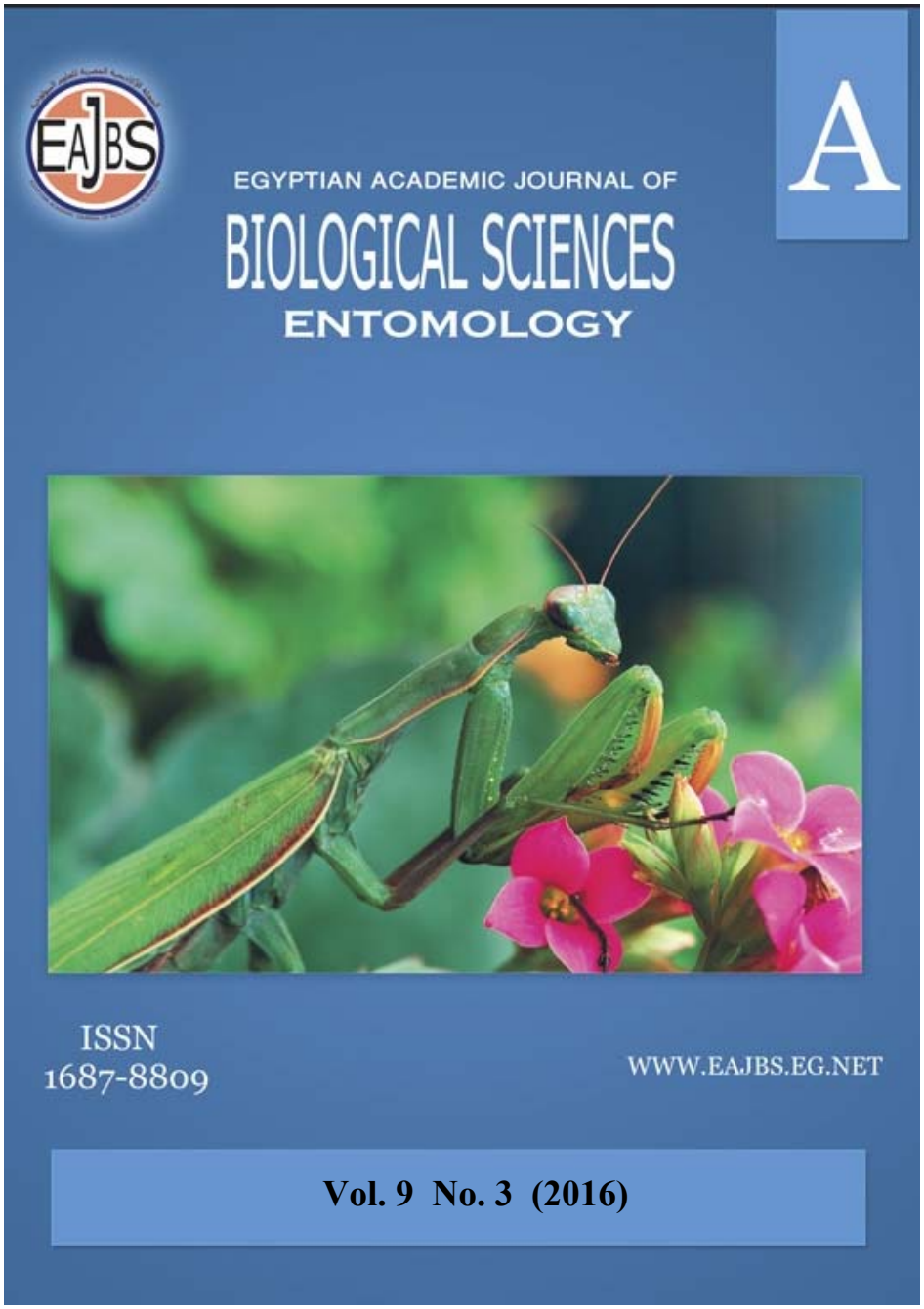

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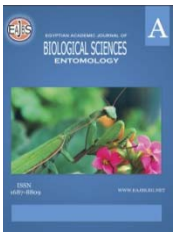

Ecological Studies of Some Mites and Associated Predaceous Mites on Eggplant at Giza, Governorate

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ABSTRACT

The phytophagous mites are common pests in agricultural systems, causing in many cases greater economic losses than other any pests.

The population fluctuation of some phytophagous and predaceous mites were determined for two successive seasons, 2014/2015 and 2015/2016 on (eggplant) at Giza, Governorate, and these mite was with relation to some weather factors (maximum, minimum temperature and relative humidity), and the predaceous mites. The population fluctuation of the phytophagous and predaceous mites was not significant positive correlation between both mites and weather temperature (Max. and Min. Temp.) during the two seasons, while for the relative humidity the correlation was negative with the phytophagous and predaceous mites during the two seasons. The predaceous mites, *Euseius scutalis*, *Typhlodromips swirskii* and *Pronematus ubiquitus* were found in relatively few numbers during January and the following months. A highly significant positive correlation was found between Tetranychidae, Eriophyidae and weather temperature (Max. and Min. Temp.). While, significant negative correlation was confirmed between mites infestation and relative humidity. Highly significant negative correlation was occurred between *Tarsonemus smithi* and weather temperature, while it was a highly positive correlation between mite infestation and relative humidity. The effect of maximum and minimum temperature on the predaceous mites showed significant effective, positive correlation between both the mites and weather temperature, while a negative correlation was confirmed between the predaceous mites infestation and relative humidity on eggplant during the two studied seasons.

INTRODUCTION

The Tetranychoidea mites are plant feeders of considerable economic importance, attacking almost major vegetable and fruit crops. They usually feed on the leaves injuring the epidermis resulting in blotching, stippling or bronzing and sometimes even accompanied by leaf full. Some of the species are most specific but majority of them are polyphagous and have a wide rang of hosts. Some of the species are known to be of great economic importance, which seriously affect the national income, as their feeding results in enormous reduction in the field of the crops.

They cause many indirect damages by transmitting several microorganisms such as viral and fungal pathogens. Their high biological attracted the attention of many Egyptian investigators (Abd El-Rahman 1996; El-Moghazy 2002; Abou-Zaid 2003; Gontijo *et al.* 2010; Farazmand *et al*. 2012 and Abou-Zaid**,** *et al*.) they tried to study various aspects of these mites including their ecology .Population fluctuation of phytophagous and predaceous mites on eggplant and The correlation between the previous infestation and some weather factors including maximum, minimum temperatures and relative humidity.

MATERIALS AND METHODS

The samples of vegetable plants are randomly collected at two weeks intervals, from different localities of Upper Egypt (Giza) Governorate. The collected samples were singly kept in tightly closed polyethylene bags with all necessary information concerning the host plant, habitat, locality and data of collection, then transferred directly to the laboratory for examination. Leaves samples were inspected directly using the stereoscopic binocular microscope. Mite's species were mounted in Hoyer's medium on slides and heated. Labels containing host plant, data of collection, locality, color of the alive individuals and scientific name were stuck on the slides. Mites were identified according to the terminology of Tenuipalpidae (Pritchard and Baker, 1958); Tetranychidae (Baker and Pritchard, 1960); Phytoseiidae (Chant, 1965); Tarsonomidae (Bear and Nvcifora, 1965); Eriophyoid (Jeppson *et al.*, 1975) and Tydeidae (Baker, 1965), (Krantz, 1978). Field population of phytophagous and predaceous mites were determined for two successive seasons (2014/2015 and 2015/2016) on eggplant, *Solanum melongena* Ness; (Fam: Solanaceae) at Giza Governorate.

Periodic samples (25 leaves per host) were randomly collected at two weeks intervals. There leaves were collected in polyethylene bags and transferred to the laboratory, then examined directly by using stereomicroscope. Estimates of mites population were based on the number of immatures and adults of phytophagous mites on 100 square inches of leaves (Moreno Vazquez, 1985) for predaceous mites, the number of all moving stages were counted.

Daily records of mean, minimum and maximum temperature and mean relative humidity throughout the investigation period, for the given locality were obtained from the metrological department. Analysis of population relationships was made through the calculation of the correlation coefficient.

RESULTS AND DISCUSION

Population fluctuation of some tetranychid and predaceous mites on eggplant was investigated throughout two seasons. Population fluctuation on eggplant showed that high population of *T. urticae* occurred in spring during March when weather temperature averaged 22.5-28.9°C and 44.5-54.0 R.H. % (Table 1).

T. ludenesis seemed to be less abundant, where its occurred in the temperature and relative humidity ranging from (29.95-34.3°C and 59.0-61.0 R.H.%) low to moderate numbers were usually noticed on eggplant at Giza Governorate during two seasons.Temperature seemed to have a positive effect on the mite reproduction.

Similar correlations between temperature and population were obtained by Pratt *el al*. (2003) who studied the population density of *T. arabicus* on eggplant. y found that the population of *T. ludeni* on aubergines increases were associated with periods

of lower relative humidity and higher mean temperatures. mentioned that, population of *T. urticae* declined abruptly on peppermint after reaching a peak density during April found that the population dynamics of the tetranychid mite, *T. ludeni* on okra appeared in the beginning of November and their peak was recorded in April Fawzy *et al*. (2004) added that there were many different factors affect on the population density of phytophagous mites other than, (predaceous mites and environmental conditions) factors.

Table 1: Mean population fluctuation of some phytophagous and predaceous mites on Eggplant, *Solanum melongena* L. at Giza Governorate during 2014/2015 season.

Date	Mean number of mites/sq. inch									Some weather factors		
	The phytophagous mites					The predaceous mites						
	Tetranychidae		Total	Eriophyidae	Tarsonemidae	Phytoseiidae		Total	Tydeidae			
	T. urticae	*T. ludenesis*		*E. neocynarae*	*T. smithi*	*E. scutalis*	*T. swirskii*		*Pronematus ubiquitus*	Max. Temp.	Min. Temp	R.H. %
28/11/2014	1.0	0.2	1.2	0.0	0.0	0.0	0.0	0.0	0.0	28.45	15.76	52.0
12/12/	0.6	0.1	0.7	0.0	0.0	0.0	0.0	0.0	0.0	24.18	13.99	60.46
27/12/	0.5	0.1	0.6	0.0	0.0	0.0	0.0	0.0	0.0	23.84	11.47	53.4
11/1/2015	1.5	0.4	1.9	0.4	1.1	0.0	0.0	0.0	0.0	20.46	9.55	59.4
26/1/	2.9	0.6	3.5	0.6	1.5	0.4	0.1	0.5	0.0	18.5	8.05	59.86
13/2/	2.7	0.4	3.1	5.87	1.2	0.2	0.1	0.3	0.1	25.08	8.63	46.06
28/2/	8.1	2.1	10.2	3.8	0.6	0.9	0.3	1.2	0.2	24.10	8.04	43.92
14/3/	33.1	17.2	40.3	1.8	0.3	2.8	0.7	3.5	4.0	28.96	14.18	47.06
26/3/	23.2	10.4	33.6	7.84	0.4	2.1	0.8	2.9	2.0	33.16	16.28	44.26
12/4/	21.55	16.2	37.75	5.4	0.1	2.2	0.9	3.1	2.0	30.02	16.23	43.6
27/4/	20.26	7.2	37.46	8.3	0.1	2.0	0.5	2.5	2.0	34.38	18.7	42.73
Total	115.41	54.9	170.31	34.01	5.3	10.6	3.4	14.0	10.3	-	-	-
Mean	10.49	4.99	15.48	3.09	0.48	0.96	0.30	1.27	0.93	-	-	-

Fisher and Mourrut (2005) found that the population of *T. urticae* was a significant increase between November and April .Concerning the mite, *Brevipalpus obovatus* Donnadieu the population dynamics on the common bean, reached to the maximum level during October. Similar conclusion was reached by Croft *et al.* (2005).

The Eriophyid mite, *E. lycopersici* was found on eggplant during the period from mid of April to the end of September and the only peak was recorded in the mid of July during the two seasons (2014/2015 and 2015/2016). The population dynamics of *E. neocynarae* on eggplant, the first count of it was found in the first of January during the two seasons, also the only peak of population of this mite occurred in the end of April at two seasons(Table 2). The obtained data are in the same harmony with on eggplant, who found that the population of *E. lycopersici* increase were associated with periods of moderate relative humidity and higher mean temperature. Who observed that the population of the trasonemid on some vegetables, temperature, rainfall, initial population and the growth condition of the food-plant influenced the rate of population increase., Onzo *et al*. (2012) found that the increase in the phytophagous mites population occurred between April and June.

The population of the predaceous mites, *Euseius scutalis* and *T. swirskii* appeared early in January, April and the beginning of September on eggplant. Some of these results are in the same direction of the studies which conducted found that the population densities of *Agistemus exsertus* Gonzalez and *Amblyseius* spp. occurred between April and October. Effect temperature factors on numbers of predatory mites could not be evaluated due to the low numbers that the relationship

between phytophagous mites and predaceous mites populations were significant only during peak population periods, usually between July and October who found that the distribution of the predaceous mite *P. persimilis* on eggplant infected by red spider mite, *T. cinnabarinus,* several times from December to January. Koller *et al.* (2007) stated that there were many different factors affect on the population density of phytophagous mites other than, (predaceous mites and environmental conditions) factors.

Table 2: Mean population fluctuation of some phytophagous and predaceous mites on Eggplant, *Solanum melongena* L. at Giza Governorate during 2015/ 2016 season.

Date	Mean number of mites/sq. inch									Some weather factors		
	The phytophagous mites					The predaceous mites						
	Tetranychidae		Total	Eriophyidae	Tarsonemidae	Phytoseiidae		Total	Tydeidae	Max. Temp.	Min. Temp	R.H. %
	T. urticae	*T. ludenesis*		*E. neocynarae*	*T. smithi*	*E. scutalis*	*T. swirskii*		*Pronematus ubiquitus*			
28/10/2015	1.9	0.5	2.4	0.0	0.0	0.0	0.0	0.0	0.0	28.52	15.91	58.66
13/11/	1.3	0.4	1.7	0.0	0.0	0.0	0.0	0.0	0.0	25.5	11.96	54.26
29/11/	2.1	0.8	2.9	0.0	0.0	0.0	0.0	0.0	0.0	23.4	10.26	56.86
12/12/	2.5	1.0	3.5	0.0	0.0	0.0	0.0	0.0	0.0	21.02	8.4	59.86
26/12/	0.06	0.0	0.06	0.0	0.0	0.0	0.0	0.0	0.0	20.63	6.35	56.8
12/1/2016	1.1	0.4	1.5	0.3	1.3	0.0	0.0	0.0	0.0	15.54	4.70	63.9
27/1	2.8	0.6	3.4	0.8	1.5	0.3	0.1	0.4	0.30	17.98	5.94	62.9
13/2	7.9	1.8	9.7	10.1	0.8	0.8	0.2	1.0	0.9	21.1	11.08	65.7
28/2/	30.0	14.3	38.0	4.8	0.5	0.3	0.1	0.4	0.35	22.5	10.56	54.32
12/3	23.0	10.7	33.7	2.1	0.4	0.3	0.0	0.3	0.25	27.49	13.02	53.46
26/3	19.0	12.6	31.6	6.0	0.6	0.25	0.0	0.25	0.20	25.42	10.86	55.66
12/4	17.1	8.0	31.4	6.2	0.2	0.1	0.0	0.1	0.15	29.95	14.11	55.26
28/4	18.0	12.4	30.4	6.3	0.1	0.26	0.0	0.26	0.20	27.20	15.05	61.0
Total	126.76	63.5	190.26	36.6	5.4	2.31	0.4	2.71	2.35	-	-	-
Mean	9.75	4.88	14.63	2.81	0.42	0.177	0.03	0.21	0.18	-	-	-

Abou-Zaid (2003) stated that the relative humidity had an important effect on the population of the Eriophyid mite inhabiting eggplant, as its role was positive. Regarding to the population fluctuation of the tetranychid mites on okra, it was found that only the predaceous mites and relative humidity has a significant role in reducing the population of these mites and relation of the maximum temperature was expressed a negatively role.

Population density studies showed that, the phytophagous mites *Tetranychus urticae* and *Tetranychus ludenesis* were the main Tetranychid mites infesting artichoke leaves throughout the two successive seasons (2014 / 2015 and 2015/ 2016). The two tetranychid mites observed from the end of November and October during the two seasons, respectively. Population reached the peak during March and April for *T. urticae* and *T. ludenesis,* respectively during the first seasons, while the peak of population occurred during the end of February and mid of April for the two species, respectively, during the second season.

The eriophyid mite, *Eriophyes neocynarae* was found in relatively few numbers during January, then, the population vibrated until it reached the peak during April at the end of two seasons. The phytophagous mite, *Tarsonemus smithi* was detected in January and reached a maximum density at the end of the same month during the two seasons.

Table 3: Correlation between the phytophagous mites population and some weather factors on Eggplant, *Solanum melongena* L. at Giza Governorate during two successive seasons.

The mites	Seasons	Factors	Simple correlation	Partial Regression	T. test	Explained
1Tetranychidae	**2014/2015**	Max. Temp.	0.784	0.616	2.34*	**32.75**
		Min. Temp.	0.658	0.541	1.93	
		R.H. %	- 0.710	0.665	2.69*	
2- Eriophyidae		Max. Temp.	0.719	0.583	2.15	**30.57**
		Min. Temp.	0.602	0.407	1.34	
		R.H. %	- 0.829	0.774	3.67**	
3-Tarsonemidae		Max. Temp.	- 0.626	0.4999	1.73	**32.71**
		Min. Temp.	- 0.761	0.580	2.14	
		R.H. %	0.274	0.401	1.27	
1-Tetranychidae	**2015/ 2016**	Max. Temp.	0.665	0.299	0.94	**36.81**
		Min. Temp.	0.765	0.294	0.92	
		R.H. %	- 0.643	0.5014	1.74	
2-Eriophyidae		Max. Temp.	0.696	0.157	0.478	**32.52**
		Min. Temp.	0.780	0.242	0.788	
		R.H. %	-0. 790	0.0814	0.245	
3-Tarsonemidae		Max. Temp.	- 0.637	0.565	2.055	**32.95**
		Min. Temp.	- 0.764	0.442	1.48	
		R.H. %	0.450	0.3818	1.242	

Max. Temp. = Maximum temperature
Min. Temp. = Minimum temperature
R.H. % = Relative humidity

The predaceous mites, *Euseius scutalis, Typhlodromips swirskii* and *Pronematus ubiquitus* were found in relatively few numbers during January and the following months.

A highly significant positive correlation was found between Tetranychidae, Eriophyidae and weather temperature (Max. and Min. Temp.). While, significant negative correlation was confirmed between mites infestation and relative humidity. Highly significant negative correlation was occurred between *Tarsonemus smithi* and weather temperature, while it was a highly positive correlation between mite infestation and relative humidity. The effect of maximum and minimum temperature on the predaceous mites showed significant effective, positive correlation between both the mites and weather temperature, while a negative correlation was confirmed between the predaceous mites infestation and relative humidity on eggplant during the two studied seasons(Table 3).

Egg plant, the phytophagous mites, *Tetranychus urticae* and *Tetranychus cucurbitacearum* appeared for the first time of infestation period in the first count during November. Population reached a maximum density in the March during the two seasons (2014/2015 and 2015/2016).

Eriophyid mite, *Eriophyes lycopersici* was the main Eriophyid mite infesting eggplant leaves throughout the two studied seasons. The first appearance of this species was occurred during the mid of April. The population of mite gradually increased until reached to its peak in the mid of July. A decline in population density occurred gradually until reached to minimum number in the end of the two seasons.

The predaceous mites, *Euseius scutalis, Agistemus exsertus* and *Pronematus ubiquitus* were associated with these phytophagous mites.

The population fluctuation of the phytophagous and predaceous mites was significant positive correlation between both mites and weather temperature (Max.

and Min. Temp.) during the two seasons, while for the relative humidity the correlation was negative with the phytophagous and predaceous mites during the two seasons(Table 4).

Table 4: Correlation between the predaceous mites population and some weather factors on Eggplant, *Solanum melongena* L. at Giza Governorate during two successive seasons.

The mites	Seasons	Factors	Simple correlation	Partial Regression	T. test	Explained variance (%)
1- Phytoseiidae	2014/2015	Max. Temp.	0.723	0.523	3.163*	32.48
		Min. Temp.	0.564	0.366	2.05	
		R.H. %	- 0.714	0.655	3.059*	
2- Tydeidae		Max. Temp.	0.674	0.718	2.738*	41.86
		Min. Temp.	0.673	0.522	2.098	
		R.H. %	- 0.563	0.546	2.04	
1- Phytoseiidae	2015/ 2016	Max. Temp.	0.479	0.230	3.002*	36.68
		Min. Temp.	0.353	0.132	1.132	
		R.H. %	- 0.332	0.138	3.056*	
2- Tydeidae		Max. Temp.	0.626	0.063	2.381	40.68
		Min. Temp.	0.666	0.0166	2.198	
		R.H. %	-0.418	0.326	2.384	

The population of phytophagous mite, *Tarsonemus smithi* begin at low level in the first count during September, then increased gradually until reached to the maximum level in the end of October during first season and reached the peak during November in the second season.

The predaceous mites *Typhlodromips swirskii* and *Euseius scutalis* were found in relatively few numbers. The peak of these mites observed in the end of October in the first season, while during the second season the peak was observed during November.

Significant positive correlation was found between both (Tetranychidae and Phytoseiidae) by weather temperature (Min. and Max. Temp.), while significant negative correlation was confirmed between mites infestation and relative humidity on egg plant during two seasons.

Insignificant negative correlation was found between (Tenuipalpidae, Tarsonemidae and Stigmaeidae) by weather temperature (Min. and Max. Temp.) and relative humidity during the two studied seasons. Relation between phytochemical components of different host plant leaves with phytophagous and predaceous mites infestation:

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ARABIC SUMMERY

دراسات بيئية لبعض ا لاكاروسات والمفترسات الاكاروسية المصاحبة لها على نبات الباذنجان فى محافظة الجيزة

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تصاحب نباتات الخضر أنواع مختلفة من الأكاروسات التي تؤثر علي إنتاجها أو خواصها – وتحتل زراعة الخضر مكانه كبيرة إذ انتشرت زراعتها لسرعة إنتاجها ووفرة ربحها. ومن أهم الخضر التي تزرع في مصر الفصيلة الباذنجانية وتتعرض الخضر للإصابة بالأكاروسات فقد كان من الضروري القيام بدراسة كثافتها العددية علي بعض من نباتات الفصيلة السابقة وهي الباذنجان وعلاقة ذلك ببعض الظروف المناخية (الحرارة العظمي والحرارة الصغرى والرطوبة النسبية). تمت دراسة الكثافة العددية وتوزيعها علي مدي عامين متتالين لبعض أنواع الأكاروسات ومفترساتها التي تتواجد علي نبات الباذنجان في محافظة الجيزة**:**أوضحت دراسة الكثافة العددية للأكاروسات النباتية ظهور النوعين ***T. cucurbitacearum*** ، ***T. urticae*** في بداية الفحص خلال شهر فبراير علي التوالي خلال الموسم الأول و الموسم الثاني. ثم تذبذب تعداد هذه الأكاروسات النباتية خلال الموسمين حتى وصل التعداد الي أعلي معدل له في نهاية شهر مارس لكل من النوعين خلال الموسم الثاني وقد انخفضت الأعداد تدريجيا بعد ذلك حتى نهاية الموسمين (2015/2014 ،2015 /2016).ظهر نوع آخر من الأكاروسات النباتية وهو الحلم الدودي ***E. lycopersici*** ابتداء من اول شهر نوفمبر وديسمبر خلال الموسمين علي التوالي. وقد ازداد التعداد تدريجيا الي أن وصل الي أعلي معدل له في شهر مارس علي التوالي خلال الموسمين أنخفض التعداد بعد ذلك حتي نهاية الموسمين.لقد تواجد علي نبات الباذنجان أكاروسات مفترسة مصاحبة للأكاروسات النباتية وهي: ***E. scutalis, Agistemus exsertus,*** ***Pronematus ubiquitus*** حيث لم تظهر هذه الأكاروسات خلال أول الفحص وكان أول ظهور لهذه الأكاروسات في نهاية شهر مارس في كل من الموسمين على التوالي.مع دراسة الظروف المناخية (الحرارة العظمي والحرارة الصغري والرطوبة النسبية) وتأثيرها علي تذبذب تعداد الأكاروسات النباتية ومفترساتها علي نبات الباذنجان وجد ارتباط غير معنوي موجب بين الحرارة العظمي والصغرى وتعداد الأكاروسات النباتية ومفترساتها بينما وجد ارتباط سالب بين الأكاروسات النباتية ومفترساتها والرطوبة علي نبات الباذنجان خلال الموسين على التوالي.