J. Product. & Dev., 22(1): 65-81(2017)

RESIDUES OF LAMBDA-CYHALOTHRIN INSECTICIDE AND ITS BIOCHEMICAL EFFECTS ON SWEET PEPPER FRUITS

Shalaby A. Aly
Plant Protection Department, Faculty of Agriculture, Zagazig University – Egypt

ABSTRACT

Field studies on residues and dissipation of lambda-cyhalothrin in green pepper fruits were conducted during 2016. Residues were quantified at different harvest intervals of (2h), 1, 3, 6, 9, 12 and 15 day after insecticide application. Persistence, dissipation, half-life value and safe harvest interval of the insecticide in green pepper were calculated. Results revealed that, loss percentages of initial deposits were higher in sweet pepper fruits than leaves. The half-life ($t_{½}$) *values of lambda-cyhalothrin 2.68 and 3.45 in green pepper fruits and leaves, respectively.*

Data indicated that pepper fruits could be consumed safely after 6 days of treatment with lambda-cyhalothrin. The pre harvest interval (PHI) value was reduced to two hours after spraying with washing the fruits with 1% sodium carbonate or frying the fruits in boiling oil when comparing with the maximum residue limit (MRL) (0.01 mg/kg). While pickling process was, however, don't alter this value. Lambda –cyhalothrin residues significantly decreased the levels of the all tested quality parameters (total soluble sugar, glucose, acidity, total soluble solids, ascorbic acid, β-carotene, and protein) in pepper fruits throughout the experiment with the exception that the dry matter. Lambda -cyhalothrin residues were significantly reduced the levels of N %, P %, K %, iron mg/kg, manganese mg/kg, calcium % and zinc %.

Conclusively*, results clearly revealed that the PHI value (6 days) was reduced to two hours after spraying with washing the fruits with 1% sodium carbonate or frying the fruits. Lambda -cyhalothrin residues were significantly reduced the levels of some quality parameters and elements.*

Key words: lambda-cyhalothrin, sweet pepper, residues, quality parameters.

INTRODUCTION

Sweet pepper (*Capsicum annuum* L) is a member of the solanaceous fruity vegetables group. It is one of the most important, popular and favorite vegetable crops cultivated in Egypt for local consumption and exportation, it is commonly called "filfil akhdar". El-Bassiony *et al.* (2010)

Among the insect pests that attack sweet pepper are cutworm (*Agrotis spp*), Egyptian cotton leave worm (*Spodoptera littoralis*), false codling month (*Cyptophlebia laucotreta*). American bollworm (*Helicoverpa armigera*) Aphids (*Aphis gossypii*), whiteflies *(Bemisia tabaci)*, mite *(Polyphagtarsonemus latus)* and moderately susceptible to rook- knot nematode *(Meloidogyne spp.*). Aphids and whiteflies are the major insect pest attacking peppers and other vegetable crops (Degri and Yoriyo, 2010).

Plant protection products (more commonly known as pesticides) are widely used in agriculture to increase the yield, improve the quality, and extend the storage life of food crops (Fernndez-Alba and Garca-Reyes 2008). Pesticide residues in fruits and vegetables are a major concern to consumers due to their negative health effects. They have been found in both raw and processed fresh produce. However, food processing techniques have been found to significantly reduce the pesticide residues in fruits and vegetables in several studies (Chavarri *et al*., 2004; Dejonckheere *et al*., 1996; Elkins, 1989; Krol *et al*., 2000; Schattenberg *et al*., 1996).

Lambda -cyhalothrin, is a non-systemic insecticide. It acts on the nervous system of the insects, by disrupting the function of neurons by interaction with the sodium channel. Lambda -cyhalothrin **was** used **to** control of a wide spectrum of insect pests, e.g. aphids, colorado beetles, thrips, lepidopteran larvae, coleopteran larvae and adults, etc., in potatoes, vegetables, cotton, and other crops. (MacBean, 2012).

The present investigation was conducted to:

- Study the residues and dissipation of lambda-cyhalothrin in pepper plant (fruits and leaves).
- Quantify the effect of some household processing (washing, pickling and frying) for removal the residues of lambda-cyhalothrin from treated fruits.
- Effects of lambda-cyhalothrin on some chemical constituents and quality attributes on fruits.

MATERIALS AND METHODS

I- Pesticide selected

Lambda -cyhalothrin **(**Lamdathrin 5% E.C.), was acquired from Central Agricultural Pesticides Laboratory, Agricultural Research Center, Dokki – Giza, Egypt.

2- *Field Experiment and sampling*

The research was conducted at private field of pepper (*Capsicum annuum* L. ver baladey) located at Kafr Abo Agwa, Alqenaiat region, Sharkia Governorate, Egypt**.** A Field trail was conducted with three replicates, plot dimensions were 6×7 m^2. At the fruiting time the plants were sprayed with lambda -cyhalothrin (Lamdathrin 5% E.C.) at 375 cm3/feddan (18.75 g a.i.) at 10 October, 2016 one time by knapsack-sprayer with one nozzle was used to deliver 200 liters water/ feddan. Rate of pesticide application was chosen on the basis of recommended rates on other related crops. Representative samples of pepper leaves and fruits were taken randomly from the experimental plots at 2 hr and after one day then each 3 days up to 15 days post-treatment to determine the residues of lambda -cyhalothrin.

To study the effect of washing, pickling and frying for removal lambda -cyhalothrin residues from the treated fruits, the first sample (2 hours after spraying) was taken and divided into three parts, the first part was divided to 5 sub-samples and each of them was soaked in a jar filled with each of the following solutions tap water, and 1% solution of each soap, $KMnO_4$, Na_2CO_3, and CH3COOH for 2 min then the washed samples were allowed to dry. The second part was pickling in water (1liter), salt (100g) and vinegar (100ml) for each kilogram (close carefully using glass jar) according to Ryad and Mahmoud (2016), then analyzed after one week and two weeks. The third part was frying in boiling oil then get filtered the excess oil to ready for analyzed.

To estimate the effect of lambda -cyhalothrin residues on some quality parameters and some trace and nutrient elements, the last three samples (9, 12 and 15 days after application) were taken to determine some quality parameters included total soluble sugars, glucose, acidity, total soluble solid, ascorbic acid, β-carotene, protein and dry matter. Total soluble sugars and glucose were determined colorimetrically using the picric acid method as described by Dubois *et al.,* (1956). β-carotene was determined by the method of Ben-Amotza and Avron (1983). Acidity, ascorbic acid, protein and dry matter were determined according to the methods of

Association of official Analytical Chemists (AOAC) (1984). Total soluble solid (T.S.S.) were estimated using a refractometer. The elements N, P, K, Fe, Mn, Ca and Zn were also determined, nitrogen, potassium and phosphorus were determined by the method of Evenhuis *et al.*, (1980). Calcium, manganese, iron and zinc were determined by atomic adsorption spectroscopy (Jackson, 1967).

3- *Extraction, clean up and residue determination*

Hundred grams of fruits and 25 g of leaf samples were transferred into a stainless steel jar blender and homogenized with 150 ml of acetone for 3 min. The macerate was filtered through a clean cotton pad into a graduated cylinder. A known volume (100 ml) of the extract was shaken successively with 100, 50 and 50 ml of methylene chloride in a separating funnel after adding 10 ml saturated sodium chloride solution. The combined methylene chloride phase was dried by filtration through a pad of cotton and anhydrous sodium sulfate then evaporated to dryness on a rotary evaporator at 40 °C (Bowman, 1980) The dry extract was then subjected to the clean up procedure suggested by Mills *et al.* (1972) using florisil chromatograph column [40 cm×18 mm (i.d.) glass column] filled with 10 g of activated florisil (60-100 mesh) and topped with 2 g anhydrous sodium sulfate and compacted thoroughly. The column was pre washed using 50 ml petroleum ether. The sample extract was dissolved in 10 ml of the same solvent and transferred to the column then eluted with 100 ml of the eluent (15% diethyl ether in petroleum ether). The eluent was evaporated to dryness by a rotary evaporator at 40 °C and stored in the freezer until residue analysis. Residues of lambda -cyhalothrin were analyzed with high-performance liquid chromatography (HPLC) using a UV-detector set at the wavelength 266 nm. A reversed-phase VP-ODS C_{18} column (250 × 4.6 mm i.d., particle size 5 mm) was used and the mobile phase was acetonitrile/water (80/20, *v/v*) at 1.25 ml min^{-1}. These conditions resulted in good separations and high sensitivity was obtained with retention time 6.9 min (Bissacot *et al*, 1997).

4- *Recovery assay*

To estimate the efficacy of the used extraction, clean-up and a final determination procedure, recovery assay was using untreated pepper fruits and leaves. Three samples from each fruit and leaves were spiked with known concentration (1 mg/kg) of the pure lambda -cyhalothrin standard solution. Extraction, clean-up as well as procedures of final determination were performed as described earlier. The obtained recovery percentages were

92.73% for leaves and 89.29% for fruits. The results were corrected according to the average of recovery.

5- Kinetic study

The rate of degradation and half-life period of lambda –cyhalothrin were calculated according to Gomaa and Belal (1975). The relationship between the logarithm of concentration of lambda –cyhalothrin residues and time intervals were potted.

A straight line was fitted using excel trend line with intercept equal to logarithm of initial concentration and the slope of line was calculated. Accordingly, the rate of degradation (K) of lambda –cyhalothrin and the half-life period ($t_{½}$) of the insecticide in fruits and leaves were calculated as follows: rate of degradation K = 2.303 × slope, the half-life period can be obtained from the following equation: $t_{½}$=0.693/K. Statistical significance of the data was determined by using the analysis of variance with L.S.D method at the probability of 0.05 (Steel and Torrie 1980).

RESULTS AND DISCUSSION

1- Residue of lambda –cyhalothrin on sweet pepper

Residues and their dissipation of lambda –cyhalothrin in / on fruits and leaves of sweet pepper during a period of 15 days are shown in Table (1). Results revealed that the initial deposits of lambda –cyhalothrin on fruits and leaves of sweet pepper were 0.253 mg/kg and 1.896 mg/kg, respectively. A moderate degradation of the tested insecticide residues was noticed, one day after application with values of 26.87% and 21.67% dissipation, respectively. The time elapsed after application resulted in more degradation of residues. The initial deposits were gradually decreased during the experimental period to reach 0.005 mg/kg and 0.091 mg/kg after 15 days of spraying recorded 98.02% and 95.20% reduction in fruits and leaves, respectively. It could be noticed that 0.080 mg/kg of lambda –cyhalothrin was detected on sweet pepper fruits 6 days after application. This indicated that only 6 days were long enough to reduce the residues below the maximum residue limits (0.1 mg/kg) on pepper according to EU Pesticides database - European Commission. Therefore, sweet pepper fruits could be marketed with apparent safely for human consumption.

Pyrethriods residues including lambda –cyhalothrin in / on vegetable fruits are reported in earlier studies. Dixit *et al* (2001) studied the residues of lambda –cyhalothrin (35 g a.i. /ha) on brinjal fruits, and they found that residues were below detectable limit after 7 days and the $t_{½}$ value was 1.45 to 2.54 days. Mathirajan *et al*, (2002) reported that the residues of lambda –cyhalothrin persisted in tomato fruits up to 5 days at 7.5 g *a.i.* and 7 days at 15 and 30 g *a.i.* /ha. Sharma *et al* (2002) studied residues of lambda –cyhalothrin on cauliflower and reported that initial residues (0.81 to 1.59

Table 1: Residues of lambda - cyhalothrin detected in pepper fruits and leaves at different intervals.

Days after treatment	Fruits		Leaves	
	Residues (mg/kg)	Loss %	Residues (mg/kg)	Loss %
2 hrs	0.253	—	1.896	—
1d	0.185	26.87	1.485	21.67
3d	0.149	41.10	1.218	35.75
6d	0.08	68.37	0.84	55.69
9d	0.029	88.53	0.35	81.54
12d	0.013	94.86	0.185	90.24
15d	0.005	98.02	0.091	95.20
K	0.257936		0.200361	
$t_{½}$	2.68 days		3.45 days	
Liner equation	y = -0.112x - 0.540		y = -0.087x + 0.323	

K = Degradation rate, $t_{½}$= Half – life

mg/kg) dissipated quickly to reach below detectable limits within 10 to 15 day with half-life of 2.2 to 2.4 days. Jayakrishnan *et al* (2005) found that initial deposits on tomato fruits after spraying of lambda –cyhalothrin with two doses 15 and 30 g a.i. /ha were 0.526 mg/kg and 0.950 mg/kg, these amounts were dissipated during 5 days to reach 0.148 mg/kg and 0.0324 mg/kg, respectively. Shweta *et al* (2010) found that in brinjal fruits the initial cypermethrin deposits of 1.57 on first day declined to 0.956 and 0.750 mg/kg in 2 and 3 days showing 39.1 and 52.22% dissipation. Also, the similar trend in the decline of initial deposits of synthetic pyrethriods on brinjal and tomatoes has been reported (Gill *et al*, 2001). Elbashir *et al* (2013) reported that in tomato fruits the residue values detected on first day with concentrations of 27.355, 3.047 and 1.103 mg/kg for fenpropathin, λ-cyhalothrin and deltamethrin, respectively. As the time elapsed after spraying, these amounts continuously decreased to reach 0.708 mg/kg, 0.004 mg/kg and undetectable amounts after 30 days of spraying, respectively. The pesticides reached level lower than MRL after 27, 18 and 3 days for fenpropathin, λ-cyhalothrin and deltamethrin, respectively. Lofty *et al* (2013) found that λ-cyhalothrin initial deposits in zucchini (0.14 mg/kg) faster degradation to reach 0.005 mg/kg after 8 days of spraying at the rate of 20 ml /100 L water from the formulation lambda super fog 5% E.C. The same author reported that the half-life time and the pre harvest interval were 4 days and 5 days, respectively. Romeh and hendawi (2014) found that the half-life value of fenpropathin in squash fruits was 1.78 days. Fenpropathin levels in squash fruits below MRL (1.0 mg/kg) were detected 3 days after application and no residues were detected on the 10^{th} day. Kadam *et al* (2015) recorded that the initial deposits of λ-cyhalothrin in whole fruits of pomegranate were 0.120 mg/kg and 0.170 mg/kg after spraying with 12.5 and 25 g a.i. /ha, respectively. These amounts were decreased to reach 0.018 mg/kg and 0.032 mg/kg after 7 days, respectively.

2- Effect of different household processing on the removal of lambda –cyhalothrin residues from treated sweet pepper.

Lambda –cyhalothrin residues and removal percentages as affected with different washing solutions and processing treatments on sweet pepper fruits are shown in Table 2. Results revealed that the residue of lambda –cyhalothrin on raw unwashed sweet pepper fruits two hours after application was 0.253 mg/kg. The washing of treated fruits with tap water reduced this amount to 0.199 mg/kg (21.14% removal).

The other washing solutions could be arranged in descending order according to their reduction percentages on the residues of lambda –cyhalothrin from treated sweet pepper fruits as follow: sodium carbonate solution (63.63%), potassium permanganate (47.82%), soap solution (41.50%) and acetic acid (36.36%). Frying in boiling oil reduced lambda –cyhalothrin residues to 0.049 mg/kg (80.63% removal). Pickling the pepper fruits reduced its residues and the reduction was more pronounced after two weeks with the level undetectable amounts (100% removal) than after one week with the level of 0.030 mg/kg (88.14% removal). These results indicated that the most efficient removal from the treated sweet pepper fruits with lambda –cyhalothrin was observed using 1% sodium carbonate solution, while the lowest one was the tap water. It is obvious as could be noticed in Table (1 and 2) that, the PHI value was reduced to two hours after spraying the sweet pepper with lambda –cyhalothrin after washing the fruits with 1% sodium carbonate or frying the fruits in boiling oil when comparing with the

MRL (0.01 mg/kg) according of EU Pesticides database - European Commission. While the pickling process was, however, don’t alter this value.

Table 2: Effect of different washing solutions on lambda -cyhalothrin residues contaminated pepper fruits.

Treatments	Residues (mg/kg)	% Loss (removal)	Amount lost (mg/kg)
Unwashed fruits	0.253	0.00	0.00
Washing solutions			
Water	0.199	21.14	0.054
Potassium permanganate 1,%	0.132	47.82	0.121
acetic acid 1%	0.161	36.36	0.092
Soap 1%	0.148	41.50	0.105
Sodium bicarbonate 1,%	0.092	63.63	0.161
Frying in oil	0.049	80.63	0.204
Pickling			
1 weeks	0.030	88.14	0.223
2 weeks	UND	100	0.253

UND = Undetectable amounts.

Removal studies are reported in the literature by several investigators working on the residues of several insecticides including the pyrethroids group on / in some vegetable fruits. Zohair (2001) studied the efficiencies of acidic solutions (citric acid, ascorbic acid, acetric acid and hydrogen peroxide) neutral solution (sodium chloride) and alkaline solution sodium carbonate in the elimination of some organophosphorus insecticides.

The percentages of removal ranged from 98.5 to 100% for pirimiphos-methyl, 87.9 to 100% for malathion and 100% for profenofos. Jayakrishnan *et al* (2005) reported that residues of lambda –cyhalothrin in tomato fruits reduced by washing with water, citrus solution, saline solution and washing + steaming with reduction percentages of 39%, 41%, 44% and 60%, respectively at zero time after application tomato at dose of 5 g a.i./ha. zhang *et al* (2007) found that washing cabbage with 10% acetic acid for 20 min. NaCl 10% (20 min.), tap water (20 min.) and stir-frying (5 min.) reduced the residues of chlorpyrofos and cypermethrin by 79.8, 74.0; 67.2, 73.3; 17.6, 19.1 and 86.6 and 84.7% reduction. Walia *et al*, (2010) reported that the concentration of λ-cyhalothrin declined with washing and reached nondetecteable on day 24 from application. Cypermethrin residues in bringal fruits reduced by 40.89, 41.40, 45.22, 50.12 and 25.47% reduction using the following processes: microwave cooking, cooking in water (boiling), cooking in oil (frying), grilling and washing with tap water, respectively after one day of spraying. Amvrazi (2011) reported that washing of Raw Agricultural Crops (RAC) is the preliminary step in both household and commercial food preparation and the rins ability of a pesticide is not always correlated with its water solubility and that different pesticides may be rinsed from processed units of RAC by different washing procedures.

The removal of pesticides with the washing of RAC may be performed not only through the dissolution of pesticide residues in the washing water or the rinsing with chemical baths (detergents, alkaline, acid, hypochlorite, metabisulfite salt, ozonated water etc). Penetration is the most dynamic process that may control the fate of a pesticide residue on RAC during washing. The use of an appropriate detergent that has the ability to solubilise waxes may dissipate the residue present in the fruits epicuticular wax layer. The same author reported that pesticide residues might be vaporized, hydrolyzed and / or thermal degraded during cooking. However, the processes and conditions used in food cooking are highly varied. The details of time, temperature, degree of moisture loss, whether the system is open or closed and whether water is added or not in the process are important for the estimation of the fate of a residue level. In general, rates of degradation and volatilization of residues are increased by the heat involved in cooking or pasteurization and rates of hydrolysis may also be increased by the water addition and the increase of temperature. Elbashir *et al*, (2013) found that washed tomato fruits with tap water three times more effective compared to single wash. Shiboob *et al* (2014) found that pickling of cucumber removed 97.5 and 98.69% of dimethoate and profenofos after one week, respectively, and complete removing of both insecticides by cucumber pickling was achieved after two weeks. Vemuri *et al*, (2014) found that running tap water washing, direct cooking, 2% salt water washing and 2% salt water washing plus cooking reduced the residues of dimethoate, methyl parathion, quinophos, endosulfan and profenofos on tomato fruits with reduction percentages ranged from 44.07 – 53.00 %; 53.41 – 61.00%; 78.00 – 91.30% and 99.0 – 100%, respectively. Sheikh *et al* (2015) found that washed onion with water, detergent, 5% NaCl and 10% NaCl and blanching process reduced the residues of bifenthrin by 34.65%, 40.59%, 45.54 and 56.43% reduction, respectively. Ryad and Mahmoud (2016) noticed that residues of lambda –cyhalothrin in black olive reduced with washing by 26.32% and pickling by 84.21%, while in green olive washing and pickling process reduced the residues of lambda –cyhalothrin by 39.13% and 84.78%, respectively. Shalaby (2016) found that the washing of the treated tomato fruits (2 hours after spraying with profenofos) with tap water or 1% of soap, 1% sodium chloride, 1% acetic acid and 1% potassium permanganate reduced the initial deposits (20.53 mg/kg) to 6.11, 9.03, 7.69, 9.87 and 5.06 mg/kg indicating 70.24, 56.02, 62.54, 51.92 and 75.35% dislodge, respectively.

Finely, it could be concluded that washing with water and /or other washing solutions as well as the cooking and pickling processes resulted in a great reduction of pesticide residues from treated vegetable fruits and in some case lead to the residue level lower than the Maximum residue limits (MRL).

3- Effect of lambda –cyhalothrin residues on internal quality parameters of sweet pepper fruits.

Residues of pesticides may interfere with biochemical and physiological processes in plants retarding the growth of the plant and yield. Also, they may reduce its food quality and may even prevent its use as food by affecting its quality parameters (**Bartholomew *et al*, 1951**). Therefore, the possible effects of lambda –cyhalothrin residues on chemical components of green sweet pepper were estimated.

The results in Table (3) showed that lambda –cyhalothrin residues significantly decreased the levels of the all tested quality parameters (total soluble sugar, glucose, acidity, total soluble solids, ascorbic acid, β-carotene, and protein) in pepper fruits throughout the experiment with the exception that the dry matter. The reduction percentages of the above mentioned parameters resulted the treated of pepper fruits with lambda –cyhalothrin were 10.78, 3.92, 10.27, 2.79, 11.55, 28.29, 13.98 and 18.99%, respectively. The mean level of dry matter was increased by 13.98%.

It is well established that certain pesticides influence the chemical composition of the plants after they are applied. Profenofos residues increased protein and ascorbic acid content in potatoes (Habiba *et al*, 1992). Also, this insecticides increased T.S.S and acidity, but decreased the glucose, protein and ascorbic acid content of tomatoes (Ismail *et al*, 1993). Radwan *et al* (1995) reported that pirimphos-methyl residues appeared to have significant adverse effects on the total soluble sugars and ascorbic acid content of tomato fruit and broad bean seeds. Pirimphos-methyl exhibited a significant increase on total soluble sugars and acidity percentage of grape berries, whereas there was no effect on T.S.S (Radwan *et al*, 2001). Radwan *et al* (2004) found that as for the internal quality parameters of green pepper, pirimphos-methyl treated fruit exhibited a significant increase in the total soluble sugars, dry matter percentage, total protein and β-carotene content. Profenofos treatment significantly decreased the total soluble sugars, dry

Table 3: Effect of lambda -cyhalothrin residues on some quality attributes of pepper fruits.

Quality parameters	Days after spraying	Untreated fruits	Treated fruits	Mean redaction %
Total soluble sugar,%	6	8.29 a	7.43 b	
	15	8.66 a	7.693 b	
	Means	**8.475 a**	**7.561 b**	**10.78**
Glucose mg/100g	6	17.113 a	16.16 b	
	15	17.23 a	16.836 b	
	Means	**17.171 a**	**16.498 b**	**3.92**
Acidity,%	6	4.093 a	4.653 b	
	15	3.943 a	4.303 b	
	Means	**4.018 a**	**4.478 b**	**10.27**
Total soluble solid T.S.S.,%	6	5.493 a	5.713 b	
	15	5.723 a	5.19 b	
	Means	**5.608 a**	**5.451 b**	**2.79**
Ascorbic acid mg/100g	6	81.34 a	72.173 b	
	15	84.213 a	74.26 b	
	Means	**82.776 a**	**73.216 b**	**11.55**
β-carotene,%	6	16.323 a	11.78 b	
	15	18.59 a	13.253 b	
	Means	**17.456 a**	**12.516 b**	**28.29**
Dry matter,%	6	17.23 a	20.19 b	
	15	18.72 a	20.26 b	
	Means	**17.975 b**	**20.225 a**	**+13.98**
Protein,%	6	11.562 a	9.187 b	
	15	12.125 a	10 b	
	Means	**11.843 a**	**9.593 b**	**18.99**

In each raw values followed by the same letter are not significantly different at P ≤ 0.05

matter and total protein percentages. Shalaby (2016 a) reveled that residues of thiamethoxam and chlorpyrifos significantly decreased total soluble sugar%, glucose mg/100g, acidity %, total soluble solids %, ascorbic acid mg/100g, protein content%, β-carotene%, protein% and dry matter % of fresh treated okra fruits, and Shalaby (2016 b) found that the mean levels of total soluble solid, ascorbic acid, β-carotene, and acidity reduced after 6, 9 and 15 days of profenofos spraying tomato.

It is obvious to note that these biochemical changes in lambda –cyhalothrin treated pepper fruits could be due to the ability of this insecticide to have local systemic effect (penetrative insecticide). Although lambda –cyhalothrin is well documented as nonsystemic insecticide, such local systemic effect may result from the penetration of lambda –cyhalothrin through lenticels on the surface of pepper fruits where it acts on certain biochemical systems. Alternatively, lambda –cyhalothrin being a lipophillic compound could dissolve in cell membrane.

4- *Effect of lambda –cyhalothrin residues on some trace and nutrient elements in sweet pepper fruits*

Results of the determination of some trace and nutrient elements lambda -cyhalothrin treated pepper fruits are shown in Table 4.

Table 4: Effect of lambda -cyhalothrin residues on some trace and nutrient elements of pepper fruits.

Elements	Days after spraying	Untreated fruits	Treated fruits	Mean redaction %
N, %	6	1.85 a	1.47 b	
	15	1.94 a	1.6 b	
	Means	**1.895 a**	**1.535 b**	**18.99**
P, %	6	0.58 a	0.52 b	
	15	0.605 a	0.561 b	
	Means	**0.592 a**	**0.54 b**	**8.78**
K, %	6	2.81 a	2.56 b	
	15	2.803 a	2.67 b	
	Means	**2.806 a**	**2.615 b**	**6.81**
Fe mg/kg	6	53.24 a	45.04 b	
	15	56.09 a	49.65 b	
	Means	**54.665 a**	**47.345 b**	**13.39**
Mn mg/kg	6	18.73 a	14.6 b	
	15	20 a	15.29 b	
	Means	**19.365 a**	**14.945 b**	**22.82**
Ca %	6	1.242 a	0.98 b	
	15	1.425 a	1.088 b	
	Means	**1.333 a**	**1.034 b**	**22.43**
Zn mg/kg	6	37.193 a	31.493 b	
	15	38.993 a	33.86 b	
	Means	**38.093 a**	**32.676 b**	**14.22**

In each raw values followed by the same letter are not significantly different at $P \leq 0.05$

Results clearly revealed that lambda -cyhalothrin residues were significantly reduced the levels of all elements under study in treated pepper fruits comparing with untreated ones. The mean values of the reduction percentages were 18.99, 8.78, 6.81, 13.39, 22.82, 22.43 and 14.22 for N %, P %, K %, iron mg/kg, manganese mg/kg, calcium % and zinc %, respectively. These results are in harmony with these obtained by Shalabey *et al* (1991), Shalaby and Eisa (1992), Salem (2011) and Shalaby (2016 a & b) working with different insecticides in same vegetables and field crops.

REFERENCES

Amvrazi, E. G. (2011). Fate of Pesticide Residues on Raw Agricultural Crops after Postharvest Storage and Food Processing to Edible Portions, *Pesticides - Formulations, Effects, Fate, Prof. Margarita Stoytchev* (Ed.), ISBN: 978-953-307-532-7, In Tech, Available from: http:// www.Intechopen.com/books/pesticidesformulations-effects-fate /fate -of-pesticide -residues-on-raw-agricultural-crops-after postharvest -storage-and food- processing.

AOAC (1984). *Association of Official Analytical Chemists.* Official Methods Of Analysis, 19th ed., Washington, D.C.

Bartholomew, E. T.; W. S. Stewart and G. E. Carman (1951). Some physiological effects of pesticides on citrus fruits and leaves. *The Botanical Gazette*, 112 (4): 501-511.

Ben-Amotz, A. B. and M. Avron (1983). On the factors which determine massive β-carotene accumulation in the halo tolerant alge Dunaliella bardawil. *Plant. Physiol*., 72: 593-597.

Bissacot, D. Z. and I. Vassilieff (1997). HPLC Determination of Flumethrin, Deltamethrin, Cypermethrin, and Cyhalothrin Residues in the Milk and Blood of Lactating Dairy Cows. *Journal of Analytical Toxicology*, (21): 397-402

Bowman, M. C. (1980). Analysis of organophosphorus pesticides. In: Moye, H.A. (Ed.), *Analysis of Pesticide Residues*. John Wiley, Sons Inc., pp. 263–332, Chapter 7.

Chavarri, M. J., A. Herrera and A. Arino (2004). Pesticide residues in field sprayed and processed fruits and vegetables. *J. of the Science of Food and Agriculture,* 84(10): 1253-1259.

Degri, M. M. and K. P. Yoriyo (2010). Efficacy of three plant extracts for the control of aphids (*Aphis gossypii* Glov) (Homoptera; Aphididae) on sweet peppers (*Capsicum annum* L.) (Solanaceae) in Nigeria Sudan Savanna, *International Journal of Food and Agricultural Research*, 7 (1): 256 -262

Dejonckheere, W., W. Steurbaut, S. Drieghe, R. Verstraeten and H. Braeckman (1996). Pesticide residue concentrations in the Belgian total diet, 1991–1993. *Journal of AOAC International*, 79(2): 520-528.

Dixit, A. K., Y. N. Srivastava and O. P. Lal (2001). Residue studies and bioefficacy of beta-cyfluthrin and lambda-cyhalothrin in brinjal (*Solanum melongena* L.) fruits. *Pestology.,* 25 (10) : 27-32.

Dubois, M., K. A. Giles; J. K. Hamilton; P. A. Robers and F. Smith (1956). Colorimetric method for determination of sugar and related substance. *Analytical Chemistry,* 28: 350-356.

Elbashir, A. A., A. E. A. Albadri and H. E. Ahmed (2013). Residues levels of pyrethroids pesticide in an open field tomatoes from Sudan by gas chromatography with electron capture detector (GC-ECD). *J. Food Science And Technology,* 1 (1): 6-12.

El-Bassiony, A. M.; Z. F. Fawzy; E. H. Abd El-Samad and G. S. Riad (2010). Growth, yield and fruit quality of sweet pepper plants (*Capsicum annuum* L.) as affected by potassium fertilization. *J. American Science,* 6 (12)

Elkins, E. R. (1989). Effect of commercial processing on pesticide-residues in selected fruits and vegetables. *Journal of the Association of Official Analytical Chemists,* 72(3): 533-535.

Evenhuis, B. and P. W. Waard (1980). Principle and practices in plant analysis F.A.O. *Soils Bell.*, 38 (1) 152-163.

Fernndez-Alba, A. R. and J. F. Garca-Reyes (2008). Large-scale multi-residue methods for pesticides and their degradation products in food by advanced LC-MS. Trac-Trend. Anal. Chem., 27 (11): 973-990.

Gill, K., B. Kumari and T. Kathpal (2001). Dissipation of alphamethrin residues in/on brinjal and tomato during storage and processing conditions. *Journal of Food Sci. Technol.,* 38:3–16

Gomaa, E.A.A. and M.H. Belal (1975). Determination of dimethoate residues in some vegetables and cotton plant. *Zagazig Journal of Agric. Res.,* 2: 215–219.

Habiba, R.A.; H.M. Ali and S. M. M. Ismail (1992). Biochemical effects of profenofos residues in potatoes. J. Agric. Food Chem. 40: 1852-1855.

Ismail, S. M.; H. M. Ali and R. A. Habiba (1993). GC-ECD and GC-M Sanalysis of profenofos residues and biochemical effects in tomatoes and tomato products. *J. Agri. Food. Chem.,* **41**:610-615.

Jackson, M. L. (1967). *Soil Chemical Analysis Prentice*. Hall Inc. Englewood cliffs N.J. Library of congress, USA.

Jayakrishnan, S., A. K. Dikshit, J. P. Singh and D. C. Pachauri (2005). Dissipation of lambda-cyhalothrin on tomato (*Lycopersicon esculentum* Mill.) and removal of its residues by different washing processes and steaming. *Bull. Environ. Contam. Toxicol*., 75, 324–328.

Kadam, D. R., B. V. Deore and S. M. Umate (2015). Residues and dissipation of lambda-cyhalothrin in pomegranate fruits. *Asian J. Bio Sci.*, 10 (1): 27-32.

Krol, W.J., T.L. Arsenault, H.M. Pylypiw and M.J.I. Mattina (2000). Reduction of pesticide residues on produce by rinsing. *Journal of Agricultural and Food Chemistry*, 48(10): 4666-4670.

Lofty, H. M., A. A. Abd El-Aleem and H. H. Monir (2013). Determination of insecticides malathion and lambda-cyhalothrin residues in zucchini by gas chromatography. *Bulletin of Faculty of Pharmacy*, Cairo University, 51, 255–260

MacBean, C. (2012). *The Pesticide*. Manual Version 5.2, 15 th Ed. lambda - cyhalothrin (213).

Mathirajan, V. G. (2002). Dissipation of lambda-cyhalothrin (Karate 5 E.C.) in/on tomato fruits. *Pest Mamt. Eco. Zoo*., 10 (1) : 99-101.

Mills, P. A.; B.A. Bong; L.R. Kamps and J. A. Burke (1972). Elution solvent system for florisil column clean up in organochlorine pesticide residue analysis. *J. AOAC*, 55 (1):39-43.

Radwan, M.A.; M.H. Shiboob; A. Abdel-Aal and M.M. Abu-Elamaym (2001). Residues of pirimiphose-methyl and fenitrothion in grapes, their effect on some quality properties and their dissipation during the removal and processing methods. *J. Pest Cont. Environ. Sci*., 9 (3): 89-107.

Radwan, M.A.; M.H. Shiboob; M.M. Abu-Elamaym and A. Abdel-Aal (2004). Residues of pirimiphos methyl and profenofos on green pepper and eggplant fruits and their effect on some quality properties. *Emir. J. Agric. Sci*. 16(1): 32-42**.**

Radwan, M.A.; M.M. Youssef; A. Abd-El-All; G.L. El-Henawy and A. Marei (1995). Residues levels of pirimiphos-methyl and chlorpyrifos-methyl on tomato and faba bean plants in relation to their impact on some internal quality parameters. *Alex. Sci. Exch*. **16** (3): 389-404.

Romeh, A. A. and M. Y. Hendawi (2014). Effect of processing on acetamiprid residues in eggplant fruits, *solanum melongena* L**.** *Afr. J. Agric. Res.,* 9 (3): 307-309.

Ryad, L. M. and A. A. Mahmoud (2016). Study the Effect of Household Processing on some Pesticide Residues in Olive Fruits. *Middle East Journal of Applied Sciences*, 6 (3): 588-593

Salem, R. E. M. (2011). Sid effects of certain pesticides on the relationship between plant and soil. Ph. D. Thesis. Fac. of Agric., Zagazig Univ.

Schattenberg, H.J., P.W. Geno, J.P. Hsu, W.G. Fry and R.P. Parker (1996). Effect of household preparation on levels of pesticide residues in produce. *Journal of AOAC International*, 79 (6): 1447-1453.

Shalaby, A. A. (2016 a). Residues of thiamethoxam and chlorpyrifos on okra in relation to their effects on some internal quality parameters and elements in fruits. *J. Product. & Dev., 21(3): 349-367.*

Shalaby, A. A. (2016 b). Residues of Profenofos with Special Reference to Its Removal Trials and Biochemical Effects on Tomato. *J. Plant Prot. and Path., Mansoura Univ*.,7 (12) ,845–849

shalaby, A.A. and E. S. Eisa (1992). Insecticide application on rape in relation to their residues, biochemical constituents in seeds and aphid infestation. *Egypt. J. Apple. Sci*., 7 (10): 144-158.

shalaby, A.A.; R. A. El-Massry; S. M. Labib and W. M. El- Attar (1991). Biochemical changes in stored potato tubers as influenced by some insecticide residues. *Egypt. J. Apple. Sci*., 6 (12): 526-545.

Sharma, D., M. D. Awasthi and D. Sharma (2002). Persistence of lambda-cyhalothrin residues in cauliflower. *Insecticide Res. J.,* 14(1): 195-198.

Sheikh, S. A., A. A. Panhwar, S. G. Khaskheli, A. H. Soomro and S. Khan (2015). Methods for removal of pesticide residues in onion (Allium cepa L). *JBPAS*, 4 (12): 6668-3381.

Shweta, W., P. Boora and B. Kumari (2010). Effect of Processing on Dislodging of Cypermethrin Residues on Brinjal. *Bulletin of Environmental Contamination and Toxicology*, 84 (4): 465–468

Steel, R. C. D. and J. H. Torrie (1980). *Principles and Procedures of Statistics:* A Biomatrical Approach, second ed. Mc-Graw Hill Kogakusha Ltd., pp. 633.

Vemuri, S. B.; C. S. Rao; R. Daris; H. Reddy; M. Aruna; B. Ramesh and S. Swarupa (2014). Methods for removal of pesticide residues in tomato. *Food Science and Technology*, 2 (5): 64-68.

Walia, S., P. Boora and B. Kumari (2010). Effect of processing on dislodging of cypermethrin Residues on Brinjal. *Bulletin of Environmental Contamination and Toxicology*, 84 (4): 465–468.

Zhang Z. Y., X. J. Liub and X. Y. Hong (2007). Effects of home preparation on pesticide residues in cabbage. *Food Control*, 18 (12): 1484–1487.

Zohair, A. (2001). Behavior of some organophosphorus and organochlorine pesticides in potatoes during soaking in different solutions. *Food Chem. Toxicol.*, 39: 751-755.

متبقيات المبيد الحشرى لمبادا- سيهالوثرين وتأثيراته البيوكيميائية على ثمار الفلفل الحلو

على عطا على شلبى
قسم وقاية النبات – كلية الزراعة – جامعة الزقازيق – مصر .

أجريت تجربة حقلية خلال عام 2016 لدراسة متبقيات مبيد لمبادا- سيهالوثرين ومعدل اختفاءه. تم تقدير متبقى المبيد على فترات مختلفة بعد ساعتين ، يوم ، 3 ، 6 ، 9 ، 12 و 15 يوم من المعاملة بالمبيد. تم حساب معدلات الثبات والاختفاء وقيمة نصف العمر وفترة الحصاد الآمنة للمبيد الحشري على نباتات الفلفل الأخضر.

وأظهرت النتائج أن نسب الفقد للمتبقى الأولي كانت أعلى في ثمار الفلفل عن الأوراق. وكانت قيمة نصف العمر ($t_{½}$) للمبيد 2.68 و 3.45 في ثمار الفلفل الأخضر والأوراق، على التوالي. وأشارت النتائج أن ثمار الفلفل يمكن استهلاكها أدميا بآمان بعد 6 أيام من المعاملة بمبيد لمبادا- سيهالوثرين. وأنخفضت هذه الفترة الى ساعتين بعد غسيل ثمار الفلفل بمحلول كربونات الصوديوم 1% أو القلى فى الزيت وذلك بمقارنتها بالحدود المسموح بها (0.01 ملجم / كجم).

بينما فى حالة التخليل لم يكن له دور فى تقليل هذه المدة. وأحدثت متبقيات المبيد انخفاضاً معنوياً لصفات الجودة مثل السكريات الكلية ، الجلوكوز ، الحموضة ، المواد الصلبة الذائبة ، حمض الأسكوربيك ، والبيتا كاروتين ، البروتين وزيادة فى الوزن الجاف. وانخفاضاً معنوياً فى كل من النيتروجين ، الفوسفور ، البوتاسيوم ، الحديد ، المنجنيز ، الكالسيوم و الزنك.

التوصية: أوضحت النتائج أن قيمة فترة ما قبل الحصاد (6 ايام) أختصرت إلى ساعتين بعد الرش بغسيل الثمار بمحلول 1% كربونات صوديوم أو القلى فى الزيت وأن متبقيات مبيد لمبادا سيهالوثرين سببت خفضا معنويا فى بعض صفات الجودة والعناصر.