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EFFICACY OF CERTAIN INSECTICIDES AGAINST TWO SUCKING PESTS OF TOMATO AND STRAWBERRY UNDER FIELD CONDITIONS

Elgohary, Laila R. A.[1] and Alyaa A. Tawfik[2]

1- Pesticide Dept., Faculty of Agriculture, Mansoura University, Egypt

2- Plant Protection Research Institute, Agricultural Research Center, Dokki, Giza, Egypt.

ABSTRACT

The aim of this study was carried out to determine the efficacy of six insecticides, acetamiprid, imidacloprid, thiamethoxam, thiacloprid, etofenprox and pirimiphos methyl for controlling some sucking pests; the sweet potato whitefly, *Bemisia tabaci* (Genn.) and the two spotted spider mite, *Tetranychus urticae* Koch on tomato and strawberry during 2012 and 2013 seasons. Data showed that the highest general mean reduction percentages of two seasons against *B. tabaci* adults and nymphs on tomato were obtained by pirimiphos methyl and thiamethoxam, while the lowest effects were obtained by thiacloprid and etofenprox. Concerning the effect of tested insecticides on strawberry, thiamethoxam recorded the highest effect against both *B. tabaci* adults and nymphs, whereas thiacloprid showed the lowest effect. On the other hand, there were significant differences in *T. urticae* population on tomato and strawberry between treatments and check after spraying. Data showed that the most effective compound of the experiment was pirimiphos methyl, while the lowest effect was obtained with thiacloprid on tomato. Acetamiprid recorded the highest effective compound of the experiment, whereas imidacloprid gave the lowest effect on strawberry in two seasons of the study.

INTRODUCTION

Among different vegetables species cultivated in Egypt, tomato and strawberry are considered as important and popular vegetable crops in both open fields or protected plantation, to cover needs for both local consumption and exporting to the foreign markets (Habashi *et al.,* 2010). Area cultivated with tomato increased yearly especially in the new reclaimed area to cover the requirements for fresh local consumption to processing purposes. Tomato plants are attacked during their vegetative growth by various pests, among which the two spotted spider mite, *Tetranychus urticae* Koch (Faris *et al.,* 2004) and the sweet potato whitefly, *Bemisia tabaci* (Genn.) during summer plantation causing various degrees of damage lately yield losses. Strawberry is a high value crop in Egypt which exported every year to some Arabian, European and Asian countries (Mohamed and Elghobashy, 2013). Strawberry plants are subjected to several pests among which, *T. urticae* and *B. tabaci*. They affect not only the quantity and the fruit size, but also the quality of the fruits (Mac Farlane and Hepworth, 1994). So, the aim of this study was to determine the efficacy of six insecticides, acetamiprid (Acetamor®), imidacloprid (Commando®),thiamethoxam (Belote®), thiacloprid (Blanche®), etofenprox (Primo®) and pirimiphos methyl (Actellic®) for controlling some sucking pests, *B. tabaci and T. urticae* on tomato and strawberry during 2012 and 2013 seasons under field conditions.

MATERIALS AND METHODS

I- Experimental design:

Experiments were conducted during 2012 and 2013 seasons in Belkas district, Dakahlia Governorate. The design of experiment was conducted in a Randomized Block Design. The area divided into seven treatments, six of them treated with tested insecticides at the recommended rates (Table 1), while the 7^{th} treatment served as a control. Each treatment contains four replicates (42 m^2 each). All the normal cultural operations were carried out in the experimental plots. Spraying was applied on 2^{nd} and 7^{th} of June on tomato and 5^{th} and 13^{th} of May during 2012 and 2013 seasons on strawberry by using motor knapsack sprayer, respectively.

Table1: The tested insecticides.

Commonname	Trade name	Formulation	Field recommended rate	Group
Acetamiprid	Acetamor	20% SP	25 gm/100L	Neonicotinoid
Imidacloprid	Commando	35% SC	75 ml/100L	Neonicotinoid
Thiamethoxam	Belote	25% WG	80 gm / fed.	Neonicotinoid
Thiacloprid	Blanche	48% SL	120 ml/ fed.	Neonicotinoid
Etofenprox	Primo	10% SC	187.5 ml/ fed.	Pyrethroid
Pirimiphos methyl	Actellic	50% EC	375 ml/100L	organophosphate

II- Procedures of evaluation:

A- The sweet potato whitefly, *B. tabaci*:

Twenty five leaves of each replicate were randomly selected from 25 plants. The numbers of *B. tabaci* adults were counted visually in the early morning before spraying and after 3, 5, 7 and 10 days of spraying. As previously mentioned in adult stage, other 25 leaves were picked up and put in paper bags then transferred to laboratory, and the numbers of *B. tabaci* nymphs were counted by the aid of a binocular stereomicroscope.

B- The two spotted spider mite, *T. urticae*:

Twenty five leaves of each replicate randomly selected from 25 plants were picked up and put in paper bags then transferred to laboratory. The samples were collected before spraying and after 3, 5, 7, 10 and 14 days of spraying. The numbers of *T. urticae* were counted by the aid of a binocular stereomicroscope.

III-Statistical analysis:

The reduction percentages were calculated according to Henderson and Tilton (1955). Data were calculated analyzed using analysis of variance technique (ANOVA) followed by Least Significant Difference (LSD). Probability of 0.05 or less was considered significant. All statistical analysis was done with CoHort Software 2004.

RESULTS AND DISCUSSION

I- Efficacy of tested insecticides against the whitefly, *B. tabaci*:

A. Efficacy on tomato:

Data in Table (2) show that the effect of the tested insecticides against *B. tabaci* adults on tomato during 2012 and 2013 seasons. The highest mean reduction percentage in the two seasons was obtained by pirimiphos methyl which caused 76.89 and 84.26% reduction, respectively. While the lowest effect was obtained with imidacloprid and etofenprox causing, 64.83 and 63.63% in the first season, whereas etofenprox and thiacloprid causing, 63.56 and 57.26% reduction in population density in the second season compared with check, respectively. The efficacy of the tested insecticides could be arranged according to the general mean of reduction percentage of the two seasons in a descending order as follows: Pirimiphos methyl, thiamethoxam, acetamiprid, imidacloprid, thiacloprid and etofenprox they were 80.57, 76.06, 72.05, 67.83, 64.96and 63.59%, respectively.

Results presented in Table (3) indicate that all treatments showed different degrees of efficacy against *B. tabaci* nymphs on tomato. Thiamethoxam exhibited the highest effect caused 72.35% reduction in the first season, while pirimiphos methyl was the highest effect caused 86.35% reduction in the population density in the second season compared with check. On the other hand, etofenprox recorded the lowest reduction, 60.26% in the first season, while etofenprox and thiacloprid showed the lowest mean of reduction recording 70.70 and 60.01% reduction, in the second season, respectively. The efficacy of the tested insecticides can be arranged according to the general mean of reduction percentages of the two seasons in a descending order as follows: Thiamethoxam, pirimiphos methyl, acetamiprid, imidacloprid, etofenprox and thiacloprid they were 79.16, 77.75, 76.94, 68.82, 65.48 and 64.95%, respectively.

B- Efficacy on strawberry:

Data in Table (4) show that both thiamethoxam and pirimiphos methyl recorded the highest effect where causing, 71.14 & 75.67 and 69.53 & 70.60% reduction in population density of *B. tabaci* adults on strawberry than Check, in 2012 and 2013 seasons, respectively. On the other hand imidacloprid and thiacloprid showed the lowest effect where recording, 50.97& 55.27 and 45.83 & 57.99% reduction percentages in population density of *B. tabaci* adults than check, in two seasons, respectively. In case of plots treated with thiacloprid and imidacloprid, increases in the population densities after ten days of treatments were observed. The efficacy of the tested insecticides could be arranged according to the general mean of reduction percentage of the two seasons in a descending order as follows: Thiamethoxam, pirimiphos methyl, etofenprox, acetamiprid, imidacloprid and thiacloprid with average reduction percentages of 73.41, 70.06, 63.02, 60.49, 53.12 and 51.91%, respectively.

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Concerning the efficacy of tested insecticides against *B. tabaci* nymphs on strawberry plants (Table 5), statistically, there were significant differences between treatments and check after spraying. The most effective compound of the experiment was thiamethoxam, which caused 71.71 and 75.33% mean reduction percentages during 2012 and 2013 seasons, respectively. While the lowest effect was obtained with thiacloprid causing, 52.16 and 40.54% reduction in population density compared with control, during the two seasons, respectively. The efficacy of the tested insecticides could be arranged according to the general mean of reduction percentage of the two seasons in a descending order as follows: Thiamethoxam, pirimiphos methyl, acetamiprid, etofenprox, imidacloprid and thiacloprid with average reduction percentages of 73.52, 65.54, 62.36, 62.30, 54.25 and 46.35%, respectively.

II- Efficacy of tested insecticides against the two spotted spider mite, *T. urticae*:

A. Efficacy on tomato:

Statistically analysis showed that, there were significant differences in *T. urticae* population on tomato between treated and untreated after spraying. Data in Table (6) show that the most effective compound of the experiment was pirimiphos methyl, which caused 82.91and 85.38% mean of reduction during 2012 and 2013 seasons, respectively., while the lowest effect were obtained with thiacloprid and etofenprox causing, 73.92 & 73.45 and 71.98 & 77.75% reduction percentages in the first & the second seasons, respectively. The efficacy of the tested insecticides could be arranged according to the general mean of reduction percentage of the two seasons in a descending order as follows: Pirimiphos methyl, thiamethoxam, acetamiprid, etofenprox, imidacloprid and thiacloprid with average reduction percentages of 84.15, 78.33, 78.25, 74.87, 74.79 and 73.69%, respectively.

B- Efficacy on strawberry:

Results presented in Table (7) indicate that all treatments showed different degree of efficacy against *T. urticae* on strawberry after spraying. The most effective compound of the experiment was acetamiprid, which caused 70.46 and 87.09% mean of reduction, whereas imidacloprid record the lowest effect causing 34.64 and 62.59% during 2012 and 2013 seasons, respectively. The efficacy of the tested insecticides could be arranged according to the general mean of reduction percentages of during the two seasons in a descending order as follows: Acetamiprid, thiacloprid, thiamethoxam, pirimiphos methyl, etofenprox and imidacloprid with average reduction percentages of 78.77, 74.05, 62.58, 56.20, 50.95and 48.61%, respectively.

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The previous researchers mentioned that, thiamethoxam was the most effective against *B. tabaci* adults, and maintained high control effect with over 90% up to 7 days after treatment (Lee *et al.,* 2002). The tested insecticides showed a variable adverse effect on whitefly *B. tabaci* and this may be due to the great variability in neonicotinoids characteristics influencing the movement in plant tissues such as water solubility which greatly affecting their toxicity especially on piercing sucking pest insects such as whitefly (Cloyd and Bethke, 2011). Thiamethoxam, a second-generation neonicotinoid insecticide (Maienfisch *et al.,* 2001), has been used extensively for the sustainable management of *B. tabaci* in horticultural and other cropping systems (Nauen and Denholm 2005). AL-Kherb (2011) reported that, thiamethoxam showed the highest rates of efficacy against whitefly infesting summer and autumn plantations of cucumber and tomato under field conditions in Saudi Arabia. It caused reduction in whitefly adult and immature stage populations attacking early summer cucumber by 87.5 and 82.4% after three sprays, respectively. In autumn plantations, acetamiprid, imidacloprid and thiamethoxam caused total reduction percentages in adults of *B. tabaci* of 67.3, 71.9 and 84.7%, respectively. The immature stages of the tested pest infesting autumn cucumber plants were reduced 60.1, 72.8 and 82.1%, respectively.

The present results also clearly indicated that thiomethoxam was high toxic against whitefly than other tested compounds and that may be due to its conversion to another neonicotinoid insecticide, clothianidin which known by its long persistence and high level of toxicity on insect pests (Nauen *et al*., 2003). Moreover, the same trend of toxicity was observed when immature stages of *B. tabaci* were treated with the same neonicotinoid insecticides. However, adult insects were more susceptible than immature stages treated with the same rates of insecticides. This may be due to soft cuticle and legible body parts as well as the bigger quantity of pesticide consumed and ingested by adults (AL-Kherb 2011). Bethke and Redak (1997) and Van Iersel *et al*. (2000) found that imidacloprid was more efficient on adults of silverleaf whitefly *B. argentifolii* Bellows and Perring than immature stages. In other words, imidacloprid had a median toxic action which was represented by percentage reduction in insect populations and that may be due to a level of resistance by the insects because it has been used for almost two decades. In addition, recent studies revealed that resistance of neonicotinoids in *B. tabaci* could be associated with an enhanced oxidative detoxification by cytochrome P450 monooxygenases (Karunker *et al.*, 2008; Wang *et al.*, 2009). Pozzebon *et al.* (2011) evaluated the effect of thiamethoxam on *T. urticae* and its predator by considering different routes of exposure (topical, residual and contaminated food exposures) and their combinations and found that, the effects of thiamethoxam on *T. urticae* was higher when residual and contaminated food exposures were considered, also the total effect was higher than 90% where contaminated food exposure was involved.

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فعالية بعض المبيدات الحشرية ضد اثنين من الآفات الثاقبة الماصة التى تصيب الطماطم و الفراولة تحت الظروف الحقلية

ليلى رجب على الجوهرى[١] و علياء عبدالقادر توفيق [٢]

١ - قسم المبيدات - كلية الزراعة - جامعة المنصورة- مصر

٢ - معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة - مصر

اجريت هذه الدراسة بهدف تقييم فعالية ٦ مبيدات حشرية وهى أسيتامبريد ، إيميداكلوبريد ، ثيامثوكسام ، ثياكلوبريد، ايتوفينبروكس و بيريميفوس ميثيل فى مكافحة بعض الآفات الثاقبة الماصة التى تصيب محصولى الطماطم والفراولة وهى الذبابة البيضاء والعنكبوت الاحمر ذو البقعتين خلال موسمى ٢٠١٢ و٢٠١٣. اظهرت النتائج أن مبيدى بيريميفوس ميثيل و ثيامثوكسام كانا اكثر المبيدات المختبرة فعالية ضد الحشرات الكاملة وحوريات الذبابة البيضاء ، بينما سجل كل من مبيدى ثياكلوبريد و ايتوفينبروكس أقل فعالية على محصول الطماطم خلال موسمى الدراسة. اشارت النتائج أيضاً أن مبيد ثيامثوكسام أعطى أعلى فعالية على محصول الفراولة فى حين سجل مبيد ثياكلوبريد أقل فعالية سواء على الطور الكامل أو حوريات الذبابة البيضاء. من ناحية أخرى كانت هناك اختلافات معنوية واضحة بين جميع المبيدات المختبرة على العنكبوت الاحمر ذو البقعتين على كلا المحصولين خلال موسمى الدراسة. وبدراسة كفاءة المبيدات المختبرة ضد العنكبوت الاحمر ذو البقعتين وجد أن مبيد بيريميفوس ميثيل قد أعطى أعلى فعالية بينما سجل مبيد ثياكلوبريد أقل فعالية على محصول الطماطم ، فى حين أعطى مركب أسيتامبريد أعلى فعالية ومبيد إيميداكلوبريد أقل فعالية على محصول الفراولة خلال موسمى الدراسة.

قام بتحكيم البحث

أ.د/ سمير صالح عوض الله — كلية الزراعة - جامعة المنصورة

أ.د/ حسن على طه — مركز البحوث الزراعية

Table (2): Efficacy of the tested insecticides against the sweet potato whitefly, *B. tabaci* adults on tomato during 2012 and 2013 seasons.

Treatment	2012						2013						General mean of reduction % of two seasons
	Before spraying	Mean number (Reduction %) after spraying				Mean	Before spraying	Mean number (Reduction %) after spraying				Mean	
		3 days	5 days	7 days	10 days			3 days	5 days	7 days	10 days		
Acetamiprid	12.08 ^{ab}	0.45 ^{b} (96.65)	0.38 ^{d} (98.42)	5.48 ^{c} (78.18)	22.45 ^{ab} (18.00)	7.19 ^{c} (72.81)	8.93 ^{a}	0.78 ^{bcd} (93.68)	0.85 ^{cd} (93.81)	5.35 ^{d} (70.57)	15.93 ^{cd} (27.10)	5.73 ^{c} (71.29)	6.46 ^{c} (72.05)
Imidacloprid	12.03 ^{ab}	0.95 ^{b} (92.90)	1.40 ^{b} (94.06)	9.75 ^{b} (60.14)	24.23 ^{ab} (12.23)	9.08 ^{b} (64.83)	9.55 ^{a}	0.60 ^{cd} (95.32)	1.00 ^{bc} (93.34)	7.83 ^{c} (60.47)	15.70 ^{cd} (34.21)	6.28 ^{c} (70.83)	7.68 ^{b} (67.83)
Thiamethoxam	12.03 ^{ab}	0.70 ^{b} (94.75)	1.05 ^{c} (95.54)	4.18 ^{c} (83.50)	21.85 ^{ab} (19.45)	6.94 ^{c} (73.31)	9.35 ^{a}	0.63 ^{cd} (95.01)	0.58 ^{d} (95.95)	3.50 ^{e} (82.01)	13.78 ^{d} (42.28)	4.62 ^{d} (78.82)	5.78 ^{cd} (76.06)
Thiacloprid	11.80 ^{ab}	0.45 ^{b} (96.56)	0.48 ^{d} (97.94)	4.78 ^{c} (81.00)	22.80 ^{ab} (15.15)	7.13 ^{c} (72.66)	8.98 ^{a}	1.03 ^{bc} (91.35)	1.33 ^{b} (90.58)	11.65 ^{b} (36.73)	19.60 ^{ab} (10.37)	8.40 ^{b} (57.26)	7.76 ^{b} (64.96)
Etofenprox	11.80 ^{ab}	1.08 ^{b} (91.72)	1.60 ^{b} (93.02)	11.20 ^{b} (53.45)	22.18 ^{ab} (16.33)	9.01 ^{b} (63.63)	9.15 ^{a}	1.10 ^{b} (90.95)	1.23 ^{b} (91.32)	10.05 ^{b} (47.73)	17.40 ^{bc} (24.22)	7.44 ^{b} (63.56)	8.23 ^{b} (63.59)
Pirimiphos methyl	13.05 ^{a}	0.68 ^{b} (95.32)	0.98 ^{c} (96.14)	4.30 ^{c} (84.08)	20.15 ^{b} (32.02)	6.53 ^{c} (76.89)	9.58 ^{a}	0.48 ^{d} (96.32)	0.55 ^{b} (96.34)	2.08 ^{e} (89.96)	10.95 ^{e} (54.41)	3.51 ^{e} (84.26)	5.02 ^{d} (80.57)
Check	11.03 ^{b}	12.35 ^{a}	21.50 ^{a}	23.20 ^{a}	25.58 ^{a}	20.66 ^{a}	8.25 ^{a}	11.15 ^{a}	12.95 ^{a}	17.78 ^{a}	21.15 ^{a}	15.76 ^{a}	18.21 ^{a}
LSD 0.05	1.43	0.62	0.32	2.53	4.14	1.26	1.84	0.41	0.32	1.69	2.64	1.03	0.95

Values followed by the same letter (s) in a column are not significantly different according to Duncan's test at level 0.05.

Table (3): Efficacy of the tested insecticides against the sweet potato whitefly, *B. tabaci* nymphs on tomato during 2012 and 2013 seasons.

Treatment	2012						2013						General mean of reduction % of two seasons
	Before spraying	Mean number (Reduction %) after spraying				Mean	Before spraying	Mean number (Reduction %) after spraying				Mean	
		3 days	5 days	7 days	10 days			3 days	5 days	7 days	10 days		
Acetamiprid	6.13 ^{a}	0.50 ^{b} (92.54)	0.50 ^{b} (96.78)	4.98 ^{c} (63.89)	14.95 ^{b} (27.15)	5.23 ^{bc} (70.09)	6.55 ^{a}	0.40 ^{b} (96.22)	0.65 ^{b} (95.64)	4.80 ^{cd} (79.28)	10.23 ^{cd} (64.03)	4.02 ^{c} (83.79)	4.63 ^{c} (76.94)
Imidacloprid	5.30 ^{bc}	0.83 ^{b} (85.50)	1.08 ^{b} (91.90)	4.73 ^{c} (59.91)	13.50 ^{b} (22.24)	5.03 ^{bc} (64.89)	4.00 ^{c}	0.43 ^{b} (93.46)	0.88 ^{b} (90.38)	5.50 ^{c} (62.27)	9.40 ^{d} (44.90)	4.05 ^{c} (72.75)	4.54 ^{c} (68.82)
Thiamethoxam	5.75 ^{ab}	0.68 ^{b} (88.96)	0.78 ^{b} (94.75)	2.73 ^{d} (79.34)	14.15 ^{b} (26.34)	4.58 ^{bc} (72.35)	5.35 ^{ab}	0.65 ^{b} (92.80)	0.60 ^{b} (95.11)	3.38 ^{de} (82.78)	6.43 ^{e} (73.17)	2.76 ^{d} (85.97)	3.67 ^{d} (79.16)
Thiacloprid	5.38 ^{bc}	0.40 ^{b} (93.09)	0.40 ^{b} (97.05)	2.80 ^{d} (77.42)	15.70 ^{b} (12.00)	4.83 ^{bc} (69.89)	4.30 ^{bc}	0.75 ^{b} (88.81)	0.80 ^{b} (91.55)	9.45 ^{b} (38.41)	14.80 ^{b} (21.29)	6.45 ^{b} (60.01)	5.64 ^{b} (64.95)
Etofenprox	5.18 ^{bc}	0.75 ^{b} (86.14)	1.18 ^{b} (90.96)	6.83 ^{b} (42.00)	13.45 ^{b} (21.93)	5.55 ^{b} (60.26)	5.40 ^{ab}	0.73 ^{b} (91.56)	0.93 ^{b} (92.09)	9.55 ^{b} (50.88)	12.03 ^{c} (48.26)	5.81 ^{b} (70.70)	5.68 ^{b} (65.48)
Pirimiphos methyl	4.80 ^{c}	0.40 ^{b} (92.35)	0.65 ^{b} (94.85)	2.38 ^{d} (78.09)	14.28 ^{b} (11.29)	4.43 ^{c} (69.15)	4.38 ^{bc}	0.40 ^{b} (94.09)	0.45 ^{b} (95.23)	2.20 ^{e} (86.08)	5.48 ^{e} (69.98)	2.13 ^{d} (86.35)	3.28 ^{d} (77.75)
Check	6.24 ^{a}	6.75 ^{a}	16.75 ^{a}	14.30 ^{a}	20.88 ^{a}	14.67 ^{a}	3.80 ^{c}	6.30 ^{a}	8.93 ^{a}	14.20 ^{a}	17.25 ^{a}	11.67 ^{a}	13.17 ^{a}
LSD 0.05	0.64	0.52	2.14	1.81	2.02	0.89	1.16	0.78	1.02	1.90	2.43	0.66	0.61

Values followed by the same letter (s) in a column are not significantly different according to Duncan's test at level 0.05.

Table (4). Efficacy of the tested insecticides against the sweet potato whitefly, *B. tabaci* adults on strawberry during 2012 and 2013 seasons.

Treatment	2012						2013						General mean of reduction % of two seasons
	Before spraying	Mean number (Reduction %)after spraying				Mean	Before spraying	Mean number (Reduction %)after spraying				Mean	
		3 days	5 days	7 days	10 days			3 days	5 days	7 days	10 days		
Acetamiprid	6.40 a	1.00 b	0.83 bc	3.88 bc	9.55 bc	3.81 c	6.00 a	0.88 bc	0.70 b	5.08 c	8.30 c	3.74 c	3.78 d
		(85.91)	(90.86)	(52.96)	(-8.92)	(55.20)		(88.60)	(91.98)	(53.63)	(28.88)	(65.77)	(60.49)
Imidacloprid	6.13 a	1.25 b	1.05 bc	3.28 cd	10.43 ab	4.00 bc	5.20 a	1.18 bc	1.00 b	5.13 c	9.48 b	4.19 b	4.10 c
		(81.68)	(87.58)	(57.51)	(-22.91)	(50.97)		(82.55)	(86.70)	(45.90)	(5.92)	(55.27)	(53.12)
Thiamethoxam	6.53 a	0.55 b	0.60 c	1.98 e	6.95 e	2.52 e	5.00 a	0.40 c	0.50 b	2.23 f	5.90 e	2.26 f	2.39 g
		(92.59)	(93.65)	(76.78)	(21.57)	(71.14)		(93.67)	(93.27)	(75.69)	(40.06)	(75.67)	(73.41)
Thiacloprid	5.98 a	0.85 b	1.23 b	4.18 b	10.85 a	4.28 b	5.95 a	1.45 b	0.88 b	6.33 b	9.50 b	4.54 b	4.41 b
		(87.25)	(84.68)	(45.45)	(-34.05)	(45.83)		(80.78)	(89.71)	(42.32)	(19.16)	(57.99)	(51.91)
Etofenprox	6.10 a	0.88 b	0.75 bc	2.60 de	8.65 cd	3.22 d	5.18 a	0.78 bc	0.80 b	4.08 d	7.00 d	3.16 d	3.19 e
		(86.51)	(91.35)	(66.62)	(-3.30)	(60.29)		(88.43)	(88.32)	(56.83)	(29.40)	(65.74)	(63.02)
Pirimiphos methyl	6.95 a	0.73 b	0.53 c	1.83 e	8.10 d	2.79 e	5.03 a	0.58 bc	0.68 b	2.83 e	6.68 de	2.69 e	2.74 f
		(90.57)	(94.58)	(79.52)	(13.44)	(69.53)		(90.96)	(90.97)	(68.95)	(31.51)	(70.60)	(70.06)
Check	6.98 a	7.93 a	9.95 a	9.10 a	9.88 ab	9.21 a	5.58 a	7.38 a	8.35 a	10.30 a	11.03 a	9.26 a	9.24 a
LSD 0.05	1.39	0.74	0.56	0.77	1.13	0.30	1.05	0.81	0.79	0.60	0.84	0.35	0.25

Values followed by the same letter (s) in a column are not significantly different according to Duncan's test at level 0.05.

Table (5): Efficacy of the tested insecticides against the sweet potato whitefly, *B. tabaci* nymphs on strawberry during 2012 and 2013 seasons.

Treatment	2012						2013						General mean of reduction % of two seasons
	Before spraying	Mean number (Reduction %)after spraying				Mean	Before spraying	Mean number (Reduction %)after spraying				Mean	
		3 days	5 days	7 days	10 days			3 days	5 days	7 days	10 days		
Acetamiprid	5.78 a	0.95 b	0.83 bcd	2.65 bc	6.58 b	2.75 c	4.68 a	0.88 bc	0.58 b	3.25 d	6.03 ab	2.68 c	2.72 c
		(84.01)	(92.21)	(66.79)	(29.59)	(68.15)		(80.55)	(91.63)	(49.96)	(4.14)	(56.57)	(62.36)
Imidacloprid	5.15 ab	0.95 b	0.93 bc	3.18 b	6.45 b	2.88 c	3.83 a	0.95 b	0.53 b	4.08 c	5.90 b	2.86 c	2.87 c
		(82.85)	(90.30)	(56.29)	(23.73)	(63.29)		(75.62)	(90.60)	(24.77)	(-10.18)	(45.20)	(54.25)
Thiamethoxam	3.93 c	0.48 b	0.45 e	1.33 d	4.25 d	1.63 e	4.28 a	0.55 cd	0.40 b	1.10 f	3.53 d	1.39 f	1.51 f
		(88.40)	(93.52)	(73.99)	(30.93)	(71.71)		(87.39)	(93.34)	(81.68)	(38.92)	(75.33)	(73.52)
Thiacloprid	4.58 bc	1.13 b	1.13 b	2.70 bc	8.10 a	3.26 b	4.75 a	0.85 bc	0.88 b	5.83 b	6.95 a	3.63 b	3.44 b
		(76.33)	(86.43)	(57.02)	(-11.12)	(52.16)		(80.71)	(85.76)	(9.61)	(-13.93)	(40.54)	(46.35)
Etofenprox	3.80 c	0.55 b	0.70 cde	1.90 cd	5.68 bc	2.21 d	4.40 a	0.70 bcd	0.70 b	2.38 e	5.15 bc	2.23 d	2.22 d
		(86.57)	(90.09)	(63.59)	(8.26)	(62.13)		(84.26)	(88.81)	(61.73)	(15.11)	(62.48)	(62.30)
Pirimiphos methyl	4.38 bc	0.60 b	0.50 de	1.75 cd	5.23 cd	2.02 d	3.68 a	0.43 d	0.40 b	2.23 e	4.55 c	1.90 e	1.96 e
		(86.88)	(93.79)	(71.42)	(27.58)	(69.92)		(88.27)	(92.27)	(57.55)	(6.53)	(61.16)	(65.54)
Check	4.70 bc	5.08 a	8.65 a	6.73 a	7.78 a	7.06 a	4.98 a	5.05 a	7.23 a	7.18 a	6.95 a	6.60 a	6.83 a
LSD 0.05	1.00	0.67	0.32	1.02	1.01	0.34	1.18	0.34	0.65	0.72	0.93	0.30	0.19

Values followed by the same letter (s) in a column are not significantly different according to Duncan's test at level 0.05.

Table (6): **Efficacy of the tested insecticides against the two spotted spider mite, *T. urticae* on tomato during 2012 and 2013 seasons.**

Treatment	2012							2013							General mean of reduction % of two seasons
	Before spraying	Mean number (Reduction %) after spraying					Mean	Before spraying	Mean number (Reduction %) after spraying					Mean	
		3 days	5 days	7 days	10 days	14 days			3 days	5 days	7 days	10 days	14 days		
Acetamiprid	15.55 ^{a}	1.10 ^{b} (94.83)	1.15 ^{b} (94.99)	2.85 ^{b} (89.52)	11.65 ^{bcd} (57.75)	20.68 ^{c} (40.46)	7.49 ^{c} (75.51)	36.40 ^{a}	1.20 ^{b} (97.25)	0.75 ^{b} (98.40)	8.95 ^{bcd} (84.65)	25.78 ^{bc} (61.71)	31.15 ^{d} (62.92)	13.57 ^{d} (80.99)	10.53 ^{d} (78.25)
Imidacloprid	16.90 ^{a}	1.03 ^{b} (95.43)	0.95 ^{b} (96.36)	2.73 ^{b} (90.82)	12.33 ^{bc} (58.37)	21.15 ^{c} (41.85)	7.64 ^{c} (76.56)	28.80 ^{b}	0.88 ^{b} (97.40)	0.98 ^{b} (97.34)	10.28 ^{bc} (77.29)	22.05 ^{d} (57.60)	42.38 ^{c} (35.49)	15.31 ^{c} (73.02)	11.47 ^{c} (74.79)
Thiamethoxam	17.13 ^{a}	0.90 ^{b} (96.12)	0.90 ^{b} (96.57)	1.95 ^{b} (93.43)	10.10 ^{cd} (66.72)	21.38 ^{c} (43.70)	7.05 ^{c} (79.31)	28.38 ^{b}	1.10 ^{b} (96.53)	0.78 ^{b} (97.77)	7.28 ^{cd} (83.35)	22.48 ^{cd} (55.34)	29.23 ^{d} (53.75)	12.17 ^{e} (77.35)	9.61 ^{e} (78.33)
Thiacloprid	17.70 ^{a}	0.98 ^{b} (95.95)	0.98 ^{b} (96.28)	3.43 ^{b} (89.13)	13.50 ^{bc} (57.01)	27.30 ^{b} (31.24)	9.24 ^{b} (73.92)	34.98 ^{a}	1.35 ^{b} (96.70)	1.40 ^{b} (96.87)	12.15 ^{b} (77.97)	29.15 ^{b} (54.86)	47.23 ^{b} (40.84)	18.26 ^{b} (73.45)	13.75 ^{b} (73.69)
Etofenprox	16.68 ^{a}	0.93 ^{b} (96.02)	1.13 ^{b} (95.49)	3.33 ^{b} (88.78)	15.35 ^{b} (48.10)	25.33 ^{b} (31.53)	9.21 ^{b} (71.98)	39.50 ^{a}	1.05 ^{b} (97.73)	1.08 ^{b} (97.87)	10.83 ^{b} (82.71)	29.05 ^{b} (60.22)	44.98 ^{bc} (50.21)	17.40 ^{b} (77.75)	13.30 ^{b} (74.87)
Pirimiphos methyl	17.18 ^{a}	0.53 ^{b} (97.74)	0.48 ^{b} (98.08)	1.80 ^{b} (94.11)	8.25 ^{c} (72.65)	18.40 ^{c} (51.97)	5.89 ^{b} (82.91)	39.35 ^{a}	1.03 ^{b} (97.75)	0.60 ^{b} (98.81)	6.85 ^{d} (89.18)	18.23 ^{c} (74.94)	30.53 ^{c} (66.23)	11.45 ^{c} (85.38)	8.67 ^{c} (84.15)
Check	16.23 ^{a}	22.20 ^{a}	24.70 ^{a}	28.78 ^{a}	29.60 ^{a}	36.48 ^{a}	28.35 ^{a}	37.18 ^{a}	44.10 ^{a}	47.80 ^{a}	59.78 ^{a}	68.93 ^{a}	85.68 ^{a}	61.26 ^{a}	44.80 ^{a}
LSD 0.05	2.69	1.18	1.46	1.58	3.53	3.83	1.04	5.18	1.72	0.95	3.11	3.31	4.14	1.11	0.64

Values followed by the same letter (s) in a column are not significantly different according to Duncan's test at level 0.05.

Table (7). Efficacy of the tested insecticides against the two spotted spider mite, *T. urticae* on strawberry during 2012 and 2013 seasons.

Treatment	2012							2013							General mean of reduction % of two seasons
	Before spraying	Mean number (Reduction %) after spraying					Mean	Before spraying	Mean number (Reduction %) after spraying					Mean	
		3 days	5 days	7 days	10 days	14 days			3 days	5 days	7 days	10 days	14 days		
Acetamiprid	**10.40 ^{ab}**	**4.95 ^{e} (75.23)**	**2.00 ^{e} (92.38)**	**6.43 ^{d} (82.91)**	**14.63 ^{e} (71.91)**	**42.55 ^{e} (29.88)**	**14.11 ^{f} (70.46)**	**41.70 ^{ab}**	**5.10 ^{d} (89.85)**	**1.20 ^{e} (98.06)**	**3.25 ^{f} (95.75)**	**10.80 ^{f} (89.54)**	**39.90 ^{g} (62.23)**	**12.05 ^{g} (87.09)**	**13.08 ^{g} (78.77)**
Imidacloprid	10.03 ^{b}	10.33 ^{b} (46.32)	10.33 ^{b} (60.62)	12.73 ^{b} (64.86)	56.05 ^{a} (-13.62)	49.60 ^{cd} (15.01)	27.81 ^{b} (34.64)	44.58 ^{a}	15.93 ^{b} (70.08)	9.83 ^{b} (85.23)	13.78 ^{b} (82.96)	65.58 ^{b} (40.43)	74.03 ^{b} (34.26)	35.83 ^{b} (62.59)	31.82 ^{b} (48.61)
Thiamethoxam	9.95 ^{b}	8.40 ^{c} (56.09)	7.65 ^{d} (70.79)	10.73 ^{c} (70.72)	37.63 ^{c} (25.04)	46.20 ^{de} (20.91)	22.12 ^{d} (48.71)	41.03 ^{b}	10.28 ^{c} (79.20)	4.68 ^{de} (92.34)	5.85 ^{e} (92.21)	25.85 ^{e} (74.38)	57.75 ^{e} (44.09)	20.88 ^{e} (76.45)	21.50 ^{e} (62.58)
Thiacloprid	10.48 ^{ab}	6.78 ^{d} (66.53)	2.18 ^{e} (92.06)	7.40 ^{d} (80.90)	24.35 ^{d} (53.91)	43.88 ^{e} (28.30)	16.92 ^{e} (64.34)	41.50 ^{ab}	6.70 ^{d} (86.69)	2.45 ^{de} (95.97)	3.15 ^{f} (95.84)	13.13 ^{f} (87.25)	49.35 ^{f} (53.02)	14.96 ^{f} (83.76)	15.94 ^{f} (74.05)
Etofenprox	10.03 ^{b}	10.33 ^{b} (46.35)	6.95 ^{d} (73.43)	12.00 ^{bc} (67.60)	48.18 ^{b} (3.27)	57.90 ^{b} (0.42)	27.07 ^{b} (38.21)	39.70 ^{b}	12.35 ^{c} (74.28)	8.48 ^{bc} (85.45)	11.13 ^{c} (84.63)	55.35 ^{c} (43.50)	69.50 ^{c} (30.54)	31.36 ^{c} (63.68)	29.22 ^{c} (50.95)
Pirimiphos methyl	10.05 ^{b}	9.40 ^{bc} (51.70)	8.58 ^{c} (67.42)	12.20 ^{bc} (66.95)	40.43 ^{c} (19.56)	53.43 ^{bc} (8.82)	24.81 ^{c} (42.89)	41.00 ^{b}	11.98 ^{c} (75.83)	5.93 ^{cd} (90.35)	8.85 ^{d} (88.19)	46.28 ^{d} (54.36)	63.48 ^{d} (38.81)	27.30 ^{d} (69.51)	26.05 ^{d} (56.20)
Check	11.50 ^{a}	22.28 ^{a}	30.23 ^{a}	42.40 ^{a}	57.78 ^{a}	67.43 ^{a}	44.02 ^{a}	39.75 ^{b}	48.15 ^{a}	59.65 ^{a}	72.60 ^{a}	98.48 ^{a}	100.65 ^{a}	75.91 ^{a}	59.96 ^{a}
LSD 0.05	1.18	1.14	0.75	1.49	3.47	5.22	1.36	3.1	2.31	3.33	1.91	2.89	2.56	1.42	1.05

Values followed by the same letter (s) in a column are not significantly different according to Duncan's test at level 0.05.