J. Agric. Sci. Mansoura Univ., 27(5): 3525 - 3532, 2002

THE APHICIDAL ACTION OF DIFFERENT PESTICIDES AND THEIR MIXTURES AGAINST FIELD POPULATION OF THE COTTON APHID, *APHIS GOSSYPII* GLOVER

Singab, M.
Central Agricultural Pesticides Laboratory, Agricultural Research Centre, Dokki, Egypt.

ABSTRACT

The toxicity of eighteen insecticides and their mixtures against adults of the cotton aphid *Aphis gossypii* Glover collected from Menufia Governorate early in 2000 cotton season were investigated.

The results revealed that Meothrin was the first most toxic followed by the mineral oil Kz-oil then Karate. MTI-446 came next in its toxicity followed by Actara, Sumicidin, Baythroid, Confidor and the natural product Neemix. However, Selecron, Aphox and Marshal were the least toxic followed by all other OP compounds, and the insecticidal soap, M.Pede.

The joint action of Kz-oil / insecticide combinations showed different levels of synergistic, additive and antagonistic effects. A high level of synergism was observed in Kz-oil / Aphox followed by Kz-oil / Sumicidin, Kz-oil / Sumithion, Kz-oil / Malathion, Kz-oil / Karate, Kz-oil / Neemix and Kz-oil / Selecron. The natural product, Neemix produced high toxic action when was combined with Reldan or Aphox, but it caused a slight synergism with Cyanox, Actellic or Selecron. As for the carbamate Aphox / insecticide mixtures, moderately synergistic effects were indicated with Aphox / MTI-446, Aphox / Tokuthion and Aphox / Sumicidin. Within pyrethroid / pyrethroid mixtures, Meothrin / Sumicidin and Meothrin / Karate produced moderate synergism. Within OP / OP insecticide mixtures, these mixtures caused different levels of additive or antagonistic effects except with Malathion / Actellic which produced synergistic effect.

INTRODUCTION

Aphids previously known as secondary pest on several crops in Egypt, are now becoming more serious as numerous cases of several infestation has been reported. The use of pesticides for their control lead to the contamination of the environment as well as to pesticides hazards. Therefore, it was necessary to need a new approach for controlling pests with a view to reduce the environmental pollution. This approach may include the use of mineral oils and natural products alone or in mixture with insecticides. This will result into lower doses of the required pesticides and an environment that is less contaminated with pesticides.

The present work is an attempt to evaluate the relative toxicity of certain insecticides, mineral oils and natural products and their binary mixtures against the cotton aphid, *Aphis gossypii* Glover.

MATERIALS AND METHODS

Samples of cotton leaves infested with *A.gossypii* Glover were collected from field of Menufia Governorate 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.

Mortality data were corrected according to Abbott's formula (1925) 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:

$$\text{Toxicity index} = \frac{LC_{50} \text{ of the most effective insecticide}}{LC_{50} \text{ of the less effective insecticide}} \times 100$$

The joint action of pesticide mixtures was studied by mixing concentrations equivalent to LC_{25} values at the ratio of 1: 1 (v/v). The combined action of the different mixtures was expressed at the Co-toxicity factor (CF), estimated according to the equation given by Mansour *et al*., (1966) as follow:

$$\text{Co-toxicity factor} = \frac{\text{Observed mortality\%} - \text{Expected mortality\%}}{\text{Expected mortality\%}} \times 100$$

The Co-toxicity factor was used to differentiate the results into three categories. A positive factor of 20 or more is considered potentiation, a negative of 20 or more is considered antagonism, while intermediate values between - 20 and + 20 indicated additive effect.

The pesticides used were seven OP insecticides, namely Cyanox (cyanofos) 50% EC, Actellic (pirimiphos-methyl) 50% EC, Reldan (chlorpyrifos-methyl) 50% EC, Selecron (profenofos) 72% EC, Sumithion (fenitrothion) 50% EC, Malathion (malathion) 57% EC and Tokuthion (prothiofos) 50% EC, four pyrethroids, namely Baythroid (cyfluthrin) 5% EC, Karate (lambda-cyhalothrin) 8.33% EC, Meothrin (fenpropathrin) 20% EC, Sumicidin (fenvalerate) 5% EC, two carbamates Aphox (pirimicarb) 50% DG and Marshal (carbosulfan) 25% WP, the mineral oil Kz-oil (miscible) 95% EC, the insecticidal soap M.Pede (potassium salts of fatty acids) 4.5% EC; the natural product Neemix (azadirachtin) 4.5% EC and three compounds belong to different groups of insecticides, namely Actara (thiamethoxam) 25% WG, Confidor (Imidacloprid) 20% SC, and MTI-446 (dinotefuran) 20% WP .

RESULTS AND DISCUSSION

Results in Table (1) showed that, the pyrethroid Meothrin was the first most toxic followed by the mineral oil Kz-oil then the pyrethroid Karate. MTI-446, Actara, Sumicidin, Baythroid, the natural product Neemix and Confidor came next in their toxicities. The relative toxicities were 63.3, 38.1, 9.3, 7.0, 4.4, 2.7, 2.1, and 2.1 for Kz-oil, Karate, MTI-446, Actara, Sumicidin, Baythroid, Neemix and Confidor, respectively as compared with Meothrin. However, the OP compound Selecron and two carbamates Aphox and Marshal were least toxic (RT were 0.15, 0.17 and 0.20 respectively) followed by all other OP insecticides tested which their relative toxicities ranged between 0.2 - 1.0

Table (1): Relative toxicity of several insecticides against Menufia field strain of the cotton aphid, *Aphis gossypii* Glover

Insecticide	Slope ± S.E.	LC50 (5% Fiducial limit) in ppm	RT
Kz-oil	1.13 ± 0.36	34.3 (11.7 - 72.9)	63.3
Neemix	2.21 ± 0.50	1o20.9 (738.4 - 1545.3)	2.10
M.Pede	2.16 ± 0.52	2956.1 (2122.8 - 4998.8)	0.70
Actara	2.09 ± 0.45	311.3 (191.9 - 486.1)	7.00
MTI-446	1.16 ± 0.37	232.6 (69.4 - 465.9)	9.3
Confidor	1.99 ± 0.45	1026.4 (597.8 - 1615.8)	2.1
Baythroid	3.25 ± 0.61	497.1 (381.5 - 636.2)	4.4
Karate	3.58 ± 0.96	56.9 (44.3 - 90.4)	38.1
Meothrin	3.63 ± 0.83	21.7 (16.9 - 28.5)	100
Sumicidin	4.92 ± 1.02	780.9 (646.2 - 969.1)	2.7
Marshal	2.86 ± 0.73	11098.5 (8652.5 - 16620)	0.2
Aphox	2.89 ± 1.68	12679.3 (- -)	0.17
Malathion	1.48 ± 0.69	5050.7 (2952.2 - 3.07004E+05)	0.4
Actellic	2.56 ± 0.23	4231.0 (3020.3 - 5656.2)	0.5
Reldan	2.58 ± 0.52	7164.0 (5292.9 - 9722.1)	0.3
Selecron	3.06 ± 0.79	14630 (11118.9 - 21309)	0.15
Sumithion	1.69 ± 0.69	2180.6 (804 - 3872.2)	1.0
Tokuthion	2.34 ± 0.74	2700.9 (1834.6 - 5182.8)	0.8
Cyanox	3.11 ± 0.58	4014.9 (3080.2 - 5200.9)	0.54

Within four pyrethroids tested Meothrin and Karate were more toxic than Sumicidin and Baythroid. As compared to pyrethroids, OP compounds were far less toxic. Within OP compounds, Sumithion and Tokuthion were more toxic than Cyanox, Actellic, Malathion, Reldan and Selecron, the relative toxicities were 1.0, 0.8, 0.54, 0.51, 0.4, 0.3 and 0.15, respectively.

In general, pyrethroids were more toxic than OP and carbamate compounds against *A. gossypii* Glover (Table 1). Similar results were found by Ayad *et al*., (1991-1992) Who reported that pyrethroids were the most potent against *A.gossypii* Glover, while OP and carbamate compounds were the least potent. However, Babu and Azam (1982) indicated that the OP, monocrotophos was the more toxic than the pyrethroid, cypermithrin against *A. gossypii* Glover.

Results in Table (1) also showed that the mineral oil, Kz-oil was more toxic than OP compounds. Similar results were also obtained by El-Deeb *et al.,*(1989) on the aricat aphid *Hyalopterus pruni* Geoffry, Keddis *et al.,* (1989) and El-Deeb (1993) on aphids infesting wheat.

Results of the response of 153 binary mixture of insecticides against adults of *A. gossypii* Glover are present in Table (2).

Table (2) : Joint action of several binary insecticide mixtures against Menufia field strain of the cotton aphid *Aphis gossypii* Glover.

Mixture	CF	Mixture	CF
Kz-oil+ Neemix	+ 27	Aphox + Meothrin	- 33
Aphox	+ 73	Sumicidin	+ 27
Actara	- 42	Marshal	- 27
MTI-446	0	Malathion	- 7
Confidor	-25	Actellic	0
Baythroid	+7	Reldan	0
Karate	+33	Selecron	0
Meothrin	- 20	Sumithion	+ 15
Sumicidin	+50	Tokuthion	+ 30
Marshal	-25	Cyanox	- 7
Malathion	+38	Actara + MTI-446	+ 17
Actellic	- 19	Confidor	- 25
Reldan	0	Baythroid	- 29
Selecron	+21	Karate	+ 8
Sumithion	+42	Meothrin	- 10
Tokuthion	- 18	Sumicidin	- 42
Cyanox	- 35	Marshal	- 50
Neemix + Aphox	+ 40	Malathion	+ 25
Actara	- 18	Actellic	- 69
MTI-446	-27	Reldan	- 55
Confidor	- 33	Selecron	+ 29
Baythroid	- 31	Sumithion	+ 14
Karate	- 27	Tokuthion	0
Meothrin	- 67	Cyanox	- 19
Sumicidin	- 9	MTI-446 + Confidor	- 13
Marshal	- 27	Baythroid	- 14
Malathion	+ 13	Karate	- 42
Actellic	+ 20	Meothrin	- 60
Reldan	+ 70	Sumicidin	- 25
Selecron	+ 20	Marshal	- 25
Sumithion	- 8	Malathion	- 13
Tokuthion	- 60	Actellic	+ 6
Cyanox	+ 27	Reldan	- 55
Aphox + Actara	- 12	Selecron	+ 14
MTI-446	+ 35	Sumithion	+ 7
Confidor	- 13	Tokuthion	0
Baythroid	- 31	Cyanox	- 63
Karate	- 27		

Table (2): Cont.

Mixture	CF	Mixture	CF
Confidor+ Baythroid	- 22	Reldan + Cyanox	- 53
Karate	- 63	Selecron + Sumithion	+ 5
Meothrin	- 36	Tokuthion	- 43
Sumicidin	- 38	Cyanox	- 11
Marshal	- 60	Sumithion + Tokuthion	- 16
Malathion	- 45	Cyanox	- 28
Actellic	- 5	Tokuthion + Cyanox	- 33
Reldan	- 47	Baythroid + Marshal	- 61
Selecron	+ 6	Malathion	- 39
Sumithion	+ 6	Actellic	- 40
Tokuthion	+ 7	Reldan	- 15
Cyanox	- 50	Selecron	- 46
Baythroid +Karate	- 29	Sumithion	- 50
Sumicidin	+ 7	Tokthion	- 8
Meothrin	0	Cyanox	- 17
Karate + Sumicidin	+ 17	Karate + Marshal	- 44
Meothrin	+ 30	Malathion	- 38
Sumicidin+Meothrin	+ 50	Actellic	- 39
Marshal + Malathion	- 55	Reldan	0
Actellic	- 32	Selecron	- 68
Reldan	- 40	Sumithion	- 75
Selecron	-38	Tokthion	- 55
Sumithion	- 45	Cyanox	- 75
Tokuthion	- 40	Sumicidin + Marshal	- 6
Cyanox	- 55	Malathion	- 25
Malathion+ Actellic	+ 36	Actellic	- 17
Reldan	- 20	Reldan	- 17
Selecron	- 27	Selecron	- 9
Sumithion	- 10	Sumithion	- 31
Tokuthion	- 47	Tokthion	- 21
Cyanox	- 40	Cyanox	- 19
Actellic + Reldan	- 35	Meothrin + Marshal	- 50
Selecron	- 10	Malathion	+ 7
Sumithion	- 25	Actellic	- 16
Tokuthion	0	Reldan	- 19
Cyanox	- 50	Selecron	+ 35
Reldan + Selecron	- 48	Sumithion	+ 7
Sumithion	- 27	Tokthion	+ 11
Tokuthion	- 29	Cyanox	- 21

As for the mineral oil Kz-oil /insecticide mixtures, a high level of synergistic effect was observed in Kz-oil / Aphox followed by moderate synergism in Kz-oil / Sumithion, Kz-oil / Malathion, and Kz-oil / Karate and low synergism in Kz-oil / Neemix and Kz-oil / Selecron.

On the other hand, mixtures Kz-oil with Baythroid, Reldan, MTI-446 or Actellic produced additive effects. However, moderate to slight antagonistic effects indicated for mixtures of Kz-oil with Actara, Cyanox, Marshal, Confidor or Meothrin (Table 2). El-Deeb (1993) found that the joint action of mineral oil / insecticide combinations revealed different levels of synergism on adult of the wheat aphid *Rhopalosiphum padi* (L.). However, El-Deeb *et al.,* (1989) found that three mineral oil apparently antagonized all OP insecticides tested against the apricot aphid *Hyalopterus pruni* Geofry. Several investigators have found that when mineral oil used in combination with insecticides increased their efficiency on the cotton leafworm *Spodoptera littoralis* Boisd. (Darwish 1987; Zidan *et al*., 1987; Abdel-Megeed *et al*. 1984-1985 and El-Attal *et al*., 1983).

The natural product, Neemix produced high synergism when it was combined with Reldan or Aphox, but it caused a slight synergism with Cyanox, Actellic or Selecron. On the other hand, mixture Neemix / Malathion produced high additive effect, followed by Neemix / Sumicidin, and Neemix / Actara . Different levels of antagonsitic effect were obtained when Neemix mixing with Meothrin, Toxuthion, Confidor, Baythroid, Karate, MTI-446 and Marshal.

As for the carbamate Aphox / insecticide mixtures, moderate synergistic effects were indicated with Aphox / MTI-446, Aphox / Toxuthion and Aphox / Sumicidin, while mixtures Aphox / Confidor, Aphox / Actara and Aphox / OP insecticides produced moderate to slight additive effects. However mixtures of Aphox with pyrethroid insecticides or with the carbamate Marshal produced moderate antagonistic effect. However the carbamate Marshal produced antagonism when it was combined with all compounds tested except with Sumicidin, which produced additive effect.

Within pyrethroid / pyrethroid mixtures, Meothrin / Sumicidin produced moderate synergism followed by Meothrin / Karate, while Sumicidin / Karate produced high additive effect followed by Sumicidin / Baythroid then Meothrin / Baythroid, but the mixture Karate / Baythroid produced a slight antagonism.

Within OP insecticide / OP insecticide mixtures, these mixtures caused different levels of additive or antagonistic effects, except with Malathion / Actellic which produced synergistic effect.

As for pyrethroid / OP insecticide mixtures, no synergistic effects were observed, but a high level of additive effect was shown by Sumicidin / Cyanox and Meothrin / Tokuthion followed by Meothrin / Malathion and Meothrin / Sumithion then Karat / Reldan, however all other mixtures produced slight additive effects or different levels of antagonistic effects. Keddis *et al*., (1984-1985) found that lower levels of potentiation as well as additive and antagonistic effects were produced by pyrethroid / organophosphate mixtures on *Pactinophora gossypiella* Saund. at higher mixing rates (LD25 / LD40 or LD40 / LD25).

As for the mixtures of aphicides (Actara, Confidor or MTI-446) / pyrethroids, OP compounds and carbamates, the results in Table (2) showed that mixtures Actara / Selecron and Actara / Malathion produced slight synergism while all other mixtures produced different levels of additive or antagonistic effects.

REFERANCES

Abdel-Megeed, M. I., M. S. El-Zemaity, S. A. El-Refai, A. A. Zidan and N. M. Hussein (1984-1985). The ovicidal action of certain insecticides and their combinations with mineral oil against *Spodoptera littoralis* (Boisd.). Bull. ent. Soc. Egypt, Econ. Ser., 14: 321-328

Abbott, W. S.(1925). A method of computing the effectiveness of an insecticide. J. Econ. Entomol., 18 : 265- 267

Ayad, F.A., M. E. Keddis, Y. F. Ghoneim, E. I. Mourad, A. M. Allam and M. A. El-Guindy, 1991-1992, Toxicity of some insecticides against *Aphis gossypii* Glover collected from different Governorates of Egypt during 1990 cotton season. Bull. ent. Soc. Egypt, Econ. Ser., 19: 101-106

Babu, T. R. and K. M. Azam (1982). Relative efficacy of certain new synthetic pyrethroids against pest complex of bhindi. Indian Journal of Plant Protection, 9 (1): 13-18., C. F. : R. A. E. 71: 1263

Busvine, J. R., 1957. A critical review of the technique for testing insecticides. Commonwealth Inst. Entomol., London.

Darwish, M. M., 1987. Adjuvants for increasing the bioactivity of insecticides against the cotton leafworm *Spodoptera littoralis* (Boisd.) (Lepidoptera : Noctuidae). M. Sc. Thesis, Fac. of Agric. Cairo Univ.

El-Attal, Z. M., O. K. Moustafa and M. E. Keddis (1983). The ovicidal effect of some local spary oils against the red mite and cotton leafworm. Proc. 5th Arab Pesticide Conf., Tanta Univ., 2: 222-226

El-Deeb,W. M., (1993). Joint action of two local mineral oils with some organophosphorus insecticides against adults of the wheat aphid *Rhopalosiphum padi.* Egypt. J. Agric.Res., 71 (2): 473-479

El-Deeb,W. M., M. E. Keddis, F. A. Ayad and M. A. El-Guindy, 1989. Aphicidal potency of certain mineral oil, organophosphate insecticides and their mixtures against adults of the apricot aphid *Hyalopterus pruni* Geofry. Proc. 1*st*. Int. Conf. Econ. Ent., II: 259-265

Keddis, M. E., M. M. Abdel-Satter, Y.H. Issa and M. A. El-Guindy, 1984-1985. The Toxicity of certain insecticide mixtures to *Pectinophora gossypiella* Saund. Bull. ent. Soc. Egypt, Econ. Ser., 14: 251-255

Keddis, M. E.; W. E. Deeb; Y. H. Issa; F. A. Ayad; M. A. Hariry and M. A. El-Guindy (1989). Laboratory screening of some insecticides against different species of aphids infesting wheat. Proc. 1st. Int. Conf. Econ. Ent., II: 243-248

Mansour, N. A.; M. E. Eldefrawi; A. Toppozada and M. Zeid (1966). Toxicological studies on the Egyptian cotton leafworm *Prodenia litura* F. VII, Potentiation and antagonism of organophosphorus and carbamates. J. Econ. Entomol., 59: 307-311

Sun, Y. P. (1950). Toxicity index-an improved method of comparing the relative toxicity of insecticides. J. Econ. Entom., 43: 45-53

Zidan, Z. H.; M.I. Abdel-Mageed; W. M. Watson and A. K. Sobeiha (1987). Ovicidal activity of certain mineral oils, organic insecticides and their mixtures against the cotton leafworm.*Spodoptera littoralis* (Boisd.). Appl. Ent. Zool., 22 (3): 241-247

تأثير بعض المبيدات المختلفه ومخاليطها على السلاله الحقليه لمن القطن

محمد سنجاب خالد
المعمل المركزى للمبيدات - مركز البحوث الزراعيه - الدقى

تم دراسة تأ ثير ثمانية عشر من المبيدات التى تنتمى لمجاميع مختلفة ومخاليطها على الطور الكامل لسلالة حقلية لمن القطن جمعت من محافظة المنوفية فى بداية موسم زراعة القطن لعام ٢٠٠٠.

ولقد اوضحت النتائج ان المركب البيرثرويد ميوثرين هو اكثر المبيدات سمية على القطن يلية الزيت المعدنى كزد أويل ثم المركب البيرثرويدزقيراط ثم ياتى بعد ذلك مركب ام تى أى ٤٤٦ ثم الاكتارا، السومسيدين ، االبايرثرويد ، كونفيدور ثم المنتج الطبيعى نيمكس. من ناحية اخرى فان المركب الفسفورى سيليكيرون كان اقل المركبات سمية على من القطن يلية مركبى الكارباماات مارشال وافوكس ثم باقى المركبات الفسفورية والمبيد الصابونى أ م بيد .

وعند دراسة الفعل التنشيطى لمخاليط المبيدات على من القطن فقد اظهر مخلوط كزد اويل مع المبيدات المختلفه مستويات مختلفه من التنشيط أو التأثير ألاضافى أو التضاد ، وكان أعلى مستوى للتنشيط لوحظ عند خلط كزد اويل مع الأفوكس يليه مع السومسيدين ثم مع السومسيون ، الملاثيون ، القيراط ، النيمكس واخيرا مع السليكرون . أما بالنسبه لمخاليط المنتج الطبيعى نيمكس مع المبيدات المختلفه فان أعلى تأثير وجد عند خلط النيمكس مع الريلدان والأفوكس ، بينما خلط النيمكس مع السيانوكس أو الاكتليك أو السيليكرون أعطى تأثير تنشيطى بسيط . أما بالنسبه للمركب الكارباماتى أفوكس عند خلطه بالمبيدات الاخرى فقد أظهر تأثير تنشيطى متوسط مع ام تى أى ٤٤٦ ، توكيثيون ، السومسيدين . أما بالنسبه للخلط بين مركبات البيرثرويدز فقد وجد ان مخلوطى الميوثرين مع السومسيدين ، والميوثرين مع القيراط أعطى تأثير تنشيطى متوسط ، وعند الخلط بين المركبات الفوسفوريه فان مخلوط الملاثيون مع الأكتليك هو المخلوط الوحيد الذى أحدث تأثير تنشيطى . من ناحيه أخرى فان باقى المخاليط المسنخدمه فى الاختبار قد أظهرت تأثيرات متنوعه من التاثير الاضافى أو التاثير التضادى .

٣٥٣٣