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Some Biological Aspects of Two-Spotted Spider Mite, *Tetranychus urticae* Koch on Three Leafy Vegetable Crops

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ABSTRACT

In this laboratory study, development and reproduction rates of the two spotted spider mite *Tetranychus urticae* Koch were assessed when reared on leaves of three leafy vegetable crops in Egypt: jew's mallow *Corchorus olitorius* L., lettuce *Lactuca sativa* L. and malva *Malva sylvestris* L. at 27 ± 3 ºC and 70 ± 5% R.H. to determine their suitability as hosts for this pest. The tested plants were markedly differed in their suitability as hosts for *T. urticae*. The most favorable host plant was jew's mallow followed by lettuce and malva. Duration of the total developmental time from egg to adult was significantly ($P \leq 0.05$) shorter on jew's mallow, while this period was relatively longer on lettuce and malva. The greatest numbers of laid eggs were counted on jew's mallow, while malva recorded the lowest numbers. These outcomes indicated that, *T. urticae* may be considered as important pest on these studied crops. Host plant species is one of the variables affecting characteristics of population growth of this mite pest.

KEYWORDS: Two-spotted spider mite, leafy vegetables, jew's mallow, lettuce, malva

1. INTRODUCTION

Spider mites of the family Tetranychidae are considered as important damaging acarine pests of crop plants. The major tetranychid species attacking many agricultural crops including vegetables all over the world is the two-spotted spider mite *Tetranychus urticae* Koch (Helle and Sabelis, 1985). Host plant quality is one of the important aspects affecting population growth of tetranychid species (Boaping et al., 2004; Adango et al., 2007; Wekesa et al., 2011; Karami-Jamour and Shishehbor, 2012; Riahi et al., 2013; Modarres Najafebadi et al., 2014; Gomes Neto *et al*., 2017; Castro et al., 2018 and Basha et al.,2020). Jew's mallow, *Corchorus olitorius* L.; lettuce, *Lactuca sativa* L. and malva, *Malva sylvestris* L. are of the most grown and consumed leafy vegetables in Egypt. They are susceptible to infestation by *T. urticae* in the field. Nothing is known about the preference of these leafy vegetables to this mite. The purpose of this research was to

determine host suitability of jew's mallow, lettuce and malva for *T. urticae* by studying development and reproduction of this pest in the laboratory.

2. MATERIALS AND METHODS

Laboratory cultures of the two-spotted spider mite *T. urticae* were separately initiated on each of the tested leafy vegetables *i.e.*, jew's mallow, lettuce and malva according to Pontier et al., (2000), under laboratory conditions of 27±3 and 70±5% R.H. Individuals of *T. urticae* were collected from infested common bean field located in Kom-Hamada district, El-Beheira governorate. The mite was fed on fresh leaf discs of the tested vegetables (one inch in diameter each), put singly with the lower surface up on a cotton pad soaked in water in open petri dishes. To prevent mites from escaping, a cotton strip soaked in water was wrapped around each disc. Every day, appropriate moisture was maintained by adding a few drops of water as needed. Mite individuals moved to new discs when the discs were deteriorated. For each crop, 25 mated females were moved separately and put singly on 25 leaf discs to lay eggs for 12 hours. The next period of egg laying, females and extra eggs were transferred, leaving one egg on a leaf disc. The deposited eggs were reared to maturity, passing through all developmental stages. Twice a day, leaf discs were inspected under a stereomicroscope, and the duration of each developmental stage was recorded.

Longevity and reproduction of *T. urticae* were investigated according to Razmjou et al., (2009). Females in the teleiochrysalis stage were separated individually and put for mating with an adult male on leaf discs. Rearing unites were checked and the quantity of deposited eggs per female was counted daily until all females died. When necessary, new leaf discs were substituted for old ones. The F test was used for statistical analysis of the obtained data according to Snedecor and Cochran, (1980).

3. RESUTS AND DISCUSSION

The two-spotted spider mite *T. urticae* was able to develop successfully from egg to adult when fed on leaves of the investigated vegetable crops in the lab at 27 ± 3 ºC and 70 ± 5% R.H. The durations of development for every stage are given in Table (1). The rapid development of *T. urticae* was recorded on jew's mallow leaves, where it required significantly ($P \leq 0.05$) shorter time (11.40 days) to complete life cycle. These values on leaves of lettuce and malva were relatively longer and averaged 12.15 and 12.65 days, respectively (Table 1). Awad (2013) reported that the life cycle of this mite species durated in 11.92 and 11.98 days when feeding on leaves of persimmon and pear, respectively. Feeding of *T. urticae* on eggplant, tomato and pepper leaves at 27±4ºC and 70±4 % R.H., the life cycle durated 11.03; 11.56 and 12.00 days, respectively.

Table 1. Average duration periods (days) of the developmental stages of *T. urticae* reared on leaves of three leafy vegetable crops at 27±3ºC, and 70±5%R.H.

Parameter	Crop			L.S.D
	Jew's mallow	Lettuce	Malva	0.05
Egg	4.25 ± 0.112 a	4.15 ± 0.061 a	4.30 ± 0.122 a	0.314
Larva	2.50 ± 0.158 b	2.85 ± 0.15 ab	2.95 ± 0.050 a	0.398
Protonymph	1.90 ± 0.061 b	2.05 ± 0.05 ab	2.15 ± 0.061 a	0.178
Deutonymph	2.75 ± 0.112 b	3.10 ± 0.061 a	3.25 ± 0.079 a	0.267
Total immatures	7.15 ± 0.170 b	8.00 ± 0.177 a	8.35 ± 0.127 a	0.491
Egg to adult	11.40 ± 0.127 b	12.15 ± 0.170 a	12.65 ± 0.232 a	0.559

Means in rows with the same letter do not differ significantly at the 0.05% probability level according to Duncan's multiple range test(Duncan, 1955). Standard Error, ± (SE).

As indicated in Table (2) plant species gave a major impact on time required by *T. urticae* female to complete generation. This time durated a markedly longer time when the mite fed on malva leaves (14.45 days). Rearing on jew's mallow leaves shortened the generation period (12.50 days). Similar findings were published by Hanna et al., (1981), who demonstrated that when the female mite was fed on the soybean cultivars Hampton

Table 2. Average duration periods (in days) of various adult female of *T. urticae* when reared on leaves of three leafy vegetable crops at 27±3 ºC and 70±5% R.H.

Period	Crop		
	Jew's mallow	**Lettuce**	**Malva**
Pre-oviposition	1.10±0.100 b	1.70±0.122a	1.80±0.122 a
Generation	12.50 ± 0.079 c	13.85 ± 0.257 b	14.45 ± 0.184 a
Oviposition	12.10± 0.187 a	9.70± 0.122 b	8.50± 0.224 c
Post- oviposition	2.65±0.187 a	2.30±0.200 a	2.25±0.158 a
Longevity	15.85±0.218 a	13.70±0.255 b	12.55±0.374 c
Life span	27.25 ± 0.237 a	25.85 ± 0.392 b	25.20 ± 0.215 b

Means in rows with the same letter do not differ significantly at the 0.05% probability level according to Duncan's multiple range test(Duncan, 1955). Standard Error, ± (SE).

and Gacson at 27±4ºC, the generation period of *T. urticae* averaged 11.38 and 11.43 days, respectively. Boaping et al., (2004) showed that generation period of the tetranychid species *Tetranychus truncatus* at 28ºC. completed in 9.30, 9.60 and 11.60 days when mite reared on kidney bean, soybean and maize leaves, respectively. The time of generation durated 13.64 and13.93 days when *T. urticae* reared on soybean and cowpea leaves, respectively (Abdelaal et al., 2015).

The average durations of pre-oviposition, oviposition and post- oviposition periods as well as longevity and life span of *T. urticae* fed on jew's mallow, lettuce and malva leaves under the aforementioned laboratory conditions are given in Table (2).

The tested plants varied in their effect on *T. urticae* adult female life span and longevity. The longest values of life span and longevity of female mite were resulted when feeding on jew's mallow leaves (27.25 and 15.85 days), while malva and lettuce recorded a relatively lower values (Table 2). According to Gotoh (1986), the total longevity of tetranychid species *Tetranychus vinnensis* averaged 17.58 days when female of mite fed on leaves of deciduous oak at 25ºC. When comparing our data with those published in the literature, some differences were detected. For example, Chahine, et al. (1994) showed that *T. urticae* female live 11 days at 22ºC. when reared on leaves of common bean. Also, Shehata (2010) showed that *T. urticae* life span averaged (34.53 days) when mite reared on the leaves of soybean at a temperature of 27±2 ºC, which was greater than our obtained results.

The duration of oviposition and pre-oviposition (the time between maturation and the first deposited egg) on the tested vegetables was short with average ranged between 1.1 days on jew's mallow to 1.8 days on malva (Table 2). A female fed on leaves of jew's mallow continued laying eggs for a noticeably longer time (12.10 days), and deposited distinctly higher number of eggs (49.40 eggs), with the greatest daily mean of oviposition (4.08 eggs/day) per female (Table 3).

Table 3. Fecundity of *T. urticae* female when reared on leaves of three leafy vegetable crops at 27±3 ºC and 70±5% R.H.

Crop	No. deposited eggs / female	
	Total average	**Daily mean**
Jew's mallow	49.40 ± 0.400 a	4.08 ± 0.038 a
Lettuce	29.40 ± 0.748 b	3.04 ± 0.102 b
Malva	23.20 ± 0.490 c	2.74 ± 0.114 c

Different letters in each column indicate significant differences (P≤0.05) between treatments according to Duncan's multiple range test(Duncan,1955).Standard Error, ± (SE).

Before death, the adult female of *T. urticae* stopped laying eggs for an average of 2.25, 2.30 and 2.65 days on malva, lettuce and jew's mallow, respectively (Table 2). Similarly, Basha et al., (2020) mentioned that female of *T. urticae* laid greater number of eggs (40.40 eggs) in the first five days of the oviposition period when reared on jew's mallow leaves.

Greater number of deposited eggs (69.83 and 58.66 eggs) by *T. urticae* female was resulted when reared on leaves of common bean and soybean, respectively (Abd-Elaal, 2015). Moreover, Chahine et al., (1994) showed that female of this mite species deposited 55.20 eggs as a total average when reared at 22ºC on leaves of common bean. Gotoh (1986) showed that the adult female of *T. viennensis* fed on deciduous oak leaves at 25 ºC deposited 43 eggs during the period of oviposition (15.09 days), with a daily rate of 3.02 eggs, and died during a day or two after completing oviposition. When *T. urticae* females fed on eggplant leaves at 27±2 ºC, it laid 61.13 eggs as a total average with a daily rate of 5.49 eggs per day.

4. CONCLUSION

On the basis of the present data, this study clearly indicated that, *T. urticae* was regarded as a damaging pest attacking a wide variety of vegetable crops including jew's mallow, lettuce and malva. They are commonly grown and considered as important popular leafy vegetables in Egypt. The tested leafy vegetables differed significantly ($P \leq 0.05$) in their suitability as hosts for this serious pest in terms of development and reproduction rates. Jew's mallow was found to be the most favorable host, followed by lettuce, making it suitable for predator mass rearing, especially for phytoseiid species. On the other hand, malva was the least favorable host plant requiring further studies to determine the factors that adversely affect the build-up of T. *urtica* populations.

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6. REFFERENCES

Abd-Elaal DM (2015). Studies on some mite species associated with certain leguminous plants at Sharkia governorate. M.Sc. Thesis, Fac. Agric., Zagazig Univ. Egypt. 94 pp.

Abdelaal D M, Mostafa EM, Hendawi MY and Basha AE (2015). Bio-ecological studies on the two-spotted red spider mite, *Tetranychus urticae* koch on some leguminous crops at Sharkia Governorate, Egypt. Zagazig J. Agric. Res., 42(2): 323-332.

Adango E, Onzo A, Hanna R, Atachi P and James B (2007). Mite pests of major importance on indigenous leafy vegetables in Benin: the search for appropriate control strategies. Acta Hort., 752: 311-317.

Awad SE (2013). Studies on some mites associated with certain deciduous fruit trees at Sharkia Governorate. M.Sc. Thesis, Fac.Agric., Zagazig Univ. Egypt. 101pp.

Baoping P, Xiaorong Z, Li S and Hongbo M (2004). Performance of *Tetranychus truncatus* Ehara (Acarina: Tetranychidae) reared on different host plants. Acta Entomologica Sinica. 47(1): 55-58.

Basha HA, Mostafa Em and Eldeeb AM (2020). Suitability of three vegetable crops for development and reproduction of *Tetranychus urticae* Koch (Acari: Tetranychidae). J. Bioscience Res. 17(2): 1176-1182.

Castro BM, Soares MA, Andrade VC, Santos-Junior VC, Fontes PC, Wilkens CF, Serrao JE and Zanuncio JC (2019). Preference of red mite *Tetranychus ludeni* Zacher (Acari: Tetranychidae) to sweet potato genotypes. Braz. J. Biol., 79(2): 208-212.

Chahine H, Aslam M and Michelakis S (1994). Longevity and fecundity of two-spotted spider mite *Tetranychus urticae* Koch on vegetables. Pakistan Journal of Zoology, 26(4): 301-303.

Duncan, D. B. (1955). Multiple range and multiple F tests. Biometrics, 11: 1–41.

Gomes Neto AV, Silva PRR, Melo JWS, deMelo Junior LC and de Franca SM (2017). Biology and life table of *Tetranychus neocaledonicus* on lima bean. Inter .J. Acarology, 43(8): 622-626.

Gotoh T (1986). Life history parameters of the Hawthorn spider mite *Tetranychus viennensis* Zacher (Acarina: Tetranychidae) on deciduous oak. App. Entomol. Zool. 21(3): 389-393.

Hanna MA, Zaher NMA and Sawires ZA (1981). Influence of host resistance on the biology of *Tetranychus urticae* Koch in soybean (Acarina : Tetranychidae) . Zagazig J. Agric. Res. 3(79):1-5.

Helle W and Sabelis MW (1985). Spider mites. Their biology, natural enemies and control. World Crop Pests. Vol. 1A, Amsterdam Elsevier. 1A 405 pp.

Karami-Jamour T and Shishehbor P (2012). Development and life table parameters of *Tetranychus turkestani* (Acarina: Tetranychidae) at different constant temperatures. Acarologia, 52(2):113-122.

Modarres Najafabadi SS, Shoushtari RV, Zamzni AA, Arabi M and Farazmand H (2014). Life parameters of *Tetranychus urticae* Koch (Acari: Tetranychidae) on six common bean cultivars. J. Econ. Entomol., 107 (2): 614-622.

Pontier KJB, de Moraes GJ and Kreiter S (2000). Biology of *Tenuipalpus heveae* (Acari: Tenuipalpidae) on rubber tree leaves. Acarologia, 41: 423-427.

Razmjou J, Tavakkoli H and Nemati M (2009). Life history traits of *Tetranychus urticae* Koch on three legumes (Acari: Tetranychidae) Mumies Entomol. Zool. 4(1): 204-211.

Riahi E, Shishehbor P, Nemati AR and Saeidi Z (2013). Temperature effects on development and life table parameters of *Tetranychus urticae* (Acari: Tetranychidae). J. Agric. Sci. and Tech., 15:661–672.

Shehata FSA (2010). Studies on some mite species infesting certain field crops in Sharkia Governorate. . M.Sc. Thesis, Fac. Agric. Moshtohor, Benha Univ. 118 pp.

Snedecor GW and Cochran G (1980). Statistical Methods ,7th ed The Iowa State Univ. Press Amer. Iowa, USA.

Wekesa VW, Vital S, Silva RA, Ortega EM, Klingen I and Delalibera JrI (2011). The effect of host plants on *Tetranychus evansi*, *Tetranychus urticae* (Acari: Tetranychidae) and on their fungal pathogen *Neozygites floridana* (Entomopathorales: Neozygitaceae). Journal of Invertebrate Pathology, 107:139–145.

الملخص العربى

بعض الخصائص الحيوية للحلم العنكبوتى ذو البقعتين *Tetranychus urticae* Koch على ثلاثة من محاصيل الخضر الورقية

هند عبدالعزيز النشرتى

قسم وقاية النبات، كلية الزراعة، جامعة الزقازيق، الزقازيق، مصر

تم فى هذه الدراسة المعملية حساب معدلات تحول وتكاثر الحلم العنكبوتى ذو البقعتين *Tetranychus urticae* عند تربيته على أوراق ثلاثة من محاصيل الخضر الورقية الشائعة فى مصر وهى الملوخية و الخس و الخبيزة على درجة حرارة ٢٧±٣ °م و رطوبة نسبية ٧٠±٥% وذلك لتحديد مدى ملاءمتها لتلك الافة، و أوضحت النتائج أن النباتات المختبرة اختلفت فيما بينها اختلافا واضحا فى مدى ملاءمتها كعوائل للحلم العنكبوتى ذو البقعتين, حيث أظهر الحلم تفضيلا و بدرجة كبيرة للملوخية تلاها فى ذلك الخس و الخبيزة حيث كان الوقت الكلى اللازم لتحول الحلم من البيضة حتى الطور البالغ أقصر وبدرجة معنوية على الملوخية ، بينما كانت تلك الفترة طويلة نسبيا على الخس و الخبيزة.

ومن ناحية أخرى سجلت أعلى أعداد للبيض الذى تضعه أنثى الحلم على الملوخية بينما سجلت أقل أعداد للبيض على الخبيزة ، وعموما تشير نتائج هذه الدراسة الى أن الحلم العنكبوتى ذو البقعتين يمكن اعتباره أفة على محاصيل الخضر محل الدراسة كما أن نوع العائل النباتى أحد العوامل المؤثرة على زيادة تعدادات هذه الأفة الأكاروسية.

الكلمات المفتاحية: الحلم االعنكبوتى ذو البقعتين ، الخضرالورقية ، الملوخية ،الخس، الخبيزة .