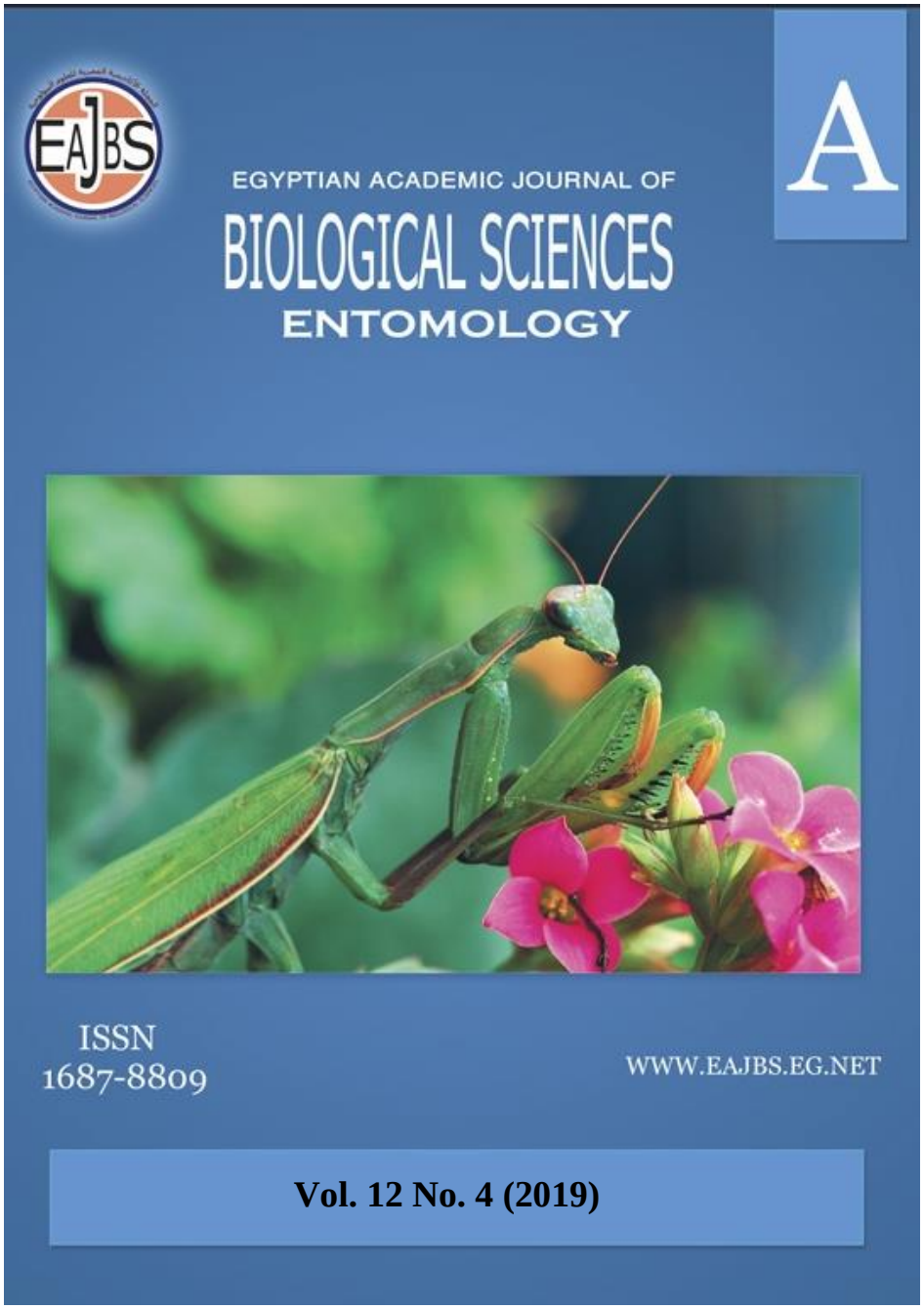

Egyptian Academic Journal of Biological Sciences is the official English language journal of the Egyptian Society for Biological Sciences, Department of Entomology, Faculty of Sciences Ain Shams University.

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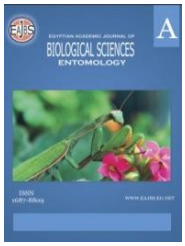
Citation: *Egypt. Acad. J. Biolog. Sci. (A. Entomology) Vol. 12(4) pp: 23-32(2019)*

Egypt. Acad. J. Biolog. Sci., 12(4):23-32 (2019)

Egyptian Academic Journal of Biological Sciences
A. Entomology

ISSN 1687- 8809
http://eajbsa.journals.ekb.eg/



Studies on Thrips, *Frankliniella occidentalis* (Pergaade) Infesting Rose Plants

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ARTICLE INFO
Article History
Received:30/5/2019
Accepted:16/6/2019

Keywords:
Seasonal abundance, thrips *Frankliniella occidentalis* , Rose plants

ABSTRACT

Seasonal abundance of thrips *Frankliniella occidentalis* (pergaade) and the relation between its population activity and weather factors were studied during 2017 and 2018 seasons on the Rose plants at. At El-Orman Garden, Giza Governorates Data of 2017 season indicated that the thrips *population* have two activity periods; the first which has the highest number occurred in mid-April while the 2nd one occurred in half of December. On the other hand, 2018 season data indicated that *F. occidentalis* population also have two activity periods; the first one with the highest number occurred in the first of May while the other occurred in half of December too. Statistical analysis shows that the simple correlation and simple regression between thrips population and each of the maximum, minimum temperature and relative humidity with were insignificant at El-Orman Garden, Giza Governorate. In 2017 season, generally the infestation whis Thrips, *F. occidentalis* was relatively higher than 2018 season. Infestation with thrips reduced chemical components; oil, protein and vitamins in flowers of rose plants.

INTRODUCTION

Rose plant is considered as one of the most important cut flowers and ornamental plants in Egypt and all over the world which cultivated in the open field and under greenhouse conditions. Also, it is a cultivated area increased gradually during the last years, especially in the newly reclaimed areas for local consumption and exportation to the foreign markets. Rose named king of flowers because it is found from oldest countries and it is the favorite flower for human all over the world. Although developing live and high technical but humans love for roses still in increase. The human love to the roses due to their beautiful colors, style of flowers, smiles, and tolerant the inferable weather factors. Later rose became one of the important components for national income for many countries all over the world through exporting these roses to the different countries, Emam (2009). Western flower thrips (WFT), *Frankliniella occidentalis* (Pergande 1895) are one of the most common insect pests infesting roses which are severely responsible for decreasing the quality and quantity of the plant. Thrips species may attack a wide range of plant species belonging to several botanical families (Belharrath et al. 1994; Kirk 2001; Kirk & Terry 2003; Cloyd 2009). Thrips are important pests of greenhouse vegetable and ornamental crops in many different regions (Lewis 1997; Moritz 2002; Morse and Hoddle 2006). In Egypt, El-Wakkad (2007) recorded and identified (*F. occidentalis*) on flowers of five fruit varieties. In other words thrips cause

considerable damage to commercial flower crops, through direct feeding on marketable produce (i.e., flowers or flower buds) or as occasional vectors of plant pathogens (Brodsgaard 2004; Jones 2005). The affected plant tissues usually have a higher rate of ethylene synthesis, accelerating the senescent processes in roses. The present work is planned to cover the following objectives: Study of population fluctuations of the most important thrips species prevailing on roses plants and evaluate the influence of certain weather factors on the population activity of thrips.

MATERIALS AND METHODS

The Present Experiments Were Carried Out in EL Orman Garden, EL Giza Governorate, Egypt, Throughout Two Successive Seasons; 2017 and 2018:

Sampling Technique:

Three plots, each of 3 x 5 m were planted with rose plants. Five rose flowers were chosen randomly from each plot – Thrips insects infested flowers were inspected by direct counting. Samples were taken to the laboratory in papers bags for, identified, inspection, counted and recorded. Samples were taken fortnightly.

Effect of Weather Factors:

In order to evaluate the influence of weather factors on the population fluctuations of thrips infested roses plants, records of certain weather factors were obtained from the Central Laboratory for Agriculture Meteorology, Agricultural Research Center, Ministry of Agriculture .

These factors were daily maximum temperature (D. Max. T.), daily minimum temperature (D. Min. T.) and daily mean relative humidity (D.M. R.H.).

The daily records of each weather factors were grouped into biweekly averages according to the sampling dates. These averages were assumed to represent the field records of weather factors at the sampling dates.

Statistical Analysis:

The simple correlation (r) and regression coefficient value (b) were adopted to clarify the change in insect population due to change in each of weather factors and the mean values compared with the least significant differences as well as, SAS program (SAS Institute 1988).

RESULTS AND DISCUSSION

Population Fluctuations of the *F. occidentalis* On Roses Plants During Seasons, 2017 and 2018:

It is well-known fact that precise knowledge of the appropriate date of the insect activity, number and duration of annual field generations are considered the fundamental basic information for Integrated Pest Management programs so, this work was dedicated to monitor the changes in the population density of the *F. occidentalis* on the rose's plants.

A) The Population Fluctuations of Thrips during 2017 Season:

Data presented in Table (1) and graphically illustrated in Fig. (1) show the population of *F. occidentalis* at El-Orman Garden, indicated by half monthly count of the different stages i.e. nymphs, ovipositing and non-ovipositing females during 2017 year. As shown in Table (1) and Fig. (1) the population fluctuations of the differentiated stages significantly different all over the year. The integration of the seasonal abundance curve revealed the presence of two peaks (Fig.1), which represent two overlapping generations.

The thrips individuals appeared by early of January and increased gradually to make the first generation with the highest number by mid of April with mean number 5.8 individuals

when maximum temperature was 27.3°C and minimum temperature was 16.7 °C while the relative humidity was 79%; the population density was high and appeared the most economically important, After that, the infestation with all stages decreased to mid-July (Table 1 and Fig.1). The infestation with total stages reincreased and fluctuated to make the second generation on the half of December with average mean number of 4.4 individuals when.

Maximum temperature was 21.9°C and minimum temperature was 13.4°C while, the relative humidity was 82% and decreased again till the end of theYear. This generation period demonstrated the moderate number as compared with the first generation.

Table (1): Half-monthly averages of Thrips *Frankliniella occidentalis* (pergaade) infesting , *Roses* plants in El-Orman Garden, during season 2017.

Date	Average no. of individual Thrips / flower	Weather Factors (Means)		
		Max. Temp	Min. Temp	RH%
01/01/2017	1.2	17.2	8.8	73
15/01/2017	0.8	18.5	9.4	79
01/02/2017	3	18.3	9.8	78
15/02/2017	2.6	19.1	10.4	84
01/03/2017	2.6	22.6	12.3	87
15/03/2017	4	22.8	14.3	74
01/04/2017	5.4	25.7	15.4	84
15/04/2017	5.8	27.3	16.7	79
01/05/2017	4	29.5	18.2	75
15/05/2017	1.6	33.8	20.9	74
01/06/2017	0.4	33	21.2	77
15/06/2017	0.4	35.6	24.1	73
01/07/2017	0.4	36.4	24.3	84
15/07/2017	0	36.5	25.4	84
01/08/2017	2.6	35.5	25.2	87
15/08/2017	2	35.4	26.3	82
01/09/2017	2	34.5	24.3	85
15/09/2017	1.4	33.9	23.9	83
01/10/2017	1	31.8	22.4	78
15/10/2017	3	29.1	20.4	80
01/11/2017	2.8	27.2	18.9	73
15/11/2017	3	25.9	16.3	82
01/12/2017	4	22.4	14.2	80
15/12/2017	4.4	21.9	13.4	82
30/12/2017	1.2	20.9	13.1	80
Total	59.6	-	-	-
Mean	2.4	-	-	-

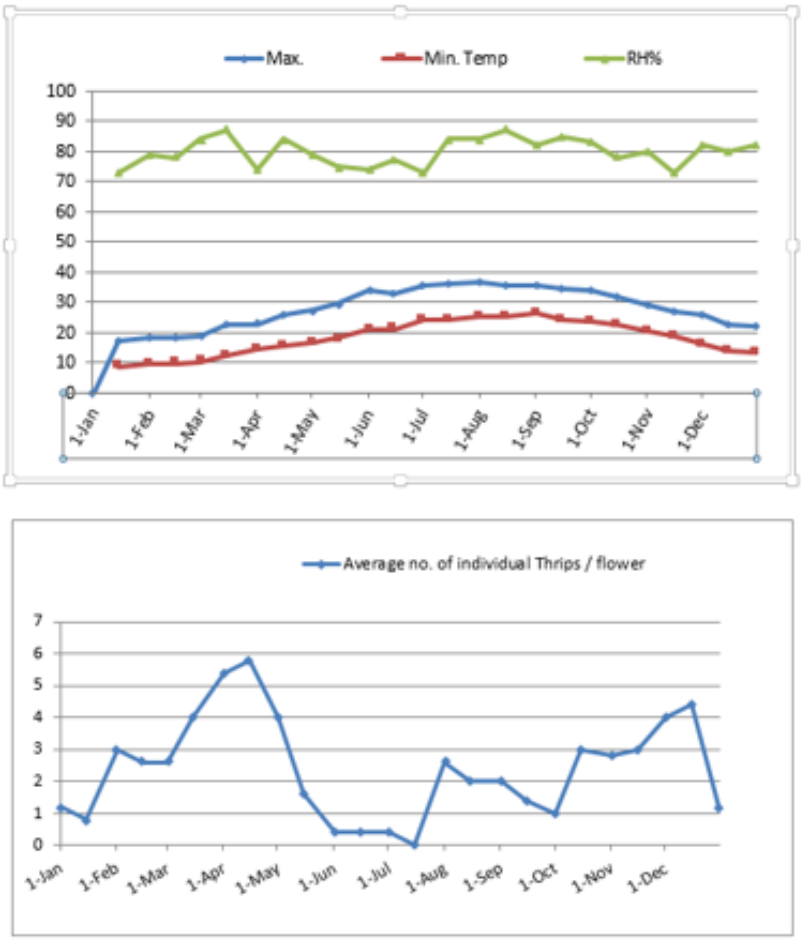

Fig. 1: Half-monthly averages number of *Frankliniella occidentalis* stages on *Roses* plants and some weather factors prevailing at in El-Orman Garden during season 2017.

Influence of Weather Factors:

The results of Statistical analysis presented in Table (2) showed a positive and insignificant effect for max. and min. temperatures on the population fluctuations of thrips during 2017 (r values were 0.157 and 0.174 respectively). The partial regression analysis showed the real influence of each factor on the amount of change in the insect population the partial regression values were – 0.117 and – 0.028 for max. And min. Temperatures respectively.

However, statistical analysis proved an obvious relation between relative humidity and the population fluctuation of thrips; simple correlation coefficient ((r)) was 1.00, while ((b)) was – 0.042.

Table 2: Correlation between The Half-monthly average numbers of F. *occidentalis* on *Rose* plants and in relation to some weather factors during season 2017 in El- Orman Garden

weather Factors	Simple correlation		Partial regression values	
	r	P	b	P
Max. temp.	0.157	0.453	-0.117	0.677
Min. temp.	0.174	0.406	-0.028	0.932
R.H.%	1.00	-	-0.042	0.573

"r" : Correlation coefficient "b": Partial regression coefficient value "P": Probability level

B) The Population During 2018 Season:

Data tabulated in Table (3) and Fig. (2) shows the population fluctuations of *F. occidentalis* at El-Orman Garden, Giza Governorate as indicated by half monthly count of insect during 2018.

As shown in Table (3) and Fig. (2) Population fluctuations of the different stages significantly different all over the year, the integration of the seasonal abundance curve revealed the presence of two peaks, which represent two overlapping generations.

Results in Table (3) and Fig. (2) indicated that the total stages of *F. occidentalis* start to appear by the beginning of January and increased gradually to make the first generation with highest number by the beginning of May with an average mean number4.2 individuals when the maximum temperature was 28.2°C and the minimum temperature was 16.8°C, while the relative humidity was 76%; After that the infestation with total stages decreased and disappear by mid of August. The infestation with the pest increased and its number fluctuated ups and down during September and November to make the second generation with peak (4.4 individuals) by mid of December,

When maximum temperature was 24.5°C and minimum temperature was 16.2°C while the relative humidity was 79%. The population decreased again untill the end of the year. This generation period demonstrated a moderate number as compared with the first generation.

Table 3: Half-monthly averages of Thrips *Frankliniella occidentalis* (pergaade) infesting, *Rose varieties* plants in El-Orman Garden, during season 2018.

Date	Average no. of individual Thrips / flower	Weather Factors (**Means**)		
		Max. Temp	Min. Temp	RH%
15/01/2018	1.2	18.3	11.1	72
01/02/2018	1.6	20.1	12	79
15/02/2018	1	18.2	11.5	77
01/03/2018	2	24.5	13.5	83
15/03/2018	3	22.4	14	78
01/04/2018	3.8	27	16.3	82
15/04/2018	3.6	28.8	16.2	72
01/05/2018	4.2	28.2	16.8	76
15/05/2018	2.4	29.9	19	70
01/06/2018	2.2	31.8	21.5	74
15/06/2018	2	36	23.4	70
01/07/2018	0.8	34.9	23.2	77
15/07/2018	0.4	36	25.3	74
01/08/2018	0.2	35.3	24.5	82
15/08/2018	0	35.7	25.7	80
01/09/2018	1.6	35.6	25.8	83
15/09/2018	0.6	34.8	24.9	82
01/10/2018	1.2	34.3	25.1	78
15/10/2018	1	33.3	23.5	83
01/11/2018	2.8	30.5	22.2	78
15/11/2018	3	29.5	20.1	68
01/12/2018	4	26.1	17.4	80
15/12/2018	4.4	24.5	16.2	79
30/12/2018	3	21	14.1	74
15/01/2018	1.4	19.2	12.4	74
Total	51.4	-	-	-
Mean	2	-	-	-

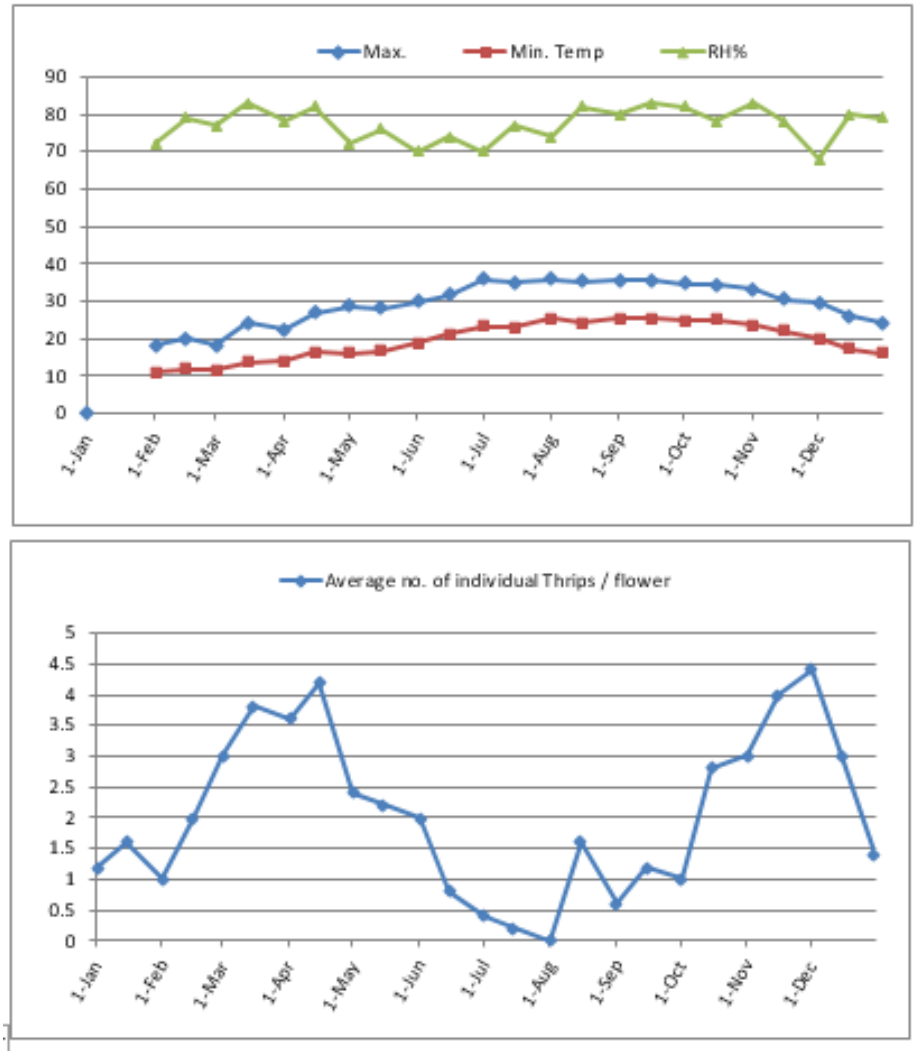

Fig.2: Half-monthly averages number of *Frankliniella occidentalis* stages on *Rose* flower and some weather factor at in El-Orman Garden during season 2018.

The results of the statistical analysis tabulated in Table (4) showed a positive and insignificant effect for max. and min. Temperatures on the population fluctuations of thrips during 2018 (r values were 0.158 and 0.173 respectively). The partial regression analysis showed the real influence of each factor on the amount of change in the insect population the partial regression values were 0.288 and – 0.373 for max. and min. temperatures respectively. However the statistical analysis proved an obvious relation between relative humidity and the population fluctuation of thrips, simple correlation coefficient ((r)) was 1.00, while ((b)) was – 0.019. In early April, it gradually increased till early May and greatest densities occurred during June each year. (Jong-DaePark; *et al*. 2002). Temperatures above 35°C and drought have been reported to be unfavorable to the survival of thrips, resulting in population decline (Varadharajan and Veeraval, 1995). In the present study, temperatures ranged from 18.2°C to 35.7°C throughout the sampling period. High temperatures which would be unfavorable to the survival of thrips. Similar results were reported by Duraimurugan and Jagadish (2002), who stated that sever infestation with thrips. *Scirtothrips dorsalis* occurred between April and May. the incidence was significantly positively correlated with maximum temperature. Also, Kumar *et al.* (2006), Stated that *F. occidentalis* population increased from December to March reaching a peak on 20th May. Ita population had a positive and significant correlation with maximum temperature, minimum temperature and negative correlation with relative humidity.

Table(4): Correlation between The Half-monthly averages numbers of *F. occidentalis* on *Rose* plants and in relation to some weather factors during season 2018 in El-Orman Garden.

weather Factors	Simple correlation		Partial regression values	
	r	P	b	P
Max. temp.	0.158	0.453	0.288	0.191
Min. temp.	0.173	0.406	-0.373	0.084
R.H.%	1.00	-	-0.019	0.749

"r" : Correlation coefficient "b": Partial regression coefficient value "P": Probability level

Effect of Infestation with *F. occidentalis* on the Chemical Components of Rose Flowers : Rose Oils:

Data in Table (5) and Fig. (3) show the %volatile oil (geraniol, citronellol and nerol) in rose plants infested by *F. occidentalis*) compared with control (non-infested plants).
For Citronellol , it was clear that percent of Citronellol reduced when plants infested with thrips (39.7%), while it was 43.7% (control). Whereas the percent of geraniol reduced from 14.7 to 126 when plants infested with the thrips. However, Nerol was reduced to 15.8% when plants infested with thrips, while it was with control (non-infested plants) 17.8%.
Statistical analysis proved that there were significant differences between the percent of geraniol in rose not infested with thrips and those infested with the pest, (Table 5).

Table 5 : Volatile oils percentages rose plants in infested with thrip *F. occidentalis*

Citronellol				Geraniol				Nerol			
infested	Non infested	F	LSD	infested	Non infested	F	LSD	infested	Non infested	F	LSD
39.77^{b}	43.74^{a}	760.29***	0.14	12.60^{b}	14.68^{a}	203.76 ***	0.53	15.80^{b}	17.84^{a}	955.65***	0.42

Means fallowed by the same letter between rows are not significantly different.

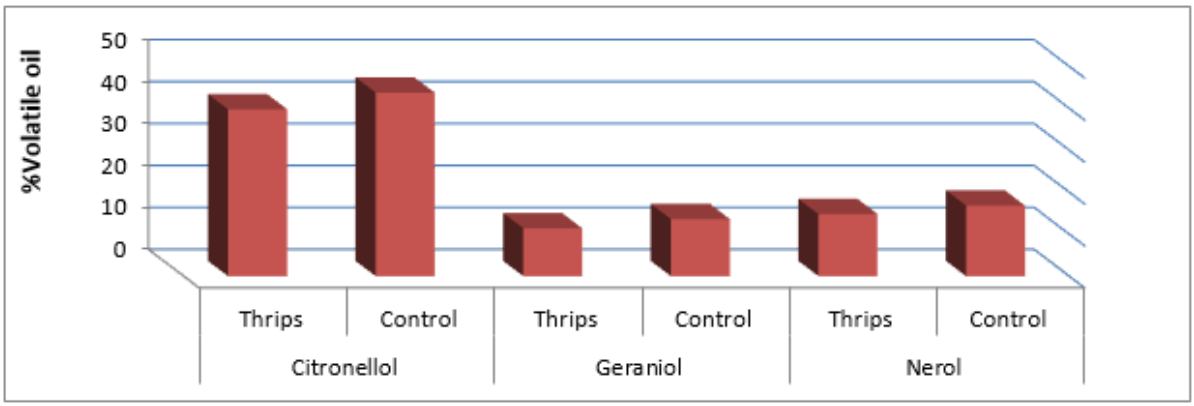

Fig. (3): Volatile oils percentages infested rose with thrips *F. occidentalis*

Rose Protein:

Data in Table (6) and Fig. (4) show the quantity of total protein in rose flowers infested by *F. occidentalis* compared with control. It was found that protein was reduced when plants infested with thrips 30.1 mg/g, while it was 34.3 mg/g in non-infested plants.
Statistical analysis proved that there were significant differences between the percent of protein in rose not infested with thrips and these infested with the insect.

Table (6): Total protein in rose infested with thrips *F. occidentalis*

Total protein (mg/g)		F	LSD
infested	Control		
30.14[b]	34.33[a]	35.19***	1.21

Means followed by the same letter between rows are not significantly different

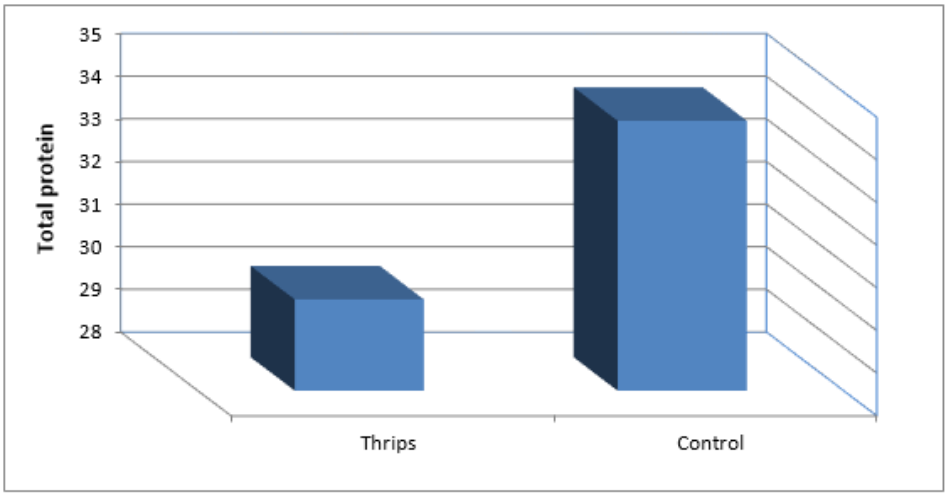

Fig. (4): Total protein in different rose flowers infested with thrips *F. occidentalis*

Rose Vitamins:

Data in Table (7) and Fig. (5) shows the total vitamin in rose flowers infested by insects *F. occidentalis*) compared with control.

For vitamins, it was found that a total of vitamins reduced when plants infested with thrips (18.2 mg/g), while it was (control (20.0 mg/g).

Statistical analysis in (Table 7) proved that there were significant differences between the quantity of vitamins in rose flowers not infested with thrips and those infested with the insect, except in the case of show non-significant differences between the quantities of vitamins in plants infested with thrips compared with control.

Zhang *et al*. (2005) in China studied the essential oil of *Rosa damascena* and studied its characteristics such as relative density, refraction coefficient, optical rotation and freezing point. and reported that the major components were ethanol , citronellol , nerol and geraniol , Almasirad *et al.* (2007) in Iran who investigated the composition of a historical rose oil sample by GC and GC/MS . Forty – five components representing 95.5 % composition of the essential oil were identified . The main components of this oil were citronellol (25.1%), geraniol (13.4 %), and nerol (11.8 %).

Table (7) : Total vitamin in rose infested with thrips *F. occidentalis*

Total vitamin (C,A) (mg/g)		F	LSD
infested	Control		
18.24[b]	20.01[a]	182.11***	2.89

Means followed by the same letter between rows are not significantly different

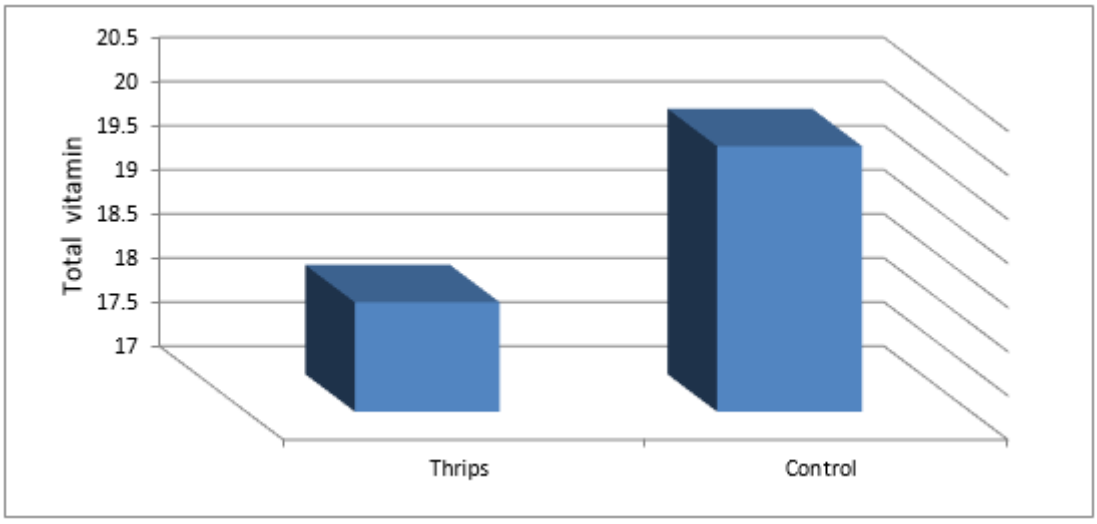

Fig. (5): Total vitamin in different rose flowers infested with thrips *F. occidentalis*

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ARABIC SUMMERY

دراسات على تربس *Frankliniella occidentalis* (pergaade) الذى يصيب نباتات الورود .

محمد عبد الغفار محمود [1] ، ابراهيم لبيب ابراهيم [1] ،محمد محمد محمود نور الدين [2] ، منير عبد السلام عبد المجيد [2]
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تمت دراسة الوفرة الموسمية لحشرة تربس *Frankliniella occidentalis* (pergaade) والعلاقة بين النشاط السكاني وعوامل المناخية خلال موسمي الدراسة 2017 و 2018 على نباتات الورد في حديقة الأورمان، أشارت بيانات محافظات الجيزة للعام الاول 2017 إلى أن تعداد حشرات التربس محل الدراسة له فترتين للنشاط؛ الفترة الاولى التي تحتوي على أكبر عدد للحشرة في منتصف أبريل بينما النشاط الثاني كان في نصف ديسمبر من نفس العام. من ناحية أخرى، أشارت بيانات الموسم الثاني 2018 إلى أن تعداد حشرة تربس في *F. Occidentalis كان* له أيضاً فترتي نشاط؛ وقعت أول نشاط في الأول من مايو بينما حدثت فترة النشاط الثانية في منتصف شهر ديسمبر أيضاً. يظهر التحليل الإحصائي أن الارتباط البسيط والانحدار البسيط بين تعداد حشرة التربس وكلاً من درجة الحرارة العظمى و درجة الحرارة الصغرى والرطوبة النسبية كان الارتباط ضئيل في حديقة الأورمان بمحافظة الجيزة. في الموسم الاول 2017، بشكل عام كانت الإصابة بحشرة تربس *F. occidentalis* أعلى نسبيًا في موسم 2018. وكانت لإصابة نباتات الورد بحشرة التربس الأثر في تقليل نسب المكونات الكيميائية؛ من الزيوت والبروتين والفيتامينات في زهور نباتات الورد.