample of 300 leaves representing different levels of the plant (25 plants x 3 leaves x 4 replicates) was taken at random. The plants were examined in the early morning before spraying and after spraying to count the living adults of whitefly at 1 day, 3 days, 5 days and 7 days after spraying. The leaves were taken to laboratory to calculate the surviving number of immature stages, *i.e.*, eggs and larvae by the aid of a binocular. Reduction percentages in infestation with immature and adult stages of whitefly for each treatment were calculated according to Hinderson and Tilton formula (1955) as follows:

$$\% \text{ Reduction} = 100 \times \frac{j \cdot \text{No of A} \cdot \text{No of C}}{\text{No of B} \cdot \text{No of D}} \times \frac{\text{No. of B}}{\text{No. of A}}$$

A= No. of insect in control before spray

B= No. of insect in treatment after spray

C= No. of insect in control after spray

D= No. of insect in treatment before

3. Determination of Lambda-cyhalothrin (lambda 5% EC) residues in or on tomato fruit:

Fruit samples of tomato were taken at zero time (after 2 hours) of treatment

3.1. Extraction of samples:

The method of Laabs *et al* (1999) and Bennett *et al.* (2000) was followed with slight modification to extract the residues of Lambda -cyhalothrin on and in tomato fruit. In general, the samples were extracted as follows. A 50 g of tomato fruit was homogenized with 100 ml of acetone or extract by a solvent mixture of acetone & ethyl acetate (1:1, v/v) and analyzed following the method of Laabs *et al.* (1999) and Bennett *et al.* (2000), using high speed warring blender for 3 minutes, then filtered with suction using a Buchner funnel and Whatman No. 1 filter paper. The extract flask was rinsed with 20 ml acetone which was added to the funnel after most of the initial filtrate had been collected. The filtrate was completely transferred to a separator funnel with acetone, then 50 ml petroleum ether was added and the mixture was diluted with saturated sodium chloride (10 ml) and sodium sulfate (2%, 10 ml). The mixture was extracted four times with petroleum ether (25 ml) which was then combined and transferred to a storage bottle. The petroleum ether extract was added

with anhydrous sodium sulfate to remove H₂O which was then stored in freezer until analysis.

3.2. Clean up:

The petroleum ether extract was concentrated with a rotary evaporator at 40°C. The extract was finally made up to 2 ml and added to the liquid-solid chromatography column. The column was eluted with ten fractions (10 ml each) of a mixture of petroleum ether-ethyl acetate (20:80, v/v); discarding the first three fractions and the last two fractions and collecting fractions were combined. The resulting elute was concentrated to 1 ml with a rotary evaporator. The diluting solvent was used as a blank. The injected volume was 1 µl (Jibao *et al.*, 2002).

3.3. Method of analysis:

Residues were determined by GLC (gas chromatography-electron capture detection) with BCD and internal standard quantization was used to determine the level of active ingredient (Bennett *et al.*, 2000). Also, Lambda -cyhalothrin analysis was analyzed by GLC using a Tracer 540 gas chromatograph equipped with a Dynatech Precision GC-411V autosampler and a 15 m X 0.53 mm i.d. J & WDB-1 (1 m film thickness) Megabore® column.

4. Removal of Lambda-cyhalothrin (lambda 5% EC) residues on or in tomato fruit:

Tomato fruit were collected from field and then treated with insecticide at the recommended rate. The treatment was done by dipping into aqueous solution of Lambda -cyhalothrin for 2 seconds. The treated fruit were dried on clean paper for 2 hours. Lambda -cyhalothrin was determined to obtain the initial concentration without any washing solution. The treated fruit were dipped into different washing solutions; *i.e.*, 2 % acetic acid, 0.02% detergent (tween), 2 % sodium chloride and 0.02 % potassium permanganate for 2 minutes, then drained on a clean paper. When free water had drained away, the samples were analyzed. The percentage removal of Lambda -cyhalothrin residues on and in tomato fruit was calculated as follows:

$$\% \text{ Removal} = \frac{\text{Cone. In control} - \text{Cone. In sample}}{\text{Cone. In control}} \times 100$$

5. Statistical analysis

Statistical analysis was provided by excel software. A percentage of reduction was calculated according to Hinderson and Tilton formula (1955).

RESULTS AND DISCUSSION

1. Insecticidal activity of Lambda -cyhalothrin (lambda 5% EC) against whitefly on tomato Plants:

1.1 Efficiency on the adult stage of whitefly on tomato plants. Data in table (1) indicate the satisfactory initial and latent effects of Lambda -cyhalothrin 5 % EC in reducing the population density of *B. tabaci* adults in both seasons 2006 and 2007. The results in table (1) indicate that 83.1 % reduction in adult numbers than

control for initial mortality and 82.3% for the mean of 7 days activity during season 2006. However, these values were 85.3 and 83.7%, respectively in the second season of 2007 table (1). The mean infestation percentages by virus symptoms were 16 and 17% in seasons 2006 and 2007, respectively among treated plants, apposed to 84 and 82% among the control plants table (1). The statistical analysis indicated no significant differences between two seasons due to the effect of Lambda -cyhalothrin on the adult stage of whitefly on the infestation by virus. Lambda-cyhalothrin 2.5% EC applied is a good controlling efficacy Maketon, *et. al.* (2008).

1.2. Efficiency on the immature stages of whitefly on tomato plants.

Table (2) shows that cyhalothrin treatment on tomato plants in season 2006 caused 84.9 and 83.1% reductions in *B. tabaci* immature stages than control after one and 7 days of treatment. The correspondent values in season 2007 were 83.5% and 81 %, respectively, table (2). Also, the data showed that the effect of Lambda -cyhalothrin on infestation by virus symptoms which were found to be 17 %. El-Khawalka *et al.* (1997) studied the efficiency of five sprays of the juvenile hormone mimic and admiral (pyriproxyfen 10 % EC) applied at recommended rate, half and quarter rate on the different developed stages of whitefly infesting tomato plants. Their results indicated that admiral at its recommended dose could be used in the control of whitefly decreased virus symptoms. So, the admiral control whitefly, *B. tabaci* with high efficient in tomato plants lambda-cyhalothrin.

1.3 Efficiency on the eggs stage of whitefly on tomato plants:

The results in table (3) show the effect of Lambda -cyhalothrin on the egg stage of whitefly, *B. tabaci* in seasons 2006 and 2007. When it was applied at the recommended dose, the initial mortality was 84.6% after 24 hours of treatment and the mean residual activity was 83.8% in the first season. In the second season, these values were 84.6% and 82.8%, respectively. The statistical analysis indicated that the differences between the effects of Lambda -cyhalothrin on the egg stage of whitefly, *B. tabaci* in two seasons were not significant. It was also shown that the effect of Lambda -cyhalothrin on infestation by virus symptoms was 15 % and 14 % for seasons 2006 and 2007, respectively.

1.4 Efficiency on different stages of whitefly on tomato plants:

Data in table (4) show the general effect of insecticide Lambda -cyhalothrin on the three tested stages of whitefly, *B. tabaci*; i.e., adult, immature stages and eggs in seasons 2006 and 2007, when applied at the recommended dose was found to be 83.1% and 82.8% in seasons 2006 and 2007, respectively. It was also shown that the mean effect of Lambda -cyhalothrin on infestation by virus symptoms in both seasons was calculated to be 16% in both seasons when the recommended dose was applied. The present results indicated that Lambda -cyhalothrin gave high efficiency in both seasons 2006 and 2007 for controlling the whitefly, *B. tabaci* which causes infestation by virus symptoms and reducing the crop yield.

These data are in agreement with those obtained by El-Maghraby *et. al.* (1997), who reported that using Evisect, a natural product from marine annelid

Table (1): The efficiency of lambda -cyhalothrin (lambda 5% EC) on the adult stage of whitefly, *B. tabaci* adults on tomato plants in season 2006 and 2007.

Season 2006														
Insecticide	Number before treatment	Insect counts and reduction percentage after different periods of treatment.										% of Virus infested* plants after		
		Initial (one day)		3 days		5 days		7 days		Mean				
		A	B	A	B	A	B	A	B	A	B	30 days	60days	Mean
Lambda - cyhalothrin	11910	2170	83.1	2380	81.6	2400	82.5	2480	82.9	2420	82.3	10	22	16
Control	12740	13680	-	13870	-	14658	-	15215	-	14881	-	78	90	84
Season 2007														
Lambda - cyhalothrin	12340	1850	85.3	1985	84.6	2176	83.4	2248	83.2	2139.7	83.7	14	20	17
Control	12650	12860	-	13230	-	13470	-	13782	-	13494	-	76	88	82

A = No. of insects.

B = % reduction.

% virus/100 tomato plants..

Table (2): The efficiency of lambada -cyhalothrin (lambada 5% EC) on the immature stage of whitefly, *B. tabaci* adults on tomato plants in season 2006 and 2007.

Season 2006														
Insecticide	Number before treatment	Insect counts and reduction percentage after different periods of										% of Virus infested* plants after		
		Initial (one		3 days		5 days		7 days		Mean				
		A	B	A	B	A	B	A	B	A	B	30 days	60 days	Mean
Lambada	9870	1540	84.	1780	83	1820	83X1	1890	83.1	1830	83.1	9	25	17
Control	11930	12350	-	12870	-	12920	-	13580	-	0133	-	73	89	82
Season 2007														
Lambada	8760	1502	83	1584	83	1733	82	1873	81	1730	82	14	22	18
Control	10840	11235	-	11545	-	11876	-	12194	-	1187L7	-	74	89	80

A = No. of insects. B = % reduction. % virus/100 tomato plants..

Table (3): The efficiency of lambada –cyhalothrin (lambada 5% EC) on the eggs stage of whitefly, *B. tabaci* on tomato plants in season 2006 and 2007.

Season 2006														
Insecticide	Number before treatment	Insect counts and reduction percentage after different periods of										% of Virus infested* plants after		
		Initial (one		3 days		5 days		7 days		Mean				
		A	B	A	B	A	B	A	B	A	B	30	60	Mean
Lambada - cyhalothrin	8890	1405	84	1520	83.%	1565	83	1890	83.7	1570	83.8	7	23	15
Control	10950	11230	-	11680	-	11860	-	12280	-	11930	-	76	88	82
Season 2007														
Lambada - cyhalothrin	9760	1512	84.6	1650	83.4	1715	83.1	1860	82.0	1741.7	82	8	20	14
Control	12470	12535	-	12784	-	12956	-	13236	-	12980	-	79	89	84

A = No. of insects. B = % reduction. % virus/100 tomato plants..

Table (4): Effect of recommended dose of lambada -cyhalothrin (lambada 5% EC) against different stages of whitefly, *B. tabaci* on tomato plants in season 2006 and 2007.

Season 2006														
Insecticide	Insect counts and mean of residual reduction percentage at different intervals of treatment										Mean of the	% of Virus infested* plants		
	Adult stage			Immature stage			Eggs stage							
	A	A	B	A	A	B	A	A	B	B				
	Pre-treatment	Post-treatm	%	Pre-treatme	Post-treatme	%	Pre-treatm	Post-treatme	%	%		30 day	60 da	Mean
lambada - cyhalothr	11910	2420	82	9870	1830	83.1	8890	1570	835	83J	8.6	23	3	16
Control		14581	-	11930	13133	-	10950	11930	-	-	73.7	89		-
Season 2007														
lambada - cyhalothrin	12340	2139.7	83.7	8760	1730	82	9740	1741.7	82£	82S	11.3	23	3	16
Control	12650	13494	-	10840	11871.7	-	12470	12980	-	-	763	87.7		82

A = No. of insects. B = % reduction. % virus/100 tomato plants..

controlled different stages of whitefly, *B. tabaci* on tomato plants and it reduced plant virus symptoms. Omar *et al.* (1994), who found that imidacloprid, gave reduction more than 97% for a period of 3 weeks against different stages of whitefly, *B. tabaci*. Also, Kandil *et al.* (1991) found that carbosulfan was the most effective compound against the immature and mature stages of whitefly in the field evaluation. It caused 85.7% reduction of both immature and adult stages of whitefly. Sammour *et al.* (1993) claimed that carbosulfan revealed high efficient) in suppressing the density of nymph during the experimental periods in the field. These data agreed with those obtained by Abdalla *et al.* (1991), who demonstrated that profenfos was the most efficient insecticide in reducing whitefly population on cucumber plants followed closely by carbosulfan and then prothiophos. The present data are in agreement with those obtained by Badawy *et al.* (1999), who found that carbosulfan at one day after spraying at the recommended rate of application induced high reduction in infestation of immature and adult stages of whitefly. It gave more than 91% reduction in infestation of immature and adult stages of whitefly. It gave a highly initial kill and long residual effect against the immature and adult stages of whitefly.

2. Determination of Lambda -cyhalothrin (lambda 5% EC) residues on and in tomato fruit.

Data in table (5) show the amounts of Lambda -cyhalothrin residues in tomato fruit after 7 days of last treatment with insecticide. The residues amount was found to be 0.002 mg/kg. The results indicated that the amount of residues from Lambda -cyhalothrin was below the tolerance level (ADI = 0.005 mg/kg). So, it is expected that there is no hazardous effects when tomato fruit are consumed. Residues of Lambda -cyhalothrin in tea dissipated exponentially after application reached below the European Union maximum residue limit (MRL) of 1 mg/kg on the 5th day, the Half-life values varied from 2.8 to 3.5 days and a safety harvest interval of 5 days is suggested for tea at the recommended dosage (Seenivasa and Manikandan (2009); Rosa. (2008).

Table (5): Determination of Lambda -cyhalothrin residues on and in tomato fruit after 7 days from last treatment.

Insecticide residues (mg/kg)			Average insecticide residues (mg/kg)
RI	R ₂	R ₃	
0.011	0.013	0.002	0.0086

Data represent the average of three replicates, ADI = 0.005 mg/kg.

3. Recovery of Lambda -cyhalothrin (lambda 5% EC):

Table (6) represents the recovery percents at two levels of concentration (0.01 and 0.05 mg/kg) for cyhalothrin. The data in this table show that the average percentage of Lambda -cyhalothrin from tomato fruit at the fortification level of 0.01 mg/kg and 0.05 mg/kg was 81 % and 82 %, respectively. These results indicate that the mean average of percentage recoveries was calculated to be 84 %. However, the extraction with acetone, ethyl acetate and

cyclohexane is a common procedure in the analysis of Lambda -cyhalothrin residues as mentioned by several investigators Ripley *et al.* (2001); Maia *et al.* (2009). The results of the present study agree with those obtained by Abdel-Aal *et al.* (1989), who showed that determination of deltamethrin residues in tomato has been carried out after extraction with chloroform and cleaning-up the plant extract on silica gel column and the efficiency of the method was evaluated as 95.22, 97.80 and 96.0 % recovery from fortified samples of tomato fruit, tomato leaves and carrot leaves, respectively. The present results agree also with those obtained by Ishii *et al.* (1994), who found that during the storage of the plant samples 2 years under frozen condition (-20°C) no degradation of imidacloprid (recovery 95-105) was observed.

3. Removal of Lambda -cyhalothrin (lambda 5% EC) residues on and in tomato fruit by different washing solutions:

Data in table (7) show the effect of different washing solutions on the removal of Lambda -cyhalothrin residues on or in tomato fruit after dipping into insecticide solution for 2 seconds, and then dried for 2 hours. The amount of Lambda -cyhalothrin residues as initial deposit (2 hours after dipping treatment) was found to be 2.15 mg/kg. Washing tomato fruit with 2 % sodium chloride solution decreased the concentration of residues from 2.15 mg/kg to 0.011 mg/kg and the removal of these residues was 99.5 %. When treating tomato fruit with potassium permanganate (0.02 %), the residues of insecticide and removal were 0.03 mg/kg and 98.6 %, respectively. Washing tomato fruit with 2 % detergent solution decreased the concentration of Lambda -cyhalothrin residues to 0.017 mg/kg and the removal of insecticide residues was 99.2 %. Washing tomato fruit with 2 % acetic acid solution resulted in decreasing the concentration of Lambda -cyhalothrin residues to 0.019 mg/kg, the removal of residues was 99.1 %. These results agreed with those obtained by Youssef *et al.* (1995), who studied the removal of pirimiphos-methyl and chlorpyrifos-methyl residues from treated tomato and broad beans by commercial and home preparative procedures.

Table (6): Percent recovery of Lambda -cyhalothrin from tomato fruit at fortification levels of 0.05 and 0.01 mg/kg.

Insecticide	% Recovery/replicate			% Average recovery
	RI	R ₂	R ₃	
Lambda -cyhalothrin	At 0.01 mg/kg level			81
	825	79.6	79	
	At 0.05 mg/kg level			82
	83	845	80.4	

The mean average for the whole recoveries was 81.5%.

They dipped tomato fruit in recommended and two recommended dose of each tested insecticide for 5 minutes under laboratory conditions.

Table (7): Removal of Lambada -cyhalothrin (Lambada 5% EC) residues from and on tomato fruit by different washing solutions.

Treatment with washing solutions	Concentration of Lambada -cyhalothrin residues (mg/kg)	% Removal of residues
Unwashed tomato fruit	2.150	-
2 % Detergent	0.017	99.2
0.02 % potassium permanganate	0.030	98.6
2 % Acetic acid	0.019	99.1
2 % Sodium chloride	0.011	99.5

Data are average of three replicates.

The residues were reduced following washing treatment and other steps of commercial processing and the results showed that the percentage of removal of such insecticides from tomato fruit by washing is affected by the washing time, the temperature of washing solution and the initial concentration of insecticides. Also, they showed that the tomatoes treated with the recommended dose of pirimifos-methyl removed more than 99% from its residues. However no detectable residues (100 % removal) were shown after treatment with chlorpyrifos-methyl. Badawy *et al.* (1999) determined the residues of carbosulfan in cucumber fruit and showed that the first day after application was critical in the disappearance of the most tested insecticide residues and the residue half-life values of carbosulfan and its metabolite on cucumber fruit were 0.5 day. Results further indicated that acetic acid; potassium permanganate, sodium chloride and sodium hydroxide solution gave greater removal of pirimifos-methyl residues from sweet pepper and eggplant fruit, while 70.16- 76.61% removal was shown in hot pepper fruit after washing with soap and acetic acid solution, respectively Radwan (2004). Also, cucumber treated with carbosulfan could be marketed after 3 days of application. These results indicated that the removal of Lambada -cyhalothrin residues from tomato fruit by the effect of tested washing solutions ranged from 98.6 % to 99.5 % and the insecticide residues remained after washing were below the MRL (0.5 ppm). Abbassy *et al.* (1992), who suggested three washing solutions; i.e., tap water, soap solution and acetic acid solution for the removal of Actellic residues from treated cucumber fruit.

The present results are comparable with those obtained by Al-Azawi *et al.* (1991), who studied the dissipation of fenitrothion residues on cucumber in protected house. Tantawy *et al.* (1975) showed that washing tomato with tap water resulted in removal of 75 to 87 % for malathion, 61 to 77 % for diclorofos, 45 to 55 % for gardona and 33 to 55 % for azodrin. Also, Tantawy *et al.* (1979) reported an intentional removal of leptophos residues from vegetable crops. The results agree, also, with those obtained by Mesallam and Moharram (1980), who reported that washing tomato with hot water for 5 minutes and steam blanching for one minute reduced the retention of

methomyl residues when compared with cold water washing and hot water blanching. The present results agree, also, with those obtained by Antonious and Abdel-Aal (1988), who reported decontamination of squash and tomato fruit from residues of pirimiphos-methyl at different time intervals using various chemical solutions. It was shown that dipping the fruit collected at 3 days after spraying in sodium chloride 1% or soap detergent (aqueous Rabso 1%) for 10 minutes caused 25.18 and 40.5% reduction of residues, respectively. Also, Fahey *et al.* (1971) investigated the removal of Azodrin residues from tomato fruit A cold wash removed 36 to 72% of residues, while a hot tyepel removed up to 93.47% of it. Data agree, also, with those obtained by Smith *et al.* (1955), which showed that washing for 3 seconds with reduced all malathion residues on tomato below 1 ppm.

REFERENCES

- Abbassy, M. A., Abdel-Baki, M. A. and El-Hamady, Sh. E. (1992). Actellic residues on and in cucumber fruit grown under plastic tunnels, their side effects and how to minimize these residues. *J. Agric. Sci., Mansoura Univ.*, 17 (12): 3919-3924.
- Abdalla, S. A., Sammour, E. A. and Abdalla, E. F. (1991). Effect of certain pesticides on cotton whitefly, *Bemisia tabaci* (Genn.), infesting cucumber. *Bull. Ent. Soc. Egypt. Econ. Set*, 19: 95-100.
- Abdel-Aal, A., Antonious, G. F. and Youssef, M. (1989). Determination of deltamethrin residues on tomato and carrot and its impact on some of the chemical constituents of treated plants. *Alex. Sci. Exch.*, 10(3): 487-503.
- Al-Azawi, K.A.; Al-Adil, K. M. and Al-Samariee, A. I. (1991). Dissipation of fenitrothion (sumithion) residues on cucumber in protected house. *Arab J. Plant Protec.*, 9 (2): 80-83.
- Antonious, G. F. and Abdel-Aal, A. (1988). Residues of decay of pirimiphos-methyl on squash and tomato plants and how to decontaminate the fruit from 2nd Hort. Sci. Conf., Tanta : toxic residues. *Proc. 2 Univ.*, M 531-546.
- Badawy, H. M. A., Abdallah, A., Barakat, A. A. and Soliman, M.M. (1999). Efficiency of certain insecticides against the whitefly *B. tabaci* (Genn.) on cucumber plants growing in greenhouses with special resistance to residue analysis in fruit. 2nd Int. Conf. of Pest Control, Mansoura, Egypt.
- Bennett, E. R., Moore, M.T., Cooper, C. M. and Smith, Jr. S. (2000). Method for the simultaneous extraction and analysis of two current use pesticides, alrazine and Lambada -cyhalothrin in sediment and aquatic plants. *Bull. Environ. Contain. Toxicol.*, 64: 825-833.
- El-Khawalka, M.H., Omar, H.I.K., El-Bessomy, M.A.M. and El-Maghraby, H.M. (1997). Effect of the insect growth regulator admiral on the different stages of the whitefly

- infesting tomato plants. Egypt.,). Agric. Res., 75 (2).
- El-Maghraby, H. M.; Omar, H.I., El-Bessomy, I.M.A.M. and El-Khawalka, IM.H.IV1. (1997). Effect of the natural insecticide Evisect on the population density of the whitefly *Bemisia* (abaci (Genn.) on tomato plants. J. Agric. Sci. Mansoura Univ., 22 (1): 229-232.
- Fahey, .I. E., Nelson, P. E. and Could, C. E. (1971). Removal of Aldrin residues from tomato by commercial preparative methods. J. Agric. Food Chem., 19:81-82.
- Henderson, C.F. and Tilton, E.W. (1955). Tests with acancides against the brown wheat mite. J. Econ. Entomol., 98: 157-161.
- Hyder, M. F., Abdel-Wahab, H., Ahmed, M. A. and El-Deeb, S.E. (1995). Effect of tomato planting date during Nili plant on *Remisia* (abaci (Genn.) population and its relation to TYLCV as a limiting factor of crop production. 1st Int. Conf. Pest. Control, Mansoura, Egypt.
- Ishii, Y.; K. Itsuro, Yasuo, A., Skin, K., Koji, I. and Shinzo, K. (1994). HPLC determination of the new insecticide imidacloprid and its behaviour in rk-e and cucumber. ,J. Agric. Food Chem., 42: 291 ~2921.
- Jibao, C.; L., Zhu, B. X. and Su. y. (2002). Determination of pyrethroid residues in tobacco and cigarette smoke by capillary gas chromatographv. Journal of Cliromatography A, 964:205-211.
- Kandil, M.A., El-Kabbaii, S. M., Sewit'y. (. H and Abdallah, M.D. (1991). Efficiency of some insecticides against the cotton whitefly. *Bemisia tabaci* (Genn.), with special regard to their side effect on predators. Bull. Ent. Soc.. Egypt, Econ. Set., 19:9-17.
- Eaabs, V.. Amelung, V\ and /ech. W. (1999). Multi-residues analysis. The study was part of the Shift Program (Studies on corn and soybean pesticides m Bra/jlian Oxisols using (.C and human impact ; i> forests and flood plains in the tropics; MSD I Em iron. yuaL 28: i ""78-1786
- Mahajan, (*., ami Singh, K. G, (2006). Ke>j»on>c >f greenhouse tomato to irrigation and Iertigation Agricultural Water Management, 84. 202 206.
- Maketon. M., Orosy-C oghlan, I', and Hotaga. I). (200S). Field evaluation of metschnik off (tc(arlii~,iii'n aniaopliael sorokin in controlling cotton jasMiH \ tmasca biguttula bi^uttula) in aubergine (Soluimni </c///i'tf/f.v.w>iiff/M).liit..l.Agri. Biol.A'ol.10. No,!. 4~>i
- sediment and aquatic plants.
- Bull. Environ. Contain. Toxicol., 64: 825-833.
- El-Khawalka, M.H., Omar, H.I.K., El-Bessomy, M.A.M. and El-Maghraby, H.M. (1997). Effect of the insect growth regulator admiral on the different stages of the whitefly infesting tomato plants. Egypt.,). Agric. Res., 75 (2).
- El-Maghraby, H. M.; Omar, H.I., El-Bessomy, I.M.A.M. and El-Khawalka, IM.H.IV1. (1997). Effect of the natural insecticide Evisect on the population density of the whitefly *Bemisia* (abaci (Genn.) on tomato plants. J. Agric. Sci. Mansoura Univ., 22 (1): 229-232.
- Fahey, .I. E., Nelson, P. E. and Could, C. E. (1971). Removal of Aldrin residues from tomato by commercial preparative methods. J. Agric. Food Chem., 19:81-82.
- Henderson, C.F. and Tilton, E.W. (1955). Tests with acancides against the brown wheat mite. J. Econ. Entomol., 98: 157-161.
- Hyder, M. F., Abdel-Wahab, H., Ahmed, M. A. and El-Deeb, S.E. (1995). Effect of tomato planting date during Nili plant on *Remisia* (abaci (Genn.) population and its relation to TYLCV as a limiting factor of crop production. 1st Int. Conf. Pest. Control, Mansoura, Egypt.
- Ishii, Y.; K. Itsuro, Yasuo, A., Skin, K., Koji, I. and Shinzo, K. (1994). HPLC determination of the new insecticide imidacloprid and its behaviour in rk-e and cucumber. ,J. Agric. Food Chem., 42: 291 ~2921.
- Jibao, C.; L., Zhu, B. X. and Su. y. (2002). Determination of pyrethroid residues in tobacco and cigarette smoke by capillary gas chromatographv. Journal of Cliromatography A, 964:205-211.
- Kandil, M.A., El-Kabbaii, S. M., Sewit'y. (. H and Abdallah, M.D. (1991). Efficiency of some insecticides against the cotton whitefly. *Bemisia tabaci* (Genn.), with special regard to their side effect on predators. Bull. Ent. Soc.. Egypt, Econ. Set., 19:9-17.
- Eaabs, V.. Amelung, V\ and /ech. W. (1999). Multi-residues analysis. The study was part of the Shift Program (Studies on corn and soybean pesticides m Bra/jlian Oxisols using (.C and human impact ; i> forests and flood plains in the tropics; MSD I Em iron. yuaL 28: i ""78-1786
- Mahajan, (*., ami Singh, K. G, (2006). Ke>j»on>c >f greenhouse tomato to irrigation and Iertigation Agricultural Water Management, 84. 202 206.
- Maketon. M., Orosy-C oghlan, I', and Hotaga. I). (200S). Field evaluation of metschnik off (tc(arlii~,iii'n aniaopliael sorokin in controlling cotton jasMiH \ tmasca biguttula bi^uttula) in aubergine (Soluimni </c///i'tf/f.v.w>iiff/M).liit..l.Agri. Biol.A'ol.10. No,!. 4~>i