

POPULATION DENSITY OF CERTAIN PIERCING SUCKING PESTS ON THREE SOYBEAN VARIETIES IN RELATION TO SOME LEAF CHARACTERISTIC

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ABSTRACT

The population density of the white fly, *Bemisia tabaci* (Genn.), the cotton aphid, *Aphis gossypii* Glov., jassids, *Empoasca* spp. and the spider mite, *Tetranychus urticae* Koch. were evaluated on three soybean varieties (Giza 35, Giza 82 and Clark) at Sakha Agricultural Research Station Farm, Kafr El-Sheikh during two successive seasons; 2008 and 2009 as well as its relation to hair numbers on leaf and chlorophyll content.

The obtained results indicated that *B. tabaci* started to appear with higher numbers than the other pests during the two study seasons and its population was the highest, while *T. urticae* was the least. *B. tabaci* recorded two peaks of abundance in every season (on 26th June and 23rd August, respectively). Both *Empoasca* spp. and *T. urticae* recorded its maximum on 26th July in the two seasons. One peak of abundance for *A. gossypii* occurred in the first season (26th July) and two peaks in the second season (12th July and 23rd August).

The statistical analysis indicated insignificant differences in chlorophyll content of leaf between the three varieties in spite of the differences in the population of the considered pests, while the hair density on leaf significantly affected the pest population. Giza 35 which possessed the highest number of hairs on leaf, harbored the highest population of *B. tabaci* and *T. urticae* and the lowest population of *A. gossypii*. The highest number of *A. gossypii* occurred on Clark variety which had the low number of hairs on leaf. Giza 82 was the least infested with *A. gossypii* and *T. urticae* and had a moderate number of hairs on leaf. The three tested varieties did not appear a significant differences to infestation with *Empoasca* spp. Thus, the varieties that had a low number of hairs on leaves should be used as a safe and easy tool in the integrated pest management program to reduce the infestation with the harmful pests of soybean.

INTRODUCTION

Soybean (*Glycin max* L.) is one of the most important protein sources of forage production and through its favorable chemical composition, it plays an increasing role in human nutrition. This crop has been subjected to attack by many piercing sucking pests such as; whiteflies, aphids, jassids and spider mite which cause serious damage either directly by sucking plant juice or indirectly by viral diseases transmission (Gamieh and El-Basuony, 2001; Taha *et al*, 2001; Salman *et al*, 2002; Magouze *et al*, 2006).

In general, the control strategies must be developed to control the pests of soybean without using the conventional pesticides which cause environmental pollution, destruction of beneficial insects and pest resistance to many pesticides. Therefore, it is necessary to select tolerant or resistant

varieties as one of the simplest useful tactics in the integrated pest management programs (Dent, 1991).

However, soybean varieties exhibited variable reactions to sucking pests infestation on plant physical properties (McAuslane, 1996) or chemical components of plant leaf (Hildebrand *et al*, 1986 and Gamieh and El-Basuony, 2001). The biochemical factors, to a large extent, affect the behavior and metabolic processes of pest, while morphological factors mostly influence the locomotion, feeding, oviposition, ingestion and diction of the pest (Kummar, 1984).

Therefore, the present study was initiated to study the population fluctuation of certain piercing sucking pests on soybean plants during two seasons; 2008 and 2009 and the relative susceptibility of three soybean varieties to the infestation with examined pests under field conditions. Also, the study involved the relationship between population of these pests and some physical and chemical contents of plant leaf.

MATERIALS AND METHODS

Field experiments were carried out at Sakha Agriculture Research Station Farm, Kafr El-Sheikh region, Egypt during the two successive seasons of 2008 and 2009 to determine the population densities of piercing sucking pests; aphids, *Aphis gossypii* Glover.; whitefly, *Bemisia tabaci* (Genn.); jassids, *Empoasca* spp. and the spider mite, *Tetranychus urticae* Koch. on three soybean varieties. Also, the relationship between the considered pest populations and some physical and chemical leaf components were investigated.

The tested soybean varieties (Giza 35, Giza 82 and Clark) were obtained from Food Legumes Research Section, Sakha Agriculture Research Station. The varieties were sown in nearly mid-May during 2008 and 2009 seasons. For each season, the experimental area was divided into 16 plots each of 42 m² in a complete randomized block design with four replicates for each variety. Normal agricultural practices were followed without any pesticidal treatments throughout the two growing seasons.

Weekly sample of ten leaflets was randomly taken from each plot when plants were one month old and continued till the end of the growing season. The number of aphids and jassids were directly counted in the field with aid of lens. The same collected leaflets were kept in paper bags and transferred to laboratory to count whitefly (nymphs) and spider mites (moving stages) using the aid of binocular microscope.

To determine the hair density, plant leaflet samples were collected from each variety at 60 days after sowing during season of 2009 and the hair numbers were counted at one cm² on the lower surface of leaflets. Also, at one month after sowing, sample of 5 leaflets were taken from each plot for each variety to determine the leaf chlorophyll contents (ppm) by using chlorophyll meter (Model: Spad-502).

The obtained data were statistically analyzed using Least Significant differences (LSD) at 5 % level (Duncan,1955) to reveal the significance among the involved varieties.

RESULTS AND DISCUSSION

1. Population fluctuation of certain sucking pests on soybean plants:

Data presented in Table (1) show the population fluctuation of four sucking pests; *Bemisia tabaci* (Genn.), *Aphis gossypii* (Glov.), *Empoasca* spp. and *Tetranychus urticae* Koch. on soybean plants during two successive seasons, 2008 and 2009. The immature stages of *B. tabaci* started to appear with relatively high numbers on 14th June with means of 76.58 and 70.17 nymphs/in² in the first and second season, respectively. Then, the population recorded the first peak after one week with 138.92 and 172.83 nymphs/in² for the first and second season, respectively. After that, the population decreased, then increased suddenly reaching the second peak on 23rd August with means of 152.33 and 153.83 nymphs/in² for the first and second season, respectively. Then, the population declined till the end of the season (20th September).

With regard to *A. gossypii*, the population appeared from the second week of July (16.33 insects/10 leaflets) and continued till the late week of August recoding its maximum (26.33 insects) on 26th July in season of 2008. In the second season (2009), the population appeared on late June with mean of 33.42 insects/10 leaflets and continued till the end of the season. Two peaks of abundance were recorded by 12th July and 23rd August with means of 61.67 and 43.92 insects/10 leaflets, respectively.

Table (1): Population fluctuation of certain sucking pests on soybean plants during two growing seasons, 2008 and 2009 at Kafr El-Sheikh region.

Sampling date	2008 season				2009 season			
	<i>Bemisia tabaci</i>	<i>Aphis gossypii</i>	<i>Empoasca</i> spp.	<i>Tetranychus urticae</i>	<i>Bemisia tabaci</i>	<i>Aphis gossypii</i>	<i>Empoasca</i> spp.	<i>Tetranychus urticae</i>
June 14	76.58	0.00	0.83	6.50	70.17	0.00	1.00	3.92
June 28	138.92	0.00	3.58	22.67	172.83	33.42	1.33	11.83
July 12	66.42	16.33	1.33	27.58	71.17	61.67	3.67	26.50
July 26	73.42	26.33	17.42	54.33	57.42	44.08	10.42	61.67
Aug. 9	61.00	10.17	6.50	12.67	57.25	16.92	1.67	16.00
Aug. 23	152.33	7.83	1.92	12.58	153.83	43.92	0.92	8.25
Sept. 6	97.83	0.00	0.42	22.33	95.00	30.92	0.33	21.83
Sept. 20	70.58	0.00	0.00	5.33	52.92	21.75	0.00	4.00
Seasonal mean	92.14a	7.58c	4.00d	20.50b	91.32a	31.59b	2.42d	19.25c
LSD* (5%)	3.54				3.60			

LSD* = Least significant differences at 5% level

As for *Empoasca* spp., the results indicated that the population started with few number on 14th June with means 0.83 and 1.00 insect/10 leaflets) in the first and second season, respectively. Then the population

increased gradually reaching its maximum on 26th July with means of 17.42 and 10.42 insects in the first and second seasons, respectively. After that, the population decreased gradually and disappeared completely at the end of the season (20th September).

Concerning *T. urticae*, the population started to appear with few number (6.50 and 3.92 individuals/10 leaflets) on 14th June in the 1st and 2nd season, respectively, then increased gradually reaching its maximum of 54.33 and 61.67 individuals/10 leaflets by 26th July in the first and second season, respectively.

Then, the population declined and increased again in the first week of September recording a moderate peak of 22.33 and 21.83 individuals/10 leaflets in the first and second season, respectively.

Based on the seasonal mean of the considered pests, *B. tabaci* was significantly the most dominant in the two seasons (92.14 and 91.32 insects/10 leaflets, respectively), while, *Empoasca* spp. was the least (4.0 and 2.42 insects/10 leaflets, respectively). *Aphis gossypii* exhibited 7.58 and 31.59 insects/10 leaflets, respectively, while *T. urticae* recorded a moderate population (20.50 individuals/10 leaflets) in the first season. In the second season, the least number took place with *Empoasca* spp. (2.42 insects/10 leaflets), while *A. gossypii* and *T. urticae* exhibited a moderate population with means of 31.59 and 19.25 individuals, respectively.

2. The relative susceptibility of three soybean varieties to infestation with certain sucking pests:

The results in Table (2) show the seasonal mean of the sucking pests on the three soybean varieties during the seasons of 2008 and 2009. Statistical analysis showed significant differences among varieties; Giza 35, Giza 85 and Clark to infestation with the considered sucking insects. Based on the mean of the two study seasons, it is apparent that Giza 35 was the most infested with *B. tabaci* and *T. urticae*. On the other hand, Clark was the highest infested with *A. gossypii*, while it was the least infested with *B. tabaci*. Giza 82 was the least infested with *A. gossypii* and *T. urticae*. With regard to *Empoasca* spp., there was insignificant differences between the three tested varieties.

These results agreed with those obtained by Gameih and El-Basuony (2001) who found that Giza 35 variety was the most susceptible to mite and *B. tabaci* infestation.

3. Leaf chlorophyll content and hair numbers of some soybean varieties in relation to infestation with sucking pests:

The results in Table (3) show the chlorophyll content of leaf and hair numbers of three soybean varieties and its relation to the population of the considered pests during 2009 season. It was apparent that the three tested varieties did not differ significantly in the chlorophyll content of leaf, while it was significant difference in number of hairs on leaf as Giza 35 possessed more hair on leaves (720.50/cm²) than Giza 83 (465.75/cm²), while the lowest number of hairs was observed on variety Clark (315.00/cm²).

These results were in a harmony with those obtained by Gamieh and El-Basuony (2001) who found that, Giza 35 possessed more hair on leaves than Giza 83 and Clark. El-Samahy (2008) showed that faba bean varieties varied to their chlorophyll content and the infestation with aphid, *Aphis craccivora* Koch.

Table (2): Seasonal mean of certain sucking pests on three soybean varieties during two successive seasons, 2008 and 2009 at Kafr El-Sheikh region.

Variety	Mean No. of <i>Bemisia tabaci</i> /10 Inch ²			Mean No. of <i>Aphis gossypii</i> /10 leaflets			Mean No. of <i>Empoasca</i> spp./10 leaflets			Mean No. of <i>Tetranychus urticae</i> /10 leaflets		
	2008	2009	Mean No. of the two seasons	2008	2009	Mean No. of the two seasons	2008	2009	Mean No. of the two seasons	2008	2009	Mean No. of the two seasons
	Giza 35	160.63 a	156.22 a	158.43 a	10.75 a	24.75 b	17.75 b	3.75 ab	2.50 a	3.13 a	25.50 a	29.75 a
Giza 82	62.25 b	73.75 b	68.00 b	5.00 c	20.50 b	12.75 c	4.75 a	2.75 a	3.75 a	16.50 c	11.50 c	14.00 c
Clark	51.50 c	44.00 c	47.75 c	7.00 b	49.50 a	28.25 a	3.50 b	2.00 a	2.75 a	19.50 b	16.50 b	18.00 b
LSD (5%)	3.25	2.92	11.24	1.52	8.76	2.42	1.50	1.26	1.46	2.48	1.56	3.18

LSD* = Least significant differences at 5% level.

Table (3): Mean number of hairs on leaf and chlorophyll content of three soybean varieties during 2009 growing season at Kafr El-Sheikh region.

Variety	Chlorophyll (ppm)/leaflet	Mean No. of hairs/cm ²	Mean No./10 Inch ²	Mean No./10 leaflets			
			<i>Bemisia tabaci</i>	<i>Aphis gossypii</i>	<i>Empoasca</i> spp.	<i>Tetranychus urticae</i>	
Giza 35	4.25 a	720.50 a	156.22 a	24.75 b	2.50 a	29.75 a	
Giza 82	3.88 a	465.75 b	73.75 b	20.50 b	2.75 a	11.50 c	
Clark	3.89 a	315.00 c	44.00 c	49.50 a	2.00 a	16.50 b	
LSD*(5%)	0.58	18.97	2.92	8.76	1.25	1.56	

LSD* = Least significant differences at 5% level

From the results, it was clear that the number of hairs on leaf affected the population of the pests on the tested varieties. Giza 35 which had the highest number of hairs (720.30 hairs/cm²) harbored the highest population of *B. tabaci* (156.22 nymphs/10 in²) and *T. urticae* (29.75 indiv./10 leaflets). On the other hand, opposite trend was found for *Ap. Gossypii* as the highest population was recorded on Clark (49.50) that had the lowest number of hairs on leaf (315.00 hairs/cm²).

Similar results were reported by Gameih and El-Basuony (2001) and Abou-Attia (2006) who found that Giza 35 which possessed more hairs on leaves, harbored the highest numbers of *B. tabaci* and *T. urticae*.

Also, Mc Auslane *et al* (1995) found greater population of immature whiteflies occurring in pubescent and hirsute soybean than in either glabrous soybean. Mc Auslane (1996) reported that whiteflies laid significantly more

eggs on hirsute soybean than on glabrous ones. Karmaker *et al* (1994) found a positive correlation but non-significant between phytophagous mite, *Schizotetranychus cajani* (Gupta) and number of hairs on pigeon peas leaflets. Heather (2000) reported that smooth-leafed cotton and soybean varieties were less favored to oviposition by the *Bemisia* females. On the other hand, the hairy leaflet ones and that glossy (less waxy) crucifers, such as Broccoli and Collard were less acceptable for oviposition than varieties with a normal wax layer.

Finally, it can be concluded that varieties of soybean that possessed a low number of hairs on leaf should be used as a safe and easy tool in the integrated pest management program to reduce the infestation with the harmful pests.

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الكثافة العددية لبعض الآفات الناقبة الماصة الموجودة على ثلاثة أصناف لفول الصويا وعلاقتها ببعض صفات الورقة

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أجريت هذه الدراسة بمحطة البحوث الزراعية بسخا - كفر الشيخ خلال موسمين متتاليين ٢٠٠٨ و ٢٠٠٩م لتقدير الكثافة العددية للآفات الناقبة الماصة (وهي الذبابة البيضاء - من القطن - الجاسيد - العنكبوت الأحمر المعادي) وعلاقتها بكثافة الشعيرات ومحتوى الكلوروفيل لبعض أصناف فول الصويا. وكانت أهم النتائج هي:

ظهور الذبابة البيضاء بأعداد أعلى من الآفات الأخرى خلال موسمي الدراسة، في حين كان العنكبوت الأحمر أقل الآفات تعدداً. سجلت الذبابة البيضاء ذروتان في ٢٨ يوليو و٢٣ أغسطس. وصل تعداد الجاسيد والعنكبوت الأحمر إلى لقصاه خلال موسمي الدراسة في ٢٦ يوليو، ولقد وجد لمن القطن ذروة واحدة في الموسم الأول (٢٦ يوليو) أما في الموسم الثاني سجلت هذه الحشرة ذروتان في ١٢ يوليو و٢٣ أغسطس.

أوضح التحليل الإحصائي عدم وجود فروق معنوية بين الأصناف الثلاثة المختبرة في محتواها من الكلوروفيل، كما وجد أنه لم يكن هناك تأثير لمحتوى الأصناف من الكلوروفيل على نسبة الإصابة بالآفات محل الدراسة. ومن جهة أخرى أثرت كثافة الشعيرات على تعداد الآفات تأثيراً معنوياً، حيث وجد أن صنف جيزة ٣٥ المحتوى على أعلى كثافة من الشعيرات سجل أعلى تعداد من الذبابة البيضاء، والعنكبوت الأحمر وأقلهم من القطن بل قد تميز الصنف كلارك بانخفاض كثافة الشعيرات مما نتج عن ذلك تسجيله لأعلى تعداد لمن القطن. وجد أن الصنف جيزة ٨٢ أقل الأصناف إصابة بمن القطن والعنكبوت الأحمر حيث أنه تميز بأنه صنف وسط بين الأصناف المختبرة في كثافة الشعيرات. لم تكن هناك اختلافات معنوية بين الأصناف الثلاثة في نسبة الإصابة بالجاسيد.

مما سبق يتضح أن الأصناف التي تتميز أوراقها بانخفاض كثافتها من الشعيرات يمكن أن تدخل ضمن برنامج الإدارة المتكاملة لخفض الإصابة بالآفات التي تصيب محصول فول الصويا.

قام بتحكيم البحث

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