

POPULATION DYNAMICS OF THE PHYTOPHAGOUS PESTS INFESTING TWO BROAD BEAN CULTIVARS ALONG WITH THEIR PREDATORY PHYTOSEIID MITES *TYPHLODROMPIS Swiriskii* (ATHIAS-HENRIOT) AT BEHEIRA GOVERNORATE.

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ABSTRACT

This study was conducted to determine the levels of infestation of two broad 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 21 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 3rd of March on the two cultivars. On the other hand, mite infestation was gradually increased reaching their peaks on March 17th for Sakhe 3. At the late season, specifically in April, the numbers of *T. urticae* stages decreased gradually on the two Broadbean cultivars. The predatory mite, *Typhlodrompis swerskii* was firstly recorded at the beginning of January for the two tested cultivars in the two successive seasons. 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 broad 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.

Keywords: Broad bean; *Vicia faba* ; *Tetranychus urticae* ; predatory phytoseiid, *Typhlodrompis swiriskii*;; *Tetranychus urticae*; Sakha1 and Sakha3

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 live stock consumption is threatened by a wide range of insects and arthropod species i.e. broad bean (*Vicia faba*); which is generally a source of nutrition in developing countries and for grazing animals in both industrialized and developing countries. broad 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.

Broad 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), and Ebadah *et al.*, (2006). Also green pods and seeds of broadbean are stricken by broad bean beetle *Bruchus rufimanus* (Boch.), Nagaich and Vashisth (1965), El-Kifel *et al.*, (1974) and Bishara *et al.*, (1967). 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 broad bean varieties with *Tetranychus urticae* and its predatory phytoseiid mite, *Typhlodrompis swiriskii* (Athias-Henriot) and some insect pests.

MATERIALS AND METHODS

Experimental procedures:

Broad bean cultivars : Two different Broad 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.

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 the predatory mites were recorded and monitored weekly. Twenty leaf samples were collected from each cultivar and placed directly into labelled 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.

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

RESULTS AND DISCUSSION

Population dynamics of phytophagous and predacious mites inhabiting two cultivars of broad bean.

A. 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 of Saka1, while an average 37, 79.14 and 86.06 individuals / leaf compound were obtained of Sakha3 in March 13th.

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 3rd 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. On the other hand, mite infestation was gradually increased and reached their peaks during March 17th on Sakhe 3 for the above mentioned stages respectively. At the late season, April, the numbers of *T. urticae* stages decreased gradually on the two broadbean cultivars.

We can conclude that the rate of infestation was higher in Saka3 than that of Saka1 in the two seasons. Where the overall mean of *T. urticae* stages increased in Saka3 reached about 2 times than those in Saka1. As shown in Table (3), the variety of tested broadbean (Sakha1 and Sakha3) was showed highly affected on the population of each of *T. urticae* stages, (adult, immatures and eggs), but the time of infestation (season) hadn't any effects on this population.

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

Date	Mean number of <i>Tetranychus urticae</i> stages / leaf					
	Sakha1			Sakha3		
	Adult	Immature	Egg	Adult	Immature	Egg
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

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

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

Date	Mean number of <i>Tetranychus urticae</i> stages / leaf					
	Saka1			Saka3		
	Adult	Immature	Egg	Adult	Immature	Egg
12-12-2010	-	-	-	-	-	-
19	-	-	-	-	-	-
26	1.00	2.22	3.45	-	-	-
1-1-2011	4.00	6.30	5.56	7.01	-	20.6
8	5.01	11.33	11.3	11.7	17.14	23.01
15	7.11	12.22	13.1	12.11	22.13	25.06
22	12.23	13.14	14.9	14.13	26.15	30.07
29	11.18	14.13	13.5	20.11	28.11	34.23
5-2-2011	13.17	20.12	17.6	19.23	35.18	45.27
12	20.25	18.11	18.2	21.3	44.14	54.28
19	17.44	26.11	24.14	23.03	50.23	53.08
26	20.33	23.6	23.13	24.1	53.44	55.25
3-3-2011	28.18	48.22	32.10	25.2	53.35	60.26
10	22.25	20.3	25.8	34.5	56.2	63.12
17	20.23	28.11	28.5	26.11	73.3	83.03
23	18.18	35.13	31.3	28.7	63.11	75.22
30	16.10	48.16	35.11	28.14	70.01	78.17
7-4-2011	25.13	40.18	30.11	30.3	74.06	78.18
15	24.14	47.77	28.6	31.5	73.6	80.11
22-4-2011	23.11	33.66	24.18	22.14	65.2	74.01
Mean	16.05	24.14	21.04	22.33	50.33	54.85

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

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

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

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.

B- Predatory mite: *Typhlodrompis swirskii* (Athias-Henriot)

One phytoseiid mite *Typhlodrompis swirskii* (Athias-Henriot) was recorded on the broadbean 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.*, (1997) 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* (Yousef and El-Brollosy) and *A.barkeri* (Huges) during March and April season 2000-2001. Frist February and April 2001- 2002 in all localities

Table (4): Recorded number of predatory mite stages *Typhlodrompis swirskii* / leaf on two broadbean 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

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

Dates	Saka1	Saka3
	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

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

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	-

C- Insect pests associated with the two broad bean cultivars:

1- Season 2010 – 2011:

This study shows that two phytophagous insect species, *Aphids gossypii* and *Thrips tabaci* in moderated number on the two broadbean cultivars Sakha1 and Sakha3. 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. gossypii* 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 gossypii* 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).

2- Season 2011-2012:

The results showed that the infestation of *A. gossypi* and *Th. tabaci* for the two Cultivars of broadbean 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).

Table (7): The average number of insect pests / leaf on two broad 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 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). 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 broad 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 BroadBean 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.

CONCLUSIONS

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.

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التذبذب العددي للعنكبوت الاحمر العادي *Tetranychus urticae* Koch

على صنفين من الفول البلدى بمحافظة البحيرة بمصر

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اجريت دراسة الكثافة العددية للعنكبوت الاحمر العادي *Tetranychus urticae* في محافظة البحيرة لموسمين متتاليين ٢٠١٠ - ٢٠١٢ على صنفين من اصناف الفول البلدى هما سخا ١ وسخا ٣ . وقد بدأت الاصابة بالعنكبوت الاحمر مبكرا في نهاية شهر ديسمبر وازدادت تدريجيا حتى وصلت لاعلى معدل لها اثناء شهر مارس للصنفين.وبدأت الزيادة في الموسم الاول بنهاية ديسمبر على سخا ١ فقط بينما الصنف سخا ٣ سجلت بداية يونيو ٢٠١٢ و زاد التعداد حتى وصل لاعلى معدل له في الثالث من مارس على الصنفين.ومن ناحية اخرى فان التعداد زاد تدريجيا وصولا لاعلى معدل له في السابع عشر من مارس على الصنف سخا ٣ وفي شهر ابريل (نهاية الموسم) فقد تناقصت اطوار العنكبوت الاحمر على الصنفين. وبالنسبة للمفترس الاكاروسى *Typhlodrompis swerskii* فقد سجل اول ظهور له في بداية شهر يناير للموسمين على الصنفين وبدا التعداد فى الانخفاض فى بداية شهر ابريل وعموما كان الصنف سخا ٣ كان اعلى تقاضلا لتواجد المفترس من الصنف سخا ١ . ولقد اثبتت الدراسة وجود نوعين من الحشرات النباتية التغذية وهما *Aphids* و *Thrips tabaci* وذلك باعداد متوسطة

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