



**Ecological studies of some tomato hybrids mites at Fayoum governorate and biological aspects of tomato russet mite *aculops lycopersici* (massee)**

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**ABSTRACT**

The present study was conducted to evaluate the population densities of the mites associated with tomato hybrids and its relation with the prevailing temperature at Demo district, Fayoum Governorate, Egypt during two summer growing seasons (2017& 2018). Four mite species were found, two species were considered as phytophagous mites *Tetranychus urticae* Koch and *Aculops lycopersici* Massee, the 3<sup>rd</sup> as heterogeneous *Tydeus californicus* Banks and the 4<sup>th</sup> as predacious mite *Amblyseius cydnodactylon* Shehata & Zaher. Population densities were evaluated on three tomato hybrids, namely, Supper-gekal, 09 and El-basha. *T. urticae* only was collected during 2017 season and showed its peaks in the second week of June, first week of June, third week of May for super-Jekal, 09 and El-basha, respectively, while during 2018 season, *A. lycopersici*, *T. californicus* and *A. cydnodactylon* were collected, *A. lycopersici* peaked once during the season in first, fourth weeks of August and first week of September for super-Jekal, 09 and El-basha, respectively. Biological aspects of *A. lycopersici* on tomato hybrid (010) at 20°C and 60% R.H were studied. The periods of protolarvae and duetolarvae were recorded (1.42 and 2.5 days) and (1.28 and 2.14 days) for females and males, respectively. Longevity of females was averaged 4.78 days. The fecundity was recorded 1.6 eggs/female with 93% egg hatchability and the egg incubation period was 1.28 days.

**Keywords:** Tomato hybrids, Mites, Population densities, Biological aspects, *Aculops lycopersici*.

**INTRODUCTION**

Tomato (*Solanum lycopersicum* L.) is one of the most nutritious, economically important horticultural crop and widely consumed vegetable all over the world. Tomato is highly valuable in fresh markets and used as an important component in the making of various industrial products **Li, et al., 2018; Malafaia, et al., 2013 and FAO, 2020.** *T. urticae* (Acari: Tetranychidae) is an enormously polyphagous mite pest that has moved from more than 3,877 host

plant species and is described as an economically critical pest of at least 150 plants **Islam, et al., 2017.** Tomato (*Lycopersicon esculentum* L.) is one of the most important vegetable crops around the world. It is attacked by an array of pest arthropods, including spider mite species (Acari: Tetranychidae), especially the two-spotted spider mite, *T. urticae* and the tomato red spider mite, *T. evansi* Baker & Pritchard **Saunyama and Knapp, 2003.**

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*Tydeus californicus* is a common species in many crops around the world **Çobanoglu and Kaźmierski, 1999**. The population of *A. lycopersici* increased exponentially for six weeks after infestation. The intrinsic rate of natural increase was estimated to be 0.175 per day **Haque, 2002**. *Aculops lycopersici* usually exhibits a patchy distribution in the tomato field and the level of group aggregation mainly depends on its habits and environmental factors **Hirata, et al., 2007**. *A. lycopersici* is a significant pest of cultivated tomato cultivars and feeds on some wild tomato species and other solanaceous species, such as eggplant and nightshade **Mason and Huber, 2001**. Tomato russet mite *Aculops lycopersici* successfully developed from egg to adult stage when reared on safeera tomato cultivar at different constant temperatures and 45% RH **Metwally, et al., 2020**.

This present study aims to study the relative abundance of mites on some tomato hybrids and the effect of temperature on the seasonal abundance of these mites and biological aspects of *Aculops lycopersici* on tomato hybrid.

## MATERIALS AND METHODS

An experiment was conducted to estimate the susceptibility of three tomato hybrids (Supper-gekal, 09 and El-basha) to infestation with mites and their population fluctuation during the two successive seasons, summer 2017 and 2018 at Fayoum Governorate. For this study, 350 m<sup>2</sup> for each tomato hybrid was planted. The samples of thirty leaves were collected randomly from each tomato hybrid every week. The leaves were examined under stereo-binocular microscope in the laboratory. Stages of different mite were counted. The first inspection of plant leaves started after two weeks of seedling plantation for tomato after establishment of planting. Weekly, samples were taken in the early morning from each plot even the end of growing season and transferred in plastic bags to the laboratory of plant protection department Faculty of Agriculture. Enough individuals of mites were mounted in Hoyer's medium, and identified later using appropriate keys of classification **Zaher, 1984**. Temperatures (maximum and minimum) were obtained from meteorological station located at

Fayoum Governorate. All agricultural practices were carried out as need of the cultivated plants, except the use of pesticides.

Biological studies of *A. lycopersici* were made on tomato hybrid (010) leaves in incubator at 20°C and 60% R.H. using 20 replicates (1.5 cm in diameter) placed with upper surface down on cotton pad soaked with water in Petri dishes. Each leaf was surrounded by a cotton strip saturated with water to serve as a barrier to prevent escaping of mites. Suitable moisture maintained by adding few drops of water as needed. Leaves were changed every three days to avoid leaf deterioration and consequent malnutrition. The durations of egg, larval stages, preoviposition, oviposition, postoviposition and longevity periods were calculated, in addition to the fecundity and egg hatchability.

### Statistical Analysis:

The correlation between the population fluctuation of recorded mites and temperatures was obtained **Snedecor and Cochran, 1980**.

## RESULTS AND DISCUSSION

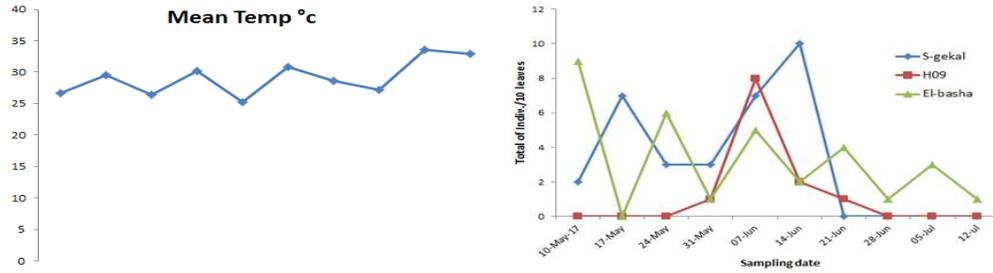
### A. Population fluctuations of *Tetranychus urticae* collected from tomato hybrids leaves during summer season 4/2017 - 7/2017:

Three tomato hybrids were planted in summer plantation during 2017 namely, Supper-gekal, 09 and El-basha. As shown in Table (1) and Fig. (1) (2&9) individuals of *Tetranychus urticae* was collected from these hybrids in 1<sup>st</sup> week of May on Supper-gekal and El-basha, while in 09 hybrid, population of *T. urticae* not observed for three weeks and began to appear in the end of May. The mites monthly average were 4, 3.75 and 0.25 indiv. /10 leaves on El-basha, Supper-gekal and 09, respectively throughout May. In June, The monthly average were 3, 4.25 and 2.75 indiv. on El-basha, Supper-gekal and 09, respectively. In July, No individual of *T. urticae* was observed

on Supper-gekal and 09 tomato hybrids while on El-basha, 4 indiv. /10 leaves were collected. Generally, In year of 2017, the populations of *T. urticae* were 32, 32 and 12 indiv. /10 leaves on El-basha, Supper-gekal and 09, respectively with mean of 3.2, 3.2 and 1.2 indiv. /10 leaves. In Supper-gekal and 09 hybrids, the mite population started in small numbers and then increased to reach its peak in June recording 10 and 8 indiv. /10 leaves on the previous hybrids respectively. On the contrary, the population of mite on El-basha hybrid started in the highest number during the year which recorded 9 indiv. /10 leaves in the first sample then decreased for the rest of the season. Insignificant negative correlation was found between mites population and temperature for three hybrids.

**Table (1): Weekly numbers of *Tetranychus urticae* collected from tomato hybrids leaves during summer plantation season 2017.**

Sampling Date	Number of mites indiv. /10 leaves			Mean Temp. °c
	Supper-gekal	09	El-basha	
10/5/2017	2	0	9	26.7
17/5	7	0	0	29.5
24/5	3	0	6	26.4
31/5	3	1	1	30.2
Monthly average	3.75	0.25	4	28.2
7/6	7	8	5	25.3
14/6	10	2	2	30.8
21/6	0	1	4	28.6
28/6	0	0	1	27.2
Monthly average	4.25	2.75	3	27.9
5/7	0	0	3	33.6
12/7	0	0	1	32.9
Monthly average	0	0	2	33.25
Total	32	12	32	
Mean	3.2	1.2	3.2	
Correlation (r)	0.187	-0.426	-0.557	



**Fig.(1) Weekly numbers of *Tetranychus urticae* collected from tomato hybrids leaves during summer plantation, season 2017.**

This result was similar to the results which obtained by **Putatunda and Tagore, 2003** they reported that temperature had direct positively impact on TSsM populations on various host plants and no relation between two spotted spider mite (TSSM) population and relative humidity. Also, this result agreement with (**Haque, et al., 2011**) they recorded that the highest number of mites per leaf observed during Aug.

#### **B. Population fluctuations of mites collected from tomato hybrids leaves during summer season 5/2018 - 9/2018:**

The population fluctuation of mites associated with three tomato hybrids in summer plantation was studied in season 2018. As shown in Table (2) *T. urticae* individuals were disappeared all over this season compared with 2017 season. *Aculops lycopersici* and *Tydeus californicus* collected from Supper-gekal, 09 and El-basha while *Amblyseius cydnodactylon* collected from 09 only. *A. lycopersici* not observed on three tomato hybrids in July but began to appear in Aug. with monthly average of 2.8, 25.4 and 1.6 indiv. /10 leaves on Supper-gekal, 09 and El-basha, respectively. While in Sept. the monthly average increased on Supper-gekal and El-basha to record 31.5 and 8 indiv. /10 leaves and reduced to 5.5 in 09. *T. californicus* started to appear in the end of July with monthly average of 0.5, 1.25 and 1.75 in Supper-gekal, 09 and El-basha, respectively. In Aug. monthly

average increased to 19.2, 18.6 and 11.2 indiv. /10 leaves respectively while in Sept. monthly average decreased in El-basha to record 3.5 indiv. /10 leaves and increased with Supper-gekal and 09 to record 28.2 and 39.5 indiv. /10 leaves. In 2018, during summer plantation the population fluctuation of *A. lycopersici* were 77, 138 and 24 indiv. /10 leaves with mean of 6.42, 11.5 and 2 indiv. /10 leaves. While *T. californicus* populations were 155, 177 and 70 indiv. /10 leaves with mean of 12.92, 14.75 and 5.83 indiv. /10 leaves on Supper-gekal, 09 and El-basha, respectively. One individual of *A. cydnodactylon* was observed on 09 tomato hybrid in Aug.

Fig. (2) showed that *A. lycopersici* was disappeared in July and reached its peak at the end of the season for three tomato hybrids. While *T. californicus* was increased rapidly till reaching its peak in Sept. for Supper-gekal, and 09 hybrids, while in El-basha hybrid, it was reached its peak in the beginning of Aug. In Supper-gekal hybrid, significant negative correlation was found between *A. lycopersici* and temperature ( $r = -0.595^*$ ), while the correlation was insignificant negative between *T. californicus* and temperature ( $r = -0.52$ ).

In 09 hybrid, insignificant negative correlation was found between *A. lycopersici* and temperature and *T. californicus* and temperature  $r = -0.257$  and  $-0.535$  respectively. In El-basha

hybrid, insignificant negative correlation was found between *A. lycopersici* and temperature ( $r = -0.531$ ), while the correlation was insignificant positive between *T. californicus* and temperature ( $r = 0.145$ ). This result agree with that recorded by **Haque, 2002** who mentioned that the population of *A. lycopersici* increased exponentially for six weeks after infestation. The intrinsic rate of natural increase was estimated to be 0.175 per day. At seven weeks after infestation, the predator, *Homeopronematus anconai* (Baker) (Acari: Tydeidae), appeared on several plants. The population of *A. lycopersici* decreased rapidly on plants where the predator appeared, due to

predation. But it decreased gradually on plants where the predator did not appear. Also, **Abou El-Saad, 2015** studied that numerical density of three phytophagous mites (i. e. *Tetranychus urticae* Koch, *Tetranychus cucurbitacearum* (Sayed) (Acari: Tetranychidae) and *Aculops lycopersici* (Masse) (Acari: Eriophyidae) inhabiting three vegetable crops squash, *Cucurbita pepo* L.; common bean, *Phaseolus vulgaris* L. and tomato, *Lycopersicon esculentum* Miller, results indicate that *T. urticae* Koch infested the three vegetable crops; *T. cucurbitacearum* (Sayed) infested squash and the common bean, while *A. lycopersici* was found only on tomato plantations.

**Table (2): Weekly numbers of mites collected from tomato hybrids leaves during summer season 2018.**

Sampling Date	Supper-gekal		09			El-basha		Mean Temp °c
	A. lycopersici	T. californicus	A. lycopersici	T. californicus	A. cydnodactylon	A. lycopersici	T. californicus	
24/6/2018	0	0	0	0	0	0	0	35
4/7	0	0	0	0	0	0	0	38
11/7	0	0	0	0	0	0	0	38
18/7	0	1	0	4	0	0	3	39
25/7	0	1	0	1	0	0	4	41
Monthly average	0	0.5	0	1.25	0	0	1.75	39
1/8	0	10	5	14	0	1	23	39
8/8	5	41	3	15	1	7	16	37
15/8	0	16	10	18	0	0	10	37
22/8	7	20	11	21	0	0	5	37
28/8	2	9	98	25	0	0	2	36
Monthly average	2.8	19.2	25.4	18.6	0.2	1.6	11.2	37.2
5/9	5	14	7	40	0	4	0	37
12/9	58	43	4	39	0	12	7	34
Monthly average	31.5	28.2	5.5	39.5	0	8	3.5	35.5
Total	77	155	138	177	1	24	70	
Mean	6.42	12.92	11.5	14.75	0.08	2	5.83	
Correlation (r)	-0.595*	-0.52	-0.257	-0.535		-0.531	0.145	

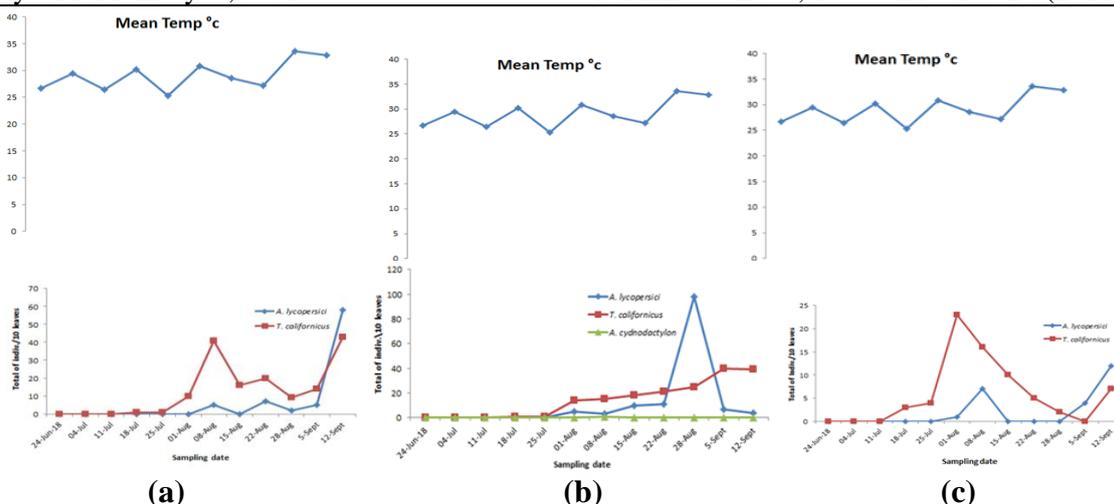


Fig.(2) Weekly numbers of mites collected from Super gekal (a), 09 (b) and El-basha (c) hybrids leaves during summer plantation, season 2018.

**C. Biological aspects of *Aculops lycopersici* on tomato hybrid (010) reared at 20°C and 60% R.H.**

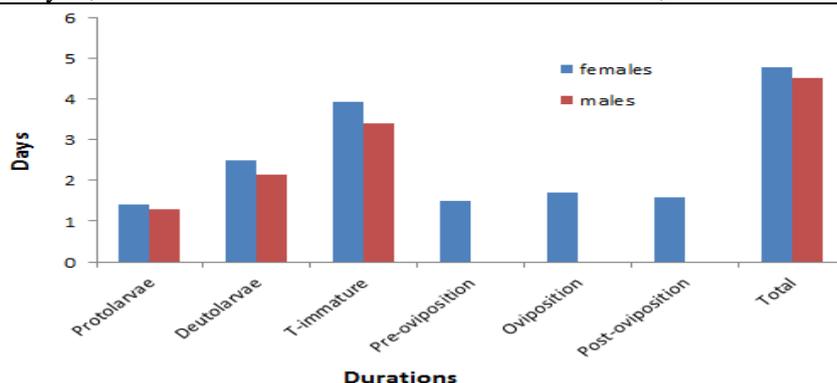
As shown in Table (3) and Fig.5, biological aspects of *A. lycopersici* on tomato hybrid (010) were illustrated as follows:

The egg incubation period was averaged of 1.28 days. The periods of protolarvae and duetolarvae were recorded 1.42 and 2.5 days for females, respectively. While

for males, the same periods were recorded 1.28 and 2.14 days respectively. Female longevity was averaged of 4.78 days, while males longevity was averaged of 4.5 days. The preoviposition, oviposition and postoviposition periods of *A. lycopersici* on tomato hybrid 010 were averaged of 1.5, 1.7 and 1.57 respectively. The fecundity of females was 1.6 eggs/female with egg hatchability of 93%.

**Table (3): Different parameters of *Aculops lycopersici* (females and males), reared on tomato hybrid (010) at 20°C & 60% R.H.**

Period (in days)	Females (Mean ±SE, Range)	Males (Mean ±SE, Range)
Incubation period	1.28± 0.1	(1-2)
Protolarvae	1.42 ±0.13 (1-2)	1.28 ±0.12 (1-2)
Deutolarvae	2.5± 0.13 (2-3)	2.14 ±0.03 (1-3)
Total immatures	3.92± 0.16 (3-5)	3.4 ±0.25 (2-5)
Pre-oviposition	1.5± 0.138 (1-2)	-
Oviposition	1.7 ± 0.163 (1-3)	-
Post-oviposition	1.57± 0.137 (1-2)	-
Total longevity	4.78 ± 0.187 (4-6)	4.5 ± 0.53 (4-6)
No. egg/ female	1.6± 0.17 (1-3)	-
Egg hatchability (%)	93%	-



**Fig.(3): Durations of *Aculops lycopersici* (females and males), on tomato hybrid (010) at 20°C & 60% R.H.**

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دراسات ايكولوجية علي الاكاروسات المرتبطة ببعض اصناف الطماطم في محافظة الفيوم والمظاهر البيولوجية  
لاكاروس صداً الطماطم *Aculops lycopersici*

آيات محمود أحمد السيد ، أشرف عبد الحفيظ رحيل ، ماهر فؤاد رمضان محمود وشيرين حسن محمد صفر  
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تم دراسة تذبذب التعداد للأكاروسات المرتبطة بنباتات الطماطم وأثبتت الدراسة وجود أربعة أنواع من الأكاروسات منهم نوعان يتغذيان تغذية نباتية هما (*Tetranychus urticae* Koch) و (*Aculops lycopersici* Masee) ، نوع واحد ذو تغذية مختلطة (*Tydeus californicus* Banks) ونوع مفترس (*Amblyseius cydnodactylon* Shehata & Zaher) وتمت الدراسة بزراعة ثلاثة أصناف من الطماطم في العروة الصيفية خلال عامي ٢٠١٧ و ٢٠١٨ وهي Supper-gekal، 09 و El-Basha. سجل نوعاً واحداً من الأكاروسات هو *T. urticae* في العروة الصيفية خلال الفترة من شهر (٤/٢٠١٧ - ٧/٢٠١٧) بينما خلال العروة الصيفية (٥/٢٠١٨ - ٩/٢٠١٨) سجلت الأنواع الأربعة السابق ذكرها على نفس الأصناف السابقة.

ونظراً لأهمية وكثرة تعداد أكاروس صداً الطماطم *Aculops lycopersici* فقد تم دراسته بيولوجياً على صنف 010 على درجة حرارة ٢٠م ورطوبة نسبية ٦٠% . وقد بلغ متوسط فترة حضانة البيض (١.٢٨ يوم) ، وسجلت متوسطات عمر (اليرقة الأولى و اليرقة الثانية) ١.٤٢ و ٢.٥ يوماً للإناث. بينما سجلت للذكور ١.٢٨ و ٢.١٤ يوماً على التوالي وبلغ متوسط فترات ما قبل وضع البيض ووضع البيض وما بعد وضع البيض (١.٥ و ١.٧ و ١.٥٧) يوماً على التوالي و كانت خصوبة الإناث ١.٦ بيضة / أنثى مع نسبة فقس البيض ٩٣٪.

**الكلمات الدالة:** الطماطم، الأكاروسات، تذبذبات التعداد ، الظواهر البيولوجية ، أكاروس صداً الطماطم.