

**BIOLOGICAL AND ECOLOGICAL STUDIES ON THE FLAT MITE
TENUIPALPUS ERIOPHYOIDES (ACARI: PROSTIGMATA:
TENUIPALPIDAE) INFESTING DATE PALM TREES IN EGYPT**

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ABSTRACT: *The tenuipalpid mites are worldwide in distribution and include several economically important pest species, about 30 genera and over 600 mite species of tenuipalpid have been described, primary in the most economically importance Tenuipalpus about 200 mite species. The flat mite, Tenuipalpus eriophyoides Baker was recorded for the first time in Egypt, whereas female and male were re-description. This mite species infesting date palm trees on the underside of leaflets in moderate numbers causing, extensive yellowing of lower leaves may be symptomatic of either –flat palm mite T. eriophyoides feeding or any of several pests or disease of palms. In this respect, biological and ecological studies were carried out to know different developmental stages and fecundity when reared on date palm leaflets Zaghloul variety under laboratory conditions. Seasonal abundance of the flat mite, T. eriophyoides infesting date palm Zaghloul and Sewi varieties in Sohag Governorate, along two seasons 2015 and 2016. Obtained data cleared that the T. eriophyoides passed through egg, larva and two nymphal stages before reaching adult. The average length of the egg stage is (13.5 & 11.2) and (11.2& 10.8 days) for female and male at 20°C and 30°C when mite reared on Zaghloul variety leaflets. 15.72 to 22.5 eggs were laid in 18.5 and 15.0 days with a daily rate of 0.85 and 1.5 eggs in the same trend. The life span lasted (63.1 & 43.7) and (44.9 & 34.3 days) for female and male, when they fed on leaflets of date palm, Zaghloul variety at 20°C and 30°C. The occurrence and seasonal abundance of the flat spider mite T. eriophyoides infesting data palm trees, zaghloul and Sewi varieties was investigated during the period from May to mid Nov. in 2015 and 2016. The population started in few numbers in May, then increased to its, peak in August on both varieties, also, data showed that Sewi variety had the higher infestation than zaghloul variety. In general season 2016 was high level infestation than season 2015, due to climatic factors.*

Key words: *Biology, Ecology, Tenuipalpus eriophyoides, date palm trees.*

INTRODUCTION

Date palm (*Phoenix dactylifera* L.) is considered one of the most crops that have a unique status. Many important industries have been initiated on dates and are considered the main income of many inhabitants, palm date fruits produced in Egypt are considered the best date fruit varieties which can be exported to foreign markets provided that the product quantities are most satisfactory being free of different pests

infestation and any residues of pesticides.

Date palm trees observed to be severely affected by different injurious mites and insects infestation. The phytophagous mites especially those belonging to families; Tenuipalpidae and Tetranychidae, which are constitute considerable agriculture problems to orchards crops.

The Tenuipalpid mites are world-wide in distribution and include several economically important pests, whereas, family Tenuipalpidae include about 30 genera and over 600 mite species have been described, 300 spp of *Brevipalpus* and 200 spp of *Tenuipalpus*. These mite species feed on stems, fruits, flowers and leaves (often on the lower surface) Mesa *et al.* (2009), Khanjani, *et al.* (2012).

In Egypt, members of genera *Brevipalpus*, *Cenopalpus*, *Tenuipalpus* are the most important as they constitute the major pests to various fruit trees. The false spider mites infest several horticultural crops, grasses and wild plants all over the world. Zaher and Yousef (1972), Zaher and Shehata (1971) and El-Halawany (2013), Zaher (1984), Zaher *et al.* (1974).

Date palm is a multi-purpose tree, being highly regarded as a national heritage in many countries. It provides food, shelter timber products and all parts of the palm can be used. Because of these qualities, and its tolerance to harsh environmental desert conditions areas under cultivation have increased tremendously in recent years. Improvement in marketing and export efficiency are properties for date palm growers.

The present study aims to through the light on some biological aspects of the developmental stages of the flat mite, *Tenuipalpus eriophyoides* under laboratory conditions of 20 & 30°C and 65% R.H. , as well as to study the seasonal abundance of the flat mite *T. eriophyoides* infesting Zaghloul and Sewi date palm varieties in Sohag Governorate, Egypt during two seasons 2015 and 2016.

MATERIALS AND METHODS

1- Biological studies on the flat mite, *Tenuipalpus eriophyoides*

Baker were carried out under laboratory conditions:

Mites were collected directly from a farm of date palm trees, Zaghloul variety and transferred to laboratory to make sure of its identification. The flat mite, *T. eriophyoides* was reared successfully on leaflets of date palm, Zaghloul variety under laboratory conditions, at 20°C and 30°C & 65% R.H. to study the biological developmental stages and fecundity.

Pure Culture of the flat mite *T. eriophyoides*:

Stock culture was maintained at the laboratory, whereas, new hatching larvae were transferred singly to leaf disk (1.0cm diameter) and left to continue its developmental stages and life span.

Thirty replicates were examined twice daily early morning and before sunset. The duration of different stages and deposited eggs were recorded.

2- Ecological studies on the flat mite *I. eriophyoides* infesting date palm (Zaghloul and Sewi) varieties in Sohag Governorate:

An area of two feddans in Sohag Governorate cultivated with date palm; Zaghloul and Sewi varieties, one feddan for each variety. Samples of 60 leaflets were collected bi-weekly from four trees 15 leaflets for each tree for each variety, these samples were transferred to the laboratory for examination using Stereomicroscope in Shandaweel Agricultural Research Station, Agric, Res. Center (ARC) in the same day.

The population fluctuation of different motile stages of the flat mite, *Tenuipalpus eriophyoides* were recorded during the period study; from May to mid November 2015 and 2016 seasons.

Mites were collected using a fine hair brush under dissection Stereomicroscope then preserved in 70% ethanol, selected mites cleared in Nesbitt

solution for about 10-12 minutes. Subsequently, mites were mounted on micro-slides in Hoyer's medium and later dried at 40°C for one week (Zhang, 2003). The terminology used in the keys followed; Lindquist (1985), and Mesa *et al.* (2009), Zaher, 1984 and Meyer, 1987.

Statistical analysis :

The statistical analysis (ANOVA) of the obtained results were performed using SAS program (SAS) Institute (1988).

RESULTS AND DISCUSSION

Date palm (*Phoenix dactylifera L.*) is one of the oldest cultivated trees and an economically crop, widely cultivated in Egypt and many Arabian countries for its quality of taste fruit production.

The date palm and its fruits are subjected to attacks by several insects and mites that are in most cases well adapted to the environment factors. Date palm trees were observed to be severely affected by different injurious mites, which cause considerable damage and lead to economic losses.

The tenuipalpid mites are worldwide, in distribution they are phytophagous, species and several are pests of crops. Mesa *et al.* (2009), Khanjani *et al.* (2012).

The flat mite, *Tenuipolpus eriophyoides* Baker was recorded for the first time in Egypt, whereas, female and male were re-described by Mohamed *et al.* (2014). This mite species was found infesting date palm trees on the lower sides of leaves near the veins causing a great damage and losses.

1- Biological studies on the flat mite *T. eriophyoides* under laboratory conditions:

The flat mite, *T. eriophyoides* reared on leaflets of date palm, Zaghloul variety at 20 & 30°C and 65% R.H. to through light on biological developmental stages

and the effect of temperature degrees on its biology, fecundity and life span.

As shown in Table (1) and Fig. (1) the obtained results revealed that the false spider mite, *T. eriophyoides* develop through; egg, larva, protonymph and deutonymph before reaching adult stages (female or male). Also, the developmental rates of all mite stages are strongly influenced by temperature degrees. This fact has documented for different mite species Taha *et al.* (2010) , Zaher *et al.* (1974), Zaher *et al.* (1969), Carey and El-Baradley (1982).

Biological aspects:

Incubation period: The obtained results in Table (1) indicated that the incubation period varied with different temperature degrees ranging from (13.5 ± 0.51) to (11.2 ± 0.39 days) for female and (11.2 ± 0.44) to (10.8 ± 0.39 days) for male, when both female and male fed on leaflets of date palm, Zaghloul variety under laboratory conditions of 20°C, 30°C and 65% R.H.

Total immature stages: Female and male immature stages; larva, protonymph and deutonymph of the false spider mite *T. eriophyoides* were significantly affected by temperature degrees, whereas, the female and male total immature stages lasted (23.8 ± 0.95 & 17.3 ± 0.47 days) at 20°C, while at 30°C lasted (13.75 ± 0.44 & 9.9 ± 0.24 days) at the same trend. These results coincided with that obtained by Hassan *et al.* (2013) and Abbassy *et al.* (2012).

Life cycle: The mean duration of life cycle for individuals of the flat mite, *T. eriophyoides*, whereas hot and dry weather accelerate the life cycle of spider mites. (Haile and Higley, 2003). Therefore, high temperature provided in the laboratory could be a reason for shorter developmental time of *T. eriophyoides*, observed in the current investigation, whereas, rearing the mites at high

temperature (30°C) shortened its developmental time and was suitable for its populations to grow dramatically faster than at low temperature (20°C).

Female life cycle being the shortest at 30°C (24.95 ± 0.24 days), while, at 20°C it lasted (37.3 ± 1.17 days).

Table (1): Duration of different stages of the flat mite *Tenuipalpus eriophyoides* when reared under laboratory conditions at 20 °C & 30 °C and 65 %R.H. (in days)

Stage	20 °C		30 °C		L.S.D.1%	
	Female	Male	Female	Male		
Egg	13.5 ± 0.51a	11.2 ± 0.44 b	11.2 ± 0.39 b	10.8 ± 0.39 c	0.40	
Larva	A	3.8 ± 0.39 a	3.0 ± 0.00 b	2.15 ± 0.34 c	1.6 ± 0.49 d	0.33
	Q	2.9 ± 0.24 a	2.4 ± 0.51 b	2.1 ± 0.33 b	1.19 ± 0.40 c	0.35
Protonymph	A	4.5 ± 0.51 a	3.6 ± 0.49 b	2.3 ± 0.49 c	1.4 ± 0.51 d	0.46
	Q	3.6 ± 0.50 a	1.8 ± 0.44 b	2.1 ± 0.33 b	1.4 ± 0.51 c	0.41
Deutonymph	A	5.2 ± 0.44 a	4.5 ± 0.51 b	2.6 ± 0.51 c	1.8 ± 0.39 d	0.42
	Q	3.8 ± 0.39 a	2.0 ± 0.00 c	2.5 ± 0.51 b	2.1 ± 0.33 c	0.33
T. Immatures		23.8 ± 0.95a	17.3 ± 0.47 b	13.75 ± 0.44c	9.9 ± 0.24 d	0.53
Life cycle		37.3 ± 1.17a	28.5 ± 0.51 b	24.95 ± 0.24c	20.9 ± 0.24d	0.60
Life span		63.1 ± 0.22 a	43.7 ± 0.45 c	44.9 ± 0.22 b	34.3 ± 0.45 d	0.65

A = Active stage Q = Quiescent stage L.S.D. = Least significant difference at 0.01 Means in each row followed by the same letter are not significantly different at 1% level.

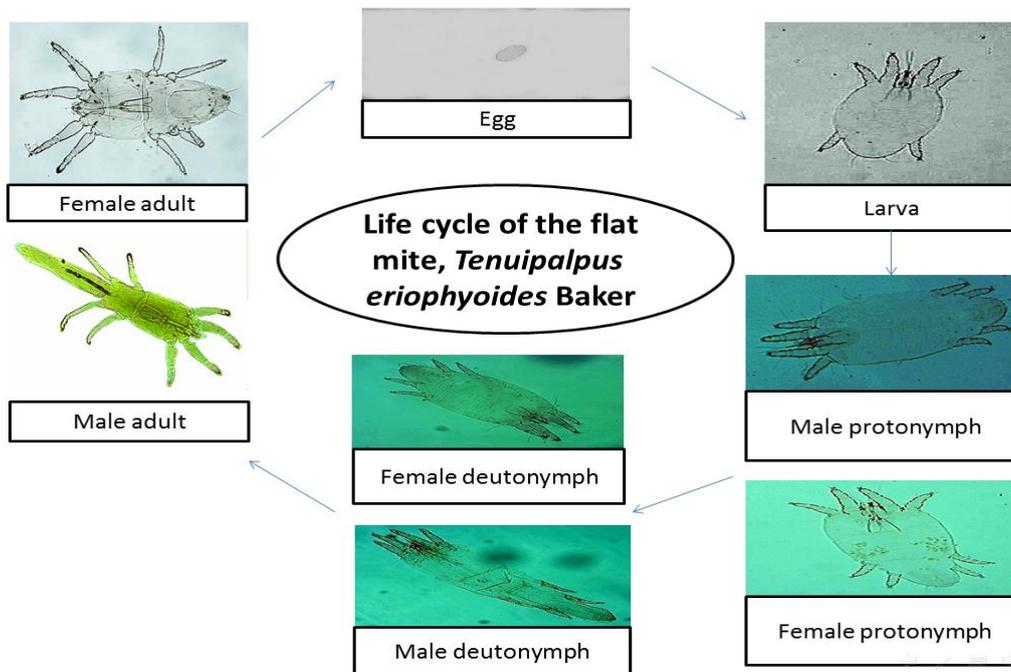


Fig. (1): Life cycle of the flat mite, *Tenuipalpus eriophyoides* Baker

Generation period: The generation period of both adult stages was affected by temperature degrees, whereas, this period was elongated with low temperature compared with that at high temperature degrees.

Longevity: Female longevity was significantly affected by temperature whereas, longevity prolonged to (25.75 ± 0.84 days) at 20°C, while, 30°C this period decreased to (19.95 ± 0.22 days).

Female fecundity (Table 2) increased as well as temperature increased, whereby, female oviposition period lasted (18.5 ± 0.50 days) and deposited an average of (19.72 ± 0.45 eggs) with a daily rate of 0.85 eggs, at 20°C, while at 30°C female deposited an average of (22.5 ± 0.50 eggs) during (15.0) days of the oviposition period with a daily rate of 1.5 eggs.

These results agree with that obtained by Taha *et al.* (2010), Abbassy *et al.* (2012) and El-Halawany (2013). They mentioned that biological developmental stages, fecundity and life table parameters of mites affected by different types of food and temperatures.

2- Seasonal abundance of the flat mite *T. eriophyoides* infesting Zaghloul and Sewi varieties of date palm in Sohag Governorate, Egypt during two seasons 2015 & 2016.

The Tenuipalpid mites are sensitive to arid conditions, usually preferring to feed on the lower surface of leaves near the veins at protected sides on fruits. In general, the false spider mite, *Tenuipolpus eriophyoides* was found infesting both date palm varieties, Zaghloul and Sewi all over the season, but definite trends in populations fluctuations were observed. The population trends were almost different on two date palm varieties, whereby, the

population density of mite individuals were relatively higher in Sewi variety, than Zaghloul variety.

As shown in Table (1) and illustrated in Figs (1 and 2), the obtained data cleared that the initial infestations of the flat mite, *T. eriophyoides* recorded from the beginning of May on both tested varieties, with low population densities, whereas, Zaghloul variety aggregated (15 & 24) mites 15 inches during the seasons 2015 and 2016 seasons, while Sewi variety harboured (42 and 33) mites/ 15 sq. inches at the same trend.

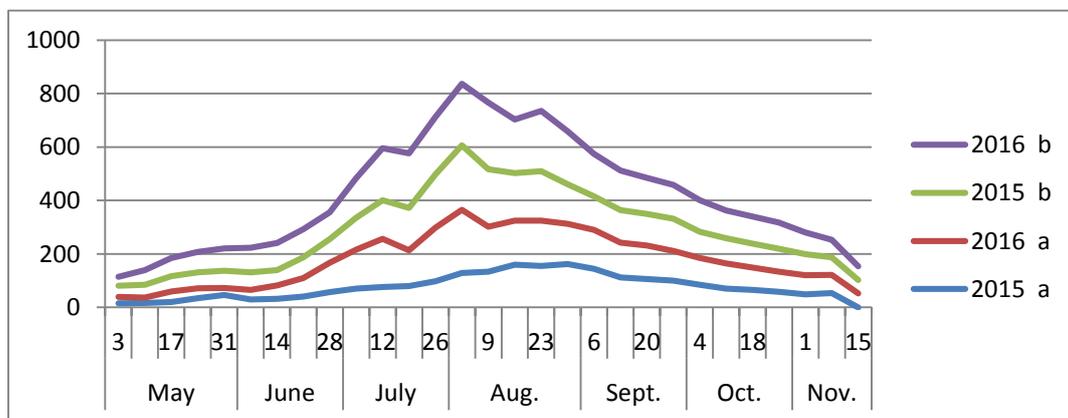
The population fluctuation was noticeably increased until reached its peak during the first week of August for Zaghloul variety during 2015 and 2016 seasons, while, Sewi variety reached its peak at the first and second week of August 2013 and 2016 seasons. These results coincided with that obtained by El-Sanady and Mohamed (2013), they mentioned that phytophagous mites infesting date palm trees population reached its peak during mid of August and high on Sewi than Zaghloul variety.

The population fluctuation of the flat spider mite, *T. eriophyoides* (Table 3) decreased gradually till reached its minimum rates at mid of November during 2015 and 2016 season, with an average total (2241 & 3022 mites) for Zaghloul variety and (3190.0 & 3369.0 mites) for Sewi variety during 2015 and 2016 seasons, with on average of 80.03 and 07.9 for Zaghloul variety and 113.9 and 134.6 mites for Sewi variety 2015 and 2016 seasons. The obtained results showed that Sewi variety more susceptible to the flat mite, *T. eriophyoides* infestation than Zaghloul variety. These results agree with that obtained by El-Sanady and Mohamed (2013).

Table (2): Adult female of *Tenuipalpus eriophyoides* longevity and fecundity when reared under laboratory conditions at 20° C ± 2°C and 30° C ± 2°C , 65 % R.H.

<i>Tenuipalpus eriophyoides</i> Female		at 20°C	at 30°C	L.S.D at 0.01
Average duration (days)	Pre oviposition Period	3.25 ± 0.50 a	2.15 ± 0.45 b	1.01
	Oviposition period	18.5 ± 0.50 a	15.0 ± 0.00 b	0.75
	Post oviposition Period	4.0 ± 0.00 a	2.8 ± 0.45 a	1.10
Longevity (Days)		25.75± 0.84 a	19.95 ± 0.22 b	1.03
Fecundity	Egg / Female	15.72 ± 0.45 b	22.5 ± 0.50 a	1.01
	Daily Rate	0.85 ± 0.22 a	1.5 ± 0.50 a	0.82

Means in each row followed by the same letter are not significantly different at 5% level.



a = Zaghloul variety

b = Sewi variety

Fig. (2): Seasonal abundance of the flat mite, *T. eriophyoides* infesting Zaghloul and Sewi varieties in Sohag Governorate during 2015 and 2016 seasons.

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Table (3): Seasonal abundance of the flat mite *Tenuipalpus eriophyoides* infesting date palm trees in Sohag Governorate during 2015 and 2016 seasons.

Inspection date	Zaghloul variety		Sewi variety		
	2015	2016	2015	2016	
May	3	15	24	42	33
	10	17	20	48	54
	17	20	40	57	68
	24	35	37	59	77
	31	47	26	64	84
June	7	30	35	66	92
	14	32	50	58	101
	21	40	70	77	105
	28	57	110	88	100
July	05	70	146	119	148
	12	76	181	144	195
	19	80	134	158	204
	26	98	200	199	215
Aug.	02	162	236	241	230
	09	133	169	215	249
	16	160	165	177	201
	23	155	170	185	225
	30	129	150	148	199
Sept.	06	144	146	125	159
	13	112	130	122	148
	20	106	125	118	135
	27	100	111	121	126
Oct.	04	85	100	98	118
	11	70	95	94	104
	18	65	84	89	102
	29	58	76	85	98
Nov.	01	49	72	78	81
	08	54	68	65	66
	15	-	52	50	52
Total	42	2241	3022	3190.00	3369.00
Mean	-	80.03 ± 46.6 a	107.9 ± 58.5b	113.9±54.14a	134.6±61.1a
L.S.D.		28.08			

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دراسات بيولوجية وإيكولوجية على الحلم المبطط (Acari: Actenidida: Tenuipalpidae, *Tenuipalpus eriophyoides* الذي يصيب أشجار النخيل في مصر

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الملخص العربي

تعتبر العناكب الكاذبة *Tenuipalpid mites* من أكبر المجموعات انتشاراً على مستوى العالم وتضم العديد من الأنواع الاقتصادية الهامة كآفات زراعية والتي تسبب خسائر كبيرة للمحاصيل المختلفة وتضم عائلة *Tenuipalpidae* 30 جنساً تشمل أكثر من 600 نوع منها جنس *Tenuipalpus* الذي يضم حوالي 200 نوعاً.

ويعتبر الحلم المبطط *Tenuipalpus eriophyoides* Baker الذي سجل لأول مرة في مصر عام 2014 على أشجار النخيل بمحافظة سوهاج من الأنواع الهامة والتي تسبب إضراراً اقتصادية هامة حيث يتغذى على العصارة النباتية للأوراق ويتواجد على السطوح السفلية لها.

لهذا أجريت دراسات بيولوجية تحت ظروف معملية للتعرف على التطور والتكاثر ، كما تم دراسة التواجد للأفراد على صنفين من أشجار النخيل الزغلول والسيوي بمحافظة سوهاج في الفترة من مايو إلى منتصف نوفمبر خلال موسمي 2015 و 2016.

أوضحت الدراسة البيولوجية أن هذا النوع يمر بمراحل البيضة ثم اليرقة ثم طوري الحورية قبل الوصول للحيوان الكامل عند تربيته على أوراق الصنف الزغلول عند درجتي حرارة 20، 30°م ورطوبة نسبية 65%.
أوضحت النتائج أن متوسط فترة حضانة البيض (11,2 & 13,5 يوماً) و (10,8 & 11,2 يوماً) لكل من الأنثى والذكر عند 20°م و 30°م على الترتيب.

كما أن متوسط وضع البيض للأنثى 15,72 و 22,5 بيضة للأنثى عند 20 و 30°م خلال فترة وضع البيض 18,5 و 15,5 يوماً واستغرقت دورة الحياة الكاملة للإناث والذكور بمتوسط (43,7 & 63,1) و (34,3 & 44,9 يوماً) على الترتيب .

أما عن نتائج التواجد الموسمي للأفراد على الصنفين الزغلول والسيوي خلال فترة الدراسة من مايو إلى منتصف نوفمبر خلال عامي 2015 و 2016، فقد بدأت الأعداد قليلة ثم ازدادت تدريجياً إلى الذروة في منتصف أغسطس ، كما أوضحت الدراسة أن الصنف السيوي أعلى إصابة من الزغلول ، كما أن مستوى الإصابة في الموسم الثاني 2016 كان أعلى منها في الموسم الأول 2015 وهذا يرجع إلى العوامل المناخية من الحرارة والرطوبة.

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