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INSECTICIDE MIXTURES FOR CONTROLLING WHITEFLY

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ABSTRACT

Many insecticides were displayed failure of its effectiveness towards whitefly; in the reason of insecticide resistance and to facilitate and solve these problems, the mixing of the depressed insecticide with another insecticide which didn't lost the efficiency were considered helpful. A binary mixtures of commonly used insecticides for controlling whitefly *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) with five organophosphorous insecticides were bioassayed using leaf dip method to accomplish the most dependable mixture. As well as the potency evaluation on the whitefly field collection with all mixtures tested was gets a good shift in LC_{50}s. Pirimiphos-methyl mixed with all other tested insecticides in ratio of 1:1exhibits the minimum potentiation ratio (PR) obtained in the study gave followed it the chlorpyrifos-methyl mixed in ratio of 1:10 and chlorpyrifos-ethyl in ratio of 1:4 ppm. The higher synergistic effect was obtained with four cases: cypermethrin, spinosad /fenitrothion 1:4 mixture and cypermethrin, deltamethrin / profenofos 1:10 mixture. Some insecticides combinations exhibit Potentiation Ratio was significantly below 1 (antagonistic effect) and in contrast some insecticides combinations exhibit PR were not significantly different from 1(additive effect).

INTRODUCTION

Whitefly *Bemisia tabaci* (Gennadius) (Homoptera: Aleyrodidae) is a species complex, several whitefly species cause crop losses through direct feeding. The worldwide spread of emerging biotypes, such as *B. tabaci* biotype B, also known as, '*B. argentifolii*', and a new biotype Q, or group of whiteflies in the genus *Bemisia* are important in the transmission of plant diseases, resulting in higher pesticide use on many crops (tomatoes, beans, cassava, cotton, cucurbits, potatoes and sweet potatoes). Outbreaks of *B. tabaci* along the Mediterranean began about 20 years ago. Such outbreaks are typified by initial high populations that later decrease, while natural enemies apparently become an important controlling factors. Both predators and parasitoids attack the pest, but the significance of any one factor in controlling *B. tabaci* is unclear (Gerling, 1996). Whiteflies have become one of the most serious crop protection problems. Pesticide resistance and control failure are reported by many searchers. El Kady and Devine 2003 write that *B.tabaci* were displayed a marked resistance to carbosulfan, aldicarb, cypermethrin, and lambda-cyhalothrin (50, 80, 30 and 25 fold) respectively but no resistance to profenofos and pirimiphos-methyl, or to imidacloprid. And in Another population, collected at the end of the growing season, resistance to carbosulfan remained high (40-fold), resistance to profenofos and cypermethrin was increased (from 20 to 50-fold respectively) and tolerance to imidacloprid was detected (6-fold). Also Roditakis *et al.*, 2005 detected high resistance levels to α-cypermethrin, bifenthrin, pirimiphos-methyl, endosulfan and imidacloprid in *B. tabaci* of greenhouse and outdoor crops from Crete.

Practically Integrated pest management, (IPM), systems aimed to reduce insecticide use in order to help re-establish the ecological equilibrium of predators, parasitoids, and microbial controls.

When single insecticide failed to give adequate control, growers seek out the use of insecticide mixtures. The combined toxicity effectiveness of the ingredient of mixtures, constantly component synergizes or antagonizes the other (Bliss 1939 and Monosson 2005). The most common mixtures were of pyrethroids plus Op's. Such mixtures soon became popular with the growers because of their increased efficacy, reduced pesticide applications and complementary pest control. This Study were designed to examine the effects of mixing five OP pesticides with others recommended for used on *B. tabaci* adults not from the same class wherever they are often additive in nature, the easiest to interpret and the complexity of the interactions depends on differences in the chemical properties and modes of toxic action of the pesticides (Ahmad 2004, 2007). There are tow point were considered in this study first: The potency of the mixture partially depends on how much part per million from each insecticide will participate in the mixture. Second: When treatment with a mixture results in more or less than the expected additive effect, it may be deduced that synergism or antagonism occurs between the two insecticides. To reveal which of these three possibilities (antagonism, additive, and synergism) appear, results from a mixture of some insecticides as well as the pest regression-lines were established with and without 'synergist' and a test of parallelism was computed.

For example: Many experiments performed by Ishaaya *et al.*, 1987 review that the potency of cypermethrin mixtures on *B. tabaci* under glasshouse conditions were synergized about 5- to 50-fold by monocrotophos, acephate or methidathion and profenofos, where the ratio of cypermethrin to the other insecticides were 1:8 to 8:1 respectively.

MATERIALS AND METHODS

Insects:

A field culture of whitefly adult's *B. tabaci* were collected using an aspirator, ice box, plastic containers with muslin cover and rubber band from kalubia vegetables and cabbage fields and transported to the lab immediately before bioassay to perform the susceptibility evaluation of the formulated insecticides and its combinations.

Insecticides:

Imidacloprid (confidor 20% Soluble Liquid), acetamiprid (mosbilan 20% Emulsifiable Concentrate), cypermethrin (cypermethrin 25% EC), deltamethrin (decis 2.5% EC), profenofos (selecron 72% EC), fenpropathrin (meothrin 20% EC), fenvalerate (sumicidin 20% EC), was obtained from Sumitomo chemical co.Ltd., and chlorpyrifos-methyl (dursban 48% EC), chlorpyrifos-ethyl (reldan 50% EC) from Dow Elanco Co., Ltd. Excluding spinosad (spintor 24% SL), thiocyclam (evisect 50%Wettable Powder), dimethoate (sygon 40%), fenitrothion (sumithion 50% EC), pirimiphos-methyl (actellic 50% EC) and malathion (malatox 57% EC) was obtained from the professors of the Central agriculture pesticide lab, Egyptian Ministry of Agriculture.

Bioassay Method for Synergized Insecticides:

The potency of each two mixed insecticides was assessed separately and together on the *B. tabaci* adult field strain. Serial dilutions of the tested compounds concentrations at 0.5-fold intervals were prepared in water. The bioassay employed was a derived from the Dittrich *et al.*, 1990 and Cahill *et al.*, 1995, 1996. Leaf discs, (3 cm diam.) were taken from 18-26 day old cotton plants and dipped for 10 s in an ascending sequence of diluted concentrations of formulated insecticides mixed in (1:1) for pirimiphos-methyl plus each pesticide, (1:4) for fenitrothion or chlorpyrifos-ethyl plus each pesticide and (1:10) for chlorpyrifos-methyl or profenofos plus each pesticide. Control discs were dipped in the water only. After drying, the discs were placed individually on a base of agar placed adaxial side down on the bottom of clean plastic Petri dishes (one 3.5 diam covered with another dish 2.5 diam) and tied together with a rubber bands. Within 1 h of dipping, 20- 30 adult whiteflies adults were released using aspirator into the covered dishes have small hole and tapped with piece of cotton, dead individuals were discarded. The dish inverted and held in laboratory conditioned at 25±2°C with a photoperiod of 14:10 (L: D) h. Treatment with each insecticide concentration was replicated four times alongside a similar untreated check. Mortality was counted 24 h after the whiteflies were placed on treated leaf discs. Whiteflies were considered dead if they showed no sign of movement.

Statistical analysis:

Data were corrected for control mortality using Abbott formula (Abbott, 1925). Dose–mortality regressions were calculated by probit analysis (Finney, 1971) using polo- PC program (Russell *et al.*, 1977) to perform (LC_{50}) and 95% confidence limits. Potency ratios (PRs) were determined by dividing the estimated lethal concentration (LC) values of the mixtures calculated for similar joint action according to Hoel, (1987) by the experimental LC_{50} values observed in the bioassay. If PR =1, the mixture was considered having additive action, if PR was <1 it showed an antagonistic action, and if PR was >1 it exhibited a potentiating action. The estimated LC value of mixture of A and B was computed as follows:

$$Estimated\ LC(A+B) = \frac{1}{\mu A / LC(A) + \mu B / LC(B)}$$

Where μ_A and μ_B represent the proportion of A and B in the mixture; $\mu_A+\mu_B=1$

RESULTS AND DISCUSSION

Table 1, shows the results of the regression lines data of LC_{50} and LC_{90} with fiducial limits of each insecticide tested alone without mixing against *B. tabaci* collection. Table 2 and 3 show the potentiation of chlorpyrifos-ethyl and fenitrothion mixed with each pesticide in ratio (1:4), Table 4 and 5 show the potentiation of profenofos and Chlorpyrifos-methyl mixed with each pesticide in ratio (1:10) and Table 6, show the potentiation of pirimiphos-methy mixed with each pesticide in ratio (1:10).

Table 1: Toxicity of the each insecticide alone on *Bemisia tabaci* adults.

Insecticide	Slope±SE	LC_{50} (Limits)	LC_{90} (Limits)
Imidacloprid	1.278±0.179	26.99 (18.46-38.46)	271.8 (155.1-677.5)
Acetamiprid	1.476±0.236	3.37(2.24-4.63)	24.86 (15.43-56.86)
Spinosad	1.104±0.209	26.61 (14.3-41.7)	385.28 (191.8-1528.2)
Thiocyclam	1.049±0.206	2.227 (1.2-3.5)	37.12 (17.0-187.2)
Cypermethrin	0.895±0.173	1.48 (0.8-2.4)	40.1 (16.3-259.87)
Deltamethrin	1.255±0.206	1.97 (1.19-2.87)	20.72 (11.97-54.47)
Fenpropathrin	1.147±0.189	64.93 (39.26-98.0)	850.9 (445.97-2706.9)
Fenvalerate	1.009±0.188	63.51 (33.8-106.3)	1184.5 (524.5-5870.6)
Dimethoate	1.023±0.238	48.23 (17.9-81.1)	863.8 (408.1-5212.7)
Malathion	1.486±0.202	33.3 (24.26-44.4)	242.5 (153.1-505.72)
Profenofos	1.256±0.239	424.7 (238.6-682.2)	4452.6 (2238.8-17075.6)
Fenitrothion	1.004±0.217	212.1 (80.17-361.9)	4004.5 (1955.3-19163.6)
Pirimiphos-methyl	0.929±0.15	8.77 (5.38-12.68)	209.9 (103.27-765.15)
Chlorpyrifos-ethyl	1.346±0.180	19.25 (13.9-25.4)	172.31 (108.3-361.7)
Chlorpyrifos-methyl	1.073±0.199	125.68 (64.2-194.3)	1967.81 (1037.7-6798.7)

Table 2: Potentiation and antagonism of Chlorpyrifos-ethyl mixed with each pesticide by ratio (1:4) on *Bemisia tabaci* adults.

Insecticide	Slope±SE	LC_{50} (Limits)	PR	LC_{90} (Limits)	PR
Imidacloprid	1.58±0.207	2.951 (2.2-3.9)	0.8793	19.1 (12.4-37.7)	1.345
Acetamiprid	1.44±0.21	0.886 (0.59-1.2)	0.4146	6.838 (4.4-13.7)	0.398
Spinosad	1.27±0.181	4.70 (3.1-6.4)	0.5453	47.80 (30.1-101.2)	0.717
Thiocyclam	1.16±0.148	0.7 (0.47-0.96)	0.3490	8.86 (5.4-18.9)	0.455
Cypermethrin	1.166±0.174	0.62 (0.41-0.87)	0.2630	7.823 (4.5-19.9)	0.555
Deltamethrin	1.395±0.188	0.58 (0.41-0.78)	0.3732	4.83 (3.0-9.9)	0.470
Fenpropathrin	1.204±0.173	9.61 (6.3-13.3)	0.5461	111.46 (66.6-260.3)	0.548
Fenvalerate	0.99±0.134	10.38 (6.9-15.5)	0.4975	212.78 (119.1-539.4)	0.351
Dimethoate	1.52±0.183	12.65 (9.7-16.3)	0.3314	88.24 (57.7-167.99)	0.699
Malathion	1.22±0.141	6.22 (4.6-8.3)	0.4990	69.64 (41.3-153.4)	0.335
Profenofos	1.31±0.145	36.5 (27.3-47.8)	0.3746	348.95 (225.16- 661.7)	0.366
Fenitrothion	1.32±0.139	19.1 (14.2-24.8)	0.5547	177.5 (118.4-315.3)	0.700
Pirimiphos-methyl	1.148±0.143	0.80 (0.558-1.1)	1.1594	10.5 (6.3-22.9)	1.956
Chlorpyrifos-methyl	1.27±0.14	16.5 (12.2-21.6)	0.4905	166.9 (108.6-310.8)	1.032

The highest synergistic effects were obtained with fenitrothion when mixed with cypermethrin in (1:4) ratio which the LC_{50} decreased from 1.48 ppm when used alone to 0.014 ppm where PR = 26.97. Similar results were found when cypermethrin and deltamethrin, when used in mixture with profenofos where LC_{50} decreased from 1.48 to 0.077 and 1.97 to 0.04 ppm respectively and PR was 9.8 and 12.38 respectively. Follow them spinosad in which the LC_{50} decreased from 26.6 ppm when used alone to 0.243 ppm when used in the mixture of fenitrothion where PR =8.263.

The lowest synergistic effect was observed for all insecticides mixed with pirimiphos-methyl whereas the decrease of LC_{50} always not exceeds 3 %. Similar results were found at LC_{50}s levels of each insecticide mixed with chlorpyrifos-ethyl and the percentage of LC_{50}s decrease was not exceeding 12 %. The synergism/antagonism in combination indexes were calculated and assessed for each mixture (Table 2, 3, 4, 5,6), expressed as PR. The

LC_{50} value of the cypermethrin mixed with chlorpyrifos-ethyl was 0.62 ppm, while the toxicity associated with cypermethrin alone was 1.48 and 19.25ppm for chlorpyrifos-ethyl alone (cypermethrin was being not toxic to 50% of the population at 1.48 ppm but after cypermethrin mixed with chlorpyrifos-ethyl the same dose become kill 66.99% of the same population). Thus, the synergistic effect of the mixture were exceeds the mortality by 16.99% of the observed mortality. A similar synergistics effect was found at the LC_{50}s level in each insecticide cited in table 2,3,4,5,6 but cypermethrin and deltamethrin, was showed higher mortality percentage as a result of the synergism almost with all mixtures.

Table 3: Potentiation and antagonism of Fenitrothion mixed with each pesticide by ratio (1:4) on *Bemisia tabaci* adults.

Insecticide	Slope±SE	LC_{50} (Limits)	PR	LC_{90} (Limits)	PR
Imidacloprid	1.023±0.189	1.154 (0.64-1.86)	2.562	20.63 (9.35-98.1)	1.453
Acetamiprid	1.566±0.225	0.126 (0.086-0.18)	2.967	0.83 (0.49-1.91)	3.326
Spinosad	0.967±0.223	0.243 (0.10-0.446)	12.000	5.126 (1.96-51.3)	8.263
Thiocyclam	1.149±0.194	0.362 (0.21-0.54)	0.683	4.73 (2.57-14.18)	0.871
Cypermethrin	1.199±0.189	0.014 (0.008-0.022)	11.737	0.165 (0.099-0.38)	26.973
Deltamethrin	1.056±0.189	0.026 (0.012-0.042)	8.410	0.424 (0.235-1.25)	5.427
Fenpropathrin	0.927±0.194	3.534 (2.04-6.3)	1.974	85.17 (29.8-913.5)	1.084
Fenvalerate	1.01±0.171	10.312 (6.2-15.99)	0.662	191.3 (89.6-781)	0.666
Dimethoate	1.503±0.220	20.8 (14.2-29.6)	0.251	148.074 (89.1-339.7)	0.633
Malathion	1.514±0.192	3.89 (2.9-5.1)	0.935	27.35 (17.6-53.97)	0.979
Profenofos	0.939±124	24.75 (15.8-35.4)	1.560	573 (314.4-1491.3)	0.768
Pirimiphos-methyl	1.12±0.156	0.64 (0.447-0.91)	1.516	8.94 (4.8-24.75)	2.594
Chlorpyrifos-ethyl	1.56±0.18	1.33 (1.0-1.77)	1.592	8.83 (5.7-17.1)	2.158
Chlorpyrifos-methyl	1.07±0.18	22.99 (14.2-35.0)	0.570	360.8 (174.9-1381.7)	0.575

PR were significantly below 1 for Imidacloprid, thiocyclam, fenpropathrin, fenvalerate, dimethoate, profenofos, fenitrothion and chlorpyrifos-methyl / pirimiphos-methyl mixture and acetamiprid, spinosad, thiocyclam, cypermethrin, deltamethrin, fenpropathrin, fenvalerate, dimethoate, malathion, profenofos and fenitrothion / chlorpyrifos-ethyl mixtures, also thiocyclam, fenvalerate, dimethoate, malathion and profenofos / fenitrothion mixtures, in addition to thiocyclam, dimethoate, chlorpyrifos-ethyl,chlorpyrifos-methyl / profenofos mixtures and imidacloprid, acetamiprid, deltamethrin, profenofos / chlorpyrifos-methyl mixtures revealing a significant synergism.

By contrast, the PR were not significantly different from 1 for acetamiprid, spinosad, cypernethrin, deltamethrin and malathion, chlorpyrifos-methyl / chlorpyrifos-ethyl mixtures, and imidacloprid, chlorpyrifos-methyl, pirimiphos-methyl / chlorpyriphos-ethyl mixture.

Also imidacloprid, fenpropathrin, pirimiphos-methyl,chlorpyrifos-ethyl / fenitrothion mixtures had only additive effects.

PR more than one in the case of cypermethrin, spinosad /fenitrothion mixture and cypermethrin , deltamethrin / profenofos mixture. These results agree with many results conducted around the world for determining the synergistic activity of those pesticide mixtures and those will exemplify in proceeding.

Table 4: Potentiation and antagonism of Profenofos mixed with each pesticide by ratio (1:10) on *Bemisia tabaci* adults.

Insecticide	Slope±SE	LC_{50} (Limits)	PR	LC_{90} (Limits)	PR
Imidacloprid	1.257±0.219	4.75 (2.8-6.9)	1.856	49.7(28.4-139.2)	1.787
Acetamiprid	1.033±0.186	0.13 (0.66-0.21)	8.618	2.26 (1.1-8.3)	3.660
Spinosad	1.045±0.234	2.534 (1.23-4.63)	3.429	42.73 (16.8-374.8)	2.921
Thiocyclam	0.971±0.195	1.245 (0.635-2.16)	0.595	25.99 (10.6-172.4)	0.475
Cypermethrin	1.029±0.208	0.077 (0.034-0.131)	6.399	1.358 (0.652-6.1)	9.813
Deltamethrin	1.124±0.185	0.04 (0.024-0.06)	16.391	0.557 (0.294-1.7)	12.381
Fenpropathrin	1.202±0.242	6.52 (3.1-10.5)	3.159	75.94 (40.2-270.3)	3.511
Fenvalerate	1.040±0.193	10.035 (5.1-15.6)	2.009	171.2 (78.0-638.4)	2.118
Dimethoate	1.146±0.223	37.02 (19.9-60.7)	0.418	485.9 (230.78-2168.3)	0.557
Malathion	1.201±0.148	4.72 (3.4-6.4)	2.291	55.1 (32.8-6.4)	1.441
Fenitrothion	1.140±0.227	13.66 (7.7-21.6)	4.439	181.85 (85.4-888.8)	5.647
Pirimiphos-methyl	1.405±0.192	1.58 (0.984-2.43)	1.838	12.915 (6.7-48.9)	5.334
Chlorpyrifos-ethyl	1.253±0.21	5.83 (3.79-8.48)	1.084	61.41 (32.93-193.54)	0.923
Chlorpyrifos-methyl	0.976±0.17	39.16 (21.98-60.8)	0.974	804.6 (379.0-3381.1)	0.711

Table 5: Potentiation and antagonism of Chlorpyrifos-methyl mixed with each pesticide by ratio (1:10) on *Bemisia tabaci* adults.

Insecticide	Slope±SE	LC_{50} (Limits)	PR	LC_{90} (Limits)	PR
Imidacloprid	0.991±0.204	13.439 (7.8-21.0)	0.625	263.994 (110.4-1827.6)	0.328
Acetamiprid	1.31±0.182	1.589 (1.1-2.2)	0.701	15.154 (9.6-31.4)	0.545
Spinosad	1.00±0.147	4.21 (2.7-6.0)	1.968	79.76 (42.1-236.1)	1.512
Thiocyclam	1.095±0.156	1.228 (0.62-1.76)	0.601	18.165 (9.8-50.7)	0.677
Cypermethrin	1.460±0.202	0.577 (0.397-0.778)	0.852	4.35 (2.84-8.52)	3.052
Deltamethrin	1.327±0.212	1.227 (0.82-1.7)	0.531	11.34 (6.7-28.8)	0.607
Fenpropathrin	1.350±0.190	20.554 (14.2-27.8)	0.898	182.97 (114.26-393.2)	1.355
Fenvalerate	1.069±0.153	12.59 (8.1-17.9)	1.439	199.1 (111.8-517.7)	1.652
Dimethoate	0.994±0.140	10.91 (6.8-15.8)	1.306	212.61 (115.8-577.8)	1.181
Malathion	1.298±0.200	4.12 (2.6-5.7)	2.476	40.04 (24.7-90.7)	1.939
Profenofos	1.328±0.159	96.63 (72.25-131.4)	0.675	910.0 (572.9-1827.5)	0.930
Fenitrothion	1.102±0.136	36.581(25.9-50.0)	1.237	532.9 (307.3-1250.14)	1.492
Pirimiphos-methyl	1.168±0.168	0.8 (0.50-1.15)	3.571	10.01 (5.87-23.8)	6.750
Chlorpyrifos-ethyl	1.122±0.159	1.435 (0.93-2.0)	4.254	19.9 (11.33-50.0)	2.804

Table 6: Potentiation and antagonism of Pirimiphos-methy mixed with each pesticide by ratio (1:1) on *Bemisia tabaci* adults.

Insecticide	Slope±SE	LC_{50} (Limits)	PR	LC_{90} (Limits)	PR
Imidacloprid	1.418±0.182	16.966 (11.9-22.5)	0.390	135.98 (91.2-249.8)	0.871
Acetamiprid	1.463±0.212	1.933 (1.4-2.7)	1.259	14.53 (8.4-36.7)	1.530
Spinosad	1.167±0.150	7.501 (5.0-10.6)	0.879	94.06 (54.6-217.6)	1.445
Thiocyclam	1.417±0.193	4.69 (3.4-6.2)	0.379	37.61 (23.9-77.96)	0.839
Cypermethrin	1.234±0.229	1.22 (0.71-1.9)	1.038	13.33 (6.6-51.5)	2.526
Deltamethrin	1.082±0.179	0.56 (0.63-0.86)	2.862	8.583 (4.0-34.9)	2.197
Fenpropathrin	1.157±0.211	36.37 (22.0-53.17)	0.212	465.62(242.5-1673.3)	0.362
Fenvalerate	1.146±0.201	35.36 (20.6-51.86)	0.218	464.1 (252.4-1457.8)	0.384
Dimethoate	1.175±0.157	38.83 (27.2-52.2)	0.191	478.68 (286.7-1090.9)	0.353
Malathion	1.487±0.222	12.73 (8.58-17.58)	0.545	92.55 (58.2-198.3)	1.216
Profenofos	1.277±0.140	183.65 (136.8-240.6)	0.047	1852.1(1193.1-3504.7)	0.108
Fenitrothion	1.288±0.143	59.84 (42.3-79.4)	0.141	591.51(401.46-1026.7)	0.337
Chlorpyrifos-ethyl	1.446±0.148	9.3 (7.16-11.9)	0.648	71.5 (47.96-125.35)	1.323
Chlorpyrifos-methyl	1.310±0.141	62.86 (45.79-82.7)	0.130	598.17 (401.56-1051.5)	0.317

Martin *et al.* 2003 found that the cypermethrin / profenofos mixture provided a synergistic effect on the susceptible strain and an additive effect for the resistant strain. By contrast, the deltamethrin / chlorpyrifos mixture showed an additive effect on the susceptible strain and a synergistic effect on the resistant strain. Jacqueline, and Kimberly 1984 tested each of three pyrethroids (decamethrin, fenvalerate, and permethrin) in a 1:10 mixture with each of four carbamates (aminocarb, carbaryl, methomyl, thiodicarb) and five OP insecticides (acephate, chlorpyrifos, fenitrothion, malathion, phosmet) by topical application to 6th-instar *Choristoneura occidentalis* Freeman, synergism was in the upper (>50% mortality). Frederic and Vincent (2006) indicated that the mixture of pyriproxyfen+spinosad remained active on *Aedes aegypt* for at least 8 months, compared with 3 months for spinosad alone, and 5 months for pyriproxyfen alone. In another experiment, pyriproxyfen and spinosad maintained the rate of adult emergence at 20% for 3 weeks and 3.5 months, respectively. Adu-Acheampong and Ackonor, 2005 reported that imidacloprid was less effective in reducing ant and spiders populations than a mixture of pirimiphos-methyl and bifenthrin. Imidacloprid caused some reduction in spider numbers for a week after spraying but they numbers rose substantially. Dharne and Kabre, 2009 indicated that the treatment by acetamiprid + indoxicarb were significantly superior in reducing the incidence of sucking pests and fruit damage by *Helicoverpa armigera* (Hubner).

Probably reasons of synergism are that, firstly: Most OPs are thiophosphates, activated by oxidases to an oxon form. Martin *et al.* 2003 found that Synergism by oxon forms of OPs may be indicative that this esterases suppression causes synergism in the susceptible strain. Profenofos was found to synergize cypermethrin in the susceptible strain. This OP is a phosphate that is an active form, able to inhibit the acetylcholinesterase and other esterases. Binding to esterases, and the profenofos phosphorylates the active serine, thus, one OP molecule inhibits the esterase molecule. In addition to the Interference with the detoxification by enzymes in insects plays the major role in insecticides synergism whereas increasing the toxicity of the two compounds by inhibiting enzymes of esterases oxidases (Wilkinson, 1976, Byrne *et al.* 1994. and Corbett, 1974). Triazophos oxon has the same synergistic effect as profenofos, strongly synergizing deltamethrin in the susceptible strain presumably by inhibiting esterases. The second reason of synergism was illustrated in (Campanhola and Plapp 1989) where metabolic resistance of the tabacco budworm was mostly a result of enhanced activity of monooxygenases and increase of esterases activity in (Zhao *et al.* 1996). Carbamate propoxur synergised pyrethroids in a pyrethroid-resistant strain of *Culex quinquefasciatus* that exhibited an increased metabolic detoxification by monooxygenases also carbofuran increased chlorpyrifos toxicity on *Schizaphis graminum* (Rondani), and carbosulfan synergised bifenthrin on *Anopheles gambiae* and *Culex quinquefasciatus*, (Corbel *et al* 2002 and 2003).

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مخاليط المبيدات لمكافحه الذبابه البيضاء

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تعتبر مكافحه الذباب الابيض بالمبيدات علي الخضروات والمحاصيل من الوسائل الهامه للحصول علي محصول عالي الكميه والجوده خالي من التشوهات والخسائر الناتجه عن تغذيه الافه. ولتوضيح الوضع الراهن للكفاءه الاباديه للمبيدات الموصي بها لمكافحه هذه الافه علي الخضر وايضا للخروج من ضائقه مقاومه الافه للمبيدات المستخدمه وايجاد حلول فعاله للبقاء علي فعاليه المبيد عاليه او زيادتها باستخدام منشطات كيماويه او خلط المبيد باخر يزيد فعاليته.

تم عمل تقييم حيوي معملي لكفاءه بعض المبيدات الفوسفوريه العضويه في تنشيط فعاليه مبيدات اخري ليست من نفس المجموعه في مكافحه الذباب الابيض باستخدام طريقه غمر الاوراق النباتيه حيث تم تحضير المبيدات بتركيزات نصفيه متتاليه ثم عمل المخاليط باضافه كل مبيد الي اخر كل منهم بنسبه محدده فمثلا مخاليط الفنيتروثيون والكلوربيريفوس ايثيل خلطت بنسبه ١:٤ اما مخاليط البروفينوفوس والكلوربيريفوس ميثيل خلطت بنسبه ١:١٠ وكذلك مخاليط البيريميفوس ميثيل خلطت بنسبه ١:١ حتي يمكن الحصول علي انسب نسبه تعطي كفاءه اباديه عاليه. تم حساب النتائج في صوره الجرعات النصفيه المميته لكل مخلوط .

ومن ابرز النتائج المتحصل عليها :

١- ازاحه عاليه لقيم الجرعه النصفيه المقدره بجذء في المليون لجميع المبيدات التي تم اختبارها في المخاليط بالمقارنه بالجرعات النصفيه قبل الخلط.

٢-اعطي مخلوط البروفينوفوس مع كل من الدلتاميثرين والسيبرمثرين وايضا مخاليط الفنيتروثيون مع كل من السيبرميثرين والسبينوساد اعطت اعلي نسبه تنشيط مما يدل علي امكانيه استعمالهما في مخاليط لتحسين الكفاءه الاباديه تجاه هذه الافه والحد من ارتفاع معدل المقاومه للمبيدات لها وهي ظاهره تظهر بصفه دائمه لهذه المبيدات.

٣-ايضا من تحليل وحساب النتائج المتحصل عليها وجدت نسبه التنشيط لبعض المبيدات لاتتعدي ١ صحيح (تاثير مضاد) مثل مخلوط البيريميفوس ميثيل مع معظم المبيدات يليه مخلوط الكلوربيريفوس ايثيل ثم مخاليط مبيد الكلوربيريفوس ميثيل بينما توجد نسبه تنشيط تكاد تتساوي مع الواحد الصحيح (تاثير اضافي) في مخاليط اسيتاميبريد و سبينوساد وسيبرمثرين و دلتاميثرين و مالاثيون و كلوربيريفوس ميثيل بالاضافه الي مخاليط ايميداكلوبريد و كلوربيريفوس ميثيل مع بيريميفوس ميثيل.

قام بتحكيم البحث

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