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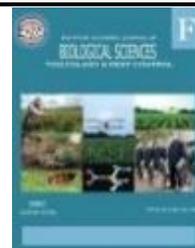


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## Population Abundance of The Two-Spotted Spider Mite, *Tetranychus urticae* Koch and Its Predators and Some Insect Predators Infesting Cotton Plants at Mansoura District

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population abundance.

### ABSTRACT

Ecological studies had been carried out in cotton plants to investigate the population density and effect of certain weather factors on the two-spotted spider mite, *Tetranychus urticae* Koch; *Phytoseiulus persimilis*, and *Tarsonemidae*. and some insect predators, *Stethorus gilvifrons* (Mulsant), *Orius insidiosus* and *Chrysoperla carnea* (Stephens), in two successive seasons, 2021 and 2022 at Mansoura district. There were two peaks in 2021 for *T. urticae* whereas three peaks in 2022. That highest peak was found in 2021 during the first week of July (1040 individuals /25 leaves), while that was in the last week of July (1043.3 individuals / 25 leaves) in 2022. The results indicated that *P. persimilis* had first seen in the second week of May in both seasons of the study. The highest peak was found during the second week of Jun (5.5 individuals /25 leaves) in 2021, but, in 2022, that was in the first week of July (4.0 individuals / 25 leaves). In addition to that, family Tarsonemidae was first seen in the second week of May 2021 and 2022. It recorded two peaks in 2021 and one beak in 2022. These peaks were found in the first and second week of July recording (2.3 individuals) in 2021. The beak in 2022 was at the last week of July with the same density as 2021 (2.3 individuals). Predatory insect *S. gilvifrons* had one peak in the 2021 whereas two peaks in 2022. The highest density was found during the first week of July (5.8 individuals) in 2021. While, *O. insidiosus* had only one peak in each season of the study, the highest density was in 2021 at the first week of July (6.0 individuals). *C. carnea* was first seen in the first week of May during the two seasons of the study. It recorded one peak in both seasons. 2022, recorded high density in the third week of July, (5.5 individuals). The statistical analysis showed that there was no significant correlation between most pests and temperature parameters in 2021. both *T. urticae* and Tarsonemidae there was positive significant for both maximum and average temperature in 2022. While a slight negative effect in 2021 for *P. persimilis*. a moderately significant correlation between the average temperature and the number of *S. gilvifrons* during the season of 2022. The statistical analysis showed that there was a highly significant positive correlation between the temperature parameters and the number of *O. insidiosus* during the season of 2022. While *C. carnea* had a non-significant correlation with temperature parameters in the two seasons of study.

## INTRODUCTION

The total agri-cultural area of El-Dakahlyia Governorate is about 645, 813 feddans. The main summer field crops are represented by cotton (11.10%), rice (44.82%), and maize (30.89%). Cotton plants are infested by different injurious mites and insect species. These injurious mites and insect species were attacked by numerous predators. Population density of piercing-sucking mites and insects and their predators were studied by many investigators (Assem *et al.*, 1991; Erkilic and uygun, 1995; Erkilic *et al.*, 1995 and Ibrahim 2005 and Bayhan *et al.*, 2006). The ecological studies on the environmental preference of various mites and insect species for evaluating the effect of some weather factors on the population density of these mites and insect pests and their predators have a significant importance in recent years for pest control research programs. The two-spotted spider mite, *Tetranychus urticae* Koch consider one of the most important polyphagous species of the family tetranychidae, which infest several agricultural crops and causes economic damage. This mite is found in several climatic conditions in almost all parts of the world. As the population increases the two-spotted spider mite especially during dry periods spread to all parts of the plant, and made webbing over the entire cotton plant. A moderate infestation can greatly affect crop production and heavy infestation may cause the death of the plant (Jeppson *et al.*, 1975). The two-spotted spider mite remains active throughout the year under the poly house as well as in open field conditions and it may cause serious damage to several crops such as cotton, alfalfa, gerbera, tomato, french bean, cucurbits, and carnation, etc. (Meyer and Rodriguez, 1966, Manjulata *et al.*, 2002, Shah and Shukla, 2014, Pokle and Shukla, 2015, Shukla and Radadia, 2015). It is very necessary to know the seasonal activities and the role of abiotic factors on the growth and development of any pest for better control of it. Therefore, The present study was carried out to Study the population density of piercing-sucking mites (*Tetranychu urticae*) infesting cotton plants and their predators, and the population density of some predatory insects at Mansoura district, and also estimate the effect of certain weather factors on their population density during two successive seasons 2021 and 2022.

## MATERIALS AND METHODS

The incidence of the two-spotted spider mite, *T. urticae* and its predators and the incidence of some predatory insects were recorded at weekly intervals. This work was carried out at cotton plants at Mansoura district in two successive seasons 2021 and 2022, each season began from May 2021 up to September 2021. For sampling, 25 randomly selected leaves were plucked from cotton plants. These leaves were held in separate properly labelled polyethylene bags and brought to the Acarology laboratory for numerical mite and insect numbers under a stereo binocular microscope. The data were recorded separately for four replicates. The observations on mites and insect numbers were recorded for the crop season. The data so obtained were summed up and converted to the total population for a week. To understand the pattern of the abundance of these mites and insects on the cotton plant in the two seasons of 2021 and 2022. The correlation studies between mites, insects population and prevailing abiotic factors viz., maximum, minimum and average temperature and average relative humidity and the simple correlation coefficient (r) were calculated. The Meteorological station, Ministry of Defense at Showa Air Base station about 5KM from Mansoura, provides us with the daily recorded temperature and relative humidity during the period of the study.

**Data Analysis:**

For the purpose of statistical analysis data were analyzed to determine the correlation coefficient (Costat, 2004).

**RESULTS AND DISCUSSION**

**Population Density of *T. urticae* and Its Predators Associated with Cotton Plant at Mansoura District during Two Seasons 2021- 2022:**

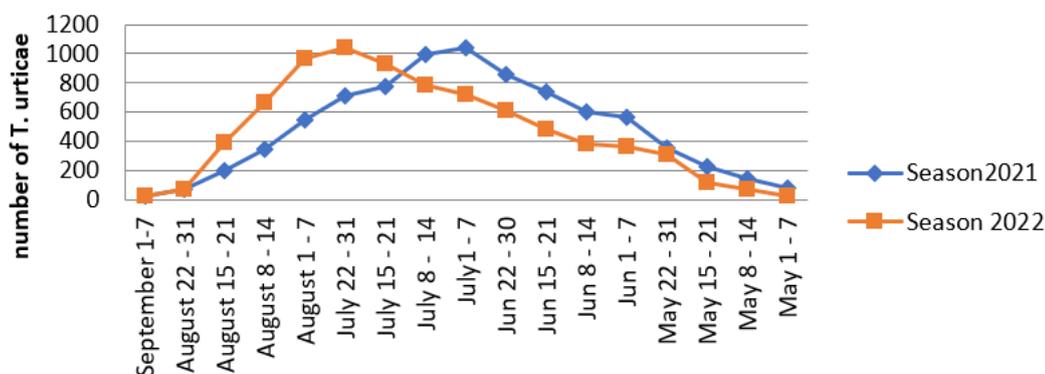
**1- *Tetranychus urticae* Koch:**

Data in Table (1) and Figure (1) revealed that *T. urticae* had two peaks in 2021 whereas three peaks in 2022. The highest peak was found during the first week of July (1040 individuals /25 leaves) in 2021, while that was in the last week of July (1043.3 individuals / 25 leaves) in 2022. The density reduced to the lowest number in the first week of September for both seasons of the study recording (25 & 26 individuals /25 leaves) respectively.

**Table 1:** Population density of *Tetranychus urticae* and its predators associated with cotton plants at Mansoura district during two seasons, 2021 and 2022.

Inspection date	<i>Tetranychus urticae</i>		<i>Phytoseiulus spp.</i>		Tarsenomidae	
	2021	2022	2021	2022	2021	2022
May 1 - 7	79.5	26.3	0.0	0.0	0.0	0.0
May 8 - 14	148	74.5	1.0	0.5	0.3	0.5
May 15 - 21	229	118.8	2.0	1.8	0.5	1.8
May 22 - 31	353.8	309	1.5	1.8	1.3	2.0
Jun 1 - 7	563.8	367.5	2.3	2.5	1.0	2.0
Jun 8 - 14	602.3	382.8	5.5	2.5	1.8	1.5
Jun 15 - 21	734.8	479.8	3.5	3.5	1.0	1.5
Jun 22 - 30	854	606.8	5.3	2.3	2.0	0.8
July1 - 7	1040	718.5	3.3	4.0	2.3	1.0
July 8 - 14	999.5	786.3	1.8	2.3	2.3	0.8
July 15 - 21	775.8	926.8	0.5	1.5	1.8	1.8
July 22 - 31	710.5	1043.3	0.8	2.3	1.8	2.3
August 1 - 7	550.3	966.5	1.8	1.8	1.0	2.0
August 8 - 14	341.5	668.5	1.5	0.8	1.5	1.3
August 15 - 21	196.8	392.5	1.8	2.3	0.5	1.3
August 22 - 31	71.8	71.5	1.0	1.5	0.3	0.5
September 1-7	25	26	0.5	1.0	0.3	0.0
<b>Total</b>	<b>8276.4</b>	<b>7965.4</b>	<b>33.1</b>	<b>32.4</b>	<b>19.7</b>	<b>21.1</b>

\* No. of mites / 25 leaves.



**Fig 1:** Population density of *Tetranychus urticae* on cotton plants at Mansoura district during two seasons 2021 and 2022.

**Table 2:** Correlation coefficient between the population density of *Tetranychus urticae* Koch and the temperature and relative humidity at Mansoura district during two seasons, 2021 and 2022.

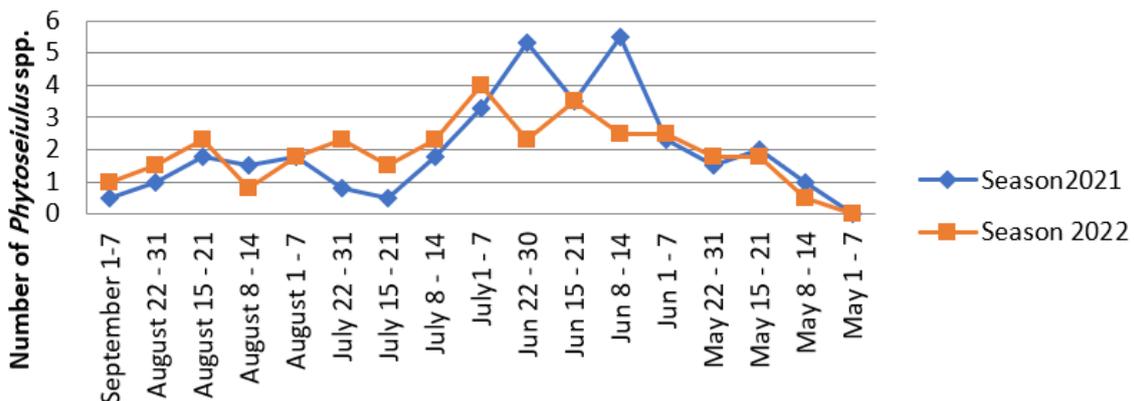
Weather variable	Season 2021			Season 2022		
	r	p	S	r	p	S
Maximum Temp.	0.3984	0.1132	NS	0.5602	0.0194	*
Minimum Temp.	0.0759	0.7723	NS	0.3767	0.1361	NS
Average Temp.	0.1241	0.6351	NS	0.5644	0.0183	*
Mean RH.	0.0662	0.8006	NS	0.3121	0.2261	NS

NS = insignificant r = Correlation coefficient P = Probability S = significant sign. \* = significant with different degrees

Data t in Table (2) shows the Correlation between the mite numbers of *T. urticae* and average temperature and relative humidity in 2021 and 2022 at Mansoura district. It can be seen that the maximum; minimum, average temperature and Average R.H. % had non-significant effect on the population density of *T. urticae* during 2021. While only the maximum and Average temperatures had significant impacts on the population density of this mite during 2022.

### 2-*Phytoseiulus persimilis*:-

Data tabulated in Table (1) and Figure (2) indicated that *Phytoseiulus persimilis* had two peaks in 2021 whereas one peak in 2022. *Phytoseiulus persimilis* had first seen in the second week of May in both seasons. The highest peak was found during the second week of Jun (5.5 individuals /25 leaves) in 2021, while that was in the first week of July (4.0 individuals / 25 leaves) in 2022. The density was reduced to 0.5 individuals in the third week of July and the first week of September in 2021, while it was 0.1 individuals for the first week of September in 2022.



**Fig. 2:** Population density of *Phytoseiulus persimilis* on cotton plants at Mansoura district during two seasons, 2021 and 2022.

**Table 3:** Correlation coefficient between the population density of *Phytoseiulus persimilis* and the temperature and relative humidity at Mansoura district during the two seasons 2021 and 2022.

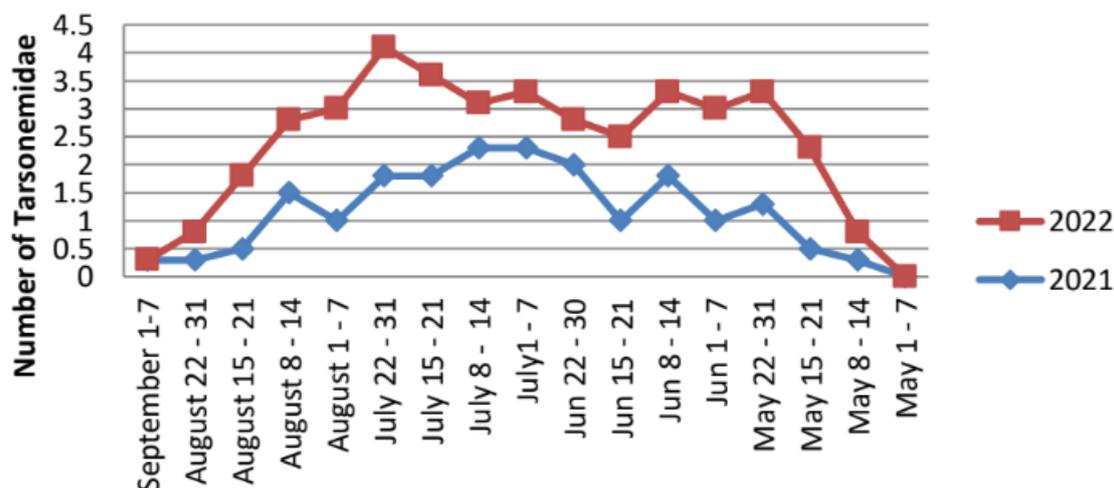
Weather variable	Season 2021			Season 2022		
	r	p	S	r	p	S
Maximum Temp.	0.0918	0.7261	NS	0.4421	0.0755	NS
Minimum Temp.	-0.0208	0.9368	NS	0.2562	0.3212	NS
Average Temp.	-0.1783	0.4936	NS	0.3802	0.1322	NS
Mean RH.	0.2224	0.3909	NS	-0.2181	0.4002	NS

NS = insignificant r = Correlation coefficient P = Probability S = significant sign. \* = significant with different degrees

Data shown in Table (3) illustrate the Correlation between the mite numbers of *Phytoseiulus persimilis* and average temperature and relative humidity in two seasons 2021 and 2022 at Mansoura district. The maximum and Average R.H. % had a non-significant effect on the population density of *Phytoseiulus persimilis* during both seasons of study. But the minimum and average temperature had a slight negative effect during 2021.

**3-Tarsonemidae:**

Table (1) and Figure (3) indicated that Tarsonemidae was first seen in the second week of May during 2021 and 2022. It recorded two peaks in 2021 and one beak in the 2022. In 2021, these peaks were in the first and second week of July recording (2.3 individuals). While, the beak 2022 was in the last week of July with the same density as 2021 (2.3 individuals).



**Fig. 3:** Population density of Tarsonemidae on cotton plants at Mansoura district during two seasons, 2021 and 2022.

**Table (4):** Correlation coefficient between the population density of *Tarsonemidae* and the temperature and relative humidity at Mansoura district during the two seasons, 2021 and 2022.

Weather variable	Season 2021			Season 2022		
	r	p	S	r	p	S
Maximum Temp.	-0.1605	0.5384	NS	0.6028	0.0104	*
Minimum Temp.	-0.0391	0.8815	NS	0.3626	0.1526	NS
Average Temp.	-0.3367	0.8979	NS	0.5805	0.0146	*
Mean RH.	0.1040	0.6911	NS	0.0337	0.8978	NS

NS = insignificant r = Correlation coefficient P = Probability S = significant sign. \* = significant with different degrees

Table (4) showed the correlation coefficient values between the density of *Tarsonemidae* and certain weather factors on the cotton plants during 2021 and 2022. The maximum; minimum, average temperature and Average R.H. % had a slight negative effect in 2021. While, only the maximum and average temperature had a significant positive effect on the population density of *Tarsonemidae* in 2022.

#### Population Density of Predatory Insects Associated with Cotton Plants at Mansoura District During Two Seasons 2021- 2022:

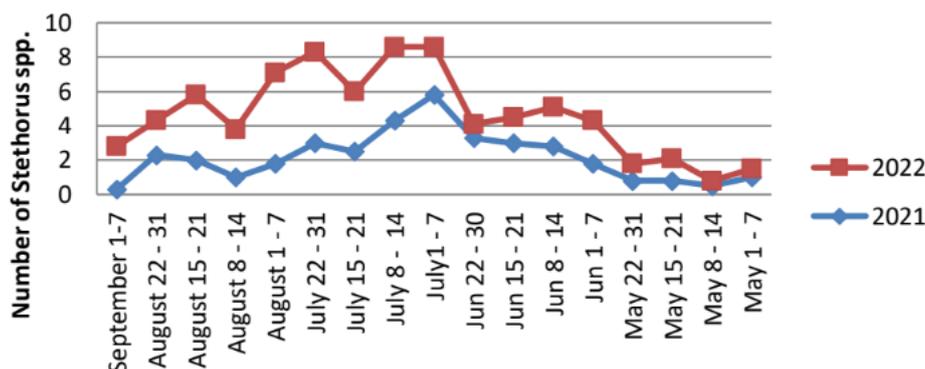
##### *I-Stethorus gilvifrons* (Mulsant):-

Data in Table (5) and Figure (4) revealed that *Stethorus gilvifrons* had only one peak in 2021, whereas two peaks in 2022. The highest peak was found during the first week of July (5.8 individuals) in 2021, while that was in the last week of July and the first week of August (5.3 individuals) in 2022. The density reduced to the lowest number (0.3 individuals) in the first week of September in 2021 and was at the second week of May in 2022.

**Table 5:** Population density of predatory insects associated with cotton plants at Mansoura district during two seasons, 2021- 2022.

Inspection date	<i>Stethorus spp.</i>		<i>Orius spp.</i>		<i>C. carnea</i>	
	2021	2022	2021	2022	2021	2022
May 1 - 7	1	0.5	0.0	0.5	0.3	1.0
May 8 - 14	0.5	0.3	0.5	0.5	0.8	1.3
May 15 - 21	0.8	1.3	0.3	1.0	1.3	0.3
May 22 - 31	0.8	1.0	1.0	1.8	1.0	1.3
Jun 1 - 7	1.8	2.5	2.0	2.8	1.0	1.5
Jun 8 - 14	2.8	2.3	3.5	3.3	1.5	2.0
Jun 15 - 21	3.0	1.5	2.0	1.8	2.0	1.5
Jun 22 - 30	3.3	0.8	1.3	2.3	3.3	3.3
July 1 - 7	5.8	2.8	6.0	3.3	1.8	4.0
July 8 - 14	4.3	4.3	4.3	2.5	2.3	5.5
July 15 - 21	2.5	3.5	2.3	2.8	0.8	4.0
July 22 - 31	3.0	5.3	2.5	3.5	1.5	3.8
August 1 - 7	1.8	5.3	0.8	1.8	1.5	3.0
August 8 - 14	1.0	2.8	1.3	1.3	1.5	1.3
August 15 - 21	2.0	3.8	2.8	1.8	0.8	1.3
August 22 - 31	2.3	2.0	1.8	1.8	1.3	1.3
September 1-7	0.3	2.5	1.5	2.0	1.3	0.8
Total	37	42.5	33.9	34.5	24	37.2

\* No. of insects / 25 leaves.



**Fig. 4:** Population density of *Stethorus gilvifrons* (Mulsant) on cotton plants at Mansoura district during two seasons, 2021 and 2022.

**Table 6:** Correlation coefficient between the population density of *Stethorus gilvifrons* (Mulsant) and the temperature and relative humidity at Mansoura district during the two seasons, 2021 and 2022.

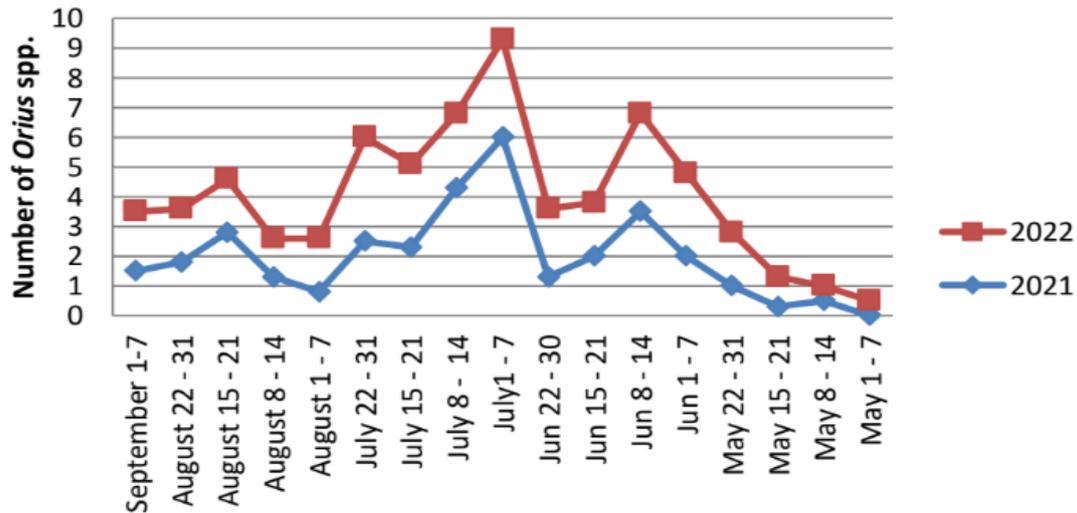
Weather variable	Season 2021			Season 2022		
	r	p	S	r	p	S
Maximum Temp.	0.3791	0.1335	NS	0.5659	0.1791	*
Minimum Temp.	0.2370	0.3597	NS	0.5631	0.0186	*
Average Temp.	0.2079	0.4233	NS	0.6110	0.0092	**
Mean RH.	0.1197	0.6473	NS	0.5601	0.0194	*

NS = insignificant r = Correlation coefficient P = Probability S = significant sign. \* = significant with different degrees

Statistical analysis showed that in Table (6) there was a moderately significant positive correlation between the average temperature parameters and the number of *Stethorus gilvifrons* during the second year of study. The average relative humidity and maximum, and the minimum temperature had a significant positive correlation in the second year also. While all parameters were non-significant in the first year of investigation.

#### 2-*Orius insidiosus*:

Table (5) and Figure (5) shows the total number of predatory insects on cotton plants during the two seasons of the study, 2021 and 2022. The obtained data indicated that *Orius insidiosus* had one peak in each season, the highest peak was at the first week of July (6.0 individuals) in 2021. In 2022, the peak was in the last week of July (3.5 individuals). The population reduced to the minimum level at the first week of May for both seasons recording (0.0- 0.5 individuals) respectively.



**Fig. 5:** Population density of *Orius insidiosus* on cotton plants at Mansoura district during two seasons, 2021 and 2022.

**Table 7:** Correlation coefficient between the population density of *Orius insidiosus* and the temperature and relative humidity at Mansoura district during the two seasons, 2021 and 2022.

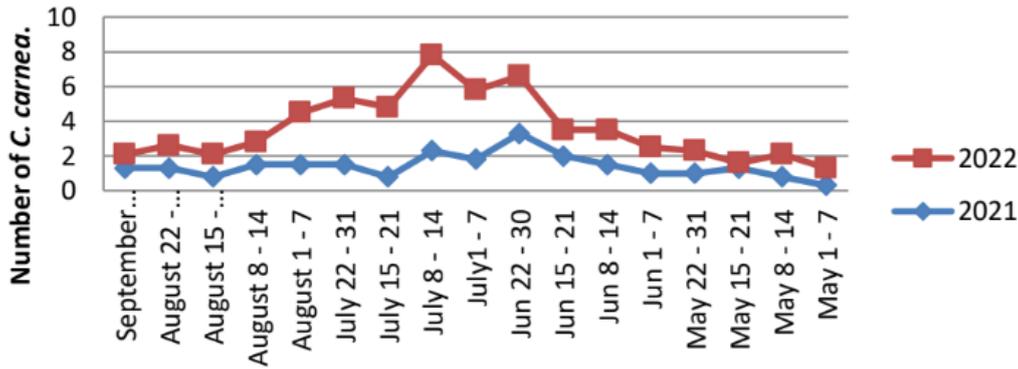
Weather variable	Season 2021			Season 2022		
	r	p	S	r	p	S
Maximum Temp.	0.3866	0.1253	NS	0.8001	0.0001	***
Minimum Temp.	0.1952	0.4528	NS	0.6063	0.0099	***
Average Temp.	0.0761	0.7718	NS	0.7583	0.0004	***
Mean RH.	0.2971	0.2468	NS	0.1696	0.5151	NS

NS = insignificant r = Correlation coefficient P = Probability S = significant sign. \* = significant with different degrees

Data in Table (7) cleared the correlation coefficient between the population density of *Orius insidiosus* infesting cotton plants at Mansoura district and temperature degrees and R.H. % during 2021 and 2022. All parameters showed a non-significant effect in 2021. But, the Maximum, Minimum and Average temperature affected greatly in the population density of this insect and showed a highly significant effect in 2022, and the average R.H. % showed non-significant effect during the two seasons of the investigation.

### 3-*Chrysoperla carnea* (Stephens):-

Table (5) and Figure (6) indicated that *C. carnea* was first seen in the first week of May in 2021. It recorded one peak in both seasons. In 2021, this peak occurred in the last week of Jun (3.3 individuals) and in the third week of July, (5.5 individuals) in 2022.



**Fig. 6:** Population density of *Chrysoperla carnea* (Stephens) on cotton plants at Mansoura district during two seasons, 2021 and 2022.

**Table 8:** Correlation coefficient between the population density of *Chrysoperla carnea* (Stephens) and the temperature and relative humidity at Mansoura district during the two seasons, 2021 and 2022.

Weather variable	Season 2021			Season 2022		
	r	p	S	r	p	S
Maximum Temp.	0.3299	0.1960	NS	0.4068	0.1050	NS
Minimum Temp.	0.1900	0.4651	NS	0.4147	0.0979	NS
Average Temp.	0.0357	0.8917	NS	0.4123	0.1001	NS
Mean RH.	0.3422	0.1788	NS	0.2872	0.2637	NS

NS = insignificant r = Correlation coefficient P = Probability S = significant sign. \* = significant with different degrees

Table (8) demonstrates the correlation coefficient values between the density of *Chrysoperla carnea* (Stephens) and certain weather factors. The results cleared that all variables had a non-significant effect on the population density of *Chrysoperla carnea* (Stephens) in 2021 and 2022.

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