Academic Journal of Entomology 16 (1): 11-14, 2023
ISSN 1995-8994

DOI: 10.5829/idosi.aje.2023.11.14

Population Fluctuation of *Aphis gossypii* on Sweet Pepper Plant (*Capsicum annuum*) and the Effect of Some Insecticides Against it

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Abstract: Sweet pepper (*Capsicum annuum* L.) is one of the important crops that were infected by many pests. One of these pests is aphid (*Aphis gossypii*), which is considered a serious pest as a result its secretion of honeydew and also sucking of the juice of plant leaves, so it causes loss in quantity and quality of the yield. So, this study troubled with detection of aphid density on the leaves of pepper in the summer season during two years and also control this pest with some new pesticides. Hence, the results illustrated that, there were two peaks on the leaves of pepper plants, one peak was at the end of April and the other, was in the middle of June during the summer season of the two years 2021/ 2022. Moreover, the most effective tested insecticide, Closer (Sulfoxaflor) SC 24% recorded 97.47 and 94.75 for 2021 and 2022, respectively.

Key words: Pepper plant · *Aphis gossypii* · Pesticides

INTRODUCTION

The sweet pepper (*Capsicum annuum* L.) is an important crop for both export and local market [1]. It's a worm season crop that requires the same growing conditions as eggplant and tomato. Also, it is known with antioxidant properties because it is a good source of vitamins A and C as soon as phenolic compounds [2]. Moreover the previous benefits, it prevents certain types of cardiovascular diseases, cancer, hemorrhage and atherosclerosis [3].

Aphid (*Aphis gossypii*) is an economic pest of many agricultural crops in Egypt. Vegetable plants of the Solanaceous family such as pepper, tomato, eggplant and potato plants are infested mainly by aphids that affect the quantity and quality of the yield due to direct feeding on plants. However, this pest is responsible for the transmission of virus diseases [4, 5]. Additionally, the excretion of honeydew causes attraction for wasps, ants and promotes the appearance of some fungal species [6].

In addition, chemical control is the most effective, but its a effects on the agro- ecosystem and cause an imbalance in the environment [7]. As soon as, the chemical insecticides make residues on pepper fruits [8].

The objective of this study is to estimate the population of *Aphis gossypii* on pepper leaves during the summer season in 2021/ 2022 and control it with chemical insecticides.

MATERIALS AND METHODS

Field Population Density: The experiment was achieved on the farm at Baramoon village, Dakahlia Governorate during two summer seasons 2021/ 2022. This field was free of pesticides. The tested area was about six kirat, which were divided into two kirates used for population fluctuation experiment and the other one used for the experiment of application of three insecticides compared with control.

Every week, the population fluctuation of *A. gossyoii* on the leaves were examined and counted.

The Used Insecticides in Field Experiment: In this experiment, three chemical insecticides were used as and pointed in Table (1). Each insecticide was applied in an area about kirate that was divided into four replicates and one kirate was used for control. 30 leaves from 10 plants were checked in each replicate and when the infection of aphid reached 25 individuals, spraying with insecticides started and the results were taken before spraying and after 1, 3, 7& 10 days after spraying.

Table 1: Names and doses of the used insecticides

Active ingredients	Trade name	Dose
Sulfoxaflor (Isoclast)	Closer SC 24%	40 cm^3/ fedan
Pirimicab	Renokid WG 50%	200 gm/ fedan
Orange oil (natural product)	Top nature EC 24%	50 cm^3/ 100 L water

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Statistical Analysis:

- The population density results were analyzed with Excel program.
- However, data in the experiment of reduction was analyzed by the equation of [9] as follows:

$$\text{Reduction mortality \%} = [1 - (\frac{C_a}{C_b} \times \frac{T_b}{T_a}) - 1] \times 100$$

whether:

C_b = The number of alive pest individuals in control before treatment.
C_a = The number of alive pest individuals in control after treatment.
T_a = The number of alive pest individuals after treatment.
T_b = The number of alive pest individuals before treatment.

RESULTS

Population Density: Results in Fig. (1) detected that there were two peaks of population density of *A. gossypii* on the pepper leaves, one peak was on 30 April which reported 265 individuals in 2021 and 150 individuals at 2022. In addition, the other peak was detected on 18 July which was 270 individuals at 2021 and 200 individuals at 2022. Rahmouni *et al.* [7] illustrated that the population density of *A. gossypii* on pepper plants extends from March to the beginning of May.

Field Experiment

During 2021: Results in Table (2) showed that, after 24 hours of treatment, the total reduction was 94.93, 93.88 & 62.25% for Closer, Renokid and Top nature, respectively. However, after 3 days of treatment, the reduction was 91.43, 93.19 & 95.15% for the three insecticides, respectively. In addition, after 7 & 10 days of treatment, orange oil was 100% for the three insecticides. Tawfiq, *et al*. [10] illustrated that, orange essential oil provides effective and safe management to *M. persicae*. Hui *et al.* [11] proved that, sulfoxaflor is effective against cotton aphids.

During 2022: Results in Table (3) detected that, after 24 hours of treatment, the total reduction was 89.5, 87.76 & 72.83% for Closer, Renokid and Top nature, respectively. However, after 3 days of treatment, the reduction was 97.17, 95.33 & 97.56% for the three insecticides, respectively. In addition, after 7 & 10 days of treatment, orange oil was 100% for the three insecticides. Shima *et al.* [12] recorded that, pirimcarb is an effective against aphid.

Comparison among the Effect of Tested Insecticides in the Two Years: Results in Table (4) illustrated that, Closer (sulfoxaflor) had the highest reduction that reported 97.47 & 94.75% at 2021 & 2022, respectively. Then Renkoid which recorded 96.94 & 93.88% at 2021& 2022, respectively. Then, Top nature recorded 81.13 & 86.42 % at 2021 & 2022, respectively. Sparks, *et al.* [13] and Hui, *et al.* [11] proved the effectiveness of sulfoxaflor against cotton aphid.

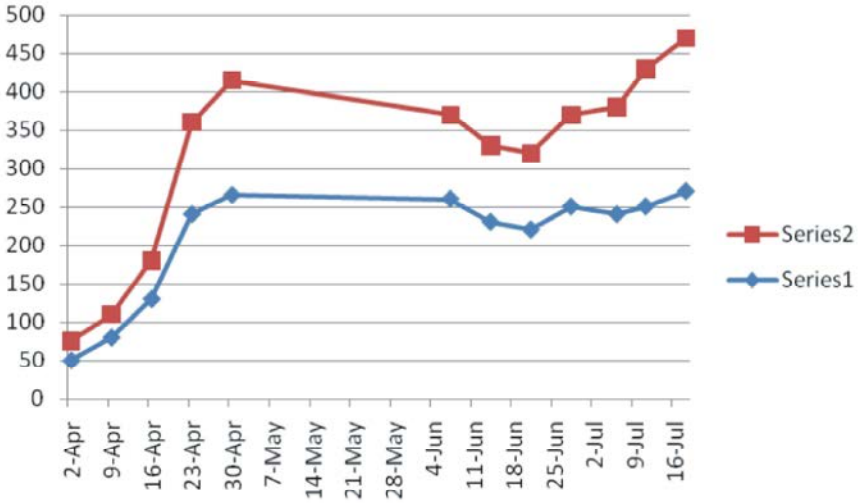

Fig. 1: Population density of *Aphis gossypii* on pepper leaves

Table 2: Reduction of *A. gossypii* due to insecticide treatment during 2021:

	1st replicate			2nd replicate			3rd replicate			4th replicate			Treatment efficiency		
	Pest number			Pest number			Pest number			Pest number			Pest number		
Treatments	Before	After	Red. %	Before	After	Red. %	Before	After	Red. %	Before	After	Red. %	Before	After	Total Red. %
							After 24 hours								
Closer	270	20	92.13	250	10	95.9	250	10	95.8	260	20	95.8	257.5	15	94.93
Renokid	255	15	93.75	255	15	94	255	15	93.9	255	15	93.9	255	15	93.88
Top nature	255	90	62.5	255	90	64	255	95	61.2	255	95	61.3	255	92.5	62.25
Control	255	240		260	255		255	245		260	250				
							After 3 days								
Closer	270	30	88.89	250	10	96	250	20	92.2	260	30	88.7	257.5	22.5	91.43
Renokid	255	25	90.2	255	15	94.1	255	15	94.2	255	15	94.2	255	17.5	93.19
Top nature	255	15	94.12	255	10	96.1	255	10	96.2	255	15	94.2	255	12.5	95.15
Control	255			260			255			260					
							After 7 days								
Closer	270	0	100	250	0	100	250	0	100	260	0	100	257.5	0	100
Renokid	255	0	100	255	0	100	255	0	100	2 55	0	100	255	0	100
Top nature	255	0	100	255	0	100	255	0	100	255	0	100	255	0	100
Control	255			260			255			260					
							After 10 days								
Closer	270	0	100	250	0	100	250	0	100	260	0	100	257.5	0	100
Renokid	255	0	100	255	0	100	255	0	100	255	0	100	255	0	100
Top nature	255	0	100	255	0	100	255	0	100	255	0	100	255	0	100
Control	255			260			255			260					

Table 3: Reduction of *A. gossypii* due to insecticide treatment during 2022:

	1st replicate			2nd replicate			3rd replicate			4th replicate			Treatment efficiency		
	Pest number			Pest number			Pest number			Pest number			Pest number		
Treatments	Before	After	Red. %	Before	After	Red. %	Before	After	Red. %	Before	After	Red. %	Before	After	Total Red. %
							After 24 hours								
Closer	230	30	87.21	250	20	92.2	240	40	83.6	190	10	94.9	227.5	25	89.5
Renokid	245	45	81.99	240	40	83.7	200	20	90.2	200	10	95.2	221.3	29	87.76
Top nature	200	60	70.58	230	60	74.4	250	70	72.5	220	60	73.8	255	63	72.83
Control	255	260		250	255		260	265		245	255				
							After 3 days								
Closer	230	8	96.71	250	10	96.4	240	12	95.5	190	0	100	227.5	8	97.17
Renokid	245	15	94.22	240	10	96.3	200	10	95.5	200	10	95.3	221.3	11	95.33
Top nature	200	0	100	230	10	96.1	250	8	97.1	220	7	97	255	6	97.56
Control	255			250			260			245					
							After 7 days								
Closer	230	0	100	250	0	100	240	0	100	190	0	100	227.5	0	100
Renokid	245	0	100	240	0	100	200	0	100	200	0	100	221.3	0	100
Top nature	200	0	100	230	0	100	250	0	100	220	0	100	255	0	100
Control	255	270		250	280		260	290		245	260				
							After 10 days								
Closer	230	0	100	250	0	100	240	0	100	190	0	100	227.5	0	100
Renokid	245	0	100	240	0	100	200	0	100	200	0	100	221.3	0	100
Top nature	200	0	100	230	0	100	250	0	100	220	0	100	255	0	100
Control	255			250			260			245					

Table 4: Mean of total reduction of *A. gossypii* during 2021/ 2022:

Year	Treatments	Mean reduction after 24 hours (Initial kill)	Mean reduction after 7+ 10 hours (Residual effect)	Mean of total reduction
2021	Closer	94.93	100	97.47
	Renokid	93.88	100	96.94
	Top nature	62.25	100	81.13
2022	Closer	89.5	100	94.75
	Renokid	87.76	100	93.88
	Top nature	72.83	100	86.42

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