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Survey and ecological studies on thrips insects (Thysanoptera) infesting jasmine flowers and their natural enemies

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Abstract

The two study seasons from January 2021 to December 2022 were studied using two different Jasminum flowers (*Jasminum grandiflorum* and *Jasminum multijlorum*)**.** The effects of seasonal populations of thrips insects and changes in weather factors such as temperature and humidity on the thrips insects were studied using two different Jasminum flowers in El-Orman Garden. population fluctuation of the thrips *Frankliniella occidentalis* (Pergande), *Thrips orientalis* (Bagnall) (Thysanoptera: Thripidae) and the relation between the population abundance and weather factors were studied during two seasons from two study seasons. Data indicated that the two total stages of thrips insects (Nymph and adult) have three activity generations; The primary one with the highest number occurred at the beginning of January the 2nd generation occurred in early April and the 3rd generation occurred in December. Statistical analysis shows the simple correlation and simple regression between the max., min. temperature, and relative humidity with the biweekly mean of sum population stages of Seasonal abundance of the thrips insects, (*F. occidentalis*, *T. orientalis*) the infestation of the *T. orientalis* infesting J. *multiflorum* cut flowers more than *F. occidentalis* infesting J. *grandiflorum* cut flowers. Has also been studied natural enemies of *Orius* sp. associated with two insects, Thrips, *F. occidentalis*, and *T. orientalis*. It was collected from jasmine flowers infected with the thrips. Two species of predatory *Orius* bugs, *Orius albidipennis* (Reuter) (Heteroptera: Anthocoridae) and *Orius laevigatus* (Fieber), have been recorded feeding on thrips. Special attention was paid to the predator *O. laevigatus*, with greater numbers than the predator *O. albidipennis*.

Introduction

Cut flowers have great value in that such flowers are pleasing to the eye and often fragrant. Besides, they are growing for medical purposes and nutrition industries. Later they became one of the important

components for increasing income for the growers themselves and for national income by exporting such plants or their products to different foreign countries (Emam, 2009). Jasmine trade is estimated to pull in some $6.5 million annually for Egypt, providing income to around 50,000 people, according to the (IFEAT, 2020). cut flowers are suffering from attacks and damage caused by different insect pests infesting them. Thrips insects are among them (Kumar *et al*., 2006 and Simala, 2006). After introduction into a new area, they may become acclimatized, surviving outdoors. In some cases, these are very harmful species.

They not only cause significant damage to cut flowers, reducing their aesthetic, market values, and their internal components but also may threaten the native flora. Thus, their invasion has become a global environmental problem regarded as one of the main factors that lead to a decline in regional biodiversity (FAO, 2005 and Chornesky *et al*., 2005). During the past decades, the losses of agricultural and horticultural produce caused by thrips have increased considerably, resulting in losses of millions of dollars (Thrips Wiki, 2015). Damage to flowers may comprise damage to petals, stamens, pistils, and peduncles.

Petals: Thrips may assault a wide variety of flower species. When infested, petals exhibit white spots which subsequently turn brown, after which the petals become deformed. Not rarely, the insects penetrate into the flower buds before blooming, totally destroying them. *Thrips orientalis* (Bagnall) (Thysanoptera: Thripidae) is a flower-dwelling oligophagous species, found linked with the blossom of *Jasminum multiflorum* and the small white flowers harbor abundant individuals of thrips which enabled to study of the biology and seasonal incidence of *T. orientalis* in to different abiotic factors (Shyam *et al*., 2019). Popularly known as jasmine thrips, is a typical flower-dwelling species commonly occurring in India, especially on Jasminuin and Marinda flowers (Varatharajan *et al*., 2010).

Orius spp. (Heteroptera: Anthocoridae) predators can prey on every one of the different stages of thrips, and they can be found on more than a few plant species (Tawfik and Ata, 1973). Adults and nymphs are often found in flowers. These comments suggest that their presence on floral structures corresponds to their feeding on thrips or pollen, or together (Salas-Aguillar and Ehler, 1977). *Orius laevigatus* (Fieber) (Heteroptera: Anthocoridae) has been extensively recognized as a potential control agent of *Frankliniella occidentalis* (Pergande) (Thysanoptera: Thripidae) (Villevielle and Millot, 1991).

Beneath cold greenhouse conditions in the south Mediterranean region, *F. occidentalis* is active all year, whereas *O. laevigatus* appears in late coil when the crops are now strongly damaged (Chyzik *et al*., 1995). This study was conducted to examine the effects of the temperature on the life history and predation activity of the two anthocorids against *F. occidentalis* and *T. orientalis* .

Materials and methods

The current study objectives for thrips insects and their predators prevailing on different jasminum cut flowers. A survey of thrips species found 7 plants of jasminum cut flowers (Flowers ornamental and aromatic plants) in El-Orman Garden of the Giza Governorate, Egypt, testing cut flower plants were carried out during the 2021 year.

1. Survey of thrips on different jasminum cut flowers plants :

Sampling technique: The work started from Jan. 2021 until Dec. 2021. We took fifteen randomly chosen flowers from different sides of the area in the early morning at 7 o'clock and picked them up from each treatment then kept them in tightly

closed paper luggage then transferred them to the laboratory on the same day for examination and identification with the aid of a stereomicroscope. The sampling was taken 7 days intervals and continued until 52 weeks. Thrips were collected from cultivated different Jasminum cut flowers with a fine brush and preserved in 70% alcohol. The classification is made by the classification department of the Plant Protection Research Institute (Ammar *et al.*, 2017).

2. The population fluctuation of thrips on jasminum cut flowers:

The population fluctuation of thrips on both *Jasminum grandiflorum* and *J. multijlorum* cut flower plants was studied. The total numbers were registered and the mean was calculated on the number of *F. occidentalis* (Nymph and adult) of thrips insects on *J. grandiflorum* and *T. orientalis* (Nymph and adult) on *J. multiflorum* to study the population density and the effect of on maximum temperature, minimum temp. and mean relative humidity (RH. %). on the population density of thrips insects in location.

2.1. The design of the experiment: The trial was conducted throughout two seasons (2021 and 2022) at El-Orman Garden, Giza Governorate, Egypt.

2.2. The estimation of population fluctuation of thrips: The biweekly random collection was done for two plants/cultivars/ replicate. The plants (Samples) were transferred in polyethylene bags for 24 samples/ biweeks from the selected cultivars and the plants were kept in the fridge at for thrips, Five flower clusters/plants were selected randomly and the number of thrips was counted. By tapping the flower twig on the whiteboard (30 cm2), individual thrips were counted and recorded (Ananthakrishnan, 1992). Well been studied.

A collection of predators belonging to the genus *Orius* was carried out for open *J. grandiflorum* and *J. multiflorum* cut flowers. The collection was undertaken during the summer periods from June to September for two years (2021-2022). Mainly the flowers were monitored and *Orius* adults were collected with a 'mouth aspirator'.

The natural enemies were collected and preserved. The slides with mounted specimens were observed under a phase contrast microscope. for identification or confirmation of identity. Predators were counted in the field and transferred to the laboratory for further examination. and their natural enemies. The number of thrips killed by nymphs and adults of *O. laevigatus* and *Orius albidipennis* (Reuter) (Heteroptera: Anthocoridae) was recorded daily and killed prey was replaced (Cocuzza *et al.*, 1997).

3. Weather factors and statistical analysis:

Effects of weather factors on the population of thrips included day-maximum temperature, day-minimum temperature, and daily mean relative humidity. were studies. Records of the weather factors of Giza Governorates were obtained from the Central Laboratory for Agriculture Meteorology, Agricultural Research Center, Ministry of Agriculture. While the simple correlation (r) and regression coefficient value (b) were adopted to clarify the change in population due to change in each of the weather factors and the mean values compared with the least significant differences as well as the SAS program (SAS Institute, 1988).

Results and discussion

1. Survey of thrips species infesting jasmine species cut flower:

This part of the present study throws light on the different species of thrips prevailing on some cut flower jasmine species planted at El-Orman Garden, Giza Governorate. This experiment was conducted for a year, extending from Jan. 2021 until Dec. 2021. Two thrips species were observed and recorded on the mentioned 7 cut flower jasmine species during the period of the

experiment at El-Orman Garden. They were common and scientific names of jasmine flowers in EL- Orman Garden:
Jasminoides gardenia (Gardenia), *Jasminum azoricum* (Jasminum azoricum). *J. grandiflorum* (Catalonian jasmine), *J. multiflorum* (Star jasmine and multifloral), *Jasminum officinale* (Jasmine shami), *Jasminum sambac* (Jasmine flower) and *Plumeria alba* (West Indian Jasmine). It is knowledge of the exact date appropriate for WFT abundance and in terms of the number and duration of annual field generations the other is on the other hand, the fundamental information for Integrated Pest Management (IPM) programs. This work has been dedicated to monitoring the changes in the population activity of *F.occidentalis* which occurs on *J. grandiflorum* .

Whereas order Thysanoptera is presented by a single family Thripidae which includes five species the most dominant insect *F. occidentalis* on marigold, rose, and carnation (Amal *et al*., 2019). The first is by integrating the fluctuations in the seasonal abundance curve expressed as a number of half-monthly count on J. *grandiflorum* at El-Orman Garden, Giza Governorate. In Egypt, surveyed of WFT *F. occidentalis* infesting flowers of some vegetable flower crops (El-Wakkad, 2007). *T. orientalis* are particularly associated with the perfumed white flowers of Gardenia, jasminum, and plumeria.

2. Population fluctuation of the two most dominant thrips insects species on two different jasmine cut flowers:

Seasonal activity and population fluctuation of the two dominant thrips insects were studied on two different species of cut flowers during 2021 and 2022 at El-Orman Garden, Giza Governorate. been studied F. *occidentalis* was studied on *J. grandiflorum* and *T. orientalis* was studied on *J. multiflorum*.

2.1. Population fluctuations of the *Frankliniella occidentalis* on *Jasminum grandiflorum* plants during seasons, 2021 and 2022:

The previous experiment was carried out to appreciate the considered weather factors on the population activity of *F. occidentalis* infesting *J. grandiflorum* plants during 2021 and 2022 years, at El- Orman garden - Giza Governorate. This work was dedicated to monitoring the changes in the population density of adults and nymphs of the *F. occidentalis* on the *J. grandiflorum* plants.

The previous experiment was carried out to appreciate the considered weather factors on the population activity of *F. occidentalis* infesting *J. grandiflorum* plants during the 2021 season throughout the complete year, at El- Orman Garden. This work was dedicated to monitoring the changes in fluctuations of adults and nymphs of the *F. occidentalis* on the *J. grandiflorum* plants. Data presented in graphically illustrated in Figure (1) and Table (1) show the population fluctuations of *F. occidentalis* on *J. grandiflorum* cut flower at El-Orman Garden, indicated by half-monthly counts of its different stages during the 2021 year. The population fluctuations of the different stages of the insect significantly differentiated all over the year. Detect the integration of the seasonal abundance curve existence of three peaks in their numbers. It represents three overlapping generations. Thrips individuals emerged in early January. It gradually increased to become the first generation with the highest number occurring at 1st the week of January by 12.8 thrips insects (Nymph+adult) / 5 flowers. The weather factors: maximum, minimum temperature°C and relative humidity% were 22.8, 14.4°C and 92.2%., respectively.

Then, the infestation in all its stages less gradually in mid-February. The infestation with all stages Increases and fluctuates to make the second generation by early in April, an almost identical 13.5 number individuals when the max. temperature was 24.4°C and the min.

temperature was 13.8°C while the relative humidity recorded 69.4%. Then, the infestation with all stages decreased gradually to zero. Then it started to increase to mid-October. The infestation with total stages increased and the population fluctuated until it was the third generation at the end of Dec. with almost a mean number of 10.9 individuals. The max. temperature was 18.4°C and the min. temperature was 11.5°C while the relative humidity recorded 76.5%. This generation duration demonstrated a moderate number similer to the first generation.

Table (1): Biweekly counts of different stages of adults and, nymphs of *Frankliniella occidentalis* infesting *Jasminum grandiflorum* cut flowers and some the weather factors are in El-Orman Garden, during seasons 2021 and 2022.

Date	Average no. of individual	Weather Factors (Means)			Date	Average no. of individual	Weather Factors (Means)		
	Total (nymph+adult)/ 5flowers	Max. Temp.	Min. Temp.	RH. %		Total (Nymph+adult)/ 5flowers	Max. Temp	Min. Temp	RH. %
01/01/2021	10.2	19.7	10.4	88.6	01/01/2022	13.6	18.9	11	83.3
15/01/2021	12.8	22.8	14.4	92.2	15/01/2022	14.2	18.4	11.5	76.5
01/02/2021	11.8	19.6	10.5	75.9	01/02/2022	12.5	15.2	8.7	72
15/02/2021	9.3	24.3	12.8	82.8	15/02/2022	11.5	18.8	10.4	77.8
01/03/2021	11.1	19.4	10.2	91.8	01/03/2022	11.4	19.5	11.6	60.8
15/03/2021	11.8	23.3	11.4	77	15/03/2022	12.6	20.3	12	74
01/04/2021	13.5	24.4	13.8	69.4	01/04/2022	14	19.6	10.5	75
15/04/2021	13.2	25.4	11.8	71.5	15/04/2022	14.2	30.6	14.1	69.6
01/05/2021	12.4	32.5	16.3	71.6	01/05/2022	12.7	30.6	16	75.8
15/05/2021	10.6	36.6	21.4	60.3	15/05/2022	11	29.6	17.5	72.8
01/06/2021	9.8	33.8	20.3	76	01/06/2022	10.8	32.9	18	71.2
15/06/2021	6.5	33	21	77.5	15/06/2022	9.2	34.8	24.2	72.8
01/07/2021	2.1	35	22.8	77.3	01/07/2022	5.8	33.8	22	80.7
15/07/2021	0	36.3	24.5	78	15/07/2022	3.6	34	23.5	81.8
01/08/2021	0	36.7	24.8	80.1	01/08/2022	0	35.2	22.7	82.8
15/08/2021	0	38.9	27.5	82.8	15/08/2022	0	34.2	23.6	80.9
01/09/2021	0	36	26	85.2	01/09/2022	0	34.8	25.4	79
15/09/2021	0	33.9	24.3	77.4	15/09/2022	0	33.1	21.3	80
01/10/2021	0	31.9	22.1	78.4	01/10/2022	0	34	22.3	75.5
15/10/2021	2.7	31.2	20.5	56	15/10/2022	4.1	29.9	22.2	74.2
01/11/2021	4.1	30.2	20.5	84.2	01/11/2022	4.8	27.4	18.7	82.1
15/11/2021	6.1	27.5	19	87.6	15/11/2022	6	25.2	17.6	78.6
01/12/2021	9.1	25.2	16.9	80	01/12/2022	8.4	24	16.2	77.8
15/12/2021	10	20.9	14.2	71.3	15/12/2022	9.7	23.4	12	71.6
30/12/2021	10.9	18.4	11.5	76.5	30/12/2022	11.1	21.1	13.8	86.8
Total	178	-	-	-	Total	201.2	-	-	-
Mean	7.1	-	-	-	Mean	8	-	-	-

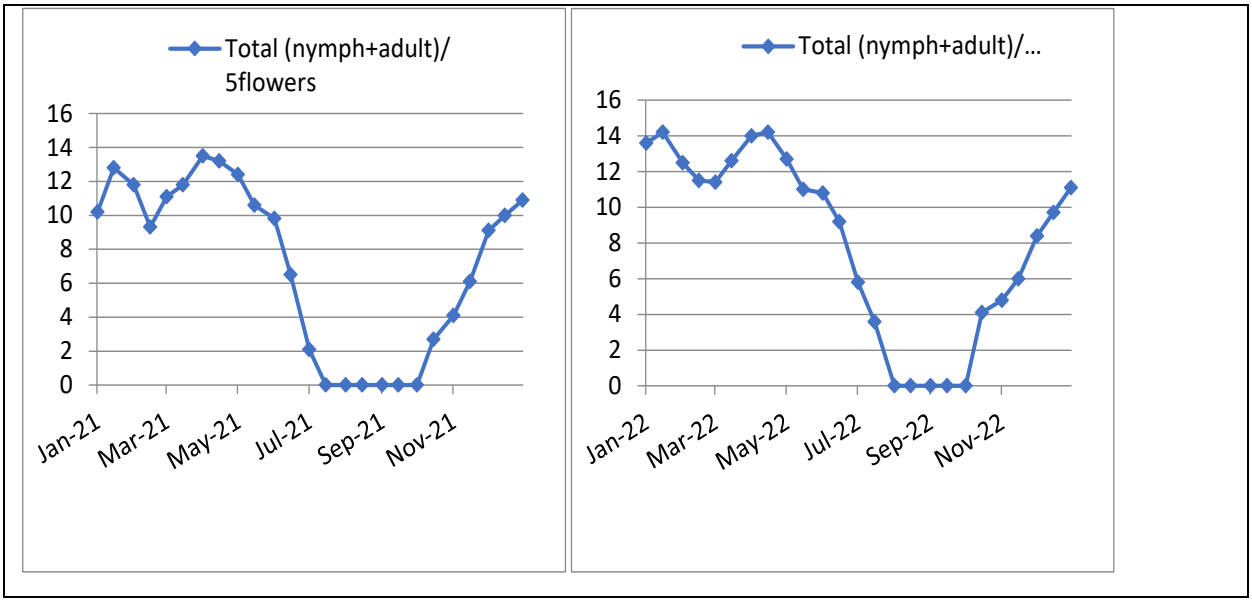

Figure (1): Biweekly averages number of *Frankliniella occidentalis* total (Nymph+adult) on *Jasminum grandiflorum* cut flower and some the weather factors are in El-Orman Garden during seasons 2021 and 2022.

While presented data explained graphically in Figure (1) and Table (1) show the population fluctuations of F. *occidentalis* on *J. grandiflorum* cut flower at El-Orman Garden, indicated by half-monthly counts of its different stages during the 2022 year. The population fluctuations of the different stages of the insect significantly differentiated all over the year. the seasonal activity curve revealed the presence of three peaks in these numbers, which are three overlapping generations. *F. occidentalis* individuals appeared by the first of January and increased gradually to the first generation with the highest number occurring on 1st the week of January by 14.2 thrips insects (Nymph+adult) / 5 flowers. The weather factors: maximum, minimum temperature and relative humidity % were 18.4, 11.5°C and 76%., respectively. After that, the infestation with all stages number decreased gradually to early March then the infestation in total stages number increased to make the second generation by the middle of April with a nearly similar mean number of 14.2 individuals when the maximum temperature was 30.6°C and the minimum temperature was 14.1°C while the relative humidity recorded 69%. Then, the infestation with all stages decreased gradually to zero, then it started to increase to mid-October. The infestation with total stages increased to make the third generation at the end of December recorded a mean number of 11.1 individuals when the max. temperature was 21.1°C, the min. temperature was 13.8°C but the relative humidity recorded 86.8%. This generation period demonstrated a moderate number as compared with the first generation.

2.2. Influence of weather factors:

Table (2) illustrates the relationship between some weather factors and the total (Nymph+adult) of *F. occidentalis*, during the 2021 and 2022 seasons. During 2021 simple correlation coefficient values (r) were -0.807 -0.852 and -0.134 respectively with significant relationships between maximum, and minimum temperature °C and relative humidity (RH. %) between *F. occidentalis*, total numbers. The results of the statistical analysis presented a very powerful negative and significant and obvious relation between max. and min. temperatures and the population fluctuation of thrips, effect for max. and min. temperatures on the

population fluctuations of thrips during 2021. The partial regression analysis gave a precise effect where the (b) values were -0.032, -1.001, and -0.098 respectively, by the change of the weather factors by one unit. In the next year, results in Table (2) illustrated the relationship between some weather factors and *F. occidentalis* during the 2022 season. Simple correlation coefficient values (r) were -0.706, -0.840, and -0.406 respectively, with significant relationships between maximum, and minimum temperatures °C and relative humidity (RH. %), between *F. occidentalis*.

The results of the statistical analysis presented a very powerful negative and significant and obvious relation between max. and min. temperatures and the population fluctuation of thrips; effect for maximum, and minimum temperatures on the population fluctuations of thrips during 2022. The partial regression analysis gave a precise effect where the (b) values were 0.321, -1.166, and -0.095 respectively, by the change of the forementioned weather factors by one unit. As mentioned, maximum, minimum temperatures and the relative humidity of *F. occidentalis* showed insignificant negative effect during the two successive seasons at vegetables crops (Ammar *et al*., 2017).

Table (2): Correlation between the biweekly average number of population fluctuations of *Frankliniella occidentalis, Thrips orientalis* and in relation to some weather factors at El-Orman Garden during seasons 2021 and 2022.

Weather Factors		*Frankliniella occidentalis*		*Thrips orientalis*	
		Simple correlation	Partial regression values	Simple correlation	Partial regression values
		R	B	r	B
2021	Max. temp.	0.807**	-0.032	-0.742**	12.607
	Min. temp.	0.852**	-1.001	-0.889**	-1.166
	RH. %	-0.134	-0.098	0.005	30.471
2022	Max. temp.	0.706**	0.321	-0.754**	7.165
	Min. temp.	0.840**	-1.166	-0.893**	25.223
	RH. %	-0.406	-0.095	-0.364	-0.506

"r" : Correlation coefficient "b": Partial regression coefficient value.

**** Correlation is significant at the 0.01 level (2-tailed).**

2.3. Population fluctuations of the *Thrips orientalis* on *Jasminum multiflorum* flowers during seasons, 2021 and 2022:

The previous experiment was carried out to appreciate the considered weather factors on the population activity of *T. orientalis* infesting *J. multiflorum* flowers during 2021 and 2022 years, at El-Orman Garden - Giza Governorate. This work was dedicated to monitoring the changes in the population density of adults and nymphs of the *T. orientalis* infesting *J. multiflorum* flowers. The previous experiment was carried out to evaluate the considered weather factors on the population activity of *T. orientalis* infesting *J. multiflorum* cut flowers during the 2021 season throughout the complete year, at El- Orman Garden. This work was dedicated to monitoring the changes in the population density of adults and nymphs of the *T. orientalis* on the *J. multiflorum* plants.

Data presented graphically illustrated in Figure (2) and Table (3) show the population fluctuations of *T. orientalis* on the *J. multiflorum* cut flower at El-Orman Garden, indicated by half monthly counts of its different stages for 2021 year. The population fluctuations of the different stages of the insect significantly differentiated all over the year. The seasonal abundance curve revealed the presence of three peaks. which represent three overlapping generations. *T. orientalis* individuals appeared in early

January and increased gradually to make the first generation with the highest average number occurring in the first week of February by 269.5 thrips insects (Nymph+adult) / 5 flowers. The weather factors: maximum, and minimum temperatures °C and relative humidity% were 19.6, 10.5°C and 75.9%., respectively.

After that, the infestation with all stages decreased gradually to mid-March. The infestation with total stages increased and fluctuated to make the second generation by the first of April with an almost similar mean number of 233.3 individuals, when the maximum temperature was 24.4°C and the minimum temperature was 13.8°C while the relative humidity recorded at 69.4%. After that, the infestation with all stages decreased gradually to zero, then it started to increase by mid-October.

The infestation with total stages increased and fluctuated of the third generation by the end of Dec. with almost a mean number of 210 individuals. The max. temperature was 18.4°C and the minimum temperature was 11.5°C while the relative humidity recorded 76.5%. This generation period demonstrated a moderate number as compared with the first generation. While data presented graphically illustrated in Figure (2) and Table (3) will find the population fluctuations of *T. orientalis* on the *J. multiflorum* cut flower, indicated by half-monthly counts of its different stages during the 2022 year. The population fluctuations of the different stages of the insect significantly differentiated all over the year. The integration of the seasonal abundance curve revealed the presence of three peaks in their numbers, which represent three overlapping generations. The thrips individuals appeared in early January and increased gradually to make the first generation the highest average number occurring in the first week of January with 278 thrips insects (Nymph+adult) / 5 flowers. The weather factors: maximum, minimum temperatures°C, and relative humidity% were 18.4, 11.5°C, and 76 %., respectively.

The infestation with all stages decreased gradually to mid-February. The infestation with total stages increased and fluctuated to make the second generation by mid-April with an almost similar mean number of 268.5 individuals when. The max. temperature was 30.6°C and the minmum temperature was 14.1°C while the relative humidity recorded 69 %. After that, the infestation with all stages decreased gradually to zero then it started to increase to mid-October. The infestation with total stages increased to the third generation by the end of December with almost a mean number of 218.4 individuals. The maximum temperature was 21.1°C and the minimum temperature was 13.8°C while the relative humidity was 86.8%.

This generation period demonstrated an approximate number as compared with the first generation. The density of thrips was noticeably good in March, April, September, and October under the climatic conditions prevailing (Shyam *et al.,* 2019).

Table (3): Biweekly counts of different stages of adults and nymphs of *Thrips orientalis* infesting Jasminum *multiflorum* cut flowers and some weather factors in El-Orman Garden, during seasons 2021 and 2022.

Date	Average no. of individual	Weather Factors (Means)			Date	Average no. of individual	Weather Factors (Means)		
	Total (Nymph+adult)/ 5flowers	Max. Temp	Min. Temp	RH. %		Total (Nymph+adult)/ 5flowers	Max. Temp	Min. Temp	RH. %
01/01/2021	250.7	19.7	10.4	88.6	01/01/2022	256.7	18.9	11	83.3
15/01/2021	267.4	22.8	14.4	92.2	15/01/2022	278	18.4	11.5	76.5
01/02/2021	269.5	19.6	10.5	75.9	01/02/2022	240.7	15.2	8.7	72
15/02/2021	208.2	24.3	12.8	82.8	15/02/2022	205.9	18.8	10.4	77.8
01/03/2021	203.5	19.4	10.2	91.8	01/03/2022	210.1	19.5	11.6	60.8
15/03/2021	199.5	23.3	11.4	77	15/03/2022	192.4	20.3	12	74
01/04/2021	233.3	24.4	13.8	69.4	01/04/2022	227	19.6	10.5	75
15/04/2021	257.5	25.4	11.8	71.5	15/04/2022	268.5	30.6	14.1	69.6
01/05/2021	244.6	32.5	16.3	71.6	01/05/2022	230.4	30.6	16	75.8
15/05/2021	194.2	36.6	21.4	60.3	15/05/2022	197.9	29.6	17.5	72.8
01/06/2021	137.6	33.8	20.3	76	01/06/2022	141.3	32.9	18	71.2
15/06/2021	65.9	33	21	77.5	15/06/2022	91	34.8	24.2	72.8
01/07/2021	39.4	35	22.8	77.3	01/07/2022	61.4	33.8	22	80.7
15/07/2021	8.6	36.3	24.5	78	15/07/2022	23.3	34	23.5	81.8
01/08/2021	0	36.7	24.8	80.1	01/08/2022	0	35.2	22.7	82.8
15/08/2021	0	38.9	27.5	82.8	15/08/2022	0	34.2	23.6	80.9
01/09/2021	0	36	26	85.2	01/09/2022	0	34.8	25.4	79
15/09/2021	0	33.9	24.3	77.4	15/09/2022	0	33.1	21.3	80
01/10/2021	0	31.9	22.1	78.4	01/10/2022	0	34	22.3	75.5
15/10/2021	16.6	31.2	20.5	56	15/10/2022	25.9	29.9	22.2	74.2
01/11/2021	38.1	30.2	20.5	84.2	01/11/2022	48.8	27.4	18.7	82.1
15/11/2021	85.3	27.5	19	87.6	15/11/2022	83	25.2	17.6	78.6
01/12/2021	123.6	25.2	16.9	80	01/12/2022	134.7	24	16.2	77.8
15/12/2021	161.3	20.9	14.2	71.3	15/12/2022	174.9	23.4	12	71.6
30/12/2021	210	18.4	11.5	76.5	30/12/2022	218.4	21.1	13.8	86.8
Total	3214.8	-	-	-	Total	3310.3	-	-	-
Mean	128.6	-	-	-	Mean	132.4	-	-	-

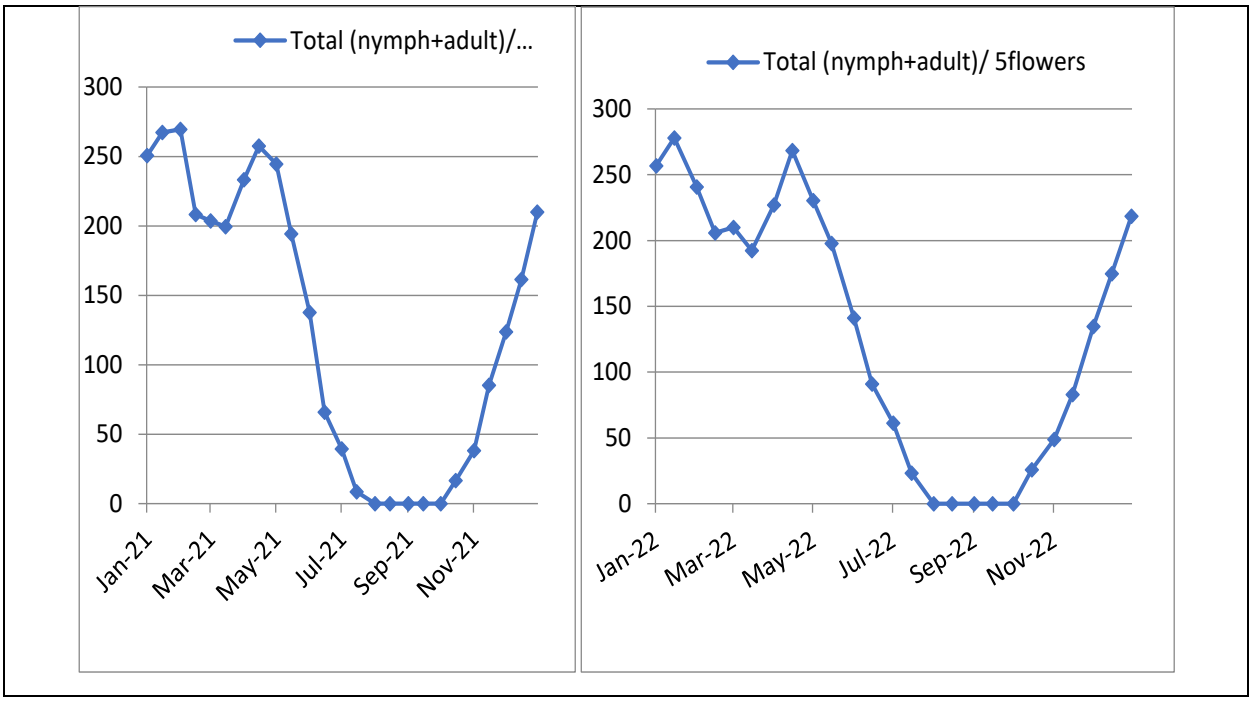

Figure (2): Biweekly averages number of *Thrips orientalis* total (Nymph+adult) on *Jasminum multiflorum* cut flower and some weather factors during seasons 2021and 2022.

2.4. Influence of weather factors:

Results in Table (2) illustrated the relationship between some weather factors and the total (Nymph+adult) of *F. occidentalis*, during the 2021 and 2022 seasons. During 2021 simple correlation coefficient values (r) were -0.807 -0.852 and -0.134, respectively, with significant relationships between maximum, minimum temperatures °C and relative humidity (RH. %) between *F. occidentalis* numbers. The results of the statistical analysis presented a very powerful negative and significant and obvious relation between maximum and minimum temperatures and the population fluctuation of thrips, the effect of maximum and minimum temperatures on the population fluctuations. While the results of the statistical analysis presented a positive and insignificant effect of relative humidity on the population fluctuations of thrips *F. occidentalis* during 2021. The partial regression analysis gave a precise effect where the (b) values were -0.032, -1.001, and -0.098, respectively, by the change of the forementioned weather factors by one unit.

In the next year, results in Table (2) illustrated the relationship between some weather factors and the total (Nymph+adult) of *F. occidentalis* during the 2022 season. Simple correlation coefficient values (r) were -0.706, -0.840, and -0.406 respectively, with significant relationships between maximum, minimum, temperatures °C and relative humidity (RH. %), between *F. occidentalis*. The results of the statistical analysis presented a very powerful negative and significant and obvious relation between max. and min. temperatures and the population fluctuation of thrips; effect of maximum and minimum temperatures on the population fluctuations of thrips during 2022. The partial regression analysis gave a precise effect where the (b) values were 0.321, -1.166, and -0.095, respectively, by the change of the forementioned weather factors by one unit. Further, it was also observed that thrips *T. orientalis* abundance was appreciably more in March, April, September, and October with the mean individuals of 8 thrips / flower than the rest of the period during which their numerical density ranged from 2-4 individuals /

blossom. However, the low temperature (Mean 10°C) during winter resulted in the prominent absence of both the flower and thrips under the weather conditions of Imphal (India). Therefore, it is pertinent to manage the thrips (Shah *et al*., 2005), winter and marginally high temperatures (25-32°C) in summer appear to influence the growth and reproduction of thrips *T.orientalis* thereby revealing the fact that moderately high temperature could enhance their density. In the present study, the positive correlation between en temperature and thrips density (Shyam *et al*., 2019).

3. Natural enemies *Orius* sp. on thrips *Frankliniella occidentalis* and *Thrips orientalis*

Also, the natural enemies of Orius spp. have been studied to associate with two insects, *F. occidentalis*, and *T. orientalis*, as the most prevalent predator in El-Orman Garden among natural enemies, *Orius* spp. was collected from jasmine flowers. recorded two species of predacious, namely *O. albidipennis* and *O. laevigatus* feeding on thrips collected from jasmine and propose the need for option control. In this context, numerous studies have been carried out on the predaceous bugs of the genus *Orius* (Heteroptera: Anthocoridae) because of their potential to limit thrips abundance. In El-Orman Garden, Giza Governorate, particular attention has been given to *O. laevigatus*. During the survey of two years 2021/ 2022, 102 samples were taken resulting in the collection of 616 individuals, which comprised 2 *Orius* species. *O. albidipennis* and *O. laevigatus. Therefore*, samples were collected in the open field. The sampling data are reported in Table (4), They formed 57.58%, and 4.05% respectively of the total number of specimens checked. In general, *O. laevigatus* was the most abundant species, this confirms the findings of Tavella *et al*. (1994) who sampled *Orius* spp. indicating a probable dominance of *O. laevigatus* in the Mediterranean basin. The various species showed differences also in their geographic distribution (Table 4). Showing that *O. laevigatus* is more adapted to high temperatures. These data also propose that *O. laevigatus* may be a good candidate for control of *F. occidentalis* in the warmest areas. *O. laevigatus* was found to be the most ordinary *Orius* species and it was often found on all ornamental plants on which *F. occidentalis* is an important pest, and it showed a wide natural distribution in the warmest regions. The survey indicates that *O. laevigatus* and *O. albidipennis* are well adapted to both climate and the main ornamental plants grown in Egypt. Therefore, these two species seem good candidates for biological control of thrips pests. The obtained results agree whereas, three predatory species were recorded. which were reported by Sood and Kakar (1990).

Table (4): Relative abundance (%) of *Orius* species found on two cut flowers plants in July 2022 in El-Orman Garden, Giza Governorate.

Cut flowers plants	Total number of predators sampled	*Orius laevigatus*	*Orius albidipennis*
Jasminum grandiflorum	82	68.6	31.4
Jasminum multiflorum	20	56.5	43.5

In Florida and Canada, researchers and growers have also planted Alyssum around strawberry crops to increase the numbers of *Orius* spp. for improved control of *F. occidentalis* (Renkema *et al*., 2020). Special attention was paid to the predator *O. laevigatus*, with greater numbers than the predator *O. albidipennis* during the years 2021/2022.

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