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Health Risk Assessment of Abamectin and Buprofezin Residues in Eggplant and Pepper Plants

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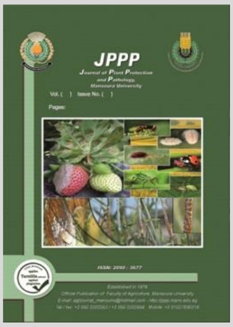

ABSTRACT

Eggplant and pepper plants were sprayed with abamectin and buprofezin, respectively once at the recommended rate to study the residues and effect of tap water and acetic acid (1%) treatment as washing solution on their residues. Their risk assessment was also studied and summarized results show the following: The initial amounts of each pesticide in leaves of eggplant and pepper were much higher than the fruits. Loss percentages in residue amounts were higher in eggplant and pepper fruits than leaves. The washing of treated fruits (eggplant and pepper) with tap water and acetic acid 1% reduced considerable amounts of abamectin and buprofezin residues and it was noticed that the effect of acetic acid 1% was better than tap water in removing pesticide residues. Abamectin half-life values were 2.23 and 3.58 days on eggplant fruits and eggplant leaves, respectively. Data also revealed that fruits were consumed safely after 9 days of treatment, according to the MRL (EU Pesticides database - European Commission was 0.09 mg/kg) and risk quotient (RQ). Washing with tap water and acetic acid (1%) doesn't change this period. The calculated half-life values of buprofezin were 1.94 and 2.55 days in pepper fruits and leaves, respectively. This indicated that only 1 day was long enough to reduce the residues below the maximum residue limits (2mg/kg) on pepper according to the EU Pesticides database – European Commission and RQ. While washing with tap water and acetic acid (1%) reduced this period to two hours.

Keywords: residues**,** abamectin, buprofezin, risk assessment, home processing

INTRODUCTION

Eggplant and pepper plants and other vegetable crops are liable to investigate with different pests; therefore farmers around the world use different types of pesticides to prevent crop losses from pests and diseases as well as to increase agriculture production to provide an adequate food supply for the increasing world population. (Ntow et al, 2006)

Also, vegetables are an essential component of a healthy diet. They constitute a major source of vitamins, minerals, and fibers. Unfortunately, vegetables can also be a source of toxic pesticide residues that might cause significant harm to consumers (Knezevic and Serdar, 2009).

Several indicators of residue levels can be used to predict the intake of pesticide residues. The maximum residue limits (MRL) is one such indicator and represents concentration of pesticides (mg / kg), that the Codex Alimentarius Commission recommends legally permissiveness in food commodities and animal feed. The Acceptable Daily Intake (ADI) which is the evaluated amount of a substance in a food (by terms of body weight) that can be ingested daily over a lifetime without telling by health risks to the consumer can also be used to divine dietary intake of pesticide residues. The evaluated nutritional amount of pesticide residues in a specific food is obtained by multiplying the residue level in the food by the amount of that food consumed. The evaluated average daily intake (EADI) of pesticide residues should be less than the estimated daily intake (WHO, 1997).

Abamectin is used to control insect and mite pests of a range of agronomic, fruit, vegetable, and ornamental crops and considered a contact and stomach action insecticide, has limited plant systemic activity but exhibits translaminar movement. Buprofizin is an acaricide that acts both on the superficies and on the stomach; Do not spin the plant. It is forbidden to throw nymphs and larvae that may develop to death. It is also forbidden to lay eggs in adults; Treated insects lay sterile eggs and are used against Homoptera and some winged sheaths as well as Acarina. Buprofezin was efficacious against Cicadellidae, Deltocephalinae (leaf hoppers), and Delphacidae (herbivores) in rice.

(MacBean, 2012). So that, the aims of this study were as follows:

1- Evaluated the residues of abamectin and buprofezin in eggplant and pepper fruits and leaves.
2- Effect of washing processes on abamectin and buprofezin residues.
3- Assess the human health risk associated with exposure

MATERIALS AND METHODS

1- Pesticides selected for this study:

The pesticides used and their rates were:

a) abamectin, 1.8% EC, 40 cm^3 / 100 L for eggplant.
b) buprofezin 25% WP**,** 400 g/ feddan for pepper

2- Field experiment and sampling

Residues of abamectin on eggplant and residues of buprofezin on pepper field experiments were carried out in a private field of eggplant and pepper located at Tallrak, Awlad Saqr, Sharkia governorate during the summer season

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of 2017. Plots consisting of 10 rows separated by a 3-row belt of eggplant var. Balady and green pepper var. California wonder was allocated and designed as randomized blocks with three replicates. Mature plants were sprayed with abamectin on the eggplant field and buprofezin on the pepper field once at the recommended rate of 40 cm3 /100 L and 400 g/ feddan, respectively. A motor sprayer (20 litter capacity) was used to apply the tested acaricides in a recommended dose. Control plots were treated with water only. Samples of eggplant and pepper (leaves and fruits) were taken at intervals of 2 hr, 1, 3, 6, 9, 12, and 15 days after application.

To study the effect of washing with a different solution for removal abamectin and buprofezin residues from the treated fruits samples were divided into three subsamples. The first subsample was washed with tap water and the second was washed with acetic acid (1%) and let fruits for air drying while the third subsample was left without washing.

3- Residue analysis

Extraction of plant samples

The fruit samples of eggplant and pepper (50 g) and leaf samples (25 g) were extracted by Mollhof methods (1975). With methanol as a solvent, a known volume of the filtrate was taken and used methylene chloride in a separator funnel for partitioning. The combined methylene chloride phase was dried by filtration through a pad of cotton and anhydrous sodium sulfate then evaporated to dryness and ready to the cleanup steps.

Clean-up of plant samples

Glass plates (20×20cm) coated with silica gel GF254; silica gel was dispersed in distilled water at 1:2 w/v. the applicator was used for coating the glass plates with a thin layer (0.25mm thickness). The plates were then put in the oven adjusted at 110 ˚C for an hour. An aliquot (0.1ml) of the concentrated extract was spotted on the plate at a distance of 3cm from the lower edge. The standard active ingredient from each acaricide (abamectin and buprofezin) the sample was also spotted on the same plate to define the RF values. The plates were developed in methylene chloride and then exposed to UV light to detect the spots of pesticides. Collected the spots of silica gel into a tube for centrifuge with acetone then collect the acetone into a clean tube to determine the residues.

HPLC conditions for quantitative analysis of abamectin and buprofezin

To determination abamectin and buprofezin we used Agilent 1100 HPLC with UV photodiode array detector (DAD). Chromatographic separation in kinetic 2.6µ C18 100A column (4.6mm i.d. ×100 mm length). with wavelength 245 nm offers suitable chromatograms for the quantification of abamectin and buprofezin. The mobile phase was acetonitrile: water (90:10 v/v) with flow rate 1 ml min-1. The column oven was preserved at 25 °C. The volume of the injection loop was 10 µl. with a retention time of 3.182 and 5.824 min, respectively.

Recovery assay

To estimate the efficacy of the used extraction, clean-up, and a final determination steps, recovery assay was using fruits and leaves of untreated eggplant and pepper. we used a known concentration (1 mg/kg) of abamectin and buprofezin standard solution to spiked samples (fruit and leaves) .The obtained recovery percentages were 93.53 and 88.45% in leaves and fruit for abamectin, respectively. The corresponding values for buprofezin were 91.68% for leaves and 87.41% for fruits.

Statistical analysis

The rate of degradation (K) and Half-life (t½) periods of each pesticide was calculated according to Gomaa and Belal (1975).

The processing factor (PF) or household processing factor (HF) was calculated by dividing the residues amounts detected after processing on residues amounts detected before processing. A processing factor below 1 indicated a decrease of pesticide residues after processing (reduction factor) and above 1 an increase of pesticide residues after processing (concentration factor) (Huan et al., 2015 and Jankowska, et al, 2018).

Estimated average daily intakes (EADI) of pesticide residue and food consumption were used to determine short and long-term health risks to consumers. For calculating the risk assessment of the consumption of eggplant and pepper fruits and their processing product, a daily dose of 0.345 kg/day was used for vegetables. This value was used based on research conducted by (Wang et al., 2005; Arora et al., 2008 and Hossain, et al., 2015)

For each type of exposure, the EADI was obtained by multiplying the mean residual pesticide concentration (mg/kg) in the food of interest in the food consumption rate, (kg/day) and dividing by body weight (Liu et al., 2019).

The health risk indices (HRIs) were obtained by dividing the EADI by their corresponding values of ADI (FAO/WHO, 2010). Assuming average adults body weight of 80 kg (Ahmed et al., 2016 and Taghizadeh et al., 2019).

The EADI and RQ (risk quotient) or HRI (health risk index) were calculated using:

$$\textbf{EADI} = \textbf{CRL} \times \textbf{FI} / \textbf{bw}$$

$$\textbf{RQ or HRI} = \textbf{EADI/ADI}$$

Where

CRL is the calculated residue level concentration of each pesticide on the eggplant and pepper fruits mg/kg, FI is the daily intake of eggplant and pepper (0.345 kg/day), bw is the average body weight of 80 kg and ADI is the acceptable daily intake. When the health risk index > 1, the food involved is considered a risk to the consumers. When the index < 1, the food involved is considered acceptable (Hamilton and Crossley, 2004; Darko and Akoto, 2008)

RESULTS AND DISCUSSION

1. Residues of abamectin in eggplant fruits and leaves

Results presented in Table 1 and Fig 1 showed that the initial deposits of abamectin in/on eggplant fruits and leaves as determined after two hours of spraying were 0.938 and 2.256 mg/kg, respectively. A moderate degradation of abamectin residues was noticed, one day after application with values of 30.49% (fruits) and 26.95% (leaves) dissipation. The time elapsed after application resulted in more degradation of residues. The initial deposits were gradually decreased during the experimental period to reach 0.006 and 0.115 mg/kg after 15 days of spraying recorded 99.36 and 94.90% reduction in fruits and leaves, respectively. Curiously enough to note that data in the same table indicated that despite the low t½ for abamectin in fruits (2.23 days). Eggplant fruits were consumed safely after 9 days of treatment, concerning health aspects, (MRL) of abamectin residues in and on eggplant according to EU

Pesticides database - European Commission was 0.09 mg/kg. Also concerning the application of the risk assessment and estimated healthy risk index (HRI), it was found that as could be noticed in table 1 when compared the residue amounts determined at different intervals with the health risk index, the contaminated eggplant fruits are considered acceptable after 9 days of treatment.

Table 1. Residues of abamectin detected in eggplant (fruits and leaves) and its risk assessment.

Time of sampling	fruits					leaves	
	Residues (mg/kg)	Loss %	EADI	HRI	Health risk	Residues (mg/kg)	Loss %
2 hours	0.938	—	0.00404	10.1	yes	2.256	—
1	0.652	30.49	0.00281	7.025	yes	1.648	26.95
3	0.284	69.72	0.00122	3.05	yes	0.868	61.52
6	0.136	85.50	0.00058	1.45	yes	0.524	76.77
9	0.069	92.64	0.00029	0.725	no	0.299	86.75
12	0.028	97.01	0.00012	0.3	no	0.187	91.71
15	0.006	99.36	0.00003	0.075	no	0.115	94.90
K	0.310905					0.193452	
$t_{½}$ (days)	2.23					3.58	

K = Degradation rate, t½= Half-life, EADI= Estimated Average Daily Intakes, HRI= Health Risk Indices, Acceptable Daily Intake for abamectin was 0.0004 mg/kg body weight per day according to the maximum residues limit (0.09 mg/kg) EU

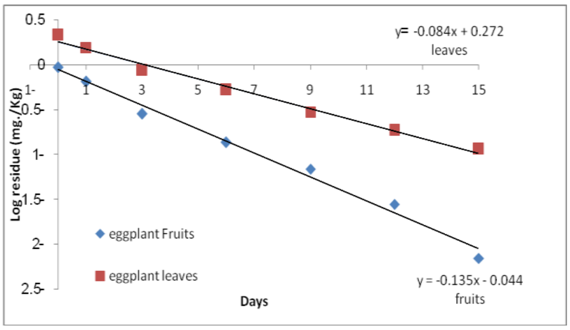

Figure 1. Log. residue–day regression line of abamectin in eggplant fruits and leaves.

2. Residues of buprofezin in pepper fruits and leaves and its risk assessment.

Data arranged in Table 2 and illustrated in Fig 2 cleared that, the amounts of buprofezin residues and its percent loss through the period of study on and in pepper fruits and leaves. The initial deposits on and in fruits and leaves were 2.164 and 4.508 mg/kg, respectively. Residue amounts decreased gradually with time to 0.011 and 0.099 mg/kg in fifteen days after spraying, respectively. The loss percentages of buprofezin residues ranged from 19.32 to 99.49% and 11.82 to 97.80 % in fruits and leaves, respectively. The half-life value of buprofezin residues in pepper fruits and leaves were 1.97 and 2.55 days, respectively. It could be noticed that 1.746 mg/kg of buprofezin was detected on pepper fruits one day after application. This indicated that only 1 day was long enough to reduce the residues below the maximum residue limits (2 mg/kg) on pepper according to the EU Pesticides database - European Commission and RQ (EU). Therefore, pepper fruits could be marketed with apparent safety for human consumption.

Table 2. Residues of buprofezin detected in pepper (fruits and leaves) and its risk assessment.

Time of sampling	Fruits					leaves	
	Residues(mg/kg)	Loss %	EADI	HRI	Health risk	Residues(mg/kg)	Loss %
2 hours	2.164	—	0.00933	1.084	yes	4.508	—
1	1.746	19.32	0.00752	0.874	no	3.975	11.82
3	0.953	40.71	0.00411	0.477	no	2.689	40.35
6	0.302	76.80	0.00130	0.151	no	1.163	74.20
9	0.112	94.82	0.00048	0.055	no	0.423	90.62
12	0.038	97.78	0.00016	0.018	no	0.155	96.57
15	0.011	99.49	0.00005	0.005	no	0.099	97.80
K	0.352359					0.271754	
$t_{½}$ (days)	1.97					2.55	

K = Degradation rate, t½= Half-life, EADI= Estimated Average Daily Intakes, HRI= Health Risk Indices, Acceptable Daily Intake for buprofezin was 0.0086 mg/kg body weight per day according to the maximum residues limit (2 mg/kg) EU

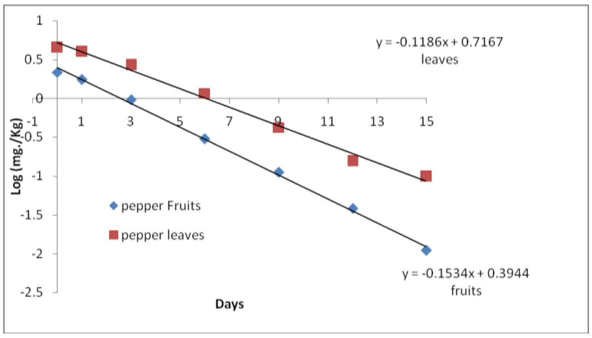

Figure 2. Log residue – day regression line of buprofezin in pepper fruits and leaves.

The results obtained in Tables 1 and 2 showed that the loss rate was higher in fruit than in leaves. These loss differences may reflect the metabolic enzyme titre and the effect of the nature of the receiving surface (i.e., morphological and chemical aspects) on residue retention, eggplant leaves also have a large surface per unit weight compared to fruits.

It is noted that the rate of degradation of abamectin in fruit and leaves more faster than buprofezin in fruit and leaves at the most of period, may be due to abamectin is rapidly destroyed by sunlight on the surfaces of fruits and leaves (Mizell et al, 1986, Rai et al 2009). On the other hand buprofezin was decomposed slowly which log P 4.1 and the rate of degradation in sunlight slow.

The above-mentioned data in Tables, 1 and 2 are in harmony with some results which obtained with several authors working on the residues of abamectin and buprofezin and other pesticide residues in eggplant and pepper and other vegetable crops. Nasr (2002) found that the initial deposits of pirimiphos-methyl in/on pepper fruits were 2.05 ppm. The preharvest interval was one day. The residue half-life values in pepper fruits and soil under pepper plants were 14.4 and 64.8 hours, respectively. Radwan *et al.*, (2004) it was reported that a 14-day waiting period after applying profenofos to green peppers and eggplant is sufficient to reduce the residue of Provinovos to less than the maximum residue limits. The half-life values for profenofos on green pepper and eggplant were 1.74 and 1.96 days. Darko and Akuto (2008) studied the pollution and health risks of organophosphorous pesticide residues in vegetables. Chlorpyrifos-ethyl, which was observed at a mean level of 0.096 ± 0.035 mg / kg in 10% of eggplant and 0.021 ± 0.013 mg / kg in 16% of peppers, was less than 0.5 mg / kg MRL. Dichlorvos was the most commonly discovered remains of all the samples analyzed. Malathion levels in pepper (0.143 ± 0.042 mg / kg-1) exceeded MRL of 0.1 mg / kg. Health risks associated with chlorpyrifos methyl, chlorpyrifos, dichlorvos, monocrotophos and omethioate have been found in eggplant. Routine monitoring of these contaminants in foodstuffs is required to prevent, control and reduce pollution and reduce health risks. Phenol et al. (2009) evaluated the dissipation of buprofen in pepper in an experimental greenhouse study. Pepper samples were collected over a period of 6 weeks during which two consecutive applications of this pesticide were performed. The half-life value was 16.28 days and 0.27 mg / kg initially. The results showed that after 7 days of the first application, residues of buprofizin were slight relative to the maximum permissible level (0.5 mg / kg). Similar behavior was obtained after the second application, with an initial residue of 0.44 mg / kg and a half-life of 13.39 days. Mohapatra *et al.* (2010) The values of abamectin administered twice to the Bringal crop showed a 15-day interval of the recommended dose and a doubling of the recommended dose of 14.4 and 28.8 g ai / ha. The primary residues of abamectin on Prinjal from the two treatments were 0.202 and 0.815 mg / kg, respectively. The residues persisted for 3 days from both treatments and reached below the quantitative limit of 0.01 mg / kg on day 5. The abamectin residue was dissipated on Pringal with a half-life of less than one day. Utture *et al.* (2012) reported on the food safety aspects of buprofen, a hangover in pomegranate. Residues of buprofizin were confined to the outer cortex, which degraded to less than MRL in Eu after 10.5 and 31.5 days with standard dose and 32.0 and 44.0 days in double dose sampling days. Dietary exposure to buprofen and imidacloprid was unharmed for all sampling days. Abdellseid and Abdel Rahman (2014) studied abamectin residue and its dispersion in tomato. The half-life of dissipation of abamectin residue in tomato was 2.4 days. The pre-harvest period (PHI) for abamectin on tomatoes was 8 days after treatment. Ramadan *et al.* (2016) found that the half-life values of abamectin were 4.1 days, so tomato fruits can be safely consumed after 7 days according to the EU Recommended (MRLs). Ibrahim *et al* (2018) monitor some pesticides on peppers. They found that 29 samples of pepper exceeded MRL set by the Codex Alimentarius Commission. The hazard index (HI %), which represents the long-term risk assessment, was in the range of 0.1273% - 4.7118% in the pepper samples from ADI. The highest exposure to Profenofos, followed by methomyl, was observed at 4.7118% and 3.4181% in pepper samples of ADI, respectively.

3. Effect of washing processes in abamectin and buprofezin residues.

Effect of washing processes in abamectin residues and its risk assessment.

Data in Table 3 and Fig 3 clearly showed that, the effect of home processing like washing with tap water and acetic acid (1%) on the reduction of abamectin residues in eggplant fruits. Results revealed that the residue of abamectin on raw unwashed eggplant fruits two hours after application was 0.938 mg/kg. The washing of treated fruits with tap water or acetic acid (1%) reduced this amount to 0.027 mg/kg and UND during 12 days, respectively.

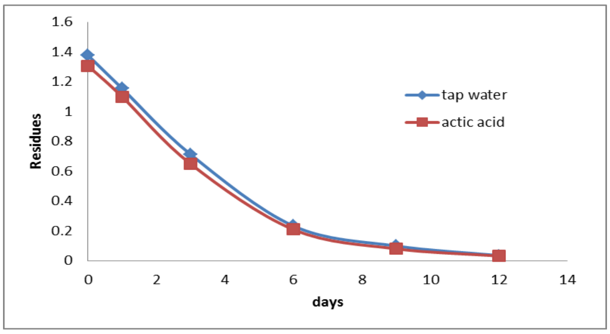

Fig. 3. Residue degradation of abamectin in eggplant fruits washed with tap water and acetic acid.

Table 3. Effect of washing with tap water and acetic acid (1%) solution in abamectin residues contaminated eggplant fruits.

Sampling time	Unwashed friuts	washed fruits with											
		Tap water						acetic acid (1%)					
		Residues (mg/kg)	% Loss by washing	PF or HF	EADI	HRI	Health risk	Residues (mg/kg)	% Loss by washing	PF or HF	EADI	HRI	Health risk
Initial (2 hrs)	0.938	0.733	21.86	0.781	0.00316	7.9	yes	0.547	41.68	0.583	0.00235	5.875	yes
1	0.652	0.563	13.65	0.863	0.00243	6.075	yes	0.421	35.43	0.646	0.00181	4.525	yes
3	0.284	0.261	8.09	0.919	0.00113	2.825	yes	0.212	25.35	0.746	0.00091	2.275	yes
6	0.136	0.127	6.62	0.934	0.00055	1.375	yes	0.114	16.18	0.838	0.00049	1.225	yes
9	0.069	0.064	4.35	0.957	0.00028	0.7	no	0.063	8.70	0.913	0.00027	0.675	no
12	0.028	0.027	3.57	0.964	0.00012	0.3	no	UND	-	-	-	-	-
15	0.006	UND	-	-	-	-	-	UND	-	-	-	-	-

UND = Undetectable amounts. **EADI= Estimated Average Daily Intakes**
HRI= Health Risk Indices **PF = processing factor, HF= household processing factor**
Acceptable Daily Intake for abamectin was 0.0004 mg/kg body weight per day according to the maximum residues limit (0.09 mg/kg) EU

With regard to the processing factor (PF) or household processing factor (HF) it was found as could be noticed in the same table, this factors ranged between 0.781 to 0.964 and 0.583 to 0.913 with tap water and acetic acid (1%) as washing solution. These digits indicated that acetic acid (1%) was capable to remove high amounts of abamectin residues. Curiously enough to note that washing eggplant fruits with tap water or acetic acid (1%) don't change the waiting period according to MRL or RQ.

Effect of washing processes in buprofezin residues in pepper fruits and its risk assessment

Table 4 shows that the initial deposit of buprofezin in unwashed pepper fruits, as determined after 2 hours of spraying, was 2.164 mg/kg. The residue of buprofezin was decreased by time till reached 0.011 mg/kg after 15 days of spraying. Washing process of pepper fruits with tap water and acetic acid previously sprayed with buprofezin removed the residues gradually to 1.376, 1.306 ; 1.153, 1.098 ; 0.711, 0.647 ; 0.232, 0.208 ; 0.098, 0.079 ; 0.034, 0.031 and 0.010, UND mg/kg, respectively after 2 hour, 1, 3, 6, 9, 12 and 15 days from spraying. As shown in Fig. 4, the rate of disappearance was faster during the first period's post-application, and as time elapsed this rate decreased slowly.

Concerning the PF or HF factor, it is clear that the capacity of acetic acid (1%) as a washing solution to remove the residues of buprofezin is, however, much higher than tap water (18.42 – 39.65% and 9.09 – 36.41%) for the two tested washing solutions, respectively.

As mentioned before in table 2 the unwashed pepper fruits can be used safely after 1 day of spraying comparing with MRL or RQ. Also according to HRI could be consumed after 2 hours of spraying, but in table 4 data revealed that the washed pepper fruits can be used safely after 2 hours, i.e., directly after spraying according to MRL and HRI.

Table 4. Effect of washing with tap water and acetic acid (1%) solution on buprofezin residues contaminated pepper fruits.

Sampling time	Unwashed fruits	washed fruits with											
		Tap water						acetic acid (1%)					
		Residues (mg/kg)	% Loss by washing	PF or HF	EADI	HRI	Health risk	Residues (mg/kg)	% Loss by washing	PF or HF	EADI	HRI	Health risk
Initial (2 hrs)	2.164	1.376	36.41	0.635	0.00593	0.689	no	1.306	39.65	0.604	0.00563	0.654	no
1	1.746	1.153	33.96	0.660	0.00497	0.577	no	1.098	37.11	0.629	0.00474	0.551	no
3	0.953	0.711	25.39	0.746	0.00306	0.355	no	0.647	32.11	0.679	0.00279	0.324	no
6	0.302	0.232	23.18	0.768	0.00100	0.116	no	0.208	31.13	0.689	0.00089	0.103	no
9	0.112	0.098	12.5	0.875	0.00042	0.048	no	0.079	29.46	0.705	0.00034	0.039	no
12	0.038	0.034	10.52	0.895	0.00015	0.017	no	0.031	18.42	0.816	0.00013	0.015	no
15	0.011	0.010	9.09	0.000	0.00004	0.004	no	UND	-	-	-	-	-

UND = Undetectable amounts. EADI= Estimated Average Daily Intakes HRI= Health Risk Indices
PF = processing factor HF= household factor
Acceptable Daily Intake for buprofezin was 0.0086 mg/kg body weight per day according to the maximum residues limit (2 mg/kg) EU

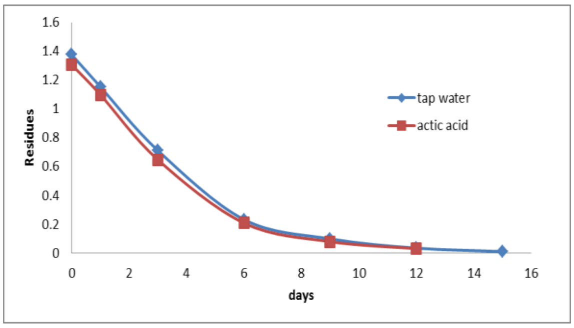

Fig. 4. Residue degradation of buprofezin in pepper fruits washed with tap water and acetic acid.

The differences between the washing solutions tested (tap water and acetic acid) in the removal of abamectin residues from the treated eggplant fruits may consist on the physical and chemical properties of abamectin and buprophysine and their stability of hydrolysis in the aqueous or alkaline vinegar solution. Sensitive to stronger base acid and alkali conditions, MacBean (2012). The percentage of pesticide plucking out from vegetables and fruits with washing erosion is affected by washing time, temperature of wash water, and initial concentration of the pesticide (Youssef et al., 1995). Douching has been shown to be the most studied method of treatment. Washing has been found to decrease pesticides that stick loosely to the surface (Abu Arab, 1999). It was also found that the removal of pesticide residues by washing depends on the age of the chemical (Guardia-Rubio et al., 2007). Washing is also an effective method for decontaminating pesticide residues but its effectiveness consist on a number of factors such as water solubility, temperature, and type of washing solution (Anita et al., 2018).

Our results are in agreement with those obtained by:

Zhang et al. (2007) found that washing cabbage with 10% vinegar for 20 min and tap water (20 min.) reduced the residues of chlorpyrifos and cypermethrin by 79.8, 74.0, and 17.6, 19.1 % reduction, respectively. It is noticed that the percent loss in buprofezin by washing with tap water higher than abamectin, may be due to abamectin cleared translaminar action while buprofezin still in the surface longtime (log P 4.1) Rai, *et al*, (2009). Kumari (2008) reported that washing of brinjal reduced the residues of OP insecticides by 77%. Walia *et al.* (2010) reported that the concentration of λ-cyhalothrin declined with washing and reached nondetectable on day 24 from the 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, boiling, frying, grilling, and washing with tap water, respectively after one day of spraying. Andrade *et al.* (2015) was mentioned that the most import mechanism that may lead to the potential change of residues during household washing operations is solubility, which is related to the water solubility of pesticide residues. Penetration is also a dynamic procedure that may control the fate of pesticide residues during washing. Pirsaheb *et al.* (2016) studied the effect of washing with tap water on reducing residues of abamectin in apple fruits and they found washing in three minutes causes a reduction of 100%. Shalaby (2016) found that the initial amounts of abamectin in leaves were much higher than those in squash fruits. Loss percentages in residues were higher in squash fruits than leaves. The residues amounts of abamectin were more greatly detected in the peel than that of the pulp and the consumable safety time was 6 days after application. The calculated half-life ($t_{½}$) values of abamectin on the squash field were 0.18, 0.21, 0.37, and 0.65 days in squash peel, soil, unwashed fruits, and leaves, respectively. Also found that washing with tap water was affected the residues of abamectin in squash fruits and the removal percentages ranged from 5.13 to 14.74%. Shalaby (2017) found that pepper fruits could be consumed safely after 6 days of treatment with lambda-cyhalothrin. The preharvest interval (PHI) value was reduced to two hours after spraying with washing the fruits with 1% sodium carbonate. Jankowska *et al* (2019) evaluated the water, mechanical and thermal processing factors (PFs) of twenty-four pesticides (Acetamiprid, Alpha-Cypermethrin, Azoxystrobin, Boscalid, Bupyrimate, Chlorpyrifos, Chlorothalonil, Cyprodinil, Deltamethrin, Difenoconazole, Fenazaquin, Fenhexamid, Fludioxonil, Folpet, Iprodione, Lambda-cyhlothrin, Metalaxyl, Pirymicarb, Ppropargite, Pyraclostrobin, Tetraconazole, Thophanate methyl, Thiram, Trifloxystrobin) in different fruit and vegetables and estimate health risk for adults and children. The water (PF = 0.09–0.94), mechanical (PF = 0.13–0.32), and thermal (PF = 0.02–0.57) technology significantly or completely reduced concentrations of twenty-one active substances in Broccoli, Tomatoes, Strawberries, and Black Currants. Pyrethroid insecticides (Alpha-Cypermethrin, Deltamethrin, and Lambda-Cyhalothrin) exhibited PF above one in berries influenced by high temperatures.

REFERENCES

Abdellseid, A. M. and T. A. Abdel Rahman (2014). Residue and dissipation dynamics of abamectin in tomato fruit using QuEChERS methodology. International Conference on Food, Biological and Medical Sci., 28(29):31-33.

Abou-Arab, A. A. K. (1999) .Behavior of pesticides in tomatoes during commercial and home preparation. Food Chemistry, 65 (4): 509-514. Academic Publishers: 392 p.

Ahmed, M. A. I., T. A. Abd El-Rahman and N. S. Khalid (2016).Dietary intake of potential pesticide residues in tomato samples marketed in Egypt. Res. J. Environ. Toxicol., 10 (4): 213-219.

Andrade, G. C., S. H. Monteiro, J. G. Francisco, L. A. Figueiredo, A. A. Rocha and V. L. Tornisielo (2015). Effects of Types of washing and peeling in relation to pesticide residues in tomatoes. J. Braz. Chem. Soc., 26 (10): 1994-2002.

Anita, S. Ahlawat and S. Devi (2018) Impact of Different Decontamination Processes on the Reduction of Pesticide Residues in Fruits and Vegetables. Int. J. Curr. Microbiol. App. Sci., 7 (5): 869-876.

Arora, M.; B. Kiran; S. Rani; A. Rani; B. Kaur and N. Mittal, (2008). Heavy metal accumulation in vegetables irrigated with water from different sources. Food Chemistry 111: 811–815.

Darko, G. and O. Akoto (2008). Dietary intake of organophosphorus pesticide residues through vegetables from Kumasi, Ghana. Food and Chemical Toxicology, 46: 3703–3706.

FAO/WHO (2010). Pesticide residues in food and feed.Acceptable Daily Intake; Codex Alimentarius Commission, FAO/WHO Food standards.

Fenoll, J., E. Ruiz, P. Hellin, A. Lacasa and P. Flores (2009). Dissipation rates of insecticides and fungicides in peppers grown in greenhouse and under cold storage conditions. Food Chem., 113: 727–732.

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

Guardia-Rubio, M., A. Canada, M. J. and A. R. Medina (2007) Effect of washing on pesticide residues in olives. J. Food Sci., 72 (2): 139-143.

Hamilton, D. and S. Crossley (2004). Pesticide residues in food and drinking water: human exposure and risks. John Wiley and Sons Ltd., Chichester, England.,pp28-59.

Hossain, M. S.; A. N. M. Fakhruddin; M. A. Z. Chowdhury; M. A. Rahman and M. K. Alam (2015). Health risk assessment of selected pesticide residues in locally produced vegetables of Bangladesh. International Food Research Journal 22(1): 110-115.

Huan, Z.; Z. Xu; W. Jiang; Z. Chen and J. Luo (2015). Effect of Chinese traditional cooking on eight pesticides residue during cowpea processing. Food Chemistry, (170): 118-122.

Ibrahim, N. M.; E. A. Eweis; S. A. M. El-Sawi and K. R. A. Nassar (2018). Monitoring and Risk Assessment of Pesticide Residues in Some Vegetables in Egypt. Middle East J. Applied Sciences, 8 (2): 669-679.

Jankowska, M.; B. Lozowicka and P. Kaczyński (2018). Comprehensive toxicological study over 160 processing factors of pesticides in selected fruit and vegetables after water, mechanical and thermal processing treatments and their application to human health risk assessment. Science of The Total Environment, 652: 1156-1167.

Knezevic, Z and M. Serdar (2009). Screening of fresh fruit and vegetables for pesticide residues on Croatian market. Food Control 20 (4): 419-422.

Kumari, B. (2008). Effects of household processing on reduction of pesticide residues in vegetables. J. Agric. Biol. Sci., 3: 46-51.

Liu, S., H. Kou, B. Mu, J. Wang and Z. Zhang (2019). Dietary risk evaluation of tetraconazole and bifenazate residues in fresh strawberry from protected field in North China. Regulatory Toxicol. and Pharmacology., 106: 1-6.

MacBean, C. (2012). The pesticide Manual version 5.2, fifteenth Ed. abamectin (1) and buprofezin (106).

Mizell, R. F.; D. E. Schiffhauer and J. L. Taylor (1986). Mortality of *Tetranychus urticae* koch (acari: tetranychidae) from abamectin residues: effects of host plant, light, and surfactants. J. of Entomological Science 21 (4): 329–337.

Mohapatra, S., S.K. Ahuja, M. Deepa, G.K. Jagdish, N. Rashmi and D. sharma (2010). Persistence of abamectin residues in/on brinjal (*Solanummelongena*). Pest Manag. Hort. Ecosystems., 16 (1): 29-33.

Mollhof, E. (1975). Method for gas-chromatographic determination of residues of tokuthion and its oxon in plant and soil samples. pflanzenschutz-Nachrichten Bayer., 28:382-387.

Nasr, I.N. (2002). Persistence of pirimiphos-methyl residues on and in pepper and chili fruits and soil. The First Conf. of The Central Agric. Pesticides Lab., 3-5 Sept.,: 1-7.

Ntow, W.J.; H.J. Gijzen; P. Drechsel (2006). Farmer perceptions and pesticide use practices in vegetable production in Ghana. Pest Manag. Sci. 62: 356 – 365.

Pirsaheb, M., R. Rahimi, M.Rezaei, K.Sharafi andN. Fatahi(2016). Evaluating the Effect of Peeling, Washing and Storing in the refrigerator Processes on Reducing the Diazinon, Chlorpyrifos and Abamectin Pesticide Residue in Apple. Int. J. Pharm. Technol., 8: 12858-12873.

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

Rai, A.B.; S. Satpathy; G.R. Gandhi and T. M. S. swamy (2009). Some approaches in management of sucking pests on chilli with special reference to tarsonemid mite *Polyphago tarsonemus* latus bank., Veg Sci, 36(3): 297-303.

Ramadan, M.M., M.A. El-Tantawy, M.B.A. Ashour and R.M. Sherif (2016). Pyridalyl insecticide residues in tomato plants. Zagazig J. Agric. Res., 43 (1): 245 – 250.

Shalaby, A. A. (2016). Residual behavior of abamectin and cyflufenamid in squash plants. Annals of Agric. Sci., Moshtohor. 54 (4): 955–960.

Shalaby, A. A. (2017). Residues of lambda-cyhalothrin insecticide and its biochemical effects on sweet pepper fruits. J. Product. & Dev., 22(1): 65-81.

Taghizadeh, S.F., M. Goumenou, R. Rezaee, T. Alegakis, V. Kokaraki,O. Anesti, D. A. Sarigiannis, A. Tsatsakis and G. Karimi (2019). Cumulative risk assessment of pesticide residues in different Iranian pistachio cultivars: Applying the source specific HQ_S and adversity specific HI_A approaches in Real Life Risk Simulations (RLRS). Toxicology Letters., (313): 91-100.

Utture, S. C., K. Banerjee, S. S. Kolekar, S. Dasgupta, D. P. Oulkar, S. H. Patil, S. S. Wagh, P. G. Adsule and M. A. Anuse (2012). Food safety evaluation of buprofezin, dimethoate and imidacloprid residues in pomegranate. Food Chem., 131: 787–795.

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.

Wang, X.; T. Sato; B. Xing and S. Tao (2005). Health risks of heavy metals to the general public in Tianjin, China via consumption of vegetables and fish. Science of the Total Environment 350:28–37.

WHO (1997). Guidelines for predicting dietary intake of pesticide residues (revised) global environment monitoring system – food contamination monitoring and assessment programme (GEMS/Food) in collaboration with Codex Committee on pesticide residues. Programme of Food Safety and Food Aid, pp. 1–44.

Youssef, M. M., A. Abdel-Aal, M.A. Radwan, G.L. El-Henawy and A.M. Marei (1995). Removal of pirimiphos-methyl and chlorpyrifos-methyl residues from treated tomatoes and broad beans by commercial and home preparative procedures. Alex. Sci. Exch., 16 (4): 461–469.

Zhang, Z. Y.; X. J. Liu and X. Y. Hong (2007). Effects of home preparation on pesticide residues in cabbage. Food Cont., 18 (12): 1484-1487.

تقييم المخاطر الصحية لمتبقيات الاباماكتين والبيبروفيزين على نباتات الباذنجان والفلفل

على عطا على شلبى ، محمد عبد العال هنداوى ، على أحمد على ايوب و خيرية محى الدين صالح
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تم رش الباذنجان بالاباماكتين والفلفل بالبيبروفيزين لدراسة متبقايتهم وايضا تاثير كل من ماء الصنبور وحمض الاسيتك (١%) كمحاليل غسيل على متبقايتهم. وايضا تم دراسة تقييم المخاطر ويمكن تلخيص النتائج كما يلى: كمية المتبقى الأولى لكلا من المبيدين على اوراق الباذنجان والفلفل أكثر من الثمار. وكانت نسبة فقد متبقى المبيدين أعلى فى ثمار الباذنجان والفلفل عن الاوارق. الغسيل بماء الصنبور وحمض الاسيتك (١%) ادى الى ازالة كميات معتبرة من متبقى كلا المبيدين (الاباماكتين والبيبروفيزين) كما لوحظ ان الغسيل بحمض الاسيتك (١%) كان افضل فى ازالة متبقى المبيد عن ماء الصنبور. فترة نصف العمر للاباماكتين على كل من ثمار واوراق الباذنجان ٢,٢٣ و ٣,٥٨ يوم على التوالى. واوضحت النتائج انه يمكن تناول الثمار الغير مغسولة بأمان بعد ٩ ايام من المعاملة طبقا الى الحدود المسموح بها (MRL) وتقييم المخاطر الصحية (RQ). كما لوحظ أن الغسيل لم يغير من فترة الانتظار للاستخدام الادمى. كانت فترة نصف العمر للبيبروفيزين ١,٩٤ و ٢,٥٥ يوم لثمار واوراق الفلفل على التوالى. لوحظ أن مرور يوم واحد كان كافى لتناول الثمار الغير مغسولة بآمان طبقا الحدود المسموح بها (MRL) و تقييم المخاطر الصحية (RQ). وانخفضت هذه المدة الى ساعتين بعد الرش فى الثمار المغسولة طبقا للمعيارين.