

## Study the population dynamics of two spotted spider mite *Tetranychus urticae* Koch infesting two *Faba bean* cultivars

\*Amal H. M. Romeih<sup>1</sup>, E.M.A.El-Saiedy<sup>2</sup> and Salwa, M. E. Sholla<sup>3</sup>

<sup>1</sup>Agric. Zoology and Nematology Dept., Fac. of Agric., Cairo Univ., Giza, Egypt. Biology department, Taif Univ. taif, KSA.

<sup>2</sup>Plant Protection Dept., National Research Center, Dokki, Egypt

<sup>3</sup>Plant Protection Res. Institute, Agric. Res. Center, Dokki, Egypt  
[amalmoaz@yahoo.com](mailto:amalmoaz@yahoo.com); [amalmoaz@hotmail.com](mailto:amalmoaz@hotmail.com).

**Abstract:** This study was conducted to determine the levels of infestation of two Faba bean (*Vicia faba*) varieties with *Tetranychus urticae* and its predatory phytoseiid mite, *Typhlodrompis swiriskii* (Athias-Henriot) and some insect pests. The study was investigated the population density of two spotted spider mite *Tetranychus urticae* in Beheira Governorate, Egypt, during 2010-2012 on two cultivars of broad bean, Sakha1 and Sakha3. Our results showed that the infestation of two cultivars by *T. urticae* was early started in late December then, gradually increased and to reach their peaks during March for the two cultivars. The infestation by *T. urticae* during the first season was started in late December in Sakha1 cultivar only, while in Sakha3 was firstly recorded during first June 2012. The infestation was slightly increased to reach their peak during 3<sup>rd</sup> of March on the two cultivars. On the other hand, mite infestation was gradually increased reaching their peaks on March 17<sup>th</sup> for Sakhe 3. At the late season, specifically in April, the numbers of *T. urticae* stages decreased gradually on the two Faba bean cultivars. The predatory mite, *Typhlodrompis swerskii* was firstly recorded at the beginning of January for the two tested seasons on the two cultivars. Both population declined at the beginning April (include dates or use months only to be consistent). The Sakha3 cultivar was more infested with higher population of predatory mites, than Sakha1. Also, the study showed the presence of the two phytophagous insect species, *Aphids gossypi* and *Thrips tabaci* in moderated number on the two-tested bean. The infestation by Phytophagous insects were started in the third week of December 2010 and increased then by the first week of January then decreased gradually for the *A. gossypi* from the mid of February, while it was increased for the *T. tabaci* from mid of Feb. to the end of April. The infestation of *A. gossypi* and *T. tabaci* for the two cultivars at the second season started at the last week of December and increased by the end of January then decreased gradually. Next they started to increase before the first week of March for both the two insects on Saka3 cultivar.

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### 1. Introduction

The two-spotted spider mite, *Tetranychus urticae*, is one of the main pests of agricultural crops due to its broad host range.

This polyphagous species feeds on more than 1,100 plant species, from which about 150 are of great economic value. Thus, it represents a very important pest for field and greenhouse crops, ornamentals, annual and perennial plants all over the world (Grbic *et al.*, 2011).

*T. urticae* was first reported from the USA by Tuttle and Baker (1968). In Egypt, as in other countries, plant production for humans and livestock consumption is threatened by a wide range of insects and arthropod species cultivated Faba bean (*Vicia faba*); which is generally a source of nutrition in developing countries and for grazing animals in both industrialized and developing countries. *Faba bean*

has been considered as a meat extender or substitute and as a skim-milk substitute as well. In addition, it can be used as a vegetable, green or dried, fresh or canned.

*Faba bean* attacked by serious pests reduces its quality and quantity, Ebadah *et al.* (2006). The major insect pests that attack the green parts of the bean in Egypt are the legume aphids, *Aphis craccivora* Koch, and the leaf miner, *Liriomyza congesta* Becker, Hammad (1955), Hafez *et al.* (1974), Abateand and Ampofo (1996) and Ebadah *et al.* (2006). Also green pods and seeds of faba bean are stricken by broad bean beetle *Bruchus rufimanus* (Boch.), Nagaich and Vashisth (1965), Bishara *et al.* (1967). and El-Kifel *et al.* (1974) Recently, several programs for pest control have been developed to enhance resistant varieties. The present work was conducted to determine the levels of infestation of two Faba bean

varieties with *Tetranychus urticae* and its predatory phytoseiid mite, *Typhlodrompis swiriskii* (Athias-Henriot) and some insect pests.

## 2. Material and Methods

### 2.1. Experimental procedures

#### 2.1.1. Faba bean cultivars

Two different Faba bean cultivars were used in this study (Sakha1 and Sakha3). The cultivars were cultivated in open field during two successive seasons (2010-2011 and 2011 /2012), at Beheira Governorate.

#### 2.1.2. Experimental design and Counting

Counting of mites started from the first week of December (2010) to the third week of April (2011) for the first season. Then, in the second season the counting started from the first week of December (2011) to the first week of June (2012). The population dynamics of *Tetranychus urticae* all stages and cited predatory mites were recorded and monitored weekly. Twenty leaf samples were collected from each cultivar and placed directly into labeled plastic bags and transported to the laboratory for examination of *T. urticae* occurrence, insect pests and the predatory mites. All mite stages (eggs, immature and adults) were counted using stereomicroscope.

### 2.2. Data analyzes

The obtained data were analyzed using ANOVA with the computer program (SAS Institute, 1988) which runs under WIN to determine any significant difference between the means.

## 3. Results and Discussion

### 3.1. Phytophagous mites (*Tetranychus urticae* Koch)

The population dynamics of adults, immature and eggs of *T. urticae* during first season (2010/2011) are shown in Table (1). The infestation of the two cultivars, Sakha1 and Sakha3 by *T. urticae* was started in late December, gradually increased and reached their peaks in March. The highest numbers of adults, immature and eggs of *T. urticae* averaged 26.4, 49.14 and 37.14 individuals / leaf compound were obtained of Sakha3 in March 13<sup>th</sup>

The infestation by *T. urticae* during the season 2011/2012 was started at late December in Sakha1 cultivar only. Where the number of adults, immature and eggs averaged 1, 2.22 and 3.45 individuals / leaf compound respectively (Table 2). While in Sakha3 adult and eggs of *T. urticae* were firstly recorded during first of June 2012 with an average of 7.01 and 20.6 individuals / leaf compound respectively. The immature were firstly recorded at the mid-January, after that the infestation was slightly increased and reached their peak during 3<sup>rd</sup> of March on the two cultivars. The number of adults, immature

and eggs averaged 28.18, 48.22 and 32.10 individuals / leaf of Sakha1, respectively.

**Table (1): population number of different spider mite stages / leaf on two faba bean cultivars during 2010- 2011 seasons.**

Date	Mean number of <i>Tetranychus urticae</i> stages / leaf					
	Sakha1			Sakha3		
	A	I	E	A	I	E
7-12-2011	-	-	-	-	-	-
14	-	-	-	-	-	-
21	0.36	1.88	1.97	2.56	11.00	9.14
28	1.44	3.04	4.32	4.33	14.00	18.1
8-1-2012	3.00	5.43	10.32	6.55	23.00	24.13
11	6.10	10.60	12.44	8.33	27.00	28.11
18	8.44	12.33	15.33	9.44	38.00	25.06
25	11.88	13.6	16.44	12.35	37.00	37.0
3-2-2012	11.06	15.0	17.32	14.32	43.00	38.00
10	13.4	19.52	20.14	17.44	55.00	48.00
17	19.56	20.14	24.33	23.00	68.00	56.00
24	18.44	25.32	24.00	24.86	55.0	68.00
6-3-2012	21.00	21.14	25.33	25.00	64.00	64.00
13	26.4	49.14	37.14	26.33	68.00	68.00
20	21.56	27.84	29.00	37.0	79.00	86.06
27	19.44	36.12	32.00	28.0	70.00	77.37
5-4-2012	18.33	49.10	36.14	29.00	74.00	84.18
12	19.55	39.18	31.4	35.00	75.6	83.00
19	24.13	48.12	29.32	34.00	77.00	85.00
26	23.88	44.55	25.00	27.00	68.00	81.00
Mean	14.88	24.55	21.77	20.25	52.58	54.45

(Please note: A=adult, E=Egg and I=Immature)  
**L.S.D. adult ( $p > 0.05 = 6.35$ ), L.S.D ( $p < 0.05$ )  
 immature= 13.59, L.S.D. ( $p > 0.05$ ) egg= 13.84.**

On the other hand, mite infestation was gradually increased and reached their peaks during March 17<sup>th</sup> on Sake 3 for the above mentioned stages respectively. At the late season, April, the numbers of *T. urticae* stages decreased gradually on the two Faba bean cultivars. We can conclude that the rate of infestation was higher in Saka3 than that of Sakal in the two seasons. Where the overall mean of *T. urticae* stages increased in Saka3 reached about 2 times than those in Sakal.

As shown in Table (3), the variety of tested Faba bean (Sakha1 and Sakha3) was showed highly affected on the population of each of *T. urticae* stages, (adult, immature and eggs), but the time of infestation (season) hadn't any effects on this population.

In this regard, Green *et al.* (1987) found that the infestation strawberry starts from March in all seasons in New Zealand, in Egypt, Rizk *et al.* (1990) recorded the peak infestation of *T. urticae* on soybean cultivar, during (May and June), while Taha *et al.* (1990) recorded that on cotton cultivar, during last week of June. Waheeb (1998) recorded that the peak infestation by *T. urticae* on Soybean cultivar occurred at May population in Egypt, while, El-

Saiedy (1999) found that April plantation had higher infestation than that of May plantation and he recorded variation between localities infestation rate.

**Table (2): population number of different spider mite stages / leaf on two faba bean cultivars during 2011- 2012 seasons.**

Dates	Sakha1	Sakha3
	Number predator/leaf	Number predator /leaf
7-12-2010	-	-
14	-	-
21	-	-
28	0.08	0.56
3-1-2011	0.36	0.62
11	0.40	1.05
18	0.47	1.37
25	0.50	1.44
3-2-2011	0.87	1.52
10	1.33	1.38
17	1.06	1.23
24	1.56	1.60
6-3-2011	1.32	1.47
13	1.37	2.37
20	1.38	2.64
27	1.40	2.5
5-4-2011	1.58	2.93
12	1.80	2.60
19	1.43	2.9
26	2.14	3.06
Mean	1.12	1.84

(Please note: A=adult, E=Egg and I=Immature)  
L.S.D. adult ( $p > 0.05 = 6.88$ ), L.S.D ( $p > 0.05$ )  
immature = 14.47, L.S.D. ( $p > 0.05$ ) egg= 14.57.

**3.2. Predatory mite: *Typhlodrompis swirskii*** (Athias-Henriot) One phytoseiid mite *Typhlodrompis swirskii*

**Table (3): Effect of different varieties and the seasons on the population dynamics of different stages of *T. urticae*.**

	Source	F.	P	L.S.D. at 0.05
A	Variety	4.0986	0.0464***	4.5945
	Season	0.1511	0.6986 ns	
	Int. variety x season	0.0046	0.9460 ns	-
I	Variety	18.682	0.0001***	9.9266
	Season	0.4592	0.5001 ns	
	Int. variety x season	0.5467	0.4619 ns	-
E	Variety	33.111	0.00002***	9.8719
	Season	0.0880	0.7674 ns	
	Int. variety x season	0.03195	0.8586 ns	-

**Please note: A=Adulat, E=Eggs and I=Immature**

(Athias-Henriot) was recorded on the Faba bean cultivars, during the two tested seasons, **Tables (4 and 5)**. The predatory mite was firstly recorded at the begging of first January 2010 and 2011 on the two cultivars population declined at beginning April. The Sakha3 cultivar was more infested with higher

population of predatory mites, than Sakha1. From the foregoing results, it could be concluded that, the predatory mite *Typhlodrompis swerskii* was higher in Sakha3 compared with Saka1 cultivars. This may be due to the higher population of *T. urticae* addition to leaf miners infection on Sakha3 cultivar several phytoseiid predatory were recorded with *T. urticae* on strawberry; Raworth (1990) recorded *A.fallacies* (German) on strawberry in British Columbia during February on November. The obtained tabulated data in **Table (6)** indicated that the effect of broad bean varieties on the population dynamics of the predatory mite, *Typhlodrompis swerskii* was obviously significant while the season factor had no significant effect on this population.

**Van de Vrie et al.** (1991) recorded *Phytoseiulus persimilis* on strawberry fields in Florida. El-Saiedy (1999) recorded *A. swirskii* during August and September at two localities Monofia and El-Beheira Governorate. El-Saiedy (2003) recorded *A. swirskii*, *A.zaheri* and *A.barkeri* (Huges) during March and April season 2000-2001, February Frist and April (2001- 2002 ) in all localities

### 3. Insect pests associated with the two broad bean cultivars

#### 3.3.1- Season (2010 – 2011)

This study shows that two phytophagous insect species, *Aphids gossypi* and *Thrips tabaci* in moderated number on the two Faba bean cultivars Sakha1 and Sakha3.

**Table (4): Recorded number of predatory mite stages *Typhlodrompis swirskii* / leaf on two faba bean cultivars during 2010- 2011 seasons.**

Dates	Sakha1	Sakha3
	Number predator/leaf	Number predator /leaf
7-12-2010	-	-
14	-	-
21	-	-
28	0.08	0.56
3-1-2011	0.36	0.62
11	0.40	1.05
18	0.47	1.37
25	0.50	1.44
3-2-2011	0.87	1.52
10	1.33	1.38
17	1.06	1.23
24	1.56	1.60
6-3-2011	1.32	1.47
13	1.37	2.37
20	1.38	2.64
27	1.40	2.5
5-4-2011	1.58	2.93
12	1.80	2.60
19	1.43	2.9
26	2.14	3.06
Mean	1.12	1.84

The infestation of the two cultivars by Phytophagous insects were started in the third week of December 2010 and increased then by the first week of January then decreased gradually for the *A. gossypi* from the mid of February, while it was increased for the *T. tabaci* from mid of Feb. to the end of April. The results concern the infestation of phytophagous insects, *Aphids gossypi* were observed as follow: Saka1 5.43 and Sakha3 9.13 individuals / leaf in the third week of January 2011. The highest population recorded on Sakha3 11.25 individuals / leaf in the last week of January 2011. *Thrips tabaci* was recorded the highest number on Sakha3 9.55 at the first week of April 2011. While it was recorded 5.32 individuals / leaf on Sakha1 at in this week (Table 7).

**Table (5): Recorded number of predatory mite stages *Typhlodrompis swirskii* / leaf on two faba bean cultivars during 2011- 2012 seasons.**

Dates	Saka3	Saka1
	Number predator /leaf	Number Predator/leaf
5-12-2010	-	-
12	-	-
19	-	-
26	-	-
1-1-2012	0.35	0.44
8	0.28	0.36
15	0.47	1.04
22	0.55	1.38
29	0.88	1.28
5-2-2012	1.00	1.56
12	1.03	1.45
19	1.44	2.3
26	1.22	2.06
3-3-2012	1.35	2.14
10	1.34	2.88
17	1.64	2.65
23	1.88	2.89
30	1.45	2.90
7-4-2012	2.14	3.10
15	2.35	3.17
19	2.38	3.32
22	2.23	3.14
Mean	1.33	2.11

### 3.3.2. Season (2011-2012)

The results showed that the infestation of *A. gossypi* and *Th. tabaci* for the two Cultivars of Faba bean Saka1 and Saka3 started at the last week of December and increased then by the end of January decreased gradually, next they started to increase

before first week of March for both the two insects on Saka3 cultivar, Table (8).

The similar results of the population fluctuation study of the 2 spotted-spider mite, *Tetranychus urticae*, and the predaceous thrips, *Scolothrips longicornis*, on cucumber and bean cultivars were obtained under greenhouse conditions, El-Saad and Embarak (2009).

**Table (6): Effect of different varieties and the seasons on the population dynamics of different stages of *Typhlodrompis swirskii*.**

Variable	Source	F.	P	L.S.D. at 0.05 level
Predatory mite numbers	Variety	7.989	0.0059 **	0.4036
	Season	1.442	0.2332 ns	
	Int. variety x season	0.0092	0.9239 ns	-

**Table (7): The average number of insect pests /leaf on two faba bean cultivars at seasons 2010-2011.**

Dates	Saka1		Saka3	
	Number / leaf Average			
	<i>Aphids gossypi</i>	<i>Thrips tabaci</i>	<i>Aphids gossypi</i>	<i>Thrips tabaci</i>
5-12-2010	-	-	-	-
12	-	-	-	-
19	0.18	0.53	0.24	0.80
26	0.67	0.88	1.34	3.18
1-1-2011	3.22	1.42	5.70	4.20
8	4.11	2.45	6.18	5.33
15	4.98	3.15	8.15	6.93
22	5.43	0.18	9.13	0.86
29	3.17	0.0	11.25	0.13
5-2-2011	2.10	0.0	7.20	-
12	0.94	0.0	3.27	-
19	0.17	0.14	2.23	-
26	0.0	0.65	0.95	0.45
3-3-2011	0.0	0.94	0.32	1.68
10	0.0	1.35	0.0	3.0
17	0.0	3.90	0.0	4.25
23	0.0	4.84	0.0	6.86
30	0.0	6.55	0.0	7.60
7-4-2011	0.0	5.32	0.0	9.55
15	0.0	4.46	0.0	8.44
22	0.0	8.72	0.0	9.36
Mean	1.31	2.4	2.9	4.5

The obtained data showed that both of *T. urticae* and *S. longicornis* exhibited one peak on cucumber and beans. Peaks of *T. urticae* and *S. longicornis* occurred on the second and third weeks of April for bean and cucumber in both seasons (2007 and 2008). The cucumber cultivars differed in their infestation by *T. urticae*. The Nile and Katia cultivars

harbored greater numbers of ova and moving stages of *T. urticae*, followed by Passandra and Asna cultivars. Bean showed significant differences among Novax, Kentucky wonder and A Slin wonder cultivars in their mite infestation. Generally, cucumber cultivars mounted lower numbers of *T. urticae* than bean cultivars. On the other hand, correlation between numbers of *S. longicornis* and the population density of ova and moving stages of *T. urticae* on all cucumber and bean cultivars in the 2 growing seasons was positive. Only cucumber cultivars affected the fertility of *T. urticae*.

**Table (8): The average number of insect pests / leaf on two faba bean cultivars at seasons 2011-2012.**

Dates	Saka1		Saka3	
	Number / leaf Average			
	<i>Aphids gossypi</i>	<i>Thrips tabaci</i>	<i>Aphids gossypi</i>	<i>Thrips tabaci</i>
7-12-2011	-	-	0.0	-
14	-	-	0.0	-
21	-	-	0.0	-
28	2.45	0.65	4.63	0.54
3-1-2012	3.98	0.73	5.36	0.86
11	4.04	0.18	6.89	0.75
18	3.18	0.0	4.98	0.18
25	0.55	0.0	3.18	0.0
3-2-2012	0.17	0.0	2.11	0.0
10	0.33	0.0	0.98	0.0
17	0.0	0.36	0.65	0.76
24	0.0	0.90	0.43	1.43
6-3-2012	0.11	1.68	0.0	2.75
13	0.17	2.86	0.0	3.90
20	0.0	3.64	0.0	4.85
27	0.0	2.18	0.0	4.18
5-4-2012	0.0	3.22	0.0	6.35
12	0.0	4.55	0.0	7.18
19	0.0	7.18	0.0	9.22
26	0.0	8.24	0.0	9.98
Mean	0.88	2.14	1.46	3.11

The six tested varieties of Faber Bean showed different susceptibility to the three insect pests, Ebadah *et al.* (2006). The highest susceptible one was Giza 461 and the lowest susceptible one was Giza 843 to aphids. The variety Giza 714 showed moderate infestation with leaf miner while the two varieties Giza 843 and Giza 429 recorded highest infestation with broad bean beetle in green pods while Giza 643 showed moderate infestation with broad bean beetle on dry seeds.

#### 4. Conclusion

*Tetranychus urticae* Koch is one of the most pests causes serious damage to bean plants. The control of this mite is very much essential to get maximum and quality yield of bean.

#### Corresponding author

**Dr. Amal Hassan Moaz Romeih,**

Agric. Zoology and Nematology Department, Faculty of Agriculture., Cairo University, Giza, Egypt.

Email: [amalmoaz@yahoo.com](mailto:amalmoaz@yahoo.com);

[amalmoaz@hotmail.com](mailto:amalmoaz@hotmail.com).

\*Present address: Biology Department, Taif university, Taif, P.O. Box : 888 , Postal Code 21974, Kingdom of Saudi Arabia. Phone number:+966 530977514

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