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Persistence of New Insecticides and Their Efficacy Against Insect Pests of Cowpea

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Abstract: The persistence of new insecticides and their efficacy against insect pests of cowpea was studied. The insecticides used were cypermethrin (Ictamethrin 10 % E.C); deltamethrin (Decis 5 2.8 % EC); lambda-cyhalothrin (Karate); acetamiprid (Mospilan 20 % SP); thiamethoxam (Actara 25 % W.G.) and ethion (Endo 50 % E.C.). The initial deposits of cypermethrin, deltamethrin, and lambada-cyhalothrin in cowpea pods were 9.21, 8.92 and 8.76 ppm, respectively. The deposited residues of neonicotinoid insecticides acetamiprid and thiamethoxam were 6.57 and 8.96 ppm. The residues of ethion in cowpea pods at the initial deposit was 11.23 ppm. The rapid degradation of residues one week after treatment i.e. 1.76 and 1.37 ppm for acetamiprid and thiamethoxam, respectively. In case of ethion more than 80 % and 90 % of these residues dissipated after 10 to 15 days, respectively. Half-life ($T_{½}$) value for degradation of ethion on cowpea pods was 2.90 days. The larval population of *H. armigera* depressed more when the tested compounds were applied 4 times than those applied two times. The residual effects of the tested compounds were varied on the *E. zinckenella* larvae after the end of experiment, the highest effective compound were ethion insecticide which reduced the insect population to 82.64 %. Cypermethrin, acetamiprid, thiamethoxam, deltamethrin and lambada-cyhalothrin were effective against the tested insect, they reduced the larvae population which presented percent reduction in infestation 80.91, 79.94, 77.96, 77.12 and 76.55 %, respectively.

Key words: Persistence, Pyrethroid, Neonicotinoid**,** Organophosphate insecticides, Cowpea (*Vigna unguiculata*), *H. armigera* and *E. zinckenella*

INTRODUCTION

Cowpea (*Vigna unguiculata* (L) Walp) is a member of the family Leguminosae. Out of 170 species in the genus, *V. unguiculata* is the most important grain legume of the world (Akinbo, *et al*., 2006; Onwueme and Sinha, 1991). World cowpea production was estimated at 12.27 million tones from 70.70 million hectares in 1992 (FAO, 1993). In most developing countries the average diet is high in starch and low in protein (Ranchie, 1985). Cereals are excellent sources of energy but comparatively poor source of protein, whereas cowpea provides some amounts of high-quality protein. The protein of cowpea contains relatively high amount of the essential amino acids, lysine and tryptophan, and thus usefully compliments the protein supply by cereals, in which the contents of lysine and tryptophan are relatively (Singh and Singh, 1992).

Cowpea are susceptible to a wide range of insect pests and pathogens that attack the crop at all stages. The most serous of insect pests is the pod borer, *Etiella zinckenella* (Treitschke) (Oladiran & Oso, 1985; Abdalla *et al*., 1994). The other pod borer, *Helicoverpa armigera* (Hubner) has been recently observed at increasing numbers, in cowpea cultivated in the newly reclaimed parts of the desert in Egypt (Gehan and Abdalla 2006). The damage of *H. armigera* usually occurs predominantly on young undeveloped pods whereas *E. zinckenella* fed on seeds only (Van Den Berg, *et al*. 1998). Chemical control represent the major method used against these insects. In Egypt vegetable crops are treated by pesticides in order to control pest infestation. Unfortunately, the indiscriminate use of potentially hazardous insecticides poses a serious threat to the human and environment. To tackle these identifiable problems associated with chemical control strategies, effective and compatible strategies and alternative control methods are essential. Residues of insecticides on vegetable crops after application should be followed and the waiting periods between application and harvesting should also be recommended to be sure that residues are below tolerance levels before marketing. The aim of this research was conducted to evaluate the efficiency of certain insecticides against two pod borer insects and determination of insecticides residue in cowpea pods at different days of pre-harvest intervals for safe consumption.

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MATERIALS AND METHODS

Investigations were conducted in summer cultivation season of 2009 (April – September) in the experimental Farm of the Faculty of Agriculture, South Valley University, Qena Governorate; where sandy loam soil type was dominant. The cowpea crop, *Vigna unguiculata* (variety Azmerly) was raised in randomized block design with seven treatments replicated thrice in 20 m^2 plot size. Appropriate agronomic practices were followed for raising the cowpea crop. The insecticides used were cypermethrin (Ictamethrin 10 % E.C); deltamethrin (Decis 5 2.8 % EC); lambda-cyhalothrin (Karate); acetamiprid (Mospilan 20 % SP); thiamethoxam (Actara 25 % W.G.) and ethion (Endo 50 % E.C.). The above mentioned concentrations were prepared in water and sprayed on cowpea plants at the fruiting stage. Spaying was conducted using knapsack sprayer 20 L capacity. Complete coverage of plants was attained. The untreated control plots were left unsprayed. Care was taken to avoid any drift among the treated plots. Three replicates were made for each insecticide. For residue analysis, the samples of pods were drawn on 0 (1 hour), 1, 3, 7, 10, 15 and 21 days after the last application. Cowpea pods samples of 1 kg were collected at random, transferred to the laboratory and thoroughly mixed. Samples were then chopped and prepared for residue determination.

For Pyrethroid insecticides, cypermethrin; deltamethrin and lambda-cyhalothrin, residues, were extracted and cleaned up from all samples using the methods of López- López, *et al*., (2001). Cowpea pods samples 100 g were chopped into small pieces and blended with 150 mL dichloromethane. The extract was filtered through Buchner funnel. Extraction was repeated two more times with 50 mL dichloromethane each time. The dichloromethane extracts were combined and filtered through anhydrous sodium sulfate to eliminate any possible water. The resulting extracts were evaporated to near dryness using a rotary evaporator at 40 ºC. The residue obtained from the extract was re-dissolved in 5 ml *n*-hexane. The extract was cleaned by column chromatography using florisil PR (6 g) in a 2 cm i.d. glass column. The extract was eluted with hexane + acetone (9:1, 150 mL). The residue was concentrated to dryness and diluted with methanol (HPLC Grade) before HPLC analysis.

For Neonicotinoid insecticides, acetamiprid and thiamethoxam the residues were extracted from all samples using the methods of Sanyal, *et al*., (2008). Cowpea pods samples 100 g were chopped into small pieces and blended with 150 mL acetone. The extract was filtered through Buchner funnel. Extraction was repeated two more times with 50 mL acetone each time. The acetone extracts were combined and filtered through anhydrous sodium sulfate to eliminate any possible water. The collected filtrate was concentrated to 5 mL using rotary vacuum evaporator (40 ºC). The concentrated extract was quantitatively transferred to a 500 mL separatory funnel containing 100 mL of 5 % NaCl solution. The extract was then partitioned with hexane (50 + 50 mL) twice. The hexane layer was discarded. The extract was finally partitioned thrice with dichloromethane (100 + 50 + 50 mL) three times and collected by passing through anhydrous sodium sulfate. The extract was concentrated near dryness using rotary evaporator (35 ºC). The extract was cleaned by column chromatography using florisil PR (6 g) in a 2 cm i.d. glass column. The extract was eluted with hexane + acetone (1:1, 150 mL). The residue was concentrated to dryness and diluted with methanol (HPLC Grade) before HPLC analysis.

The residues of Pyrethroid insecticides and Neonicotinoid insecticides were estimated by high performance liquid chromatography (HPLC). The HPLC analysis was conducted with an instrument (water associates, Inc., Milford, MA) was operated with a reversed phase column using a solvent mixture of acetonitrile, methanol and water (60: 20: 20) at flow rate of 2 mL/min. An ultraviolet (254 nm) detection cell was used at sensitivity setting of 0.02 AUFS.

For Organophosphate insecticide, ethion residue an aliquot of 100 g of chopped cowpea pods from the collected samples was macerated in a blender and this sample dipped in about 150 mL acetone and kept overnight **(**Singh**,** *et al*., 2007). The extracted sample was filtered through anhydrous sodium sulfate to eliminate any possible water. The resulting extracts were evaporated to near dryness using a rotary evaporator at 35 ºC. The concentrate was taken in 1 ml *n*-hexane for clean up. Each sample was extracted three times using 100 mL acetone for each extraction. The acetone extract was filtered and transferred quantitatively to 500 mL separatory funnel, then 100 mL of distilled water was added and residues re-extracted three times with chloroform using 50 mL each time. The chloroform layer was dried over anhydrous sodium sulfate and then evaporated using rotary evaporator at 35 ºC**.** The residues were kept at – 10 ºC for 24 hr., then re-dissolved with 30 mL cold aqueous acetone (1:1) for 5 minutes, filtered and extracted three times with chloroform using 30 mL each time. The combined extracts were dried and evaporated as previously described. Residues were re-dissolved in 2 mL acetone and kept in the refrigerator until determination (Barakat *et al*., 1994).

The estimation of ethion residues was carried out by Gas Liquid Chromatography equipped with NPD and Pyrex glass column (1m x 2 mm i.d) packed with 3 % OV-101 on Chromosorb W HP. The injector, detector and oven temperatures were maintained at 260, 270 and 230 ºC, respectively. The flow rates of nitrogen, hydrogen and zero air were set at 40, 20 and 100 mL min^{-1}, respectively (Singh**,** *et al*., 2007).

For the efficacy evaluation against the pod borer, insects *H. armigera* and *E. zinckenella* weekly samples (10 pods / plot) were randomly collected during the reproductive growth stage, examined in the laboratory and when the average numbers of larvae of *H. armigera* and *E. zinckenella* considerably increased, the pesticides were applied. For each compound, spraying was conducted 2, 4 or 6 times throughout the reproductive stage (Gehan and Abdalla 2006). A Cifarelli knapsack sprayer 20 L capacity was used in applying the tested compounds as foliar treatments, dilute with water at the rate 400 L / fed. For assessing pod borer infestation Population reduction over control (PROC) was calculated by the formula (Flemming and Retnakaran 1985): PROC (%) $= 100 \times 1 - (T_a \times C_b) / (T_b \times C_a)$, where T_a = Population in treatment after spray; T_b = Population in treatment before spray; C_a = Population in control after spray; C_b = Population in control before spray.

RESULTS AND DISCUSSION

Rate of Recovery of Insecticides:

The average of recovery percentages of the insecticides from cowpea pods samples were 91**.**07, 88.57, 88.99, 91.05, 90.57 and 91.86 % for cypermethrin, deltamethrin, lambda-cyhalothrin, acetamiprid, thiamethoxam and ethion, respectively (Table 1).

Persistence of Insecticides in Cowpea Pods:

Residues of cypermethrin, deltamethrin, lambada-cyhalothrin, acetamiprid, thiamethoxam and ethion insecticides in cowpea pods are shown in Table (2) and figure (1). Results in Table 2 showed that the initial deposits of the pyrethroid insecticides, cypermethrin, deltamethrin, and lambada-cyhalothrin in cowpea pods were 9.21, 8.92 and 8.76 ppm, respectively. The deposited residues of neonicotinoid insecticides acetamiprid and thiamethoxam were 6.57 and 8.96 ppm.

The residues of ethion in cowpea pods at the initial deposit was 11.23 ppm (Table 2). Samples analyzed after one day from application proved recovered percentages, 75.24, 61.10, 51.48 for the pyrethroid insecticides, cypermethrin, deltamethrin and lambada-cyhalothrin, respectively. Cypermethrin residues decreased to 0.03 ppm after 15 days of application. At 21^{st} after spraying non detectable amount of cypermethrin, deltamethrin and lambada-cyhalothrin, in cowpea pods. More than 90 % of the tested pyrethroid and neonicotinoid insecticides residue dissipated after 10 days except the ethion insecticides dissipated after 15 days.

The residues of cypermethrin, deltamethrin and lambada-cyhalothrin, in cowpea pods after 15 days were 0.03, 0.04 ppm and non detectable residue, respectively (Table 2). Half life value ($T_{½}$) were 2.85, 145 and 0.95 days for cypermethrin, deltamethrin and lambada-cyhalothrin, respectively which indicate that cypermethrin was the highest persistent compound. The disappearance differed from compound to another as well as the period after which the evaluation of dissipation was assessed (Fig. 1).

Abdullah, *et al*., (2001) studied the cypermethrin insecticide residues in vegetable soybean at different days of pre-harvest interval. They found that cypermethrin residues were 1.62 mg/ kg at initial level (0 day) followed by 1.17, 0.94 and 0.69 mg /kg at 1, 3 and 5 days, respectively, in early wet season which were all above the maximum residue limit. At 10 day, the residues were 0.48 mg /kg which was below the maximum residue level set by FAO/WHO.

Brian, *et al*., (2001) determined the dissipation rates of pyrethroid insecticides when applied on various vegetable crops as foliar treatments. Cypermethrin residues on head lettuce were below 0.1 mg/kg^{-1} by day 10 but on the leafier romaine and endive varieties it was more persistent and required 14 – 19 days to dissipate below this concentration. On asparagus, deltamethrin and cypermethrin residues declined to less than 0.1 mg/kg^{-1} by days 1 and 2, respectively. In general, permethrin, cypermethrin and deltamethrin residues declined to acceptable concentrations within an acceptable pre-harvest interval.

Results in the same table also prove the rapid degradation of residues one week after treatment i.e. 176 and 1.37 ppm for acetamiprid and thiamethoxam. Prolonging the time of treatment to 10 and 15 days indicates negligible residues in cowpea pods i.e. 0.56 and 0.07 ppm for acetamiprid and 0.80 and 0.06 ppm for thiamethoxam. This is in accordance with the finding of Sanyal *et al*., (2008), Gupta, *et al*., (2005), Pramanik, *et al*., (2006), Reddy, *et al*., (2007). The rate of dissipation of acetamiprid and thiamethoxam residues was worked out by determining the $T_{½}$ value i.e. 3.0 and 2.95 days, respectively.

In case of ethion more than 80 % and 90 % of these residues dissipated after 10 to 15 days, respectively. Dissipation percentage of increased with progress in time and reached 95 – 99.5 % for ethion after 15 – 21

Table 1: Recovery percentage of the tested insecticides from cowpea pods

Amount added (ppm)	Cypermethrin	Deltamethrin	Lambada-cyhalothrin	Acetamipird	Thiamethoxam	Ethion
0.1	89.63	88.19	92.46	88.56	91.72	95.12
0.5	90.12	85.69	88.16	94.23	89.63	92.11
1.0	93.47	91.84	86.35	90.37	90.35	88.34
Mean	91.07	88.57	88.99	91.05	90.57	91.86

Table 2: Residues and recovered (%) of Cypermethrin, Deltamethrin, Lambada-cyhalothrin, Acetamipird, Thiamethoxam and Ethion insecticides used against two pod borer insects on cowpea pods after the last application.

Sampling (days)	Cypermethrin		Deltamethrin		Lambada-cyhalothrin		Acetamipird		Thiamethoxam		Ethion	
	Amount	% Recovered	Amount	% Recovered	Amount	% Recovered	Amount	% Recovered	Amount	% Recovered	Amount	% Recovered
* Initial	9.21	100	8.92	100	8.76	100	6.57	100	8.96	100	11.23	100
1	6.93	75.24	5.45	61.10	4.51	51.48	5.31	80.82	6.91	77.12	8.25	73.46
3	4.27	46.36	3.18	35.65	2.84	32.42	3.48	52.97	2.76	30.80	5.60	49.87
7	1.55	16.83	1.61	18.05	0.26	2.97	1.76	26.79	1.37	15.29	3.04	27.07
10	0.17	1.85	0.19	2.13	0.07	0.80	0.56	8.52	0.80	8.93	1.96	17.45
15	0.03	0.33	0.04	0.45	N.D	0.00	0.07	1.07	0.06	0.67	0.15	1.34
21	N.D	0.00	N.D	0.00	N.D	0.00	N.D	0.00	N.D	0.00	0.02	0.18
$T_{½}$	2.85		1.45		0.95		3.00		2.95		2.90	

* = One hour after spraying ND = no detectable $T_{½}$ = Half life values (days)

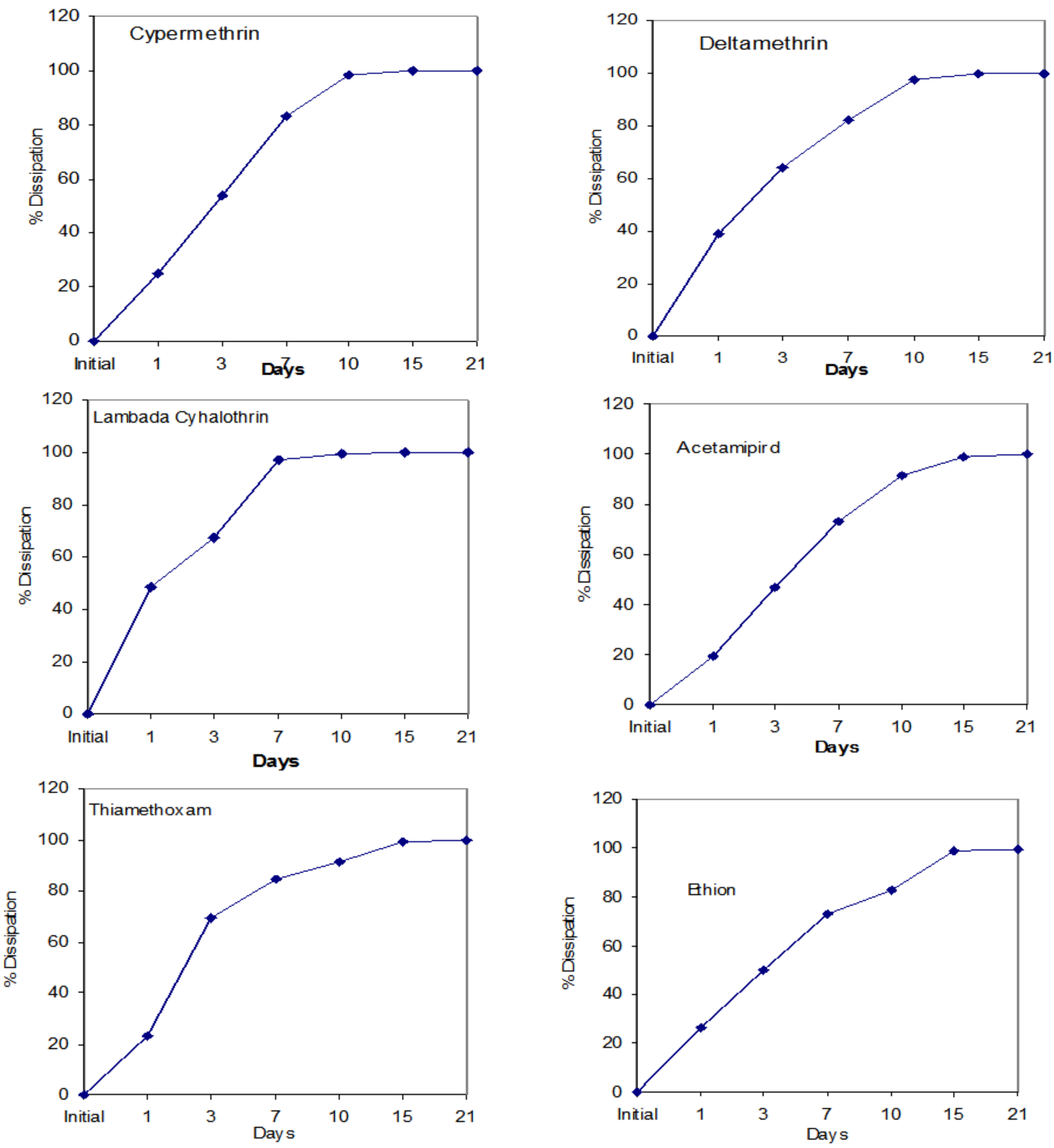

Fig. 1: Dissipation of Cypermethrin, Deltamethrin, Lambada-cyhalothrin, Acetamipird, Thiamethoxam and Ethion insecticides in cowpea pods at different intervals after the last application

days of treatment (Table 2 and Fig. 1). Half-life ($T_{½}$) value for degradation of ethion on cowpea pods was 2.90 days. This is in accordance with the finding of Singh, *et al*., (2007).

Effect of the Tested Compounds on H. Armigera:

The average number of larvae/replicate and percent of reduction in infestation are presented in tables (3 and 4). The results showed that the most insecticides were able to suppress the levels of infestation to different degrees in comparison to that of untreated control. In the 1st week after spraying, where all the plots were treated once, thiamethoxan and ethion gave 67.05 and 66.31 % reduction in infestation, respectively, meanwhile lambada-cyhalothrin, cypermethrin, acetamiprid and deltamethrin gave 60.03, 56.82, 55.62 and 52.29 % reduction in infestation, respectively. The present results also indicated that, the reduction in infestation obtained in 3rd and 4th inspections varied according to number of sprays applied. The larval population of *H. armigera* depressed more when the tested compounds were applied 4 times (treatments B) than those applied twice (treatments A).

The reduction in infestation amounted to be 57.73 and 33.61 % when thiamethoxan was applied twice compared to 83.22 and 92.40 % in those received 4 times application, at 3rd and 4th inspections, respectively. A similar pattern of efficiency was manifested in most corresponding treatments (Table 3 & Fig. 2).

Table 3: The efficacy of certain insecticides against *H. armigera* after 2nd spray and 4th spray

Treatment		Before treatment	Mean number larvae / 10 cowpea pods and % percent reduction as indicated weeks after treatments								General mean	
			1		2		3		4			
			NO.	% R.	NO.	% R.	NO.	% R.	NO.	% R.	NO.	% R.
Cypermethrin	A	8.5	3.8	56.82	3.7	59.78	4.1	57.73	7.9	33.61	4.88	52.00
	B	9.4	3.1	68.15	3.0	70.51	1.8	83.22	1.0	92.40	2.23	78.57
Deltamethrin,	A	8.3	4.1	52.29	3.3	63.27	4.3	54.60	8.5	28.65	5.05	49.70
	B	9.2	4.0	58.00	2.9	70.88	1.5	85.71	1.2	90.68	2.40	76.32
Lambada-cyhalothrin	A	8.7	3.6	60.03	3.0	68.14	3.3	66.76	8.2	32.68	4.53	56.90
	B	8.5	3.2	63.70	2.7	70.65	1.0	89.69	0.5	95.80	1.85	79.96
Acetamipird	A	7.4	3.4	55.62	2.9	63.79	4.2	50.26	7.3	29.54	4.45	49.80
	B	8.7	3.5	61.14	3.4	63.40	2.1	78.85	0.7	94.25	2.43	74.41
Thiamethoxam (Actara 25 % W.G.)	A	8.5	2.9	67.05	2.7	70.65	3.8	60.82	7.2	39.50	4.15	59.51
	B	9.2	2.9	69.55	2.6	73.89	1.4	86.67	0.4	96.89	1.83	81.75
Ethion	A	8.6	3.0	66.31	2.8	69.92	4.6	53.13	7.0	41.86	4.35	57.81
	B	9.1	2.7	71.43	2.5	74.62	1.2	88.44	0.6	95.29	1.75	82.45
Control		8.5	8.8		9.2		9.7		11.9		9.90	

A = Received two applications B = Received four applications
No = Average number of larvae / 10 pods % R = Reduction in infestation

Table 4: The efficacy of certain insecticides against the pod borer, *E.zinckenlla* after 2nd spray, 4th spray and 6th spray

Treatment		Before treatment	Mean number larvae / 10 cowpea pods and % percent reduction as indicated weeks after treatments												General mean	
			1		2		3		4		5	6				
			NO.	% R.	NO.	% R.	NO.	% R.	NO.	% R.	NO.	% R.	NO.	% R.	NO.	% R.
Cypermethrin	A	7.2	4.8	41.67	4.0	50.22	5.6	41.93	9.6	12.16	11.3	4.47	16.4	0.00	8.62	25.08
	B	8.4	3.8	60.42	3.0	68.0	2.4	78.67	1.3	89.80	7.2	47.83	12.0	25.92	4.95	61.77
	C	11	4.2	66.59	3.2	73.93	3.0	79.64	3.0	82.03	2.0	88.93	1.2	94.34	2.67	80.91
Deltamethrin	A	7.6	4.4	49.34	3.6	57.56	5.0	50.88	9.0	21.98	11.9	4.69	14.2	3.12	8.02	31.26
	B	9.0	4.4	57.22	3.4	66.15	2.0	83.41	1.8	86.82	14.1	2.47	17.1	0.00	7.13	49.35
	C	11.2	4.8	62.50	4.4	64.80	3.4	77.33	3.1	81.76	3.0	83.70	1.6	92.60	3.38	77.12
Lambada-cyhalothrin	A	8.9	4.3	57.72	3.8	61.74	7.3	38.76	10.4	23.01	12.0	17.93	15.2	11.44	8.83	35.10
	B	8.8	4.3	57.24	4.0	59.27	2.5	78.80	2.0	85.03	8.0	37.57	14.0	6.93	5.80	54.14
	C	9.7	5.2	53.09	4.0	63.05	2.8	78.44	2.4	83.70	2.0	87.45	1.2	93.59	2.93	76.55
Acetamipird	A	9.0	3.4	66.94	3.6	64.16	6.4	46.90	12.0	12.16	15.4	0.04	20.4	0.00	10.20	31.70
	B	7.8	3.6	59.62	3.2	63.24	2.6	75.11	2.4	79.73	8.7	28.44	13.8	3.30	5.72	51.57
	C	9.2	4.6	56.25	2.6	74.68	2.4	78.90	2.0	85.68	1.8	88.09	0.7	96.05	2.35	79.94
Thiamethoxam	A	8.6	3.6	63.37	3.4	64.58	5.8	49.64	11.9	8.84	16.7	0.00	19.6	0.00	10.17	31.70
	B	7.4	3.6	57.43	3.4	58.83	3.0	69.73	1.2	89.32	8.7	28.44	13.8	3.30	5.62	51.18
	C	9.0	4.4	57.22	2.8	72.12	2.6	78.43	2.4	82.43	2.3	84.44	1.2	93.09	2.62	77.96
Ethion	A	7.9	3.8	57.91	2.8	68.24	5.2	50.85	12.0	0.07	15.6	0.00	17.4	0.00	9.47	29.51
	B	8.6	3.4	65.41	3.1	67.70	2.6	77.43	1.9	85.32	9.2	34.88	13.6	18.00	5.63	58.12
	C	9.8	4.6	58.93	2.6	76.23	2.0	84.76	2.0	86.55	1.2	92.55	0.6	96.83	2.17	82.64
Control		11.2	12.8		12.50		15.0		17.0		18.4		21.6		16.22	

A = Received two applications B = Received four applications C = Received six applications
No = Average number of larvae / 10 pods % R = Reduction in infestation

Effect of the Tested Compounds on E.zinckenlla Infestation:

Data in table (4) and Fig. (2) showed the different potencies of the six tested insecticides against the pod borer insect, *E. zinckenella*. The treatments were recognized at 3rd inspection and forth where pesticides were applied 2, 4 and 6 times throughout the season. A progressive increase in larval population was observed in the successive samples collected from treatments A (where the plots were received only twice sprays) table (4). This mean that the direct spray was able to affect the pod borer and protect cowpea plants for only two weeks after application and the insect population regained its vitality afterwards i.e. indicating short residual effects of the tested compounds.

Acetamiprid presented 66.94 and 64.16 % reduction in infestation after one and two weeks of spraying while thiamethoxam displayed 63.37 and 64.58 % reduction against *E. zinckenella* population, respectively.

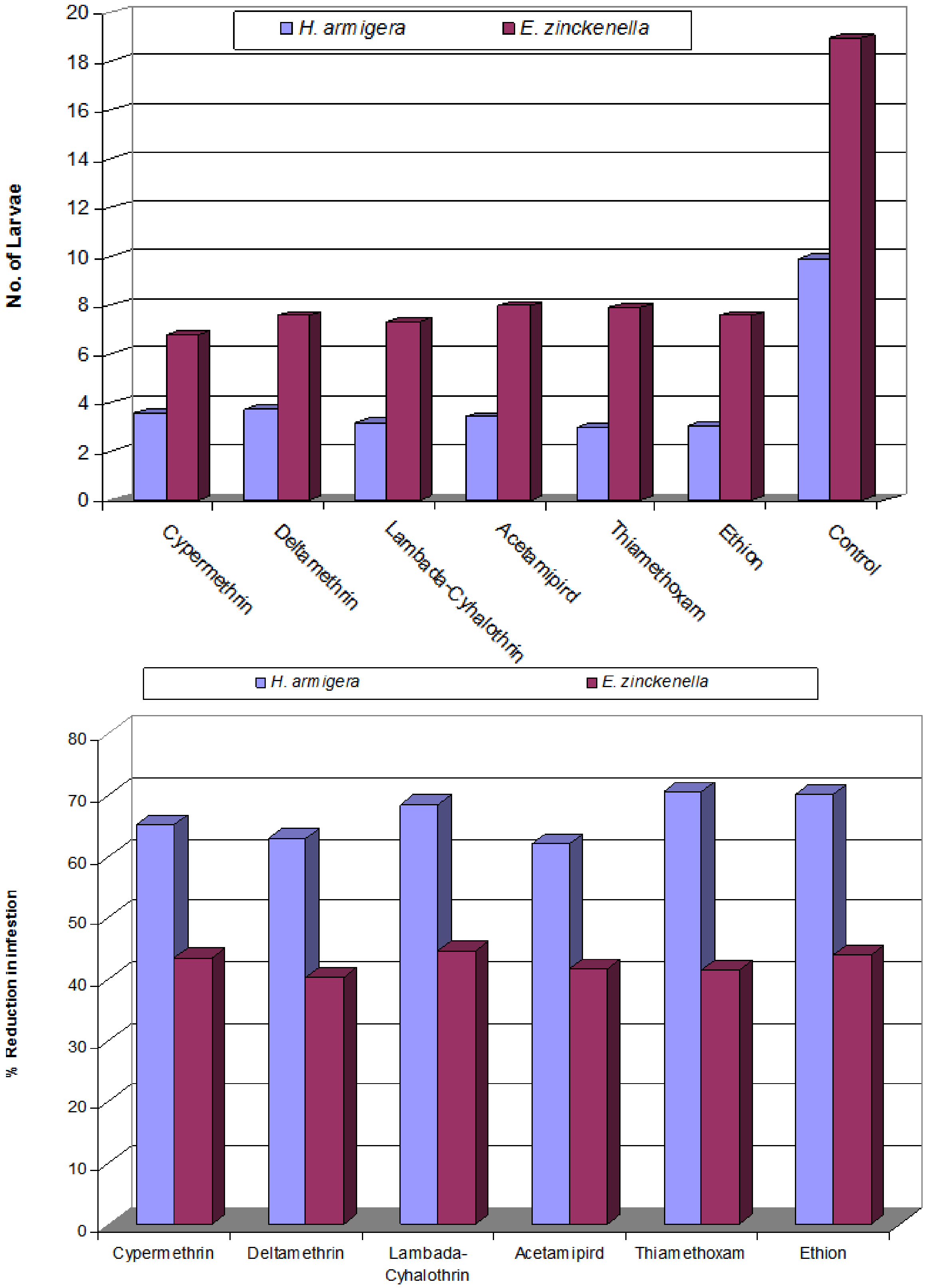

Fig. 2: The efficacy of the tested insecticides against the two pod borer insects, *H. armigera* and *E. zinckenella* after 2nd spray and 4th spray

After four weeks of application, the highly effective compounds on *E. zinckenella*, larval stages were recorded by pyrethroid insecticides, the percentages reduction increased to 89.80 % (cypermethrin), 86.82 % (deltamethrin) and 85.03 % (lambada-cyhalothrin), respectively (Table 4).

Abo El-Ghar *et al*., (1994), mentioned that the numbers of *E. zinckenella* larvae found 7 days post treatments of selected organophosphorous, carbamates and pyrethroids insecticides were significantly reduced by < 86 % than those in the untreated plots. However, the IGRs applied alone, flufenoxuron, Dowco–439 or mixtures methomyl / flufenoxuron and chlorpyrifos / Dowco–439 exhibited moderate levels in controlling the larvae through 21 days after treatments.

Similarly, the insect population of treatments B raised with the time elapsed after spraying compared to those treated six times (treatments C). this confirm the previous results of short residual effects of the tested compounds. Such decline (short persistence) of the activity was manifested even in the conventional pesticides. The residual effects of the tested compounds were varied on the *E. zinckenella* larvae after the end of experiment, the highest effective compound were ethion insecticide which reduced the insect population to 82.64 %. Cypermethrin, acetamiprid, thiamethoxam, deltamethrin and lambada-cyhalothrin were effective against the tested insect, they reduced the larvae population which presented percent reduction in infestation 80.91, 79.94, 77.96, 77.12 and 76.55 %, respectively.

In controlling the major insect pests, including *H. armigera* and *E. zinckenella* of soybean in Thailand, Abdullah *et al*., (2001) concluded that better control and highest yield were achieved when applied cypermethrin at 0.007 %, Azadirachtin at 0.01 % or Delfin at 53.000 unit/mg at 10 days interval until harvest.

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REFERENCES

Abdalla, S.A., A.A. Barakat, E.A. Sammour, H.M.A. Badawy and M.M.M. Soliman, 1994. Field evaluation of certain insecticides against cowpea pod borer, *Etiella zinckenella* (Treitschke). Bull. Ent. Soc. Egypt Econ. Ser., 21: 191-197.

Abdullah, Md., S. Ouab and J. Suratwadee, 2001. Cypermethrin insecticide residues in vegetable soybean, Glycine max (L.) Merrill, at different days of pre-harvest interval. Kasetsart J. (Nat. Sci.), 35: 115-121.

Abo El-Ghar, G.E.S., A.M. El-Sayed, A.E. El-Shiekh and H.S.A. Radwan, 1994. Field tests with insecticides and insect growth regulators to control insect pests of cowpea and its effects on certain beneficial insects. Arch. Phytopath. Pflanz., 28: 531-543.

Akimbo, O., S.A. Ogunbyo, K.A. Sanni and A.O. Ojo, 2006. Effect of different rates and methods of benomyl and mancozeb application on delay in senescence and grain yield of cowpea (*Vigna unguiculata* (L) Walp) under different cropping season. Afr. J. Biotechnol., 5(17): 1545-1550.

Barakat, A.A., S.A. Abdalla, H.M.A. Badawy, E.A. Sammour and M.M.M. Soliman, 1994. Persistence of profenofos and pirimiphos methyl in green cowpea pods and on films exposed to Ultra-Violet and sun rays. Bull. Ent.Soc. Egypt Econ. Ser., 21: 103-111.

Brian, D.R., M.R. Gwen, C.H. Ronald, D. MaryAnne and D.B. Pamela, 2001. Pyrethroid insecticide residues on vegetable crops. Pest. Manag. Sci., 57: 683-687.

FAO, 1993. Plant production and protection paper 56. Pesticide Residues in food. Rep. Joint meeting on pesticide residues held in Geneva, December 5 – 14, Rome 4(4): 12-20.

Flemming, R. and A. Retnakaran, 1985. Evaluating single treatment data using Abbot's formula with references to insecticides. J. Econ. Entomol., 78: 1179-1181.

Gehan, Y.A. and E.F. Abdalla, 2006. Evaluation of some selected pesticides against the two pod borers, *Helicoverpa armigera* and *Etiella zinckenella* population infesting cowpea in the newly reclaimed regions. Res. J. Agric. Biol. Sci., 2(6): 578-583.

Gupta, R.K., S. Gupta, V.T. Gajbhiye, H.C. Meher, G. Singh, 2005. Residues of imidcloprid, acetamiprid and thiamethoxam in gram. Pestic. Res. J., 17(1): 46-50.

López- López, T., M.D. Gil-Garcia, J.L. Martinez-Vidal and M. Martinez-Galera, 2001. Determination of pyrethroids in vegetables by HPLC using continuous on-line post elution photoirradiation with fluorescence detection. Analytica Chemica Acta., 447: 101-111.

Manuel Mateu-Sanchez, Mercedes Moreno, F. Javier Arrebola and Jose Luis Martinez Vidal, 2003. Analysis of Acetamiprid in vegetables using Gas Chromatography-Tandem Mass Spectrometry. Analytical Science, 19(5): 701-704.

Onwueme, C.J. and O.T. Sinha, 1991. Field crop C.T.A publication, pp: 259.

Pramanik, S.K., J. Bhattacharyya, S. Dutta, P.K. Dey and A. Bhattacharyya, 2006. Persistence of acetamiprid in/on mustard (*Brassica juncea* L.). Bull. Environ. Contam. Toxicol., 76: 356-360.

Rachie, K.O., 1985. Introduction; Cowpea research, production and utilization. Edited by Singh and Rachie. John Wiley and Sons Ltd., pp: 320.

Reddy, K.N., S. Satyanarayana and K.D. Reddy, 2007. Persistence of some insecticides in chilies. Pestic. Res. J., 19(2): 234-236.

Sanyal, D., D. Chakma and S. Alam, 2008. Persistence of a Neonicotinoid Insecticide, Acetamiprid on Chili (Capsicum annum L.). Bull. Environ. Contam. Toxicol., 81: 365-368.

Singh, B.B. and S.R. Singh, 1992. Breeding for Bruchid resistance in cowpea (*Vigna unguiculata* (L) Walp) II TA. Research Reports, 5: 1-4.

Singh, G., B. Singh, R.S. Battu, G. Jyot, B. Singh and B.S. Joia, 2007. Persistence of Ethion residues on Cucumber, *Cucumis sativus* (Linn.) using Gas Chromatography with Nitrogen Phosphorus Detector. Bull. Environ. Contam. Toxicol., 79: 437-439 .

Tianwen, C. and C. Guonan, 2007. Identification and quantitation of pyrethroid pesticide residues in vegetables by solid-phase extraction and liquid chromatography/electrospray ionization ion trap mass spectrometry. Rapid Commun. Mass Spectrom., 21: 1848-1854.

Van Den Berg, H., B.M. Shepared and N. Nasikin, 1998. Damage incidence by *Etiella zinckenella* in soybean in East Java, Indonesia. Inter. J. Pest Management, 44(3): 153-159.