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LABORATORY EVALUATION OF TOXICITY OF SEVERAL PESTICIDES AGAINST FIELD STRAINS OF THE COTTON APHID *Aphis gossypii* GLOVER COLLECTED FROM DIFFERENT GOVERNORATES AT THE EARLY COTTON GROWING SEASON 2000

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ABSTRACT

Sixteen insecticides and one of each mineral oil, natural product and insecticidal soap were tested against adults of the cotton aphid *Aphis gossypii* Glover collected from eight Egyptian Governorates in early 2000 cotton growing season. The results showed that the pyrethroid Karate was the most toxic followed by the mineral oil KZ-oil and the pyrethroid Meothrin then the pyrethroids Baythroid and Sumicidin, while the carbamate Aphox and most of the organophosphorus compounds and the insecticidal soap M.Pede were the least toxic. The natural product Neemix was less toxic when compared with pyrethroids, but it was more toxic than OP compounds. Compared with OP compounds, Actara, MTI-446 and Confidor were more toxic in Lower Egypt but they were less toxic in Fayoum.

INTRODUCTION

In recent years, cotton aphid *Aphis gossypii* Glover became a serious pest on cotton crop. This pest attack cotton at the early and late of its growing season. Therefore, laboratory screening of insecticides against cotton aphid was required to help developing a sound control program in the future.

The purpose of the present work is to investigate the potency of several compounds belonging to seven OPs, four pyrethroids, two carbamates and one of each mineral oil, natural product and insecticidal soap against field strains of the cotton aphid *Aphis gossypii* Glover collected from eight different Governorates at the early of cotton growing season 2000.

MATERIALS AND METHODS

Samples of cotton leaves infested with *A.gossypii* Glover were collected from field of Menofia, Sharkia, Dakahlia, Gharbia, Behera, Fayoum, Beni-Suef and Menia Governorates early in 2000 cotton season.

Slide-dipping technique was used to evaluate the toxicity of the tested insecticides against the adult stage. Serial concentrations of each insecticide was prepared by dissolving in water. By means of fine brush, ten adults were affixed to double faced scotch tap and stuck tightly to slide on the dorsal part. The slides were then dipped in the prepared insecticide aqueous solutions for ten seconds. Each insecticide was tested at five different concentrations. Three replicates of ten adults each were used for each concentration.

Mortality was recorded two hours after treatment and all insects responded to touching with the fine brush were considered alive.

Abbott formula (1925) was adopted and data were then subjected to statistical analysis by the method of Busvine (1957). The toxicity index of each insecticide was determined according to Sun (1950) as follow:

$$\text{Toxicity index (TI)} = \frac{LC_{50} \text{ of the most effective insecticide}}{LC_{50} \text{ of the least effective insecticide}} \times 100$$

Pesticides used:

I - OP insecticides: cyanofos (Cyanox) 50% EC, pirimiphos-methyl (Actellic) 50% EC, chlorpyrifos-methyl (Reldan) 50% EC, profenofos (Selecron) 72% EC, fenitrothion (Sumithion) 50% EC, malathion (Malathion) 57% EC, prothiofos (Tokuthion) 50% EC.

II - Carbamate insecticides: carbosulfan (Marshal) 25% WP and pirimicarb (Aphox) 50% DG.

III - Pyrethroids: cyfluthrin (Baythroid) 5% EC, lambda-cyhalothrin (Karate) 8.33% EC, fenpropathrin (Meothrin) 20% EC, fenvalerate (Sumicidin) 5% EC.

IV - Mineral oil: miscible (KZ-oil) 95% EC.

V - Natural product: azadirachtin (Neemix) 4.5% EC.

VI - Insecticidal soap: potassium salts of fatty acids (M.Pede) 4.5% EC.

VII - Different groups of insecticides: thiamethoxam (Actara) 25% WG, Imidacloprid (Confidor) 20% SC, dinotefuran (MTI-446) 20% WP.

RESULTS AND DISCUSSION

Toxicity index of 16 insecticides and one of each mineral oil, natural product and insecticidal soap tested against field strains of *A. gossypii* are shown in Table (1). In general, results showed that the pyrethroid Meothrin was the most toxic insecticides in all Governorates with LC50 values of 12.4, 9.7, 21.8, 27.5, 27.9, 32.1, 39.6 and 40.7ppm in Fayoum, Sharkia, Menofia, Behera, Dakahlia, Beni-Suef, Menia and Gharbia.The another pyrethroid Karate came next on the list of toxicity followed by the mineral oil KZ-oil in Gharbia, Behera, Fayoum and Menia. In the other Governorates, Karate and KZ-oil exchanged their places to be KZ-oil and Karate. On basis of toxicity index, the toxicity of Karate and KZ-oil ranged between 38.1-71.4% and 37.1-90.4%, respectively of the toxicity of Meothrin. However, the carbamate Aphox was the least toxic insecticides followed by OP compounds, the carbamate Marshal and M.Pede in all Governorates of Lower Egypt. The relative toxicity factors of Aphox, OP compounds and M.Pede ranged between 0.17-0.44%, 0.14- 3.1% 0.17-8.7% and 0.7-1.2%, respectively of the toxicity of Meothrin. As for Upper Egypt, Aphox was also the least toxic insecticides in all Governorates followed by M.Pede, Actara, MTI-446 and Confidon only in Fayoum. On basis of toxicity index, Aphox was 0.2, 0.4 and 0.6% as toxic as Meothrin in Fayoum, Beni-Suef and Menia, respectively. The toxicity of M.Pede, Actara, MTI-446 and Confidor ranged between 0.6 -

1.4% of the toxicity of Meothrin. On the other hand, all other compounds lie between high and low toxic insecticides on the list of toxicity.

With regard to pyrethroids, Meothrin was the most toxic followed by Karate then Sumicidin and Baythroid in Dakahlia and Sharkia. In all other Governorates, the descending order of toxicity was the same except for a switch in position of Sumicidin and Baythroid. On the other hand, pyrethroids were more toxic in Upper Egypt than of Lower Egypt. The toxicity of these compound in Lower Egypt and Upper Egypt ranged between 38.1-71.4% and 41.9-69.2% for Karate, 4.2-7.5% and 33.2-55.7% for Baythroid, 2.7-15.9% and 6.8-19.0% for Sumicidin when compared with Meothrin, respectively.

Compared to pyrethroids, OP compounds were far less toxic action in each Upper Egypt and Lower Egypt. On the other hand, OP compounds were more toxic in Upper Egypt than in Lower Egypt. On basis of toxicity index, the toxicity of OP compounds ranged between 0.14-3.1 and 1-10.3% of the toxicity of Meothrin in Lower Egypt and Upper Egypt, respectively. Within OP compounds, the higher toxicity of OP compounds in different Governorates was as follows: Sumithion and Tokuthion in Menofia, Tokuthion and Reldan in Gharbia, Reldan and Sumithion in Sharkia, Selecron in Behera, Selecron and Reldan in Dakahlia, Selecron in Fayoum, Selecron and Sumithion in Beni-Suef, Reldan in Menia. However the lowest toxic OP compounds was Selecron in Menofia, Gharbia and Sharka, Sumithion and Cyanox in Dakahlia and Behera, Malathion in Fayoum and Menia and Tokuthion in Beni-Suef.

As for Actara, MTI-446 and Confidor, the results showed that these compounds were less toxic in Upper Egypt than in Lower Egypt. On the other hand, MTI-446 was the most toxic followed by Actara then Confidor in Menofia, Gharbia and Dakahlia, while in Sharkia, the order of toxicity was Confidor, Actara and MTI-446, but it was Confidor followed by MTI-446 then Actara in Fayoum.

Going to Neemix, Data showed that it was less toxic when compared with pyrthroids, however inconsistent toxic effect was noticed when compared with OP compounds. Similar results were also obtained with M.Pede.

In general, summarized results showed that pyrethroids were more toxic than organophosphorus and carbamate compounds against *A. gossypii.* Similar results were found by Ayad *et al.*, (1991-1992) who reported that pyrethroids were the most toxic insecticides against *A.gossypii* Glover followed by OP compounds then carbamates. However, Babu and Azam (1982) found that the OP monocrotophos was more toxic than the pyrethroid cypermethrin in *A. gossypii.* Results in Table (1) also showed that the mineral oil KZ-oil was more toxic than OP compounds against *A. gossypii* Glover. Similar findings were also indicated by El-Deeb *et al.*, (1989) who found that except for pirimiphos-ethyl which was the most effective chemical tested against the apricot aphid *Hyalopterus pruni* Geofry, the mineral oil Star oil was superior over all the organophosphorus insecticides recommended for aphid control.

Table (1): Toxicity index of several insecticides against different Governorates field strain of cotton aphid *Aphis gossypii* Glover

Insecticide	Fayoum			Sharkia		
	Slope ± S.E	LC_{50} (5% fiducial limit) in ppm	TI	Slope ± S.E	LC_{50} (5% fiducial limit) in ppm	TI
Meothrin	4.52 ± 0.77	12.4 (10.3 -15)	100	3.60 ± 0.58	9.7 (7.6 -12.3)	100
Karate	2.32 ± 0.41	29.6 (22.9 -39.6)	41.9	1.66 ± 0.48	46.7 (30.7 -118.5)	41.2
Baythroid	2.39 ± 0.41	7.3 (5.7 - 9.5)	33.9	1.26 ± 0.45	257.3 (97.4 - 490.7)	7 5
Sumicidin	3.81 ± 0.79	65.2 (51.9 - 81.7)	19.0	1.54 ± 0.45	121.3 (73.1 - 210.5)	15.9
Malathion	3.06 ± 0.63	370.2 (237.2 -493.3)	3.3	2.10 ± 0.52	4601.5 (3255.9 - 8485.8)	0.42
Selecron	1.08 ± 0.36	120.5 (60.7 - 233.7)	10.3	1.63 ± 0.42	1398.9 (629.8 -2341.7)	0.14
Reldan	3.25 ± 0.73	239.1 (170.3 -298.9)	5.2	2.69 ± 0.77	3562.1 (2119.8 - 8416.7)	0.54
Tokuthion	1.39 ± 0.37	211.6 (138.2 - 370.8)	5.9	1.51 ± 0.52	6557.4 (4014 -16463.4)	0.29
Actellic	2.23 ± 0.33	185.6 (139.7 -239.4)	6.7	4.05 ± 0.87	7499.9 (5929.1 - 9487.1)	0.26
Sumithion	2.03 ± 0.68	348.4 (----------)	3.7	1.33 ± 0.53	4496.7 (268.6 -9236.3)	0.43
Cyanox	1.55 ± 0.41	343.9 (238.1 - 615.5)	3.6	2.87 ± 0.76	11427 (8155.9 -15637.4)	0.17
Marshal	2.97 ± 1.38	173.6 (----------)	7.1	1.87 ± 0.54	11504.9(7464.7- 35179.3)	0.17
Aphox	2.60 ± 0.56	9743.5 (7318.1 -13454.1)	0.2	2.02 ± 0.72	6757.2 (4568.1 -15607.3)	0.29
Actara	5.80 ± 1.27	1992.3 (1654.0 - 2429.1)	0.62	2.52 ± 0.53	634.2 (460.1 - 916.7)	3.0
MTI-446	2.78 ± 0.55	1399.0 (1064.0 - 1904.9)	0.9	2.16 ± 0.49	739.6 (531.2 -1124.6)	2.6
Confidor	1.92 ± 0.49	914.1 (462.4 - 1323)	1.4	1.70 ± 0.49	581.4 (359.1 -1627.0)	3.3
KZ-Oil	2.66 ± 0.69	33.4 (20.3 - 43.7)	37.1	2.92 ± 0.77	39.6 (27.2 - 52.9)	48.7
Neemix	2.75 ± 0.85	509.6 (370.2 -1165.3)	2.4	3.36 ± 2.37	666.9 (----------)	2.9
M.Pede	2.88 ± 0.46	2011.8 (1604.1 -2576.8)	0.6	2.67 ± 0.66	2870.9 (2109.3 - 4990.9)	0.7
	Dakahlia			Menufia		
Meothrin	0.68 ± 0.21	27.9 (3.7 - 80.1)	100	3.64 ± 0.83	21.8 (16.9 - 28.5)	100
Karate	1.83 ± 0.50	48.9 (32.9 - 112.7)	57.1	3.58 ± 0.96	56.9 (44.3 - 90.4)	38.1
Baythroid	3.12 ± 0.58	665.5 (515.2 - 870.8)	4.2	3.25 ± 0.61	497.1 (381.5 - 636.2)	4.4
Sumicidin	1.40 ± 0.33	910.8 (286.2 -1627.6)	3.1	4.92 ± 1.02	780.9 (646.2 - 969.1)	2.7
Malathion	1.40 ± 0.45	2424.9 (1340.9 - 4397.3)	1.2	1.48 ± 0.69	5050(2952 - 3.07004E+05)	0.4
Selecron	0.99 ± 0.43	1390.8 (107.2 - 2867.3)	2.0	3.06 ± 0.79	14630 (11118.9 - 21309)	0.15
Reldan	0.86 ± 0.43	1491 (2.80525E -5 - 9401)	1.9	2.58 ± 0.52	7164.2 (5292.8 - 9722.1)	0.3
Tokuthion	3.50 ± 0.82	3556.8 (2673.4 - 4583.5)	0.78	2.34 ± 0.74	2700.9 (1834.6 - 5182.8)	0.8
Actellic	1.19 ± 0.44	3805.5 (1118.2 - 6846.6)	0.73	2.56 ± 0.53	4231.0 (3020.3 - 5656.2)	0.51
Sumithion	0.95 ± 0.43	9728 (4238 - 2.10259E+05)	0.29	1.69 ± 0.69	2180.6 (804.0 - 3872.2)	1.0
Cyanox	1.63 ± 0.45	6975.1 (3928.5 -10822.9)	0.4	3.11 ± 0.58	4014.9 (3080.2 - 5200.9)	0.54
Marshal	2.00 ± 0.71	2555.5 (1293.8 - 3952.9	1.1	2.86 ± 0.73	11098.5 (8652.5 - 16619	0.2
Aphox	1.88 ± 0.47	9325.2 (6426.2 - 15404.4)	0.3	2.89 ± 1.68	12679.3 (---- ----)	0.17
Actara	3.57 ± 0.84	502.4 (393.6 - 681.9)	5.6	2.09 ± 0.45	311.3 (191.9 - 486 1)	7.0
MTI-446	2.01 ± 0.55	244.1 (160.3 - 376.8)	11.4	1.16 ± 0.37	232.7 (69.4 - 465.5)	9.3
Confidor	2.04 ± 0.75	737.1 (494.2 - 3276.9)	3.8	1.99 ± 0.45	1026.4 (597.8 - 1615.8)	2.1
KZ-Oil	2.49 ± 0.53	482.3 (332.6 - 647.3)	57.9	1.13 ± 0.36	34.3 (11.7 - 72.9)	63.3
Neemix	3.10 ± 0.78	1126.9 (842.8 - 1531.3)	2.5	2.21 ± 0.50	1020.9 (738.4 - 1545.3)	2.1
M.pede	1.89 ± 0.47	228.7 (1574.4 - 3774.1)	1 2	2.16 ± 0.52	2956.1 (2122.8 - 4998.8)	0.7

Toxicity index (TI) = (LC_{50} of the most effective insecticide / LC_{50} of the least effective insecticide) x 100

Table (1): Cont.

Insecticide	Behera			Gharbia		
	Slope ± S.E	LC_{50} (5% fiducial limit) in ppm	TI	Slope ± S.E	LC_{50} (5% fiducial limit) in ppm	TI
Meothrin	2.98 ± 0.50	27.5 (21.4 – 36.6)	100	3.83 ± 0.73	40.7 (32.6 - 52.2)	100
Karate	4.32 ± 0.78	43.5 (36.6 – 53.1)	63.2	3.85 ± 1.02	56.9 (44.9 - 86.8)	71.4
Baythroid	1.76 ± 0.41	607.5 (429.0 - 1122.4)	4.5	1.06 ± 0.43	964.1 (484.2 - 5416)	4.2
Sumicidin	2.87 ± 0.54	967.9 (766.7 - 1369.1)	2.8	3.37 ± 0.81	1081.5 (489.8 - 1398)	3.8
Malathion	2.80 ± 0.49	4314.4 (3445.3 - 5819.9)	0.64	1.53 ± 0.39	11031.9 (6372 - 32405)	0.37
Selecron	1.95 ± 1.14	3458.7 (————)	0.80	1.87 ± 0.49	14628 (10060 - 28923.6)	0.28
Reldan	3.51 ± 0.59	6131.1 (4905.8 - 7745.8)	0.45	1.16 ± 0.34	4393.7 (2831.1 - 6572.1)	0.93
Tokuthion	2.90 ± 0.46	4960.8 (3957.6 - 6146.4)	0.55	2.92 ± 0.47	3701.4 (2849.9 - 4788.6)	1.1
Actellic	1.61 ± 0.39	4483.5 (2584.2 - 8234.6)	0.61	4.14 ± 0.95	10339.3 (8297 - 13709)	0.39
Sumithion	2.25 ± 0.50	7909.8 (5986.1 - 10915.3)	0.35	2.42 ± 0.53	10200.3 (7555.9 - 15110)	0.40
Cyanox	3.37 ± 0.50	10953 (9028 .3 - 13488.9)	0.25	4.33 ± 0.92	6837.1 (5500.9 - 8648.9)	0.60
Marshal	2.24 ± 0.66	8736.7 (6408.8 - 17627.5)	3.1	1.86 ± 00	7583.9 (5420.8 - 11734)	0.54
Aphox	4.00 ± 0.73	6273 (5235.5 - 7721.6)	0.44	3.82 ± 1.05	15064.9 (11019 - 18656)	0.27
Actara	———	————	—	3.28 ± 0.79	1846.2 (1363.2 - 2597.8)	2.2
MTI-446	———	————	—	1.11 ± 0.35	1379.1 (557.5 - 2664.9)	3.0
Confidor	———	————	—	1.65 ± 0.40	2268.1 (1345.5 - 4288.1)	1.8
KZ-oil	2.86 ± 0.43	114.2 (89.6 - 144.7)	24.1	2.48 ± 0.76	72.4 (51.3 - 142.2)	56.2
Neemix	2.87 ± 0.45	800.5 (642.9 - 1001.0)	3.4	3.12 ± 0.59	757.0 (582.9 - 982.2)	5.4
M.Pede	3.74 ± 0.68	2437.4 (1968.2 - 3016.8)	1.1	2.42 ± 0.76	3733.7 (2682.9 - 7611.9)	1.1
	Menia			Beni-Suif		
Meothrin	2.18 ± 0.46	39.6 (30.5 - 49.3)	100	2.12 ± 0.36	32.1 (21.6 - 42.3)	100
Karate	3.77 ± 0.88	57.2 (43.5 - 99.4)	69.2	2.24 ± 0.69	55.1 (42.8 - 83.2)	58.3
Baythroid	2.13 ± 0.78	71.1 (————)	55.7	1.68 ± 0.39	96.7 (69.2 - 167.2)	33.2
Sumicidin	0.99 ± 0.36	583.4 (325.0 - 6731)	6.8	1. 38 ± 0.79	184.1 (125.3 - 280.3)	17.4
Malathion	2.20 ± 0.41	3348.2 (2579.9 - 4626.8)	1.2	2.43 ± 0.47	1602.9 (1175.9 - 2059)	2.0
Selecron	3.88 ± 0.91	1372.0 (1117.5 - 1981)	2.9	2.37 ± 0.60	955.0 (727.3 - 1445.3)	3.4
Reldan	3.09 ± 0.71	753.3 (598.9 - 1045.9)	5.3	2.55 ± 0.36	325.8 (258.3 - 415.9)	9.8
Tokuthion	2.03 ± 0.59	3073.2 (2243.3 - 5943.3)	1.3	1.39 ± 0.39	3190.4 (2070 - 8465.1)	1.0
Actellic	1.38 ± 0.37	1117.9 (740 - 2305.9)	3.5	2.92± 0.46	589.8 (470.9 - 730.4)	5.4
Sumithion	2.24 ± 0.72	1250.4 (888.1 – 3235.4)	3.2	3.54 ± 0.59	342.9 (279.3 - 424.5)	9.4
Cyanox	———	————	—	0.80 ± 0.37	1037.8 (————)	3.1
Marshal	1.46 ± 0.37	453.2 (281.9 - 690.3)	8.7	2.81 ± 0.49	602.6 (481.5 - 780.5)	5.3
Aphox	1.50 ± 0.38	6629.2 (4554.1 - 13490)	0.60	1.28 ± 0.56	8515.2 (————)	0.38
Actarar	———	————	—	———	————	—
MTI-446	———	————	—	———	————	—
Confidor	———	————	—	———	————	—
KZ-oil	———	————	68 0	4.03 ± 0.76	35.5 (28 6 - 42.4)	90.4
Neemix	———	————	—	2.81 ± 0.69	480.0 (372.2 - 779 5)	5.5
M Pede	———	————	—	3.14 ± 0.48	1781.8 (1450 - 2193.4)	1 8

Toxicity index (TI) = (LC_{50} of the most effective insecticide / LC_{50} of the least effective insecticide) x 100

El-Deeb (1993) indicated that the mineral oils Shekrona super and Star oil were more toxic than the OP compounds monocrotophos, dimethoate and Malathion against the wheat aphid *Rhopalosiphum Padi* (L.), while the OP compound pirimiphos- methyl and pirimiphos-ethyl were more toxic than Shekrona super and Star oil.

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التقييم المعملى لسمية عديد من المبيدات فى السلالات الحقليه لمن القطن فى المحافظات المختلفه لموسم زراعة القطن لعام ٢٠٠٠

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المعمل المركزى للمبيدات – مركز البحوث الزراعيه – الدقى

أختبر فى هذه الدراسه ستة عشر مبيد وأحد الزيوت المعدنيه وأحد المنتجات الطبيعيه ومبيد صابونى على الحشرات الكامله لمن القطن التى جمعت من حقول القطن فى ثمانية محافظات اثناء موسم زراعة القطن لعام ٢٠٠٠ .

ولقد أوضحت النتائج أن مركب قيراط كان اكثر المركبات المختبره سميه يليه كزد اويل ثم الميوثريون ثم البايثرويد ثم السومسيدين فى جميع المحافظات . من ناحية اخرى فان مركب الافوكس ومعظم المركبات الفوسفوريه كانت اقل المركبات سميه . وعند مقارنة سمية المركب الطبيعى نيمكس مع سمية المركبات الفوسفورية والكارباماتيه والبيرثرويدز فقد لوحظ ان مركب النيمكس كان اقل سميه من المركبات البيرثرويدز الا انه كان اكثر سميه من المركبات الفوسفوريه اوالكارباماتيه. بالنسبه لسمية المركبات المستخدمه فى مكافحة المن الاكتارا ، ام تى اى ٤٤٦ ، الكونفيدور فقد لوحظ انها كانت اكثر سميه من المبيدات الفوسفوريه والكارباماتيه فى جميع المحافظات فيما عدا محافظة الفيوم التى اظهرت سميه منخفضه عن المبيدات الفوسفوريه .