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Effectiveness of Organophosphates and Carbamates Applied Alone or in Combinations With Synthetic Pyrethroids Against Field Populations of Whitefly, *Bemisia tabaci*, (Gennadius), on Cotton in Egypt

GAMAL E.S. ABO EL-GHAR, ANWAR E. EL-SHEIKH, and ZEINAB A. EL-BERMAWY

Department of Pesticides, Faculty of Agriculture, Minufiya University, Shibin El-Kom, Egypt

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ABSTRACT

Field tests were conducted to determine the effectiveness of several organophosphorus and carbamate insecticides applied alone or in combinations with synthetic pyrethroids, against the adult and immature stages of cotton whitefly, *Bemisia tabaci* (Gennadius), on cotton. Acephate, alpha-cypermethrin, and thiodicarb applied alone at rates of 300, 25, and 400 g AI/feddan were effective against adult populations throughout 18 days after application. Most selected insecticides alone, however, failed to have effective control of immature populations. Chlorpyrifos, thiodicarb, and acephate applied in combinations with cypermethrin at reduced rates, i.e. 456+24, 376+24, 276+24 g AI/feddan, respectively, were significantly more effective for adult control than insecticides alone. Treatments of methamidophos + cypermethrin (276+24 g AI/ feddan) and carbaryl + cypermethrin (1251+24 g AI/ feddan) gave a considerable control to immature populations compared with treatments of insecticides alone. Addition of alpha-cypermethrin to most selected insecticides, at reduced rates, did not signifi-

cantly reduce adult infestation compared to insecticides alone. However, alpha-cypermethrin added to carbaryl at reduced rates (10+1265 g AI/feddan, respectively) provided excellent control to immature populations than insecticides alone. All selected insecticides were significantly more effective in reducing adult populations when combined with alphamethrin,at reduced rates, than insecticides alone. Alphamethrin added to methamidophos or thiodicarb at rates of 10+290 or 10+390 g AI/feddan, respectively, significantly decreased immature populations compared to insecticides alone.

INTRODUCTION

The cotton whitefly, *Bemisia tabaci* (Gennadius), emerged as one of the most economically important insect pests of cotton in Egypt recently. It damages the crop by depleting the plants' nutrients and contaminates the cotton lint with honeydew, which renders it unfit for ginning and spinning (Dittrich *et al.*, 1986). The outbreaks were suspected to have been triggered by the use of insecticides for the control of other pests in the cotton fields such as cotton leafworms and bollworms (Dittrich *et al.*, 1986 & 1990). Chemical control is the primary method to manage whitefly populations in cotton fields in Egypt (Radwan *et al.*, 1990). However, the use of chemicals to manage *B. tabaci* field populations has been inadequate; two major factors that contribute to this whitefly's annual resurgence on cotton are the development of resistance to various organophosphates, carbamates, and pyrethroids (Prabhaker *et al.*, 1985, 1988, 1989 & 1992; Forer, 1990) and effective of aerially applied insecticides on the lower surfaces of cotton leaves (Johnson *et al.*, 1982). This is where large numbers of immature stages are present and cause a substantial amount of plant damage by larval feeding and honeydew secretion.

Development of insecticide resistance in *B. tabaci* has highlighted the need for an effective resistance management. The combinations of organophosphates and carbamates with synthetic pyrethroids (All *et al.*, 1977; Koziol & Witkowski, 1982; Robertson & Smith, 1984) can play an integral role in increasing the spectrum of insect control. Plapp (1979) determined that acephate and other insecticidal compounds acted as synergists when mixed with pyrethroids, which improved toxicity to the budworm, *Heliothis* spp. Mistric and Clark (1979) found slightly increased efficacy against the budworm from tank mix sprays of endosulfan and permethrin, which indicated some synergism. Tappan *et al.* (1982) indicated that tank mixes of pyrethroids fenvalerate and permethrin with certain organophosphate insecticides increased the spectrum of control of several insect pests on flue-cured tobacco, and decreased residues on the cured leaf.

In this study, we present the results of field experiments to determine the effectiveness of certain organophosphates, carbamates, and pyrethroids against the whitefly, *B. tabaci*, populations, and the effect of reduced dosage rates of selected pyrethroids on the efficacy of the organophosphates and carbamates tested.

MATERIALS and METHODS

Insecticides:

The insecticides tested in this study were currently recommended for use in cotton fields by the Egypt Pest Control Extension Service for control of insect pests attacking cotton. These included five organophosphates: acephate 'as ORTHENE 75SP' (Chevron Chem. Co., USA), chlorpyrifos 'as CYANOX 50EC' (Sumitomo Chem. Co., Japan), chlorpyrifos-methyl 'as Reldan 50EC' (Dow Chem. Co., USA), and methamidophos 'as TAMARON 60SL' (Bayer AG, FRG); two carbamates: carbaryl 'as SEVIN 85WP' (Union Carbide Corp., USA) and thiodicarb 'as LARVIN 80DF' (Rhone-Poulenc Agrochemic, France); three pyrethroids: cypermethrin 'as CYMBUSH 30EC' (ICI Midox, England), alpha-cypermethrin 'as BESTOX 20FL' (FMC Corporation, USA), and alphamethrin 'as FASTAC 10EC' (Shell Chem. [UK] Ltd., England).

Field tests:

Cotton variety 'Giza 75' was planted the 3rd week of March, 1992, at which all agronomic practices recommended for cotton production in Egypt were followed. Small-plot tests were conducted at the Experimental Farm, Faculty of Agriculture, Minufiya University, Shibin El-Kom, in 1992. Plots were arranged in a randomized block design with three replications for each treatment. Plot size was 0.01 feddan (~42 m^2, with 7 rows x 11 m long). Teatments were initiated when cotton leaves in the experimental plots were highly infested by adult (> 10/leaf) and immature (> 10/leaf) stages of whitefly. A single foliar spray of tested insecticides was applied on 15 September. The commercially formulated insecticides were diluted in water to the tested dosage rates (wt/vol AI). The insecticides, alone or in combinations , were applied at the rates within the manufacturer's recommendations. Spray was done by using a knapsack sprayer with one nozzel, calibrated to deliver 200 liters of the diluted liquid per feddan (4200 m^2).

Sampling and insect counting:

Pre- and posttreatment insect counts were made at 24h before and at 4, 11, and 18 days after insecticide application. For an estimate of whitefly adult infestation, 15 cotton leaves were selected of the 3 center rows of each plot and examined at which adult counts were recorded. Records of whitefly immature stages were taken by cutting 15 fully expanded leaves from the upper portion of each plot and placing them in labelled paper pags which were returned to the laboratory for examination under a binocular microscope and the number of whitefly eggs, black eggs, larvae, and pupae were recorded.

All data were subjected to analysis of variance, and means were separated with Duncan's (1955) multiple range test. An estimate of percent control for an insecticide was calculated by Henderson & Tilton, 1955) which adjusted for natural changes in population density occurring in the untreated check.

RESULTS and DISCUSSION

The results presented in Table 1 show that acephate, alpha-cypermethrin, and thiodicarb applied alone, under the conditions of the test, resulted in significant adult whitefly, *B. tabaci*, control (≥ 84%) at rates of 300, 25, and 400 g [AI]/feddan, respectively, through day 4 after treatment. These compounds still significantly effective in reducing adult populations below those in the untreated check, through the remainder period of the test. It was obvious that, most selected insecticides were not

Table 1. Effectiveness of different insecticides in controlling whitefly, *B. tabaci*, populations on cotton.[a,b]

Treatment	Rate g [AI]/feddan	Stage	24h Pre-treatment Sept. 14	4 days Sept. 19	11 days Sept. 26	18 days Oct. 3	Overall mean
			Mean no. whitefly/leaf (Reduction %)				
Acephate	300	Adult	30.7a	11.7cde (89)	10.4ab (80)	5.9b (95)	9.3bc (90)
		Immature	14.2cde	118.4b	29.2d	80.2b	75.9b
Chlorpyrifos	480	Adult	24.5bc	20.7ab (58)	12.7a (49)	5.9b (90)	13.1b (71)
		Immature	32.8b	52.7c	12.6e	79bc	48.1c
Cyanophos	500	Adult	16.2cd	22.0ab (33)	9.7ab (41)	7.4b (82)	13.0b (56)
		Immature	25.4b	33.3d	40.3c	61.5c	45.0c
Chlorpyrifos-methyl	500	Adult	17.3cd	11.3cde (68)	6.7b (62)	6.8b (84)	8.3bc (74)
		Immature	24.6b	13.9e (39)	2.4f (32)	39.7d	18.7ef
Methamidophos	300	Adult	22.9bc	17.8abc (62)	4.8b (79)	3.4b (90)	9.3bc (78)
		Immature	16.6bcd	13.3e (14)	13.1e	15.6e	14.0ef
Carbaryl	1275	Adult	19.0bcd	14.8bcd (63)	9.9ab (48)	8.3b (82)	10.9bc (69)
		Immature	29.4b	4.1f (85)	17.5e	20.1de	13.9ef (25)
Thiodicarb	400	Adult	32.9b	11.0cde (84)	3.6b (89)	3.3b (93)	6.7c (89)
		Immature	22.7bc	5.5f (74)	3.9f (16)	61.6c	23.7de
Cypermethrin	60	Adult	12.0d	7.3de (70)	3.6b (54)	3.3b (89)	5.4c (76)
		Immature	10.9de	5.2f (49)	13.0e	29.2de	15.9ef
Alpha-cypermethrin	25	Adult	19.4bcd	5.6e (86)	4.3b (78)	8.6b (82)	6.2c (83)
		Immature	15.3d	30.0d	76.9a	14.9e	40.6cd
Alphamethrin	25	Adult	12.3d	7.3de (71)	3.5b (56)	6.2b (80)	6.3c (72)
		Immature	15.4de	8.7ef (39)	2.4f	17.1de	9.4f (3)
Untreated	—	Adult	12.1d	24.6a	12.2a	30.0a	22.3a
		Immature	200.2a	186.5a	53.7b	134.8a	125.7a

a-Means followed by the same letter(s), for each stage, in a column are not significantly different (P = 0.05; Duncan's [1955] multiple range test).
b-Percent reduction, in parenthesis, adjusted for natural changes in population density occurring in untreated check by Henderson's formula (Henderson and Tilton, 1955).

significantly effective in controlling immature stages, though all insecticidal treatments kept immature numbers below those of check.

Table 2 shows the effect of addition of cypermethrin to selected organophosphorus and carbamate insecticides, at reduced rates, on whitefly control. Chlorpyrifos, thiodicarb, and acephate applied in combinations with cypermethrin at rates of 456+24, 376+24, and 276+24 g [AI]/feddan, respectively, were significantly more effective for adult control (≥ 93%) than insecticides alone, by day 4 after treatment. Also, addition of cypermethrin to carbaryl (1251+24 g [AI]/feddan), cyanophos (476+24 g [AI]/feddan), or methamidophos (276+24 g [AI]/feddan) resulted in relatively adult control (≥75%) compared with insecticides alone. On that day, methamidophos and carbaryl mixed with cypermethrin, at tested rates, were significantly more effective for whitefly immature control (92%) than insecticides alone. These treatments kept immature counts below those of the check providing a relatively control by 78 and 64%, respectively, 18 days after spray.

Data also showed that whitefly adult control with most selected insecticides which applied in mixtures with alpha-cypermethrin, at reduced rates, was not significantly better than those obtained by the insecticides alone (Table 3). However, treatments of acephate + alpha-cypermethrin (290+10 g [AI]/feddan), methamidophos + alpha-cypermethrin (290+10 g [AI]/feddan), and carbaryl + alpha-cypermethrin (1265+10 g [AI]/feddan) were significantly more effective in controlling whitefly immature populations (81, 74, and 97%, respectively) than insecticides alone, 4 days after application. These treatments kept the numbers of immatures below those of the check through

Table 2. Effectiveness of certain organophosphorus and carbamate insecticides applied in combinations with cypermethrin in controlling whitefly, *B. tabaci*, populations on cotton.[a,b]

Treatment	Rate		Stage	Mean no. whitefly/leaf (Reduction %)				
					Days after treatment			
	Mixing ratio (AI)	g (AI)/feddan		24h Pre-treatment Sept. 14	4 Sept. 19	11 Sept. 26	18 Oct. 3	Overall mean
Acephate + Cypermethrin	9.2:0.8	276+24	Adult	34.2b	5.3bc(93)	5.9a(79)	4.7b(95)	5.3b(92)
			Immature	19.0d	10.4cd(48)	35.0	8.6cd(23)	18.0c
Chlorpyrifos + Cypermethrin	9.5:0.5	456+24	Adult	23.0c	1.6c(97)	4.3a(78)	8.3b(87)	4.7b(90)
			Immature	13.5d	4.5d(68)	5.0c	21.2c	10.2cd
Cyanophos + Cypermethrin	9.5:0.5	476+24	Adult	10.8d	4.7bc(79)	5.5a(35)	3.9b(86)	4.7b(76)
			Immature	21.9d	15.0c(38)	3.9c(42)	23.8c	14.2cd
Chlorpyrifos-methyl + Cypermethrin	9.5:0.5	476+24	Adult	9.8d	10.5b(49)	4.7a(39)	2.8b(89)	6.0b(67)
			Immature	13.1d	4.5d(67)	6.7c	84.3b	31.8b
Methamidophos + Cypermethrin	9.2:0.8	276+24	Adult	11.7d	6.2bc(75)	3.2a(65)	3.8b(80)	4.4b(80)
			Immature	49.2c	4.0d(92)	4.1c(73)	6.4d(78)	4.8d(84)
Carbaryl + Cypermethrin	9.8:0.2	1251+24	Adult	11.4d	4.9bc(79)	3.3a(63)	4.6b(85)	4.3b(80)
			Immature	96.8b	8.1cd(92)	0.7c(98)	20.3c(64)	9.7cd(84)
Thiodicarb + Cypermethrin	9.4:0.6	376+24	Adult	50.0a	5.8bc(94)	4.7a(88)	4.0b(97)	4.8b(95)
			Immature	12.7d	29.2b	51.5a	18.5c	33.1b
Untreated	—	—	Adult	11.4d	24.0a	8.9a	30.0a	21.0a
			Immature	195.5a	186.5a	60.3	115.3a	120.7a

a-Means followed by the same letter(s), for each stage, in a column are not significantly different (P = 0.05; Duncan's (1955) multiple range test).

b-Percent reduction, in parenthesis, adjusted for natural changes in population density occurring in untreated check by Henderson's formula (Henderson and Tilton, 1955).

Table 3. *Effectiveness of certain organophosphorus and carbamate insecticides applied in combinations with alpha-cypermethrin in controlling whitefly, B. tabaci, populations on cotton.*[a,b]

Treatment	Rate: Mixing ratio (AI)	Rate: g (AI)/feddan	Stage	24h Pre-treatment Sept. 14	Mean no. whitefly/leaf (Reduction %), Days after treatment: 4, Sept. 19	11, Sept. 26	18, Oct. 3	Overall mean
Acephate + Alpha-cypermethrin	9.7:0.3	490+10	Adult	46.3ab	5.8f(93)	5.3bc(67)	3.5b(91)	4.9b(84)
Chlorpyrifos + Alpha-cypermethrin	9.8:0.2	470+10	Immature	39.7c	9.6a(61)	35.3c	14.8d(58)	19.9d(46)
			Adult	56.6a	9.9b(76)	15.8a(21)	1.8b(96)	9.2b(75)
Cyanophos + Alpha-cypermethrin	9.8:0.2	490+10	Immature	88.9c	48.7d(57)	33.5c(41)	24.0cd(69)	35.5bc(57)
			Adult	122.2c	5.9b(63)	10.6ab	1.8b(91)	6.1b(57)
Chlorpyrifos-methyl + Alpha-cypermethrin	9.8:0.2	490+10	Immature	44.4cd	94.6b	38.6c	15.8d(60)	49.7b
			Adult	17.2d	3.7b(46)	4.2bc(30)	1.9b(87)	3.9b(65)
Methamidophos + Alpha-cypermethrin	9.7:0.3	290+10	Immature	51.0d	75.3c	18.4d(44)	33.0bc(27)	42.2b(11)
			Adult	11.9d	3.9b(54)	2.9c(31)	1.4b(86)	2.7b(65)
Carbaryl + Alpha-cypermethrin	9.9:0.1	1265+10	Immature	32.6d	17.6e(74)	57.9b	19.1d(59)	31.5bc(36)
			Adult	32.9c	7.0b(70)	5.1bc(55)	2.4b(91)	4.8b(77)
Untreated	—	—	Immature	297.2a	11.4e(97)	34.9c(82)	35.8b(86)	27..4cd(90)
			Adult	39.0bc	28.6a	13.7a	33.8a	25.2a
			Immature	166.3b	235.3a	120.3a	164.8a	173.5a

a-Means followed by the same letter(s), for each stage, in a column are not significantly different (P = 0.05; Duncan's (1955) multiple range test).
b-Percent reduction, in parenthesis, adjusted for natural changes in population density occurring in untreated check by Henderson's formula (Henderson and Tilton, 1955).

the remainder period of the test.

Table 4 shows that all selected insecticides were significantly more effective in reducing whitefly adult numbers (≥ 75%) than insecticides alone, when applied in mixtures with alphamethrin, 4 days after treatment. These treatments provided continuing control through the remainder period of the test. The results indicated also that methamidophos and thiodicarb applied in mixtures, at reduced rates of 290+10 and 390+10 g [AI]/feddan, repectively, provided a satisfactory control (90 or 77%, respectively) of whitefly immatures, 11 days after spray, compared to insecticides alone.

This study showed that the insecticides acephate, thiodicarb, and alpha-cypermethrin applied alone were the best selected compounds in controlling *B. tabaci* adult populations. It was obvious that immature stages of whitefly were more resistant to most selected insecticides alone than adult stage. However, addition of either cypermethrin or alpha-cypermethrin to carbaryl at subrecommended field rates provided effective control to immature populations through 18 days after treatment. Also, a considerable control of the immature stages was obtained when cypermethrin was added to methamidophos at subrecommended rates. Collmann & All (1982) indicated that the organophosphorus compounds, malathion and sulprofos, and the pyrethroid resmethrin were toxic to greenhouse whitefly, *Trialearodes vaporariorum* (Westwood), adults, but egg and pupal stages were not highly affected. Elhag & Horn (1983) also reported that greenhouse whitefly adults were more susceptible to the insecticides tested than nymphs. Adults are usually exposed to more toxicant than nymphs because of their greater mobility. Elhag & Horn (1983) reported that resistance in field populations of whitefly developed to

Table 4. Effectiveness of certain organophosphorus and carbamate insecticides applied in combinations with alphamethrin in controlling whitefly, *B. tabaci*, populations on cotton.[a,b]

Treatment	Rate			Mean no. whitefly/leaf (Reduction %)				
					Days after treatment			
	Mixing ratio (AI)	g (AI)/ feddan	Stage	24h Pre-treatment Sept. 14	4 Sept. 19	11 Sept. 26	18 Oct. 3	Overall mean
Acephate + Alphamethrin	9.7:0.3	290+10	Adult	47.0	11.7(89)	6.2(90)	6.1(95)	8.0(92)
			Immature	43.9	22.1(45)	62.1	35.4	39.9
Chlorpyrifos + Alphamethrin	9.8:0.2	470+10	Adult	19.7	3.3(93)	1.9(93)	1.0(98)	2.1(95)
			Immature	41.0	17.4(54)	86.7	19.6(15)	41.2
Cyanophos + Alphamethrin	9.8:0.2	490+10	Adult	14.0	4.1(87)	2.0(89)	2.1(95)	2.7(91)
			Immature	88.4	88.7	77.5	44.3(11)	70.2
Chlorpyrifos-methyl + Alphamethrin	9.8:0.2	490+10	Adult	33.3	10.4(86)	2.5(94)	1.3(99)	4.7(93)
			Immature	76.0	110.6	37.5	16.3(62)	54.8
Methamidophos + Alphamethrin	9.7:0.3	290+10	Adult	18.7	8.9(79)	3.9(84)	2.2(96)	5.0(87)
			Immature	215.9	71.9(64)	6.7(90)	61.2(49)	46.6(64)
Carbaryl + Alphamethrin	9.9:0.1	1265+10	Adult	30.8	17.4(75)	4.1(90)	1.3(98)	7.6(88)
			Immature	74.8	89.9	8.4(62)	7.3(83)	35.2(20)
Thiodicarb + Alphamethrin	9.75:0.25	390+10	Adult	36.2	8.8(89)	2.5(95)	1.8(98)	4.4(94)
			Immature	65.6	16.3(73)	4.5(77)	19.7(46)	13.5(65)
Untreated	—	—	Adult	10.8	24.6	14.2	30.0	22.9
			Immature	203.2	186.5	60.4	113.8	120.2

a-Means followed by the same letter(s), for each stage, in a column are not significantly different (P = 0.05; Duncan's (1955) multiple range test).
b-Percent reduction, in parenthesis, adjusted for natural changes in population density occurring in untreated check by Henderson's formula (Henderson and Tilton, 1955).

insecticides used directly for whitefly control, to insecticides used for control of other pests, and to insecticides that had never been used. Recently, Omer *et al.* (1992) suggested that resistance in greenhouse whitefly may be lessened if the chemicals used for control on cotton were not the same as those used for whitefly or other insect pests in the agroecosystem. If whitefly control is needed and the resistance to recommended organophosphorus and carbamate insecticides is high, addition of pyrethroids at reduced rates, will probably increase control efficacy. In this respect, Robertson & Smith (1984) indicated that were synergism to occur in a mixture consisting of a small proportion of a pyrethroid and a large proportion of a less active chemical of the other types, e.g. organophosphorus and carbamate compounds, use of such a mixture might reduce the cost of treatment substantially and still environmentally acceptable. For example, they found that each of the pyrethroids fenvalerate and decamethrin tested in a 1:10 mixture with acephate, carbaryl, or fenitrothion had significant synergism on the toxicity of those insecticides against western spruce budworm, *Choristoneura occidentalis* Freeman larvae. Plapp (1979) determined that acephate and other insecticidal compounds acted as synergists when mixed with pyrethroids, which improved toxicity to the budworm *Heliothis* spp. In addition, Tappan *et al.* (1982) reported that the pyrethroids fenvalerate and permethrin applied alone on fluecured tobacco had limited insecticidal properties, against the green peach aphid, *Myzus persicae* (Sulzer), and tobacco budworm, *H. virescens* (F.), and left large chemical residues on the cured leaf, which could deter commercial acceptance for insect control. However, tank mixes of those compounds with certain organophosphorus insecticides increased the spectrum of control and decreased residues on the cured leaf, which may mitigate resistance to the use of the compounds on the crop.

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فعالية المبيدات الفوسفوريه العضويه ، والكارباماتيه ، منفردة أو فى مخاليط مع مبيدات البيرثرويدات المخلقه ، على تعداد العشائر الحقليه لحشرة ذبابة القطن والموالح البيضاء بحقول القطن بمصر

جمال السيد أبو الغار ، أنور السيد الشيخ ، زينب عبد الغنى البرماوى
قسم مبيدات الآفات ، كلية الزراعة – جامعة المنوفية – شبين الكوم ، مصر

ملخص البحث

أجرى هذا البحث بحقول القطن لتقديم فعالية بعض المبيدات الحشريه المختلفه : الفوسفوريه العضويه ، والكارباميت ، سواء منفدره أو فى مخاليط ثنائيه مع بعض مبيدات البيرثرويدات المخلقه ، فى مكافحة الطور البالغ ، والأطوار غير تامة البلوغ لحشرة ذبابة القطن والموالح البيضاء . ولقد سجلت التجارب النتائج التاليه :

١ – فعالية المبيدات . أسيفات ، ألفا – سيبرميثرين ، ثيوديكارب المستخدمه منفردة بتركيزات ٣٠٠ ، ٢٥ ، ٤٠٠ جرام فعال / فدان ، على الترتيب ، ضد التعداد الحشرى للطور البالغ ، خلال ١٨ يوم من تاريخ المعامله بالمبيدات .

٢ – انخفاض فعالية معظم المبيدات الحشريه المختبره ضد التعداد الحشرى للأطوار غير البالغه .

٣ – أظهرت المخاليط الثنائيه للمبيدات : كلوربيرفوس + سيبرميثرين ، ثيوديكارب+ سيبرميثرين ، أسيفات + سيبرميثرين ، والمستخدمه بجرعات حقليه أقل من الجرعات الموصى باستخدامها ، ٤٥٦ + ٢٤ ، ٣٧٦ + ٢٤ ، ٢٧٦ + ٢٤ جرام فعال/ فدان ، فعاليه ملحوظه فى مكافحة الطور البالغ للحشره ، بالقطع التجريبيه المعامله بها . بالمقارنه بالنتائج المسجله عند استخدام هذه المبيدات فى حاله منفردة .

٤ – إنخفاض التعداد الحشرى للأطوار غير البالغه ، بشكل معنوى ، بالقطع

التجريبيه المعامله بمخاليط المبيدات الآتيه : ميثاميدوفوس + سيبرميثرين (٢٧٦ + ٢٤ جرام فعال / فدان) ، كاربريل + سيبرميثرين (١٢٥١ + ٢٤ جرام فعال / فدان) ، إذا ماقورنت بمثيلتها المعامله بهذه المبيدات بحاله منفرده .

٥ - لم تؤد إضافة مبيد آلفا - سيبرميثرين ، الى معظم المبيدات الحشريه المختبره ، فى مخاليط ثنائيه ، الى اختلافات معنويه ملحوظه فى خفض التعداد الحشرى للطور البالغ ، بالقطع المعامله ، مقارنة بمثيلتها المعامله بالمبيدات الحشريه بحالة منفردة .

٦ - انخفض التعداد الحشرى للأطوار غير البالغه ، بشكل معنوى جداً ، بالقطع المعامله بمخلوط كاربريل + آلفا - سيبرميثرين (١٢٦٥ + ١٠ جرام فعال / فدان) ، عند مقارنته بالقطع المعامله بالمبيدات مفرده .

٧ - أدت إضافة مبيد ألفاميثرين ، لأى من المبيدات الحشريه المختبره بجرعات حقليه ، أقل من الجرعات الموصى باستخدامها ، الى انخفاض معنوى فى التعداد الحشرى للطور البالغ ، بالمقارنه بالنتائج المتحصل عليها باستخدام المبيدات بصورة منفردة .

٨ - انخفاض التعداد الحشرى ، الأطوار غير البالغة ، بالقطع المعامله بمخاليط ميثاميدوفوس + ألفاميثرين (٢٩٠ + ١٠ جرام فعال / فدان) ، ثيوديكارب + ألفاميثرين (٣٩٠ + ١٠ جرام فعال / فدان) ، ثيوديكارب + ألفاميثرين (٣٩٠ + ١٠ جرام فعال / فدان) ، بشكل معنوى ، بالمقارنه بالنتائج المسجله بالقطع المعامله بالمبيدات منفردة