

Population Density of the Red Spider Mite *Tetranychus urticae* Koch (Acari:Tetranychidae) on Some Vegetable Crops at Fayoum Governorate

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ABSTRACT

Population density of different stages of *Tetranychus urticae* Koch. was conducted on two host plants; cucumber and eggplant during the two successive seasons 2015 and 2016 from March to August. Data indicated that *T. urticae* stages disappear in samples of March and reached to the highest peak on July during the two seasons on cucumber and eggplant. The correlation was significant positive between different stages of *T. urticae* and temperature during the two seasons for two the plant crops.

Keywords: *Tetranychus urticae*, Population density, Cucumber, Eggplant.

INTRODUCTION

The two-spotted spider mite, *Tetranychus urticae* Koch, is a polyphagous arthropod herbivore that feeds on a remarkably broad array of species, with more than 150 of economic value. It is a major pest of greenhouse crops, especially in Solanaceae and Cucurbitaceae (e.g., tomatoes, eggplants, peppers, cucumbers) and greenhouse ornamentals (e.g., roses and chrysanthemum), annual field crops (such as maize, cotton, soybean, and sugar beet), and in perennial cultures (alfalfa, strawberries, grapes, citrus, and plums) (Jeppson *et al.*, 1975 and Migeon & Dorkeld, 2013). Number of vegetable crops such as tomatoes, squash, eggplant and cucumber were recorded that they were subjected to two spotted spider mite infestation and damage (Bostanian *et al.*, 2003). Eggplant, *Solanum melongena* L. is one of the most important solanaceous crops. It is a good source of nutrients, minerals, antioxidants, vitamins, dietary fiber and body building factors and proteins (Matsubara *et al.*, 2005). Cucumber, *Cucumis sativus* is one of the most important crops and widely grown under greenhouse conditions (Rich *et al.*, 2013 and Khaghani, 2009). In Fayoum, *T. urticae* was reported as the main mite pest found on marjoram all over the season, with the highest population densities in May and September recorded 99 and 92 individuals / 40 plants (Rahil, 2006). Of three eggplant cultivars tested for their relative susceptibility to spotted spider mite, *T. urticae* and some other sucking pests, results showed that spherical black cultivar was the most susceptible to spider mites, while long black cultivar was lowest level infestation (Azouz, *et al.*, 2014).

So, the aim of this work was to investigate the effect of temperature and relative humidity on population density of *T. urticae* at Fayoum Governorate during seasons 2015 and 2016.

MATERIALS AND METHODS

Population density of *T. urticae* was conducted separately on two host plants, cucumber and eggplant. Experimental plots of 1/8 feddan for each crop were divided into three equal parts at Fayoum region, Fayoum governorate, Egypt. These host plants were planted in the first day of March 2015 and planted again in March 2016. No insecticide, miticide or any other chemicals were applied to control the pest during the period of study. The plants were attacked naturally by *T. urticae*. The samples were made by collecting thirty leaves randomly from each host plant every week. The leaves were examined under

stereo-binocular microscope in the laboratory. All stages of mite, eggs, immatures (larvae and nymphs), and adults of both sexes were counted on each leaf. The survey was started from the middle of (March - August 2015) and repeated again in the same period in 2016 season.

RESULTS AND DISCUSSION

A) Population density of *T. urticae* on cucumber plants in the field:

a) During 2015 season:

Samples were obtained during this season from March to August. Results indicated that stages of *T. urticae* disappear during the period of March 15-29 then appeared slowly with the first sample of April.

Table 1. Population density of *T. urticae* stages on cucumber plants during 2015 season in Fayoum Governorate.

Sampling date	Mean number / 30 leaves						Total	Tem p.	R.H. %
	Eggs	Larvae	Nymphs	Adults					
				♀	♂				
March	15	0	0	0	0	0	0	21.85	47.95
	22	0	0	0	0	0	0		
	29	0	0	0	0	0	0		
Monthly mean	0	0	0	0	0	0	0		
April	5	2	0	2	0	0	4	24.25	45
	12	10	0	1	0	0	11		
	19	15	1	2	3	2	23		
	26	26	9	9	4	2	50		
Monthly mean	13.25	2.5	3.5	1.75	1	22			
May	3	34	18	19	11	8	90	29.29	39.38
	10	59	30	33	24	19	165		
	17	78	57	53	32	31	251		
	24	84	74	70	37	30	295		
	31	95	88	81	37	30	331		
Monthly mean	70	53.4	51.2	28.2	29.6	226.4			
June	7	111	102	94	38	35	380	28.73	41.5
	14	123	103	99	42	38	405		
	21	134	121	101	47	41	444		
	28	145	131	128	49	41	494		
Monthly mean	128.25	114.25	105.5	44	38.75	430.75			
July	5	157	137	131	52	42	519	29.4	38
	12	173	154	141	52	41	561		
	19	189	169	157	60	44	619		
	26	200	161	141	54	39	595		
Monthly mean	179.75	155.25	142.5	54.5	41.5	573.5			
August	2	250	132	101	31	29	543	30.93	36.26
	9	121	81	54	17	18	291		
	16	85	35	21	11	10	162		
Monthly mean	152	82.67	58.67	19.67	19	332			
G. mean ± SE	90.91 ±15.32	69.69 ±12.66	62.52 ±11.44	26.13 ±4.42	21.74 ±3.59	271.0 ±46.32	27.35 ±0.91	40.47 ±1.14	

The obtained result in Table (1), indicated that, the monthly mean number of different stages was increased in April compared with that of March recorded 13.25, 2.5, 3.5 and 2.75 for eggs, larvae, nymphs and adults, respectively. With increasing temperature and leaves area of plants, the

number of stages was increased. So results showed that, the number of *T. urticae* during June was higher than that during March, April and May. Numbers of different stages reached to the highest peak during July recorded 179.75, 155.25, 142.5 and 96 for eggs, larvae, nymphs and adults, respectively with mean of total number 573.5 compared with that in previous months. At the end of this season, the mean number of stages was reduced during August to reach 152, 82.67, 58.67 and 38.67 for eggs, larvae, nymphs and adults, respectively, with mean of total number 323, because of ending the plant foliage, the data obtained clarified in Fig. (1).

In Table (5), the correlation value between total number of *T. urticae* stages and temperature was positively high significant ($r = 0.59^{**}$) and was negatively insignificant with relative humidity ($r = - 0.35$).

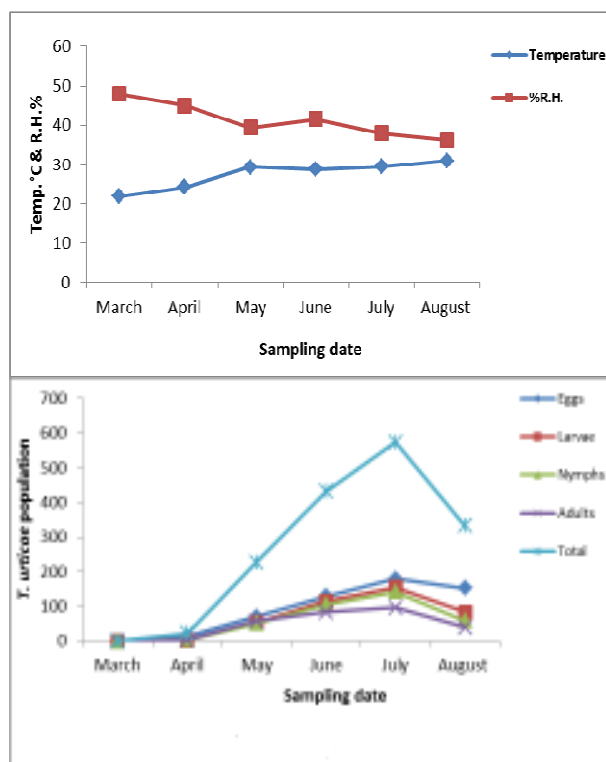


Fig. 1. Population density of *T. urticae* on cucumber plants during 2015 season

b) During 2016 season:

Data in Table (2) and Fig. (2), clarified that, the population of each stage increased gradually with increasing temperature and relative humidity during April then rapidly reached to peak levels. Samples were obtained during this season from March to August. Results indicated that stages of *T. urticae* disappear during the period from March 15 to April 19 then appeared slowly with the last sample of April. The monthly mean number of different stages was increased in May compared with that of March and April recorded 13, 6, 3 and 4.6 for eggs, larvae, nymphs and adults, respectively with mean of total number 26.6.

The number of *T. urticae* during June was higher than that during March, April and May recorded 23.5, 11, 7 and 9.5 for eggs, larvae, nymphs and adults, respectively with mean of total number 51.

Table 2. Population density of *T. urticae* stages on cucumber plants during 2016 season in Fayoum Governorate.

Sampling date	Mean number / 30 leaves					Total	Temp.	R.H. %	
	Eggs	Larvae	Nymphs	Adults					
March	15	0	0	0	0	0	20.7	36	
	22	0	0	0	0	0			
	29	0	0	0	0	0			0
Monthly mean	0	0	0	0	0	0			
April	5	0	0	0	0	0	26.5	35	
	12	0	0	0	0	0			
	19	0	0	0	0	0			0
	26	5	1	1	1	1			9
Monthly mean	1.25	0.25	0.25	0.25	0.25	2.25			
May	3	7	3	1	1	13	27.9	32	
	10	10	5	2	3	21			
	17	13	7	4	3	29			
	24	15	7	4	4	32			
	31	20	8	4	3	38			
Monthly mean	13	6	3	2.8	1.8	26.6			
June	7	20	9	5	3	40	32.3	34	
	14	23	9	7	4	48			
	21	24	12	7	5	53			
	28	27	14	9	7	63			
Monthly mean	23.5	11	7	4.75	4.75	51			
July	5	30	15	9	7	68	32.7	38	
	12	33	18	11	7	77			
	19	39	16	11	7	81			
	26	30	15	8	5	62			
Monthly mean	33	16	9.75	6.5	6.75	72			
August	2	21	11	8	4	46	32.2	36	
	9	6	5	7	1	19			
	16	6	5	7	1	19			
Monthly mean	9	7	7.3	2	0.67	28			
G. mean ± SE	14.3 ± 2.59	6.95 ± 1.25	4.56 ± 0.81	2.87 ± 0.53	2.52 ± 0.57	31.22 ± 5.63	28.77 ± 1.09	34.06 ± 1.25	

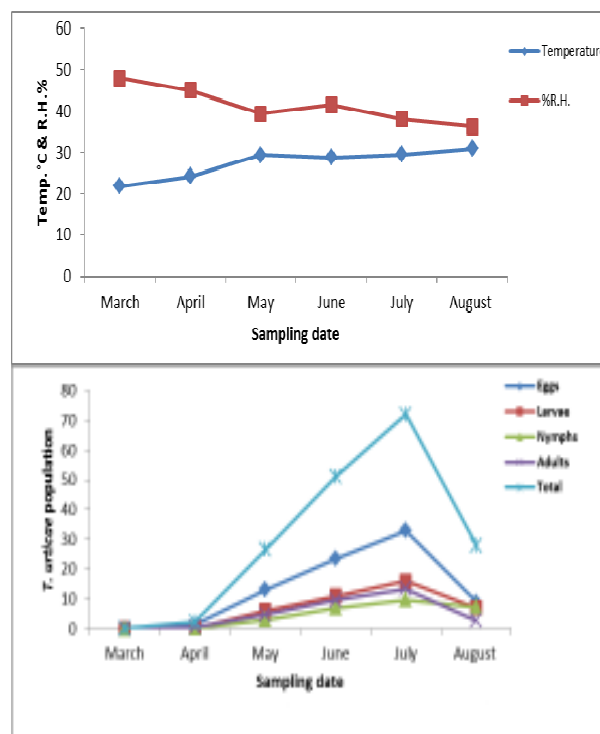


Fig. 2. Population density of *T. urticae* on cucumber plants during 2016 season

Numbers of different stages reached to the highest peak during July recorded 33, 16, 9.75 and 13.25 for eggs, larvae, nymphs and adults, respectively with mean of total number 72 compared with that in previous months. At the

end of this season, the mean number of stages was reduced during August to reach 9, 7, 7.3 and 2.67 for eggs, larvae, nymphs and adults, respectively, with mean of total number 28, because of ending the plant foliage. In this respect, population density of the adults and total life stages of *T. urticae* on different agricultural crops including cucumber (var. Superdaminus) and bean was studied and recorded (150.71 mites per leaf) for cucumber crop which was significantly more than bean crop (Mehrkhou, et al, 2008).

The obtained results in Table (6), showed that, the correlation value with temperature was positive highly significant ($r = 0.687^{**}$) and was positively insignificant with relative humidity ($r = 0.332$) with mean of total number of *T. urticae* stages.

B) Population density of *T. urticae* on eggplant in the field:

a) During 2015 season:

From obtained results in Table (3), during the period from March to August, stages of *T. urticae* disappear during March then appeared slowly with the first sample of April. The monthly mean number of different stages in April was recorded 13.25, 3.25, 1.5 and 2 for eggs, larvae, nymphs and adults, respectively. The number of *T. urticae* during June was higher than that during March, April and May. Numbers of different stages reached to the highest peak during July recorded 34.75, 20.75, 22.5 and 38.25 for eggs, larvae, nymphs and adults, respectively with mean of total number 116.25 compared with that in previous months, look Fig.(3).

Table 3. Population density of *T. urticae* stages on eggplant crop during 2015 season in Fayoum Governorate.

Sampling date	Mean number / 30 leaves					Temp.	R.H. %
	Eggs	Larvae	Nymphs	Adults ♀	Adults ♂		
March	15	0	0	0	0	0	21.85 47.95
	22	0	0	0	0	0	
	29	0	0	0	0	0	
Monthly mean	0	0	0	0	0	0	
April	5	12	1	1	1	1	24.25 45
	12	13	2	1	1	1	
	19	14	3	2	1	1	
	26	14	7	2	1	1	
Monthly mean	13.25	3.25	1.5	1	1	20	
May	3	15	9	2	1	1	29.29 39.38
	10	16	9	2	1	1	
	17	18	9	3	1	1	
	24	22	12	11	5	3	
	31	24	13	12	5	4	
Monthly mean	13	10.4	6	2.6	2	40	
June	7	25	13	12	7	6	28.73 41.5
	14	27	14	13	7	7	
	21	28	16	14	7	8	
	28	32	19	18	12	8	
Monthly mean	28	15.5	14.25	8.25	7.25	73.25	
July	5	32	21	21	18	8	29.4 38
	12	37	22	24	25	12	
	19	35	24	24	28	17	
	26	35	16	21	25	20	
Monthly mean	34.75	20.75	22.5	24	14.25	116.25	
August	2	31	10	15	21	18	30.93 36.26
	9	21	8	7	10	12	
	16	11	5	2	5	3	
Monthly mean	21	7.67	8	12	11	59.67	
G. mean	20.09	10.13	9.00	7.91	5.78	52.91	27.35 40.47
±SE	±2.36	±1.53	±1.76	±1.90	±1.29	±8.37	±0.91 ±1.14

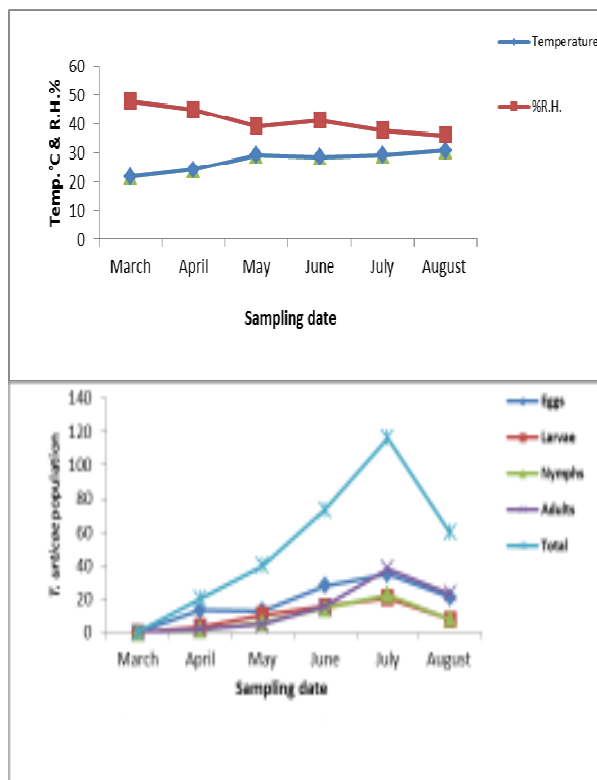


Fig. 3. Population density of *T. urticae* on eggplant crop during 2015 season

At the end of this season, the mean number of stages was reduced during August to reach 21, 7.67, 8 and 23 for eggs, larvae, nymphs and adults, respectively, with mean of total number 59.67, because of ending the plant foliage.

Data in Table (5), showed that, the correlation value with temperature was positively high significant ($r = 0.529^{**}$) and was negatively insignificant with relative humidity ($r = - 0.323$) with mean of total number of *T. urticae* stages.

Al-sayed, (2014), mentioned that, the population fluctuation of *T. urticae* on eggplant (eggs & individuals) in summer plantations throughout season 2012/2013 at Fayoum Governorate, Egypt was studied. Data in season 2012 revealed that the highest numbers were collected either from the 1st week of May to the 1st week of June (to record 25, 37, 16, 10 and 32 indiv./10 leaves, respectively) or in the 2nd and 3rd weeks of July (to record 18 and 17 indiv./ 10 leaves, respectively) while in season 2013, the highest number (35 indiv./ 10 leaves) was recorded in 2nd week of July.

b) During 2016 season:

The obtained results in Table (4) and Fig. (4), indicated that, the stages of *T. urticae* disappear during March and April months then appeared slowly with the first sample of May. The monthly mean number of different stages was increased in July compared with that of May and June recorded 42.75, 27.25, 41.25 and 45.5 for eggs, larvae, nymphs and adults, respectively with mean of total number 156.75. At the end of this season, the mean number of stages was reduced during August to reach 2.33, 6, 7 and 14.67 for eggs, larvae,

nymphs and adults, respectively, with mean of total number 40, because of ending the plant foliage.

In Table (6), data indicated that, the correlation value with temperature was positively significant ($r = 0.6^*$) and was positively significant with relative humidity ($r = 0.425^*$) with total number of *T. urticae* stages.

Table 4. Population density of *T. urticae* stages on eggplant crop during 2016 season in Fayoum Governorate.

Sampling date	Mean number / 30 leaves						Temp.	R.H. %	
	Eggs	Larvae	Nymphs	Adults		Total			
				♀	♂				
March	15	0	0	0	0	0	20.7	36	
	22	0	0	0	0	0			
	29	0	0	0	0	0			
Monthly mean	0	0	0	0	0	0			
April	5	0	0	0	0	0	26.5	35	
	12	0	0	0	0	0			
	19	0	0	0	0	0			
	26	0	0	0	0	0			
Monthly mean	0	0	0	0	0	0			
May	3	0	0	2	0	2	27.9	32	
	10	10	5	5	4	1			25
	17	14	5	6	4	1			30
	24	20	6	6	5	2			39
	31	23	6	7	5	2			43
Monthly mean	13.4	4.4	4.8	4	1.2	27.8			
June	7	27	13	11	7	6	32.3	34	
	14	35	17	20	17	15			104
	21	37	20	27	23	19			126
	28	41	25	33	23	19			141
Monthly mean	35	18.75	22.75	17.5	14.75	80.25			
July	5	50	27	37	27	22	32.7	38	
	12	53	30	42	30	27			182
	19	57	31	48	21	22			179
	26	11	21	38	20	13			103
Monthly mean	42.75	27.25	41.25	24.5	21	156.75			
August	2	7	10	27	12	11	32.2	36	
	9	0	5	17	10	8			40
	16	0	3	7	2	1			13
Monthly mean	2.33	6	17	8	6.67	40			
G. mean	16.74	9.74	14.39	9.22	7.35	57.43	28.77	34.06	
±SE	±4.1	±2.26	±3.35	±2.11	±1.88	±13.21	±1.09	±1.25	

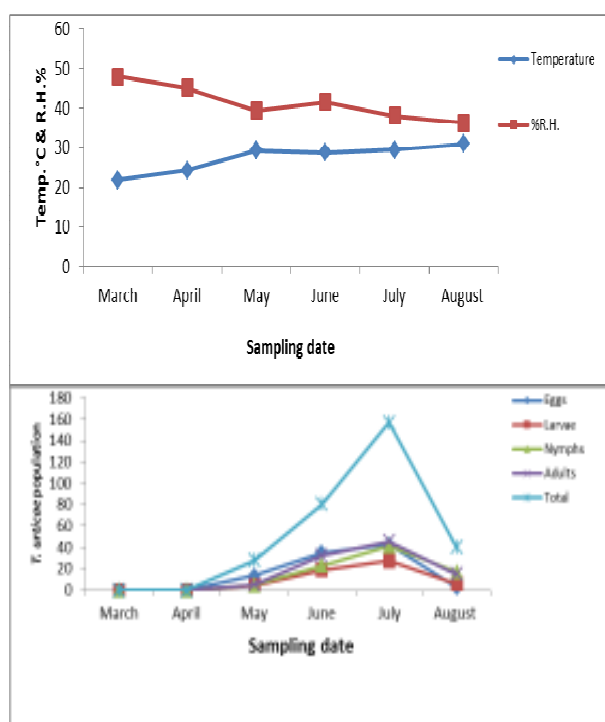


Fig. 4. Population density of *T. urticae* on eggplant crop during 2016 season

Similar results were obtained by Imran and Janardan , 2006 who found that the population density of *T. urticae* infesting aubergine in a field experiment conducted from March to August Also, Hoque, *et al.*, 2010, recorded the population density of *T. urticae* on three host plants showed, the highest number of *T. urticae* on bean (153.2) and eggplant (172.3) in the month of May 2006, and on lady's finger (174.35) in August, the lowest (22.0, 8.99 and 9.81) was recorded in December 2006. The number of mites in three host plants differed significantly ($P < 0.001$) among seasons. The temperature had significant ($P < 0.05$) impact on the abundance of *T. urticae*.

Table 5. Correlation between *T. urticae* population on cucumber & eggplant crops and (Temp.&R.H.%) during 2015 season in Fayoum Governorate.

Crops	Factor	Values	Eggs	Larvae nymphs	Adults		Total	
					♀	♂		
Cucumber	Temp.	r	0.667**	0.566**	0.513*	0.541**	0.583**	0.599**
		P	0.001	0.005	0.012	0.008	0.003	0.003
	RH%	r	-0.419*	-0.333	-0.286	-0.316	-0.338	-0.357
		P	0.047	0.120	0.186	0.141	0.115	0.095
Egg plant	Temp.	r	0.591**	0.503*	0.439*	0.433*	0.510*	0.529**
		P	0.003	0.014	0.036	0.039	0.013	0.010
	RH%	r	-0.343	-0.347	-0.262	-0.282	-0.282	-0.323
		P	0.109	0.105	0.228	0.192	0.192	0.133

- Numbers followed by star are significant ($P\text{-value} \leq 0.05$)

Table 6. Correlation between *T. urticae* population on cucumber & eggplant crops and (Temp.&R.H.%) during 2016 season in Fayoum Governorate.

Crops	Factor	Values	Eggs	Larvae nymphs	Adults		Total	
					♀	♂		
Cucumber	Temp	r	0.674**	0.689**	0.744**	0.618**	0.571**	0.687**
		P	0.0051	0.001	0.001	0.002	0.004	0.001
	RH%	r	0.290	0.337	0.415*	0.330	0.324	0.332
		P	0.180	0.116	0.049	0.124	0.132	0.122
Egg plant	Temp	r	0.497*	0.592**	0.619**	0.631**	0.607**	0.600*
		P	0.015	0.003	0.002	0.001	0.002	0.002
	RH%	r	0.342	0.426*	0.459*	0.422*	0.440*	0.425*
		P	0.111	0.043	0.028	0.045	0.036	0.043

- Numbers followed by star are significant ($P\text{-value} \leq 0.05$)

In this respect, (Al-sayed, 2014) studied the population fluctuation of *T. urticae* on eggplant (eggs & individuals) in summer plantations throughout season 2012 /2013 in Fayoum Governorate, Egypt and mentioned that in season 2012, insignificant negative correlation was found between the individuals of *T. urticae* and temperature ($r = -0.07$), while the correlation was insignificant positive with relative humidity ($r = 0.18$) while in season 2013, Significant negative correlation was found between the eggs of *T. urticae* and temperature ($r = -0.76^{**}$), while the correlation was insignificant positive with relative humidity ($r = 0.19$). Insignificant negative correlation was found between the indiv. of *T. urticae* and temperature ($r = -0.35$), while the correlation was insignificant positive with relative humidity ($r = 0.32$)

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الكثافة العددية لأكاروس العنكبوت الأحمر تترانيكس يورتيكا التابع لعائلة تترانيكيدي على بعض محاصيل الخضر في محافظة الفيوم

ماهر فؤاد رمضان محمود و شيرين حسن محمد صفر
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تهدف الدراسة في هذا البحث الى متابعة تعداد اطوار العنكبوت الاحمر على محصولي الخيار والباذنجان خلال عامي ٢٠١٥ و ٢٠١٦ في الفترة الزمنية من مارس الى اغسطس في محافظة الفيوم ومدى ارتباط هذا التعداد بدرجات الحرارة والرطوبة النسبية. وقد اظهرت نتائج هذه الدراسة ان اطوار العنكبوت الاحمر لم تظهر خلال شهر مارس وبدأ ظهورها في منتصف ابريل ٢٠١٥ و اخر ابريل ٢٠١٦ وقد وصلت الاطوار الى اعلي تعداد لها خلال شهر يوليو مقارنة بالشهور السابقة وذلك على محصول الخيار. اما على محصول الباذنجان فقد بدأ ظهور الاطوار في اول شهر ابريل ثم بدأ التعداد في الزيادة حتي وصل اعلي تعداد له في يوليو ٢٠١٥ اما في موسم ٢٠١٦ فقد بدأ ظهور الاطوار في اول شهر مايو ووجد انه هناك ارتباط موجب عالي المعنوية بين متوسط الحرارة ومتوسط تعداد اطوار العنكبوت الاحمر في كلا العامين.