J. Agric. Sci. Mansoura Univ., 30 (11): 7083 - 7088, 2005

TOXIC EFFECTS OF SOME ORGANOPHOSPHORUS AND CARBAMATE INSECTICIDES AGAINST FIELD POPULATION OF THE COTTON APHID, *Aphis gossypii* GLOVER (HOMOPTERA: APHIDIDAE)

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ABSTRACT

Ten insecticides organophosphorus and four carbamate compounds were tested against adult stages of the cotton aphid *Aphis gossypii* Glover collected from eight Egyptian Governorates at the early of cotton growing season 2004.The results showed that there are tow lists of toxicity in the Governorates tested:

In the first list, Marshal was the most toxic in four Governorates followed by lannate, Dursban, Selecron and Curacron. While Aphox was the least toxic followed by Cyanox, Malathion and Cygon, but Larvin did not test in this Governorates.

In the second list, Dursban was the most toxic followed by Marshal in four other Governorates, then lannate, Selecron and Curacron, but Larvin was the least toxic insecticides followed by Aphox, Cyanox, Malathion and Cygon.

In general, results showed that Marshal and Dursban were the most toxic effects on *A. gossypii* followed by Lannate or Selecron then Curacron. While Larvin and Aphox were the least toxic effects followed by Cyanox, Malathion and Cygon.
Keywords: *Aphis gossypii*, insecticide resistance, OP and carbamate compounds

INTRODUCTION

In recent years, cotton aphid *A.gossypii* Glover (Homoptera: Aphididae) is an important pest attacking cotton crop early and late in the cotton season. A few reports have been published on toxic effect of insecticides against field strains of the pest, (singab, 2002 , Singab *et al.*, 2002, Ghoneim, 2002).

The present work is to investigate the potency of several compounds belonging to OPs and carbamates against field strains of the cotton aphid *A. gossypii* Glover collected from eight different Egyptian Governorates.

MATERIALS AND METHODS

Cotton leaves infested with cotton aphid, *Aphis gossypii* Glover were collected from cotton fields at Fayoum, Beni-Suef, Menia, Gharbia, Kafr-El-Sheikh, Dakahlia, Menufia and Behera Governorates early in 2004 cotton season.

Slide-dip technique was used to evaluate the toxicity of the tested insecticides against the adult stage of *A. gossypii* Glover. By fine brush, ten adults were affixed to double faced scotch tap and stuck tightly to slide on their dorsal side. The slides were then dipped in the prepared insecticide water solutions for ten seconds, each insecticide was tested at five different concentrations, each concentration was replicated three times. Mortality

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

Natural mortality was corrected according Abbot's formula (Abbott, 1925), and data were then subjected to statistical analysis by the method of Busvine (1957). The toxicity index (the relative toxicity factor) 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 - Organophosphorus insecticides :

Cyanox (cyanofos) 50 % EC, Actillic (pirimiphos-methyl) 50 % EC
Selecron (profenofos) 72 % EC, Curacron (profenofos) 72 % EC
Dursban (chlorpyrifos) 48 % EC, Sumithion (fenitrothion) 50 % EC
Malathion (malathion) 57 % EC, Tokuthion (prothiofos) 50 % EC
Dimethoate (dimethoate) 40 % EC, Cygon (dimethoate) 40 % EC

II - Carbamate insecticides :

Marshal (carbosulfan) 25 % WP, Aphox(pirimicarb) 50 % DG
Lannate (methomyl) 90 % EC, Larvin (thiodicarb) 80 % WP

RESULTS AND DISCUSSION

Toxicity index of fourteen OP and carbamate insecticides tested against field strains of the cotton aphid *Aphis gossypii* Glover is shown in Tables (1 and 1 cont.). In general, results showed that there are two lists of toxicity in tested Governorates.

The first list of toxicity (Table 1), showed that Marshal was the most toxic insecticide in four Governorates with LC_{50} (ppm) values of 50.48 in Menia, 53.73 in Kafr El-Sheikh, 101.86 in Beni-Suef and 108.97 in Gharbia. Dursban came next followed by Lannate, Curacron and Dimethoate in Menia, but Selecron came next followed by Lannate, Curacron and Dursban in Kafr El-Sheikh. Lannate came next followed by Selecron, Dursban and Actillic in Beni-Suef, while Marshal followed by Lannate, Dursban, Curacron, and Selecron in Gharbia. The relative toxicity factors of Lannate, Dursban, Curacron, Selecron, and Actillic ranged between (19.34% - 69.13%), (14.3% - 69.26%), (12.07% - 21.46%), (6.08% - 40.21%) and (4.25% - 21.21%) respectively, of the toxicity of Marshal. While Aphox was the least toxic in Menia and Gharbia followed by Malathion and Cygon or Malathion and Actillic, respectively but Cyanox was the least toxic in Kafr El-Sheikh followed by Malathion and Sumithion, also Malathion was the least toxic in Beni-Suef followed by Cygon and Tokuthion, the relative toxicity factors of Aphox, Cyanox, Malathion, Cygon, Tokuthion, Sumethion and Dimethoate ranged between (1.05% - 2.71%), (1.83% - 6.98%), (2.46% - 6.61%), (2.54% - 9.02%), (3.81% - 9.9%), (3.63% - 10.61%) and (5.7% - 12.61%), respectively of the toxicity of Marshal.

Table(1): Toxicity index of organophosphoruss and carbamate insecticides against field strain of cotton aphid *Aphis gossypii* Glover collected from different Governorates in the cotton season 2004

Menia				Kafr El - Sheikh			
Insecticide	Slope ± ES	LC_{50} ppm 5 % Fiducial limits	TI*	Insecticide	Slope ± ES	LC_{50} ppm 5 % Fiducial limits	TI*
Marshal 25 % WP	0.94 ± 0.17	50.48 (26.9 - 111.9)	100	Marshal 25 % WP	2.01 ± 0.44	53.73 (32.3 - 72.9)	100
Dursban 48 % EC	1.67 ± 0.34	72.89 (50.4 - 131.3)	69.26	Selecron 72 % EC	1.52 ± 0.39	184.11 (84.9 - 272.7)	29.18
Lannate 90 % WP	0.51 ± 0.14	260.99 (109.1 -1256.8)	19.34	Lannate 90 % WP	1.31 ± 0.45	208.47 (69.7 - 348.2)	25.77
Curacron 72% EC	1.78 ± 0.29	300.29 (217.6 - 405.4)	16.81	Curacron 72% EC	2.09 ± 0.46	322.66 (214.1 - 444.6)	16.65
Dimethoate 40 % EC	1.61 ± 0.28	400.35 (286.2 -557.8)	12.61	Dursban 48 % EC	2.64 ± 0.52	375.69 (284.8 - 480.3)	14.30
Sumithion 50% EC	1.37 ± 0.29	475.75 (222.2 - 743.9)	10.61	Actillic 50 % EC	1.60 ± 42	497.84 (302.1 - 736.7)	10.79
Selecron 72 % EC	0.88 ± 0.26	830.21 (471.2 - 3135.3)	6.08	Cygon 40 % EC	1.74 ± 0.89	710.69	7.56
Actillic 50 % EC	2.15 ± 0.31	1187.65 (915.2 - 532.5)	4.25	Tokuthion 50 % EC	1.83 ± 0.35	938.65 (532.4 - 1342.5)	5.72
Tokuthion 50 % EC	1.20 ± 0.26	1325.18 (857.9- 2090.6)	3.81	Dimethoate 40 % EC	3.22 ± 0.54	941.86 (769.9 - 1203.7)	5.70
Cygon 40 % EC	2.31 ± 0.43	1987.73 (1498.5-2787.3)	2.54	Sumithion 50% EC	1.33 ± 0.33	1481.66 (844.9 - 316.6)	3.63
Malathion 57 % EC	1.07 ± 0.26	2055.69 (1276.8-3618.9)	2.46	Malathion 57 % EC	1.23 ± 0.27	1841.42 (1151.3 - 2857)	2.92
Aphox 50 % EC	1.01 ± 0.35	4788.58 (2125 - 9139.6)	1.05	Cyanox 50 % EC	2.44 ± 0.49	2941.40 (1910.3 - 3854)	1.83
Cyanox 50 % EC	----------	----------	----------	Aphox 50 % EC	----------	----------	----------
Larvin 80% WP	----------	----------	----------	Larvin 80% WP	----------	----------	----------
Beni-Suef				**Gharbia**			
Insecticide	Slope ± ES	LC_{50} ppm 5 % Fiducial limits	TI*	Insecticide	Slope ± ES	LC_{50} ppm 5 % Fiducial limits	TI*
Marshal 25 % WP	1.97 ± 0.39	101.86 (75.9 - 141.6)	100	Marshal 25 % WP	1.57 ± 0.37	108.97 (76.2 - 170.9)	100
Lannate 90 % WP	2.26 ± 0.41	240.10 (176.7 - 310.2)	42.42	Lannate 90 % WP	1.35 ± 0.41	157.62 (44.1 - 250.1)	69.13
Selecron 72 % EC	1.94 ± 0.30	253.29 (185.5 - 331.9)	40.21	Dursban 48 % EC	2.64 ± 0.52	298.79 (198.7 - 385.6)	36.47
Dursban 48 % EC	2.91 ± 0.76	336.54 (177.9 - 444.2)	30.27	Curacron 72% EC	2.19 ± 0.35	507.74 (373.5 - 654.9)	21.46
Actillic 50 % EC	2.07 ± 0.39	480.28 (354.5 - 638.3)	21.21	Selecron 72 % EC	2.16 ± 0.49	601.93 (440.9- 890.9)	18.10
Curacron 2% EC	2.89 ± 0.63	843..88 (623.3 - 1062.2)	12.07	Dimethoate 40 % EC	2.06 ± 0.46	962.28 (711.2 - 1462.8)	11.32
Tokuthion 50 % EC	1.77 ± 0.42	1028.84 (546.4 -1449.4)	9.90	Cygon 40 % EC	1.11 ± 0.36	1207.93 (731.4 -5210.9)	9.02
Cygon 40 % EC	2.47 ± 0.42	1428.86 (1114.5-1834.6)	7.13	Cyanox 50 % EC	0.99 ± 0.26	1562.27 (775.4 -2703.6)	6.98
Malathion 57 % EC	1.94 ± 0.39	1540.52 (1150.3 - 197.8)	6.61	Tokuthion 50 % EC	1.76 ± 0.42	1578.35 (1131.3 -747.2)	6.90
Dimethoate 40 % EC	----------	----------	----------	Actillic 50 % EC	1.77 ± 0.42	2220.56 (1602.1-571.9)	4.91
Cyanox 50 % EC	----------	----------	----------	Malathion 57 % EC	1.73 ± 0.64	3012.13 (1403.9 -606.1)	3.62
Aphox 50 % EC	----------	----------	----------	Aphox 50 % EC	2.05 ± 0..33	4018.28 (2947.9-246.0)	2.71
Sumithion 50% EC	----------	----------	----------	Sumithion 50% EC	----------	----------	----------
Larvin 80% WP	----------	----------	----------	Larvin 80% WP	----------	----------	----------

Toxicity index (T*) = (LC_{50} of the most effective insecticide / LC_{50} of the east effective insecticide) X 100

The second list of toxicity (Table 1 Cont.), showed that Dursban was the most toxic insecticide in the other Governorates with LC_{50} (ppm) values of 51.44 in Dakahlia, 64.98 in Fayoum, 114.33 in Behera and 126.80 in Menufia. Marshal came next on the list of toxicity followed by Selecron, Lannate, and Curacron in Dakahlia and Fayoum, but it followed by Lannate and Selecron or Lannate and Dimethoate in Behera and Menufia, respectively. However, the relative toxicity factors of Marshal, Selecron, Lannate, Curacron and Dimethoate ranged between (63.67% - 98.81%), (24.03% - 55.18%), (17.63% - 51.19%), (13.09% - 39.35%) and (4.48% - 34.49%), respectively of the toxicity of Dursban. While Larvin was the least toxic insecticides followed by Aphox and Cyanox in Dakahlia or Malathion and Aphox in Behera, But Aphox was the least toxic followed by Cyanox and Actillic in Fayoum or Malathion and Cyanox in Menufia, the relative toxicity factors of Larvin, Aphox, Cyanox, Malathion, Actillic, Sumithion, Tokuthion and Cygon ranged between (0.68% - 2.26%), (0.87% - 4.73%), (2.19% -5.53%), (3.23% - 4.81%), (3.33 - 13.74%), (7.67% - 9.52%), (4.04% - 13.84%) and (3.13% - 29.39%), respectively of the toxicity of Dursban.

In comparison toxicity index between carbamate and OP insecticides tested, results showed that the carbamate Marshal was the most toxic in all Governorates then Lannate, but Larvin and Aphox were far less toxic action in all Governorates. While OP Dursban was the most toxic in Dakahlia, Fayoum, Menia, Behera and Menufia, but it low toxic in the other Governorates. As well as Selecron and Curacron had high toxic action in most Governorates, but the other OP compounds tested were low toxic action without Malathion and Cyanox were far less toxic action in all Governorates.

Summarized results indicated that Marshal and Dursban were the most toxic effects on *A. gossypii* followed by Lannate or Selecron then Curacron. While Larvin and Aphox were the least toxic effects followed by Cyanox Malathion. Dimethoate, Cygon, Sumithion, Actillic and Tokuthion lie between the high and low toxicants in the list of toxicity. Similar results were also reported by Ayad *et al.*, (1991-1992) who found that Dursban was the most toxic effect and Aphox was the least toxic effect on Sharkia field strain of *A. gossypii*, while Lannate, Actillic, Malathion and Dimethoate lie between Dursban and Aphox. The same results were also found that by Singab *et al.*, (2002) and Ghoneim, (2002). They found that Selecron was more toxic than Tokuthion, Actillic, Sumithion, Cyanox and Aphox on the cotton aphid, *A. gossypii*.

On the other hand, the cotton aphid, *A. gossypii* revealed resistance levels to monocrotophos and dimethoate (Degine,1996) and to carbosulfan and primicarb (Nibouche *et al.*, 2002). Moores *et al.*, (1996) reported that the main mechanism of resistance of *A. gossypii* to both OP and carbamate insecticides was insensitive AChE.

Table (1): Cont.

Dakahlia				Fayoum			
Insecticide	Slope ± ES	LC_{50} ppm 5 % Fiducial limits	TI*	Insecticide	Slope ± ES	LC_{50} ppm 5 % Fiducial limits	TI*
Dursban 48 % EC	1.69 ± 0.31	51.44 (31.6 -71.2)	100	Dursban 48 % EC	2.68 ± 0.39	64.98 (50.1 - 81.8)	100
Marshal 25 % WP	1.58 ± 0.30	80.79 (52.9 - 114.2)	63.67	Marshal 25 % WP	2.98 ± 0.74	76.31 60.7 - 95.7)	85.15
Selecron 72 % EC	1.29 ± 0.28	214.07 (102.6 - 324.3)	24.03	Selecron 72 % EC	1.19 ± 0.32	117.77 (53.9 - 195.8)	55.18
Lannate 90 % WP	1.47 ± 0.28	214.99 (124.5 - 310.4)	23.93	Lannate 90 % WP	2.22 ± 0.32	368. 281.1 - 467.7)	17.63
Curacron 72% EC	1.40 ± 0.28	393.09 (229.8 - 565.7)	13.09	Curacron 72% EC	1.29 ± 0.27	449.93 ((252.6 - 667.6)	14.44
Sumithion 50% EC	1.08 ± 0.27	670.43 (217.0 - 1130.7)	7.67	Dimethoate 40 % EC	1.75 ± 0.29	753.30 (537.6 - 1011.8)	8.63
Actillic 50 % EC	1.14 ± 0.26	730.21 (419.5 - 1120.9)	7.04	Cygon 40 % EC	1.80 ± 0.31	1183.35 871.8 -1619.9)	5.49
Dimethoate 40 % EC	0.52 ± 0.26	1147.04	4.48	Tokuthion 50 % EC	1.33 ± 0.28	1209.73 (651.9 -1801.4)	5.37
Tokuthion 50 % EC	1.46 ± 0.27	1272.57 (824.8 - 1793)	4.04	**Malathion 57 % EC**	1.51 ± 0.27	1402.08 (960.5 -1963.4)	4.63
Malathion 57 % EC	2.62 ± 0.47	1591.33 1181.7-1959)	3.23	Actillic 50 % EC	1.75 ± 0.46	1953.35 (1213.7-3001.3)	3.33
Cygon 40 % EC	1.89 ± 0.43	1643.43 (1174.6 -3083.)	3.13	**Cyanox 50 % EC**	1.53 ± 0.41	2896.84 (1995 -5387.4)	2.24
Cyanox 50 % EC	1.68 ± 0.29	2348.92 (1551.9- 3231)	2.19	Aphox 50 % EC	1.78 ± 0.29	7496.32 (5593. -10307)	0.87
Aphox 50 % EC	1.14 ± 0.36	3457.59 (1894.4-6141)	1.49	**Sumithion 50% EC**	---------	---------	---------
Larvin 80% WP	1.38 ± 0.27	7567.18 5260 - 11563)	0.68	Larvin 80% WP	---------	---------	---------
Behera				**Menufia**			
Insecticide	Slope ± ES	LC_{50} ppm 5 % Fiducial limits	TI*	Insecticide	Slope ± ES	LC_{50} ppm 5 % Fiducial limits	TI*
Dursban 48 % EC	1.67 ± 0.30	114.33 (70.0 - 159.7)	100	Dursban 48 % EC	1.50 ± 0.28	126.80 (77.8 - 178.5)	100
Marshal 25 % WP	1.52 ± 0.51	115.71	98.81	Marshal 5 % WP	4.25 ± 0.73	151.99 (122.9 - 183.8)	83.42
Lannate 90 % WP	2.28 ± 0.37	227.09 (166.1 - 291.5)	50.35	Lannate 90 % WP	2.17 ± 0.49	247.72 (134.3 - 346.3)	51.19
Selecron 72 % EC	1.51 ± 0.29	264.43 (157.9 - 377.5)	43.24	Dimethoate 40 % EC	2.93 ± 0.56	457.08 (350.5 - 584.9)	27.74
Curacron 72% EC	1.56 ± 0.28	290.56 (201.3 - 402.4)	39.35	Selecron 2 % EC	1.87 ± 0.29	499.48 357.2 - 668.3)	25.39
Dimethoate 40 % EC	2.12 ± 0.31	331.45 (252.5 - 427.7)	34.49	Cygon 40 % EC	2.97 ± 0.48	698.48 (557.5 - 882.0)	18.15
Cygon 40 % EC	1.66 ± 0.28	389.04 (274.3 - 529.1)	29.39	Curacron 72% EC	2.84 ± 0.79	768.04 (147.8 - 2913.5)	16.51
Tokuthion 50 % EC	1.16 ± 0.27	826.20 (373.4 - 1284.4)	13.84	Actillic 50 % EC	1.50 ± 0.28	923.18 (601.2 - 1304.9)	13.74
Sumithion 50% EC	1.36 ± 0.34	1201.38 (516.8 -1868.9)	9.52	Tokuthion 50 % EC	1.16 ± 0.26	1502.51 (985.5 - 309.6)	8.44
Actillic 50 % EC	1.23 ± 0.26	1240.67 (827.2 -2002.6)	9.22	**Cyanox 50 % EC**	1.48 ± 0.27	2483.88 (1737.5 - 3550)	5.10
Cyanox 50 % EC	2.93 ± 0.51	2069.10 (1585.6 -2574)	5.53	**Malathion 57 % EC**	1.66 ± 0.33	2632.03 1853.5 -714.7)	4.81
Aphox 50 % EC	1.48 ± 0.29	2419.37 (1364.4 -3542)	4.73	Aphox 50 % EC	1.70 ± 0.38	4028.57 (2873.6 -5918)	3.15
Malathion 57 % EC	1.19 ± 0.29	2933.34 (1538.6 - 4551)	3.90	**Sumithion 50% EC**	---------	---------	---------
Larvin 80% WP	1.44 ± 0.27	5064.97 (3369.9- 323.6)	2.26	Larvin 80% WP	---------	---------	---------

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

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التأثيرات السامة لبعض المبيدات الفوسفورية العضوية والكرباماتية على سلالات حقلية لمن القطن

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المعمل المركزي للمبيدات مركز البحوث الزراعية - الدقى

أختبرت عشرة مركبات فوسفورية عضوية وأربعة مركبات كرباماتية ضد الأطوار الكاملة لمن القطن والتي جمعت من ثمانية محافظات مصرية في بداية موسم نمو القطن لعام ٢٠٠٤ ، وقد أظهرت النتائج وجود قاتلتين للسمية في المحافظات المختبرة كما يلي :-

في القاتلة الأولي كان المارشال هو الأعلى سمية في أربعة محافظات يليه اللانت والدروسبان والسيليكرون والكوراكرون. أما الأفوكس فكان هو الأقل سمية يلية السيانوكس والملاثيون والسايدون ، بينما اللارفن فانه لم يختبر فى هذه المحافظات.

وفى القاتلة الثانية كان الدروسبان هو الأعلى سمية يليه المارشال في الأربعة محافظات الأخرى ثم اللانت والسيليكرون والكوراكرون ، وكان اللارفن هو الأقل سمية يليه الافوكس والسيانوكس والملاثيون والسايدون.

وبشكل عام أظهرت النتائج أن المارشال والدورسبان كانا هما الأعلى فى التأثيرات السامة ضد حشرات من القطن ، ويأتى بعدهما اللانت والسيليكرون وأخيراالكوراكرون ، بينما كان اللارفن والأفوكس هما الأقل فى التأثيرات السامة يليهما السيانوكس والملاثيون ثم السايدون.