



Comparison between biological and chemical control on controlling *Myzus Persicae* (Sulzer) infesting tomato plants under plastic greenhouses

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Abstract

Experiments were carried out to comparison between biological and chemical control on controlling *Myzus Persicae* (Sulzer) (Hemiptera: Aphididae) infesting tomato plants, *Lycopersicon esculentum* (var. Lopena) under plastic greenhouses at Dokki region, Giza Governorate during two seasons 2020, 2021. Biological control was carried out by using release the predator, The seven spotted lady beetle, *Coccinella septempunctata* L. (Coleoptera: Coccinellidae) at three levels of release (25, 50 and 75 eggs/plant). And chemical control was carried out by using three aphicides (Marshal, Malathion and Dimethoate). Releasing the predator and spraying the aphicides conducted on the beginning of March on tomato plants at both of the two tested seasons 2020, 2021. Data obtained at season 2020 showed that when we applied the three levels of release of the successive predator the reduction percentages in the population of *M. persicae* increased gradually whereas it were 23.9, 35.5, 46.8, 52.1 and 61.4% in mid-March, first-April, mid-April and first-May, respectively in the first level of release and were 27.9, 37.7, 47.5, 54.4 and 68.3% (at the same dates respectively) in the second level of release and were 29.9, 38.1, 48.7, 57.9 and 74.3% (in the same dates respectively) in the third level of release. While in the chemical control when we use the three successive aphicides, the reduction percentages (the general effect percentages) of the tested aphicides (Marshal, Malathion and Dimethoate) arranged descending as follow: Marshal, Malathion and Dimethoate whereas the general affect percentages for them were 96.2, 95.1 and 94.6% respectively in season 2020. The same trend was achieved at the second season 2021 both in the two experiments (biological and chemical) control.

Keywords: *Myzus persicae*, biological, chemical, control, tomato plants, giza governorate, plastic greenhouses

Introduction

Tomato (*Lycopersicon esculentum*) fam. Solanaceae is one of the most important vegetable plants in Egypt and all over the world which it is widely cultivated in both the open field and under greenhouse conditions, Goda *et al.* (2015) who reported that tomato (*L. esculentum*) is considered one of the most important vegetable crops worldwide and in Egypt, the crop is cultivated annually in 2-3 plantations during season. Tomato plants infested by a large scale of insects belong to many orders and families. The green peach aphid, *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) has one of the most important insects that infesting tomato plants. Abdul Basit *et al.* (2021) reported that (*M. persicae*) is a destructive insect pest of tomato responsible for huge losses in the production as well in the vegetable industry. Patricia *et al.* (2013) ^[18] found that The green peach aphid, *M. persicae* causes direct damage to tomato plants and transmit phytoviruses, causing large economic losses. The seven spotted lady beetle, *Coccinella septempunctata* L. (Coleoptera: Coccinellidae) consider one of the most important predators of many aphid species (Ibrahim 1955 and Bilashini *et al.* 2017) ^[55, 61]. Anonymous 1997 reported that both the adult and larval stages feed on insects harmful to plants such as aphids and scale insects. Also, Arnett, *et al.* 1980 found that adults can be killing up to 100 aphids per day. Fleming 2000 found that seven spotted lady beetle, *C. septempunctata* lives in a wide variety of habitats, any place where there are plants and aphids may attract these species. Experiments were carried out to comparison between biological and chemical control on controlling *M. Persicae* infesting tomato plants, *L. esculentum* (var. Lopena) under plastic greenhouses at Dokki region, Giza Governorate during two seasons 2020, 2021.

Materials and Methods

Experimental design

Experiments were carried out at El-Dokki area (Giza governorate) on tomato plants (*Lycopersicon esculentum*) (var. Lopena) during seasons 2020, 2021 under plastic greenhouses. Tomato seedlings were cultivated at both of the two tested seasons at the same time in a timely manner for the cultivation of tomato plants at January month (winter plantation). Biological and chemical experiments were carried in both of the two tested seasons at the same time in the beginning of March. For biological control, The seven spotted lady beetle, *Coccinella*

sempunctata L. was rearing on the Cowpea Aphid, *Aphis craccivora* (Koch) in the laboratory since about one month ago before began of the experiment and releasing the successive predator was conducted in the first of March. In both of the two tested seasons, experiments were conducted at two plastic greenhouses. The first plastic greenhouse was dedicated for biological control and the second once was dedicated for chemical control. The first once was divided into four parts (4x6m for each part) cultivated with tomato plants. Three parts for the three release levels and the fourth part left free as control. Each part also divided into three plots for each release level. The normal release and recommended agricultural practices were applied, also no chemical control against aphid were used during the whole experimental period. Therefore, three levels of *C. sempunctata* eggs were used: first level consists of 25 eggs (one card), second level consists of 50 eggs (two cards) and the third one consists of 75 eggs (three cards) were released to encouragement the normal predator population to reduce the aphid. Samples were randomly taken bi-weekly at both the two tested seasons and counting started from the beginning of March in tomato plants. Ten plants were examined from each plot (five leaves for each plant) were made by a hand lens for counting the alive insects and the predator and took the mean numbers. Both surfaces of the leaf were inspected for the presence of aphid (Mangoud 2009) [17].

For chemical control, the second plastic greenhouse also divided into four parts (4x6m for each part) Three parts for the three successive aphicides ((Marshal, Malathion and Dimethoate) and the fourth part left free as control. Treatments were applied (the first application) on the beginning of March and the second application was conducted after 14 days the past one. Numbers of aphids were counted after periods 1, 7, 14, 21, 28 and 35 days. Count of larvae and adults before and after spraying was carried out as previously mentioned. Alive larvae and adults were counted in untreated and treated areas, and then the % mortality was calculated after 1, 7, 14, 21, 28 and 35 days from application according to Buckley and Koppenhofer (2002) [8]. An ordinary hand sprayer of 20 liters capacity with a bent down Nozzle was used. Normal agricultural practices for greenhouse tomato were carried out regularly (Raymond, 2003) [19]. The obtained results were statistically analysed by using Handerson and Tilton equation (1955).

Statistical analysis

The percent reduction (general effect percentage %) of The Green Peach Aphid, *M. persicae* after released the tested predator and sprayed the tested aphicides was calculated according to Henderson and Tilton equation (1955). The data was subjected to analysis of variance (ANOVA) and the means were compared by L.S.D. test at 0.05 level, using SAS program (SAS Institute, 1988) [20].

Results and Discussion

I. Season 2020

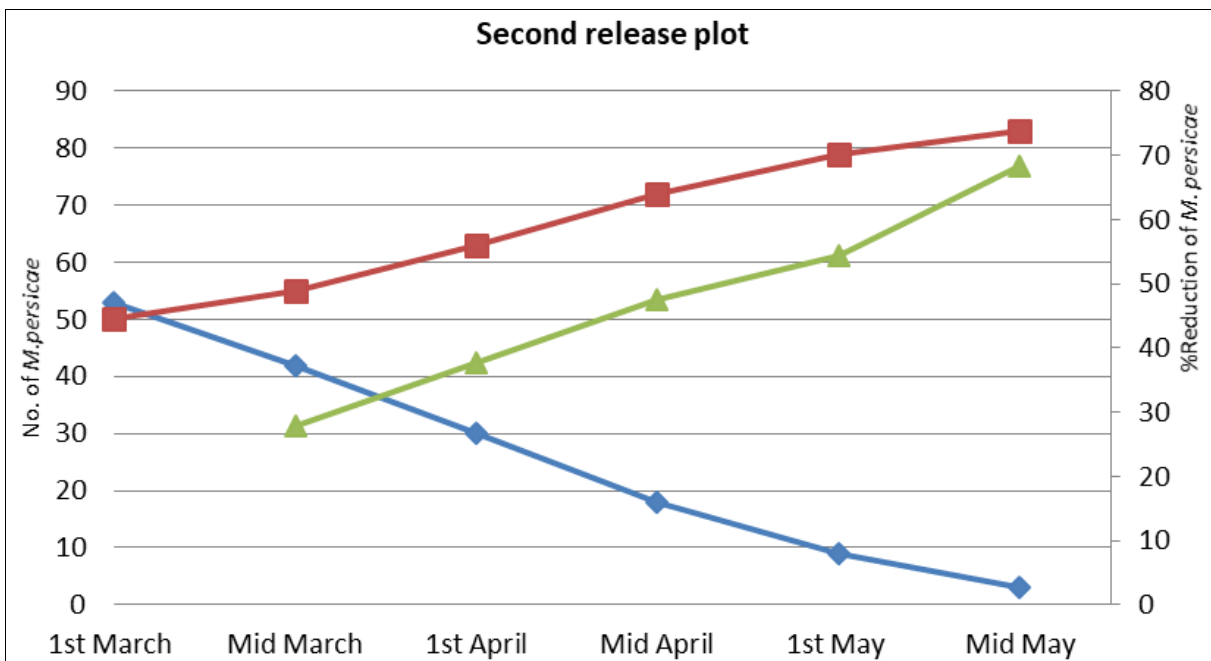
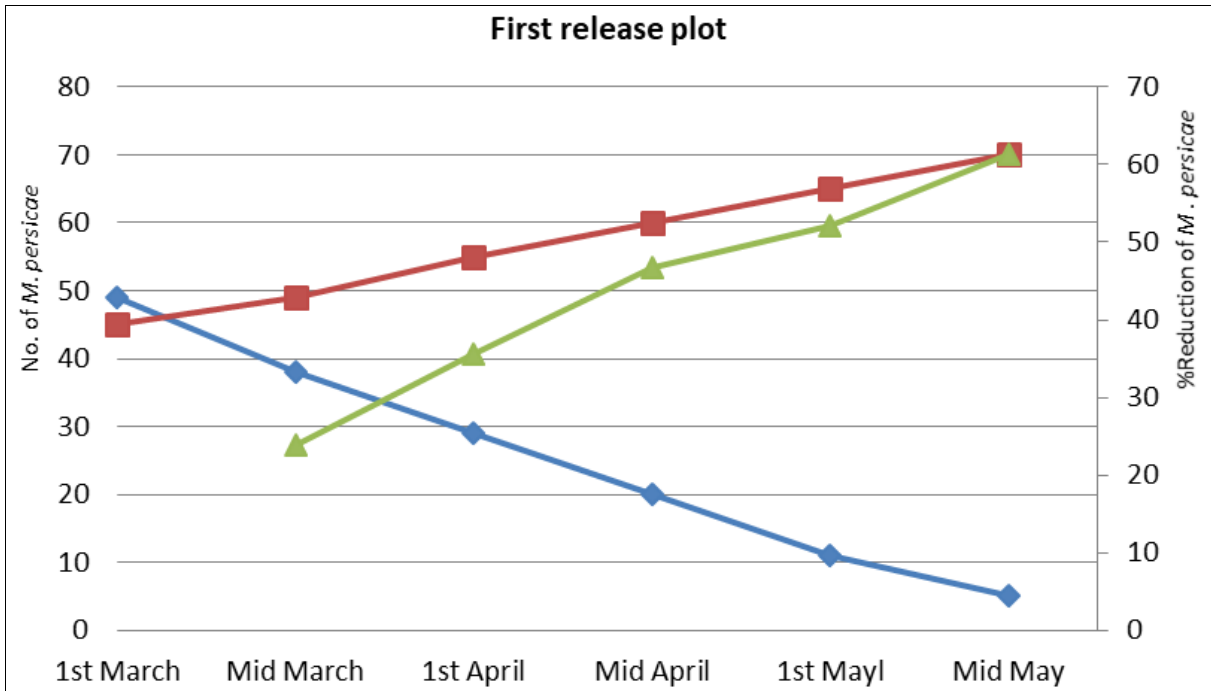
I.1. Biological control

Data obtained in Table (1) and Fig. (1) Indicated to the population of *M. persicae* in the three release levels of *C. sempunctata* at season 2020. Data obtained show that in the first release level (25 egg/plant) the population of aphid decreased gradually from 49 on the 1st March to 38, 29, 20, 11 and 5 individuals/plant on mid-March, first-April, mid-April, first-May and mid-May respectively, while in the control plot the population of *M. persicae* changed from 45 individuals/plant on first-March to 49, 55, 60, 65 and 70 individuals/plant in the same dates respectively. Also, data obtained showed that the percent reduction (%) of *M. persicae* increased gradually to reach 23.9, 35.5, 46.8, 52.1 and 61.4% on the mid-March, first-April, mid-April, first-May and mid-May respectively. While in the second release level (50 egg/plant), the aphid population decreased gradually from 53 on the 1st March to 42, 30, 18, 9 and 3 individuals/plant on mid-March, first-April, mid-April, first-May and mid-May respectively, while in the control plot the population of *M. persicae* changed from 50 individuals/plant on first-March to 55, 63, 72, 79 and 83 individuals/plant in the same dates respectively. Also, the percent reduction (%) of *M. persicae* increased gradually to reach 27.9, 37.7, 47.5, 54.4 and 68.3% on the mid-March, first-April, mid-April, first-May and mid-May respectively. Whereas in the 3rd release level (75 egg/plant), the aphid population decreased gradually from 55 on the 1st March to 40, 27, 15, 7 and 2 individuals/plant on mid-March, first-April, mid-April, first-May and mid-May respectively, while in the control the population of *M. persicae* changed from 53 individuals/plant on first-March to 55, 60, 65, 72 and 80 individuals/plant in the same dates respectively. Also, the percent reduction (%) of *M. persicae* in 3rd release plot increased gradually to reach 29.9, 38.1, 48.7, 57.9 and 74.3% on the mid-March, first-April, mid-April, first-May and mid-May respectively. Statistical analysis obtained from Table (1) also showed that were highly significant differences between the three releasing levels (25, 50 and 75 eggs/plant) of *C. sempunctata* predator in reduction of *M. persicae* population compared to control, whereas the (F 0.05) and (L.S.D) values for the three releasing levels were (327.87, 1.0231), (422.35, 1.0122) and (395.24, 1.0125), respectively.

Table 1: Population fluctuations of *M. persicae* in the three release levels of *C. sempunctata* at season 2020

Date	First release level 25 eggs			Second release level 50 eggs			Third release level 75 eggs		
	Release plot	Chick plot (Control)	% Reduction	Release plot	Chick plot (Control)	% Reduction	Release plot	Chick plot (Control)	% Reduction
First - March	49	45	-	53	50	-	55	53	-
Mid -	38	49	23.9	42	55	27.9	40	55	29.9

March									
First - April	29	55	35.5	30	63	37.7	27	60	38.1
Mid - April	20	60	46.8	18	72	47.5	15	65	48.7
First - May	11	65	52.1	9	79	54.4	7	72	57.9
Mid - May	5	70	61.4	3	83	68.3	2	80	74.3
F(0.05)	327.87			422.35			395.24		
L.S.D	1.0231			1.0122			1.0125		



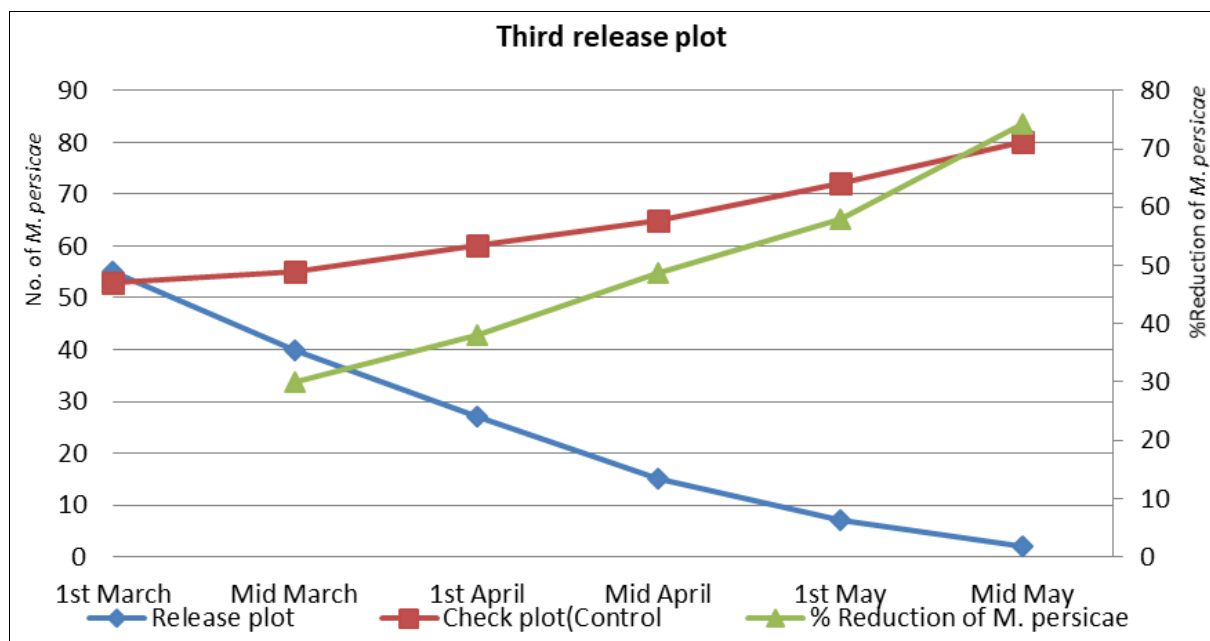


Fig 1: Population fluctuations of *M. persicae* in the three release levels of *C. septempunctata* at season 2020

I.2. Chemical control

Data obtained in Table (2) indicated to the population of *M. persicae* after sprayed three different aphicides (Marshal, Malathion and Dimethoate) after periods 1,7,14, 21, 28 and 35 days respectively. Two applications were conducted, the first one in the beginning of March and the second once after 14 days from the first. Data obtained also show the general effect percentage (%) of the same tested aphicides and indicated to that the general effect percentage were arranged descending as follow: Marshal, Malathion and Dimethoate whereas the general affect percentages (%) for them were 96.2, 95.1 and 94.6% respectively.

Table 2: Numbers of aphids/plant and the general effects (%) of the tested compounds during season 2020

Compound	Rate of application	No. of aphids /plant (pre-treatment)	Post-treatment periods (in days)						General effect%
			1	7	14	21	28	35	
Marshal	100cm/100liter water	30	(0.0) 100	(0.2) 99.5	(8.0) 82.1	(0.0) 100	(0.3) 98.5	(2.0) 97.3	96.2
Malathion	150 cm/100 liter water	32	(0.0) 100	(0.4) 97.5	(10.0) 80.5	(0.0) 100	(0.5) 97.5	(3.0) 95.5	95.1
Dimethoate	150 cm/100 liter water	31	(0.0) 100	(0.5) 97.0	(12.0) 80.0	(0.0) 100	(0.7) 95.8	(3.5) 95.0	94.6
Control	-	33	35	37	40	43	45	47	-

LSD_{0.05} Insecticides: 5.26

LSD_{0.05} Days: 4.92

LSD_{0.01} Insecticides: 7.53

LSD_{0.01} Days: 8.35

2. Season 2021

2.1. Biological control

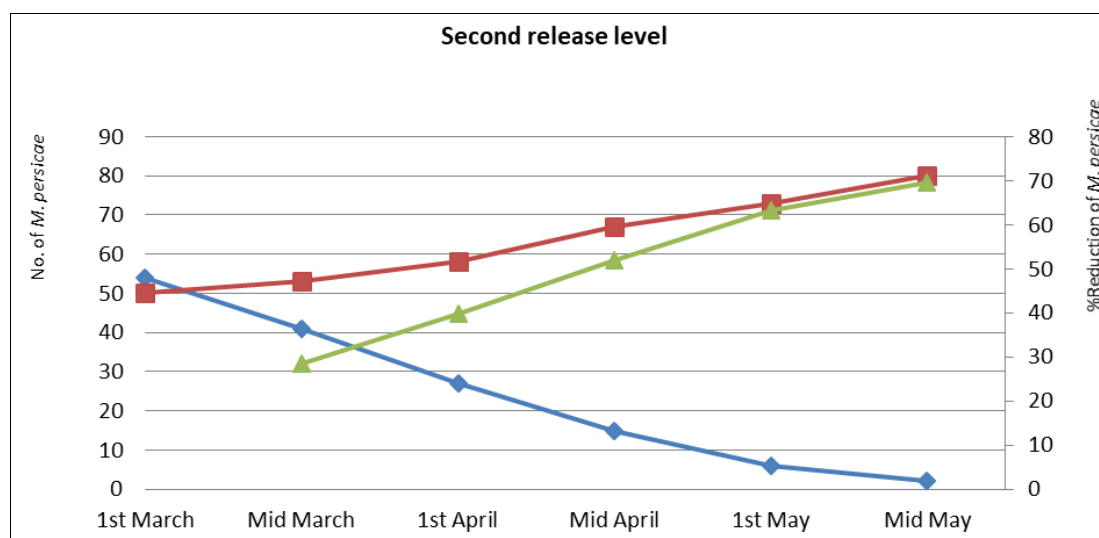
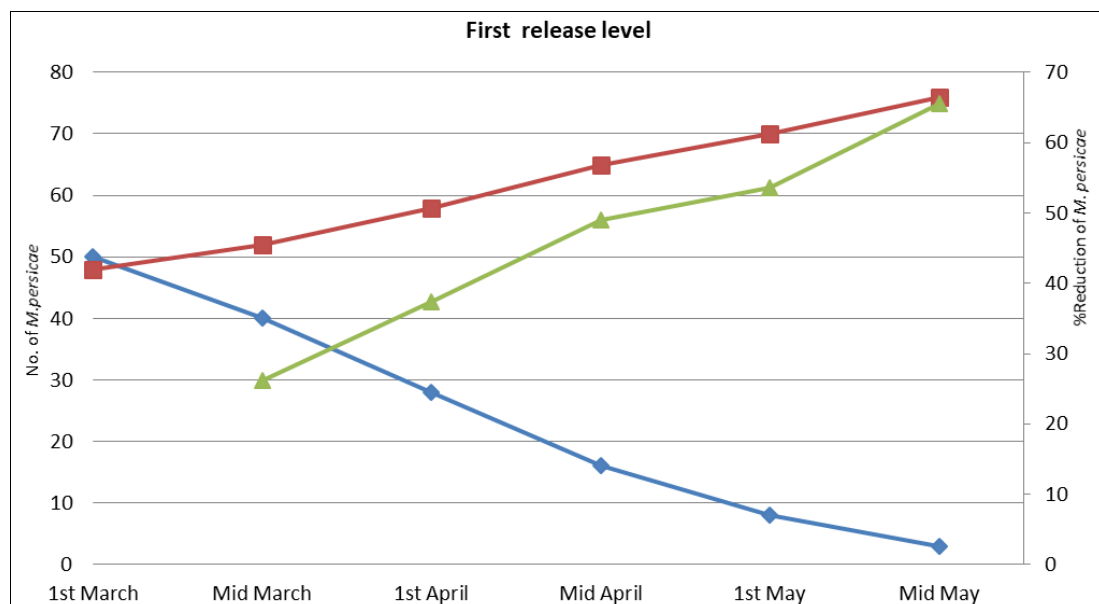
Data obtained in Table (3) and Fig. (2) Indicated to the population of *M. persicae* in the three release levels of *C. septempunctata* at season 2021. Data obtained show that in the first release level (25 egg/plant) the population of aphid decreased gradually from 50 on the 1st March to 40, 28, 16, 8 and 3 individuals/plant on mid-March, first-April, mid-April, first-May and mid-May respectively, while in the control plot the population of *M. persicae* changed from 48 individuals/plant on first-March to 52, 58, 65, 70 and 76 individuals/plant in the same dates respectively. Also, data obtained showed that the percent reduction of *M. persicae* increased gradually to reach 26.2, 37.3, 49.0, 53.6 and 65.5% on the mid-March, first-April, mid-April, first-May and mid-May respectively. While in the second release level (50 egg/plant), the aphid population decreased gradually from 54 on the 1st March to 41, 27, 15, 6 and 2 individuals/plant on mid-March, first-April, mid-April, first-May and mid-May respectively, while in the control plot the population of *M. persicae* changed from 50 individuals/plant on first-March to 53, 58, 67, 73 and 80 individuals/plant in the same dates respectively. Also, the percent reduction (%) of *M. persicae* increased gradually to reach 28.4, 39.8, 51.9, 63.3 and 69.6% on the mid-March, first-April, mid-April, first-May and mid-May respectively. Whereas in the 3rd release level (75 egg/plant) the aphid population decreased gradually from 55 on the 1st March to 41, 26, 13, 5 and 1 individuals/plant on mid-March, first-April, mid-April, first-May and mid-May respectively, while in the control the population of *M. persicae* changed from 52 individuals/plant on first-March to 57, 63, 69, 76 and 77 individuals/plant in the same dates respectively.

Also, the percent reduction (%) of *M. persicae* in 3rd release plot increased gradually to reach 32.0, 42.6, 54.4, 65.1 and 80.3% on the mid-March, first-April, mid-April, first-May and mid-May respectively.

Statistical analysis obtained from Table (3) also showed that were highly significant differences between the three releasing levels (25, 50 and 75 eggs/plant) of *C. septempunctata* predator in reduction of *M. persicae* population compared to control, whereas the (F 0.05) and (LSD) values for the three releasing levels were (525.11, 1.0135), (371.15, 1.0135) and (285.79, 1.0125), respectively.

Table 3: Population fluctuations of *M. persicae* in the three release levels of *C. septempunctata* at season 2021

Date	First release level 25 eggs			Second release level 50 eggs			Third release level 75 eggs		
	Release plot	Chick plot (Control)	% Reduction	Release plot	Chick plot (Control)	% Reduction	Release plot	Chick plot (Control)	% Reduction
First - March	50	48	-	54	50	-	55	52	-
Mid - March	40	52	26.2	41	53	28.4	41	57	32.0
First - April	28	58	37.3	27	58	39.8	26	63	42.6
Mid - April	16	65	49.0	15	67	51.9	13	69	54.4
First - May	8	70	53.6	6	73	63.3	5	76	65.1
Mid - May	3	76	65.5	2	80	69.6	1	77	80.3
F (0.05)	525.11			371.15			285.79		
L.S.D	1.0135			1.0135			1.0125		



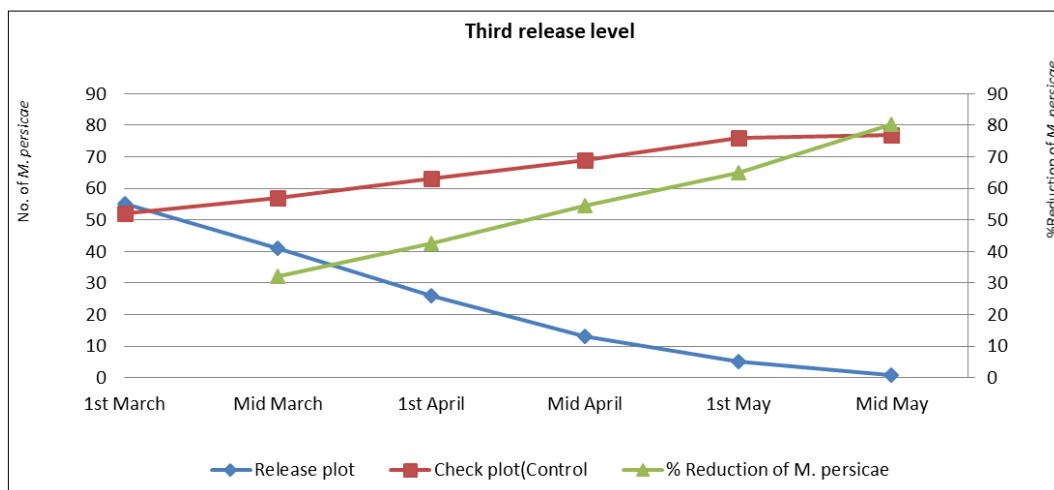


Fig 2: Population fluctuations of *M. persicae* in the three release levels of *C. septempunctata* at season 2021

2.2. Chemical control

Data obtained in Table (4) indicated to the population of *M. persicae* after sprayed three different aphicides (Marshal, Malathion and Dimethoate) after periods 1,7,14, 21, 28 and 35 days respectively. Two applications were conducted, the first one in the beginning of March and the second once after 14 days from the first. Data obtained also show the general effect percentage (%) of the same tested aphicides and indicated to that the general effect percentage were arranged descending as follow: Marshal, Malathion and Dimethoate whereas the general affect percentages (%) for them were 95.6, 94.5 and 93.7% respectively.

Table 4: Numbers of aphids/plant and the general effects (%) of the tested compounds during season 2021

Compound	Rate of application	No. of aphids /plant (pre-treatment)	Post-treatment periods (in days)						General effect%
			1	7	14	21	28	35	
Marshal	100cm/100liter water	35	(0.0) 100	(0.3) 97.9	(11.0) 80.5	(0.0) 100	(0.5) 97.5	(3.0) 97.5	95.6
Malathion	150 cm/100 liter water	33	(0.0) 100	(0.5) 96.5	(12.0) 79.3	(0.0) 100	(0.7) 95.3	(3.5) 96.2	94.5
Dimethoate	150 cm/100 liter water	34	(0.0) 100	(0.7) 95.7	(13.0) 77.8	(0.0) 100	(0.9) 93.5	(4.0) 95.3	93.7
Control	-	32	36	39	44	47	49	52	-

LSD_{0.05} Insecticides: 6.53 LSD_{0.05} Days: 5.65

LSD_{0.01} Insecticides: 8.25 LSD_{0.01} Days: 7.21

Results were obtained from biological control experiments are in agreement with those obtained by Mangoud (2003) ^[16] who stated that the seven spotted lady beetle, *C. septempunctata* is an important predator of aphid reducing the population density of The green peach aphid, *M. persicae* and the cotton aphid, *Aphis gossypii* (Homoptera: Aphididae) attacking apple trees. Also, these results are in agreement with those obtained by Mangoud (2009) ^[17] who reported that the seven spotted lady beetle, *C. septempunctata* is an important predator of aphids reducing the population density of the woolly apple aphid, *Eriosoma lanigerum* (Homoptera: Aphididae) attacking apple trees. Results were obtained from biological control experiments also agreement also with those obtained by El-Aish *et al.* (2004) ^[9] who reported that the predator *C. septempunctata* in biological suppressing of cereal aphids showed that the eggs last 2-3 days and the 1st, 2nd, 3rd and 4th larval instars were lasted 3, 2, 2 and 4 days, respectively, the pupal stage lasted 8 days at the room temperature. Also, Hoyt and Madsen (1960) ^[14] found that the control of aphid species complex is complicated by the continue dispersal of aphids from the roots to the aerial portions of the tree, and a corresponding dispersal in the opposite direction. Also, Fang *et al.* (1984) ^[10] found the *C. septempunctata* is a good controlling of *B. brassicae* in cotton fields at yellow Rever valley in China. Lastly, Brar and Kanwar (1994) ^[7] in field experiments in India found that *C. septempunctata* was an effective predator against *A. craccivora* infesting *Fenugreek germplasm*. Also, Shirck (2012) ^[21] referred to the effect of malathion on The green peach aphid, *M. persicae* and found that insecticide had high effect on most strains of this aphid. Bethke *et al.* (1989) and Sharma *et al.* (2000) found that, triazonphos, deltamethrin, malathion, imidacloprid and chloropyrifos were highly general effective against *M. persicae* on chrysanthemum plants in greenhouse.

Also, results were obtained from chemical control experiments are in agreement with those obtained by Shirck (2012) ^[21] who studied effect of malathion on several strains of The green peach aphid, *M. persicae* and found that insecticide had high effect on most strains of this aphid. Al-Antary and Abdel-Wali (2016) ^[2] studied the toxic effect some insecticides on The green peach aphid, *M. persicae* and this insecticide was applied directly to the infested plants by spraying and found that high effect of this insecticide after treatment.

Conclusion

Results concerning efficacy management of *Myzus persicae* (Sulzer) (Hemiptera: Aphididae) which infesting tomato plants *Lycopersicon esculentum* by biological and chemical. Biological control through releasing three levels of the seven spotted lady beetle, *Coccinella septempunctata* L. (Coleoptera: Coccinellidae). Results obtained referred to the efficiency of using *C. septempunctata* on controlling *M. persicae* which infesting tomato plants at three levels of release (25, 50 & 75 eggs/plant). And we can recommend using this biological method to control this pest as the same levels in the text. For chemical control data obtained referred to the efficiency of the three tested aphicides (Marshal, Malathion and Dimethoate) on controlling *M. persicae* that were arranged descending as follow: Marshal, Malathion and Dimethoate, respectively.

List of abbreviations

var.: variety
C.: Coccinella
&: and.
RH%: Relative humidity
CKs: Cytokinin Hormone
C°: Centigrade

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