POPULATION DENSITY OF *TETRANYCHUS CUCURBITACEARUM* (SAYED) AND *BEMISIA TABACI* (GENN.) ON CERTAIN SOYBEAN VARIETIES IN RELATION TO SOME WEATHER FACTORS AND LEAF CHEMICAL CONTENTS

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ABSTRACT

The population density of the spider mite, *Tetranychus cucurbitacearum* (Sayed) and the white fly, *Bemisia tabaci* (Genn.) were evaluated on three soybean varieties (Giza21, Giza22 and Giza111) at Sakha Agric. Res. Station Farm, Kafr El-Sheikh during seasons of 2003 and 2004 as well as its relation to some prevailing weather factors and chemical contents of leaves.

The obtained results indicated that in the first season, the highest numbers of the spider mite existed on Giza111, while Giza21 harbored the least numbers. During the second season, there were no significant differences between the three varieties As for the white fly, Giza21 and Giza111 were the highest infested variety in the first and second season, respectively, while Giza22 was the least one in both seasons. Also, the tested varieties exhibited higher numbers of spider mite in the second season than the first one, while the reverse occurred for the white fly.

The population density of both pests was not significantly affected by the prevailing temperature and relative humidity on the tested varieties and the combined effect of the two weather factors on the population was less pronounced in the two study seasons. The population of the spider mite was negatively related to the leaf contents of N., P. ,K., Mn and Fe, while the reverse was recorded for the white fly. The population of both pests were negatively correlated with the total phenols.

Thus, the obtained results are of a great importance ,as they are taken into account in planning programs of integrated pest management.

INTRODUCTION

Soybean, *Glycin max* L. is one of the most important legume crops all over the world. In the field, the plants are attacked by several serious pests e.g.; the spider mite, *Tetranychus cucurbitacearum* (Sayed) and the whitefly, *Bemisia tabaci* (Genn.) (Taha *et al.*,1995; El-Khouly *et al.*,1998 and Taha *et al.*,2001).

In general, the chemical control of the pests creates several problems i.e., environmental pollution, destruction of beneficial insects and pest resistance to many pesticides (John *et al.*, 1986). Therefore, it is necessary to select tolerant or resistant varieties as one of the simplest and useful tactics in the integrated pest management programs (Dent,1991). However, varieties of soybean exhibit variable reactions to the sucking pests infestation depending on plant physical properties or chemical components of plant leaves (Zaher *et al.*,1980; Hildebrand *et al.*,1986; McAuslane *et al.*,1995 and McAuslane , 1996) as biochemical factors, to a large extent, affect the behavior and metabolic processes of pest, while morphological factors mostly influence the mechanisms of locomotion, feeding, oviposition, ingestion and digestion of the pest (Kumar, 1984). Also, plant resistance to insects is generally derived from certain biochemical and / or the metabolism of insects which affect the behavior and / or the metabolism of insects influencing the relative degrees of damage caused by these insects (Metcalf and William ,1975).

So, the present work was carried out to evaluate the population density of *T. cucurbitacearum* and *B. tabaci* on three soybean varieties (Giza21, Giza22 and Giza111) at Sakha Agric. Res. Station Farm, Kafr El-Sheikh during seasons of 2003 and 2004 as well as its relation with some prevailing weather factors and chemical contents of leaves.

MATERIALS AND METHODS

The present experiment was carried out at Sakha Agric. Res. Station Farm, Kafr El-Sheikh during the two summer seasons of 2003 and 2004.. The experimental area was divided into 12 plots; each of 1/ 100 fed. Every variety was replicated four times in a completely randomized block design. The varieties were sown in late-June in the first season and in late-May in the second one. The normal agricultural practices were conducted during the two

seasons without any pesticidal treatments. Weekly samples of ten soybean leaflets were collected at random from each plot 40 days after sowing date until the end of the season. The collected leaflets were kept in paper bags and transferred to the laboratory to count the motile stages of *T. cucurbitacearum* and immature stages of *B. tabaci* by the aid of binocular microscope. The data obtained were statistically analyzed using least significant difference (LSD) at 5 % to reveal the significance among the involved varieties.

The daily records of temperature and relative humidity during the inspection period were obtained from the Meteorological Department at Sakha Research Station. The weekly means of the two factors were used to calculate the simple correlation, regression coefficients for the relationship between each pest population and each of the two weather factors (Fisher, 1950).

The three Varieties of soybean leaves were collected at harvest, dried , ground and digested by sulfuric and perchloric acids to determine the concentrations of N, P, K, Fe, Mn and Zn as described by Page (1982). Total phenols were determined by Folin Denis reagent according to the method described by Swain and Hills (1959).

RESULTS AND DISCUSSION

1 – Population density of *T. cucurbitacearum* and *B. tabaci* on three soybean varieties:-

Data presented in Table (1) show the population density of motile stages of *T. cucurbitacearum* and immature stages of *B. tabaci* on three soybean varieties ; Giza21, Giza22 and Giza111 during season of 2003. The motile stages of *T. cucurbitacearum* started with relatively high numbers on the three tested varieties on 5th August with means of 49.25 , 229.25 and 358.25 individuals/ 10 leaflets for Giza21, Giza22 and Giza111, respectively. Then, the population decreased slowly till the end of the season for all varieties.

As for *B. tabaci*, the results indicated that the population of immature stages (nymphs) started with a few numbers, then increased gradually reaching its maximum on 9 September for Giza21 and Giza22 with means of 2387 and 695.75 individuals/ 10 leaflets , respectively. Giza111 harbored the highest number on 2 th

September being 1745.25 individuals . After that, the population declined gradually till the end of the season.

Table (1): Mean number of motile stages of *Tetranychus cucurbitacearum* (Sayed) and immature stages of *Bemisia tabaci* (Genn.) /10 leaflets on three soybean varieties during 2003 season.

Sampling date	Giza21		Giza22		Giza111	
	Spider mite	whitefly	Spider mite	whitefly	Spider mite	whitefly
Aug., 5	49.25	134.50	229.25	83.25	358.25	147.75
12	20.00	296.25	7.00	211.75	18.25	155.00
19	1.00	366.25	1.00	207.00	1.00	442.75
26	0.25	1307.00	0.50	335.25	4.50	952.25
Sept. ,2	1.50	1913.50	1.00	660.50	1.50	1745.25
9	1.00	2387.00	0.25	695.75	0.50	1285.00
16	1.00	1325.25	13.75	286.50	0.50	390.00
23	1.25	367.00	2.00	205.00	0.25	256.00
Oct., 1	2.00	364.00	3.00	91.75	3.50	264.75

These results agreed with those obtained by Younes *et al.*,(,2001) who reported that immature stages of *B. tabaci* reached its peak on soybean plants in early of September. Also. Taha *et al.*(1995) found that the high population of *B. tabaci* may be attributed to the enhanced of vegetable growth of soybean plants.

During season of 2004, the results in Table (2) revealed that the motile stages of *T. cucurbitacearum* started to appear with high numbers in the first week of July on all the tested varieties and continued till the end of the month. Then, sharp decline in the population took place during August. After that, the population started to increase again till the end of the season.

Concerning *B. tabaci*, the results indicated that the population of immature stages appeared with few numbers on Giza21 and Giza22 in the first week of July. After that, the population increased suddenly recording high numbers during August. On the other hand, Giza111 exhibited high population during July, then declined sharply till the end of the season.

The obtained results were in accordance with those of Sawires *et al.*(1990) and Amer (2003) who found that the spider mite reached its peak on soybean during July.

Table (2): Mean number of motile stages of *Tetranychus cucurbitacearum* (Sayed) and immature stages of *Bemisia tabaci* (Genn.) /10 leaflets on three soybean varieties during 2004 season.

Sampling date	Giza21		Giza22		Giza111	
	Spider mite	whitefly	Spider mite	whitefly	Spider mite	whitefly
July, 4	278.75	3.00	287.00	4.75	445.25	926.25
11	283.75	6.75	596.25	8.75	367.50	617.75
18	251.00	3.75	522.75	3.75	463.50	295.75
25	416.00	6.00	13.25	4.50	44.00	16.00
Aug., 1	5.00	7.25	1.75	13.75	0.00	1.00
7	0.75	38.00	0.75	90.25	2.75	3.00
14	0.00	55.50	1.50	104.00	1.50	5.00
21	0.00	186.75	0.00	110.00	0.00	0.00
29	1.25	113.75	0.00	116.25	1.50	2.25
Sept., 5	3.25	194.25	1.00	87.75	2.50	3.25
12	16.50	113.00	3.50	50.00	3.50	0.50
19	25.25	170.50	1.50	24.25	18.75	8.25
26	23.75	154.50	19.50	13.25	14.50	16.50
Oct., 3	67.25	105.00	11.50	91.25	26.25	10.25

Based on the seasonal mean of the population, the results in Table (3) revealed that, in the first season, Giza111 harbored the highest number of the spider mite , while Giza21 received the least number . In the second season ,there was insignificant differences between the three tested varieties. As for the white fly, the highest population took place on Giza21 and Giza111 in the first and second season , respectively, while the least number occurred on Giza22 in both seasons. Generally, it was apparent that all the tested varieties exhibited higher numbers of the spider mite in the second season than in the first one, while the reverse occurred for the white fly.

Table (3): Seasonal mean of motile stages of *Tetranychus cucurbitacearum* (Sayed) and immature stages of *Bemisia tabaci* (Genn.) on three soybean varieties during 2003 and 2004 seasons.

Variety	*T. cucurbitacearum*			*B. tabaci*		
	1st season	2nd season	LSD at 5%	1st season	2nd season	LSD at 5%
Giza21	8.58	98.19	12.418	940.10	82.70	199.876
Giza22	28.65	104.30	12.727	308.50	51.60	34.858
Giza111	43.15	99.20	41.492	626.50	136.10	180.896
LSDat5%	10.429	32.440	------	203.551	25.848	------

LSD = Least significant difference

Statistical analysis (Table 4) showed a negative insignificant correlation between the spider mite and whitefly on the three varieties in the first season , while in the second season, this relationship was significant on Giza 21 and Giza 22 and high significant positive on Giza 111. This may be attributed to the competition on the feeding site as both pests prefer the lower surfaces of leaves.

Table (4): Simple correlation and simple regression between the population of *Tetranychus cucurbitacearum* (Sayed) and *Bemisia tabaci* (Genn.) on three soybean varieties during 2003 and 2004 seasons.

Variety	2003		2004	
	Simple correlation	Simple regression	Simple correlation	Simple regression
Giza 21	- 0.477	- 23.747	- 0.651*	- 0.337
Giza 22	- 0.393	- 1.169	- 0.539*	- 0.116
Giza 111	- 0.330	- 1.593	0.886**	1.425

* =Significant ** = High significant

However, Gamieh and El-Basuony (2001) reported that Giza21 was more susceptible to infestation with whitefly nymphs and moving stages of spider mite followed by Giza22 , while Giza111 was the least infested one. Also, Amer (2003) found that Giza22 was resistant to spider mite and whitefly infestation.

Taha *et al.*(2001) reported that Giza21 was less susceptible to infestation with the spider mite and whitefly.

2 – Effect of certain weather factors on the population density of *Tetranychus cucurbitacearum* (Sayed) and *Bemisia tabaci* (Genn.):-

Data depicted in Table (5) reveal the effect of the prevailing temperature and relative humidity on the motile stages of *T. cucurbitacearum* on the three soybean varieties during seasons of 2003 and 2004. The results refer that the population of this pest were not significantly affected by the two considered weather factors in the two study seasons. This means that the two factors were within the optimum range for the population activity .

Table (5) : Simple correlation (r),partial regression (b) and explained variance (EV) for the population density of *Tetranychus cucurbitacearum* (Sayed) on the three soybean varieties under weekly mean temperature (Temp.C^0) and relative humidity (RH%) during 2003 season.

Season	Variety	Factor	r	b	%EV
2003	Giza 21	Temp.	0.111	5.625	3.43
		R.H.	0.004	-1.604	
	Giza22	Temp.	0.079	57.370	20.99
		R.H.	- 0.199	- 22.359	
	Giza111	Temp.	0.103	88.899	19.35
		R.H.	- 0.166	- 33.262	
2004	Giza 21	Temp.	- 0.377	- 38.923	15.35
		R.H.	- 0.086	- 4.796	
	Giza22	Temp.	0.152	22.146	2.44
		R.H.	- 0.044	- 2.360	
	Giza111	Temp.	- 0.001	- 1.954	6.63
		R.H.	- 0.257	- 14.457	

The combined effect of the two considered factors (expressed as percentage of explained variance) on the spider mite population was

3.43%, 20.99% and 19.35% on Giza21, Giza22 and Giza111,respectively in the first season, while it was 15.35%, 2.44% and 6.63%, respectively in the second season. This means that there are many other unconsidered factors influencing the spider mite population.

As for the white fly, the results in Table (6) showed that the population were affected insignificantly by temperature and relative humidity on the three tested varieties during the two seasons. The combined effect of the two weather factors on the population was 2.32%,3.58 and2.09% on Giza21, Giza22 and Giza111,respectively in the first season , while in the second season, it was 4.41%, 38.05% and 5.02%,respectively.

Table (6) : Simple correlation (r),partial regression (b) and explained variance (EV) for the population density of *Bemisia tabaci* (Genn.) on the three soybean varieties under weekly mean temperature (Temp.C^0) and relative humidity (RH%) during 2004 season.

Season	Variety	Factor	r	b	%EV
2003	Giza 21	Temp.	- 0.133	- 25.763	2.32
		R.H.	- 0.151	- 40.083	
	Giza22	Temp.	- 0.189	-50.766	3.58
		R.H.	- 0.144	2.316	
	Giza111	Temp.	0.091	151.747	2.09
		R.H.	0.009	- 42.058	
2004	Giza 21	Temp.	0.089	5.219	4.41
		R.H.	0.185	4.431	
	Giza22	Temp.	0.591	19.424	38.05
		R.H.	0.144	2.534	
	Giza111	Temp.	0.008	- 0.896	5.02
		R.H.	- 0.224	- 20.209	

These results were in agreement with those obtained by Helaly *et al.*(1990) who found that mean temperature and relative humidity showed insignificant effect on the population of *T. urticae*. On the other hand, Taha *et al.*(2001) revealed that the

was significant relationship between the infestation level of soybean with sucking pests and the climatic factors; temperature and relative humidity.

3- Leaf chemical contents of soybean varieties in relation to infestation with *Tetranychus cucurbitacearum* (Sayed) and *Bemisia tabaci* (Genn.) :-

Data presented in Table (7) showed significant differences in leaf nitrogen content between the three soybean varieties, as giza21 had higher content of nitrogen followed by Giza111, while Giza22 had the least content. Also, Giza21and Giza111 exhibited higher content of potassium than Giza22. There was no significant differences in phosphorus content between the tested varieties.

Table (7): The relationship between leaf chemical contents of some soybean varieties and infestation with *Tetranychus cucurbitacearum* (Sayed) and *Bemisia tabaci* (Genn.) :-

Variety	Macro-elements (%)			Micro-elements (mg/Kg)			Total phenols (%)
	N	P	K	Zn	Mn	Fe	
Giza21	3.490	0.030	1.090	10.0	56.7	214.1	0.0144
Giza22	2.220	0.023	0.960	40.0	42.8	154.6	0.0142
Giza111	3.060	0.023	1.150	10.2	66.4	237.4	0.0141
LSD at 5%	0.274	0.009	0.091	0.922	0.800	1.792	0.0005
Correlation coefficient values							
Mite	-0.983*	-0.988*	-0.892	+0.989*	-0.879	-0.909	-0.489
Whitefly	+0.528	+0.781	+0.936	-0.777	+0.945	+0.922	-0.312

* Significant at 5 %

The three tested varieties differed significantly in its contents of micro-elements; zinc, manganese and iron , as Giza22 had higher content of zinc , while Giza111 had higher content of manganese and iron. On the other hand, there was insignificant differences between the tested varieties in total phenols . A negative correlation was evident between the population density of motile stages of mite and nitrogen, potassium, phosphorus ,manganese and iron . while the correlation was positive for *B. tabaci* nymphs. Both

of *T. cucurbitacearum* and *B. tabaci* were negatively related with phenols content in soybean leaves.

However, Gamieh and El-Basuony (2001) reported that the soybean leaves content of nitrogen and phosphorus were positively correlated with the moving stages of spider mite and *B. tabaci* nymphs. Zaher *et al.*(1980) found insignificant positive correlation between infestation of soybean with the two spotted spider and the leaf content of nitrogen.

Generally, it could be concluded that Giza111 was susceptible to infestation with the spider mite and whitefly and there was a correlation between the chemical characteristics of leaves and the infestation with both pests. Also, the prevailing temperature and relative humidity did not significantly affected the population density of the two pests during the two study seasons.

Thus, the gained results can encourage adopting breeding programs to select soybean varieties which are less susceptible to pest infestation as an attempt to minimize the pesticides use.

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الملخص العربى

الكثافة العددية للعنكبوت الأحمر *Tetranychus cucurbitacearum* (Sayed) والذبابة البيضاء *Bemisia tabaci* (Genn.) على بعض أصناف فول الصويا وعلاقتها ببعض الظروف الجوية والمكونات الكيماوية للأوراق

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أجريت الدراسة لتقدير الكثافة العددية لكل من العنكبوت الأحمر *Tetranychus cucurbitacearum* (Sayed) والذبابة البيضاء *Bemisia tabaci* (Genn.) على ثلاثة أصناف من فول الصويا (جيزة ٢١، جيزة ٢٢ ، جيزة ١١١) في مزرعة محطة البحوث الزراعية بسخا – كفر الشيخ خلال موسمي ٢٠٠٣ ، ٢٠٠٤ وعلاقة التعداد ببعض العوامل الجوية السائدة والمكونات الكيماوية للأوراق.

وقد أوضحت النتائج المتحصل عليها أنه في الموسم الأول كان أعلى تعداد للعنكبوت الأحمر على الصنف جيزة ١١١ ، بينما كان أقل تعداد على الصنف جيزة ٢١ وفى الموسم الثاني لم توجد فروق معنوية في التعداد بين الأصناف الثلاثة. أما في حالة الذبابة البيضاء فكان الصنف جيزة ٢١ والصنف جيزة ١١١ أكثرهم حساسية للإصابة في الموسم الأول والثاني على التوالي، بينما كان الصنف جيزة ٢٢ اقلهم حساسية في الموسمين ، وأيضا كان تعداد العنكبوت الأحمر أعلى في الموسم الثاني عن الموسم الأول على الأصناف الثلاثة بينما كان العكس في الذبابة البيضاء.

وقد وُجد أن تعداد العنكبوت الأحمر والذبابة البيضاء على الأصناف الثلاثة لم يتأثر بدرجة معنوية بالحرارة والرطوبة النسبية السائدة وكان التأثير المشترك لهما على تعداد كل من الآفتين أقل وضوحا خلال موسمي الدراسة . كما وُجد ارتباط سالب بين تعداد العنكبوت الأحمر ومحتوى الأوراق من النتروجين والفوسفور والبوتاسيوم والمنجنيز والحديد ، بينما كان الارتباط موجبا في حالة الذبابة البيضاء. كما وُجد ارتباط سالب بين تعداد الآفتين والفينول الكلى في الأوراق .

وهكذا فان النتائج المتحصل عليها لها أهمية كبيرة حيث تؤخذ في الاعتبار عند تصميم برامج الإدارة المتكاملة للآفات.