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RESISTANCE OF SOME SOYBEAN VARIETIES TO *BEMISIA TABACI* (GENN.) (HOMOPTERA: ALEYRODIDAE) AND *THRIPS TABACI L.* (THYSANOPTERA: THIRPIDAE) IN ASSIUT

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ABSTRACT:

The present investigations were conducted at the Experimental Farm of the Agriculture Research Station, Arab-El-Awamer (Abnoub district), Assiut Governorate during 2013 and 2014 soybean growing seasons. The obtained results showed that the populations of *T. tabaci* and *B. tabaci* started in a few numbers on all soybean varieties during the first week of July in 2013 and 2014 seasons. The peak populations of these pests occurred during August and/or during September and ranged from 1 to 3 peaks for *T. tabaci* and from 1 to 2 peaks for *B. tabaci* according to each variety. Results also indicated that there were highly significant differences in susceptibility between the soybean varieties (F = 7.72 and 18.84 > 0.01) and between seasons (F = 10.44 and 4.27 > 0.01) for *T. tabaci* and *B. tabaci* populations, respectively. The combined effect of the weekly mean of maximum and minimum temperature, average relative humidity and predator populations was responsible for 81.80 % and 87.10 % of the changes in the populations of *T. tabaci* and *B. tabaci* during the two seasons of study. Concerning the resistant status of the tested soybean varieties to the whitefly and the cotton thrips, the results showed different susceptibility degrees to these pests. The cultivars H 117, G 22 G 111 and H 32, G 22, G 111 appeared as susceptible (S) to the cotton thrips and the whitefly infestations, respectively. Meanwhile, the cultivars H 117, H 30, Clark and H 117, H 127, H 30 Clark appeared as low susceptible (LR) to the aforementioned pests infestations, respectively.

INTRODUCTION:

Soybean crop, Glicn max Merr. is considered one of the most important legume crops during summer plantations, with great nutritive value, containing relatively high percentage of oil and proteins contains many essential amino acids (Badenhop and Hacker, 1971; Hamed, 1989; Metwally, 1989; El-Doksh, 2006; Abou-Attia and Youssef, 2007 and El-Sanady *et. al.*, 2008).

Piercing and sucking insect pests such as, whitefly, *Bemisia tabaci* (Genn.) and cotton thrips, *Thrips tabaci L.* are the major insect pests attacking soybean plants in the field and causing severe damage (Awadalla *et. al.*, 1991; El-Khouly *et. al.*, 1998). Populations of these pests have previously been reported by several authors (Gammel, 1972; El-Kifl *et. al.*, 1974; Hamed, 1977; Shaheen, 1977; Ohnesorge, 1981; Ohnesorge *et. al.*, 1981; Karaman *et. al.*, 1984; Metwally, 1989; and Sedaration *et. al.*, 2010).

Resistant plants appear to be one of the most promising alternatives to the use of chemicals for pest control as reported by

Mentia and Particia, 1993; Mahmoud, 2013 and Abdel-Galil and Amro, 2014 (on sesame plants), Nossir, 1996; Amro, 1999 and 2004 and Mohamed *et. al.*, 2000 (on cowpea plants), Amro *et. al*., 2007 (on soybean plants) and Amro, 2008 (on cucurbit plants).

The present studies were carried out to clarify the relative resistance of seven soybean varieties to whitefly and thrips. Also, study the population of these pests and factors affecting the population density of these pests.

MATERIALS AND METHODS

The present investigations were carried out at the Experimental Farm of Agricultural Research Station, Arab-El-Awamer (Abnoub district), Assiut Governorate during 2013 and 2014 soybean growing seasons. The soybean varieties (i.e., Hybrids 117, 127, 30, 32, Giza 22, 111 and Clark) were planted in the first half of May in both seasons.

An area of about ¼ feddan was chosen and divided into 28 plots (4 replicates / variety). The varieties were planted in a randomized complete blocks design. Regular conventional agricultural practices were normally performed and insecticides were prevented.

The population of whitefly and thrips were monitored weekly from July to September during two growing seasons. Samples of 10 leaves were picked up at random from each plot and transferred to the laboratory in paper bags. Leaves were examined under stereomicroscope to count thrips and whitefly. Numbers of the cotton thrips (nymph and adult) and whitefly (egg and nymph) were counting and recorded. Also, the associated predators were recorded on each plot.

Temperature (maximum and minimum) and average relative humidity for Assiut governorate were obtained from the central laboratory for agricultural climate, ARC, MOA at Giza Governorate. The relationship between the population of these pests and both abiotic and biotic factors were statistically analyzed using multiple regression analysis (Fisher, 1950).

Data obtained were statistically analyzed by using F-test and means were compared according to Duncan's multiple range test (Duncan, 1955).

Resistance status of each soybean cultivars was dependent on the general mean number of the pest (X) and the standard deviation (SD) as reported by Chiang and Talekar (1980). Cultivars that had mean numbers more than X+2SD, were considered highly susceptible (HS); between X and X+2SD, susceptible (S); between X and X-1SD, low resistant (LR); between X-1SD and X-2SD, moderately resistant (MR) and less than X-2SD, were considered highly resistant (HR).

Results and Discussion

1- Population density of *T. tabaci* and *B. tabaci* infesting soybean varieties:

Data in Figures 1 and 2 show the population fluctuations of T. tabaci and B. tabaci infesting seven soybean varieties during 2013 and 2014 seasons.

a) The cotton thrips, *T. tabaci*

2013 season:

Data in Figure (1) show that the infestation of soybean varieties by T. tabaci during 2013 began to appear in relatively

few numbers ranged from 2.7 to 6.3 individuals / 10 leaves in the 1st wk of July for all soybean varieties, then it tended to increase gradually reaching peak of population in the 3rdwk of August for H 127 and Clark varieties (108.00 and 100.00 individuals) and in the 4thwk of August for H117, H30, H32, G22 and G111varieties (111.00, 92.30, 126.00, 200.30 and 124.70 individuals, then the population decreased gradually reaching few numbers at the end of September for all varieties. Variety H 127 was recorded two peaks, first in the 2nd and 3rdwks of August, respectively. The results also indicated that the highest mean numbers of *T. tabaci* was observed on Giza 22 (38.90individuals), while the lower mean numbers was recorded on H 30 (20.10individuals).

2014 season:

Data in Figure (1) show that the population of the cotton thrips showed a similar trends to that obtained during 2013 season. The cotton thrips appeared during the 1st wk of July in small numbers ranged 1.00-5.70 individuals). The highest mean numbers of the pest were 129.30, 138.00, 89.30, 159.70, 100.00, 221.70 and 124.00 individuals / 10 soybean leaves for H 117, 127, 30, 32, G 22, 111 and Clark varieties, respectively. Two peaks were occurred in case of G 22 variety in the 3rd and 2ndwks of August and September, respectively. The results also indicated that the lower mean number of *T. tabaci* was recorded on H 30 variety as 21.50 individuals/10 leaves, meanwhile, the highest number of this pest was recorded on G 111 as 72.70 individuals / 10 leaves.

b) The whitefly, *B. tabaci*:

2013 season:

Data in Figure (2) show the number of whitefly/leaf during 2013 and 2014 seasons on soybean varieties. The results indicated that the population of the whitefly started in few numbers after 45 days of sowing date on all tested varieties, then the population increased gradually until reached its main peak during the period which extended from the 1stwk of August until the 2ndwk of September for all tested varieties. After that numbers of the whitefly decreased gradually until the end of season. Data in Figure (2) also indicated that three peaks of this pest on some tested soybean varieties. The first peak (74.70, 81.70, 53.70 and 77.30 individuals/10 leaves) was recorded for H 117, 32, G 22 and Clark, respectively. The second peak was (58.70, 172.00, 135.00 and 52.30 individuals / 10 leaves), respectively. The third peak was (67.30, 112.30, 141.70 and 89.30 individuals / 10 leaves), respectively. On the other hand, two peaks were recorded on the remaining soybean varieties. The first was (75.70, 106.00 and 107.00individuals / 10 leaves) for H 127, 30 and G 111, respectively. The second peak was (133.00, 106.70 and 203.00 individuals/10 leaves), respectively. As shown in Fig. (2) Giza 111 variety was the most susceptible to the whitefly infestation, which received a mean number of 71.00 insect/10 leaves, while soybean variety Clark was high tolerance than other varieties where it received a mean number of 40.60 insect / 10 leaves.

2014 season:

In 2014 season, Fig. (2) indicated that the whitefly began to appear in soybean fields in a relatively low level during the 1stwk of July on all tested varieties. Thereafter, the population tended to increase gradually with fluctuations through July and the first half of August. The maximum level (79.70, 99.30, 106.00, 147.00, 204.30 and 279.30 individuals/10 leaves) was attained during August, 14 for H 117, 127, 30, 32, G 22 and 111, respectively. The highest number (131.00 individuals/10 leaves) was recorded during August, 31 for Clark variety later than one week for the rest of the soybean varieties. Fig. (2) also showed that G 111 variety was the most susceptible to the *B. tabaci* infestation (mean number 121.30 insects / 10 leaves), while soybean variety H 127 was high resistance (mean number 34.50 insects / 10 leaves).

2 - Susceptibility of soybean varieties to *T. tabaci* and *B. tabaci* infestation:

Data in Table (1) summarize the average numbers of the cotton thrips and the whitefly insects, based on samples of 10 soybean leaves/variety during 2013 and 2014 soybean growing seasons. Statistical analysis revealed that highly significant differences between all the tested varieties concerning the populations of sucking pests (F= 7.72 and 18.84> 0.01). Regardless of the seasons, Giza 111 was the most susceptible varieties to infestation with the cotton thrips populations, 52.26 individuals/10 soybean leaves. On the contrary, Hybrid 30 variety was the most resistant harboring the highest population of thrips (20.77 individuals/10 leaves). On the other side, G 111 also was the most susceptible varieties to infestation with the whitefly population (96.18 individuals/10 leaves), meanwhile, H 117, H 127 and Clark were the most resistant varieties to infestation with this pest and harboring 40.40, 41.37 and 41.71 individuals / 10 leaves, respectively.

The present results in Table (1) also indicated that, regardless of the soybean varieties, statistical analysis revealed highly significant differences between the first and the second seasons for the cotton thrips and the whitefly (F= 10.44 and 4.27>0.01, respectively). The mean numbers were higher in the second season (36.14 and 63.08 individuals / 10 leaves) than that of the first season (26.66 and 55.44 individuals/10 leaves) for both *T. tabaci* and *B. tabaci*, respectively. The differences in levels of infesting between the two seasons might be attributed to the differences in climatic factors (mainly temperature and RH) and/or the effect of the common natural enemies.

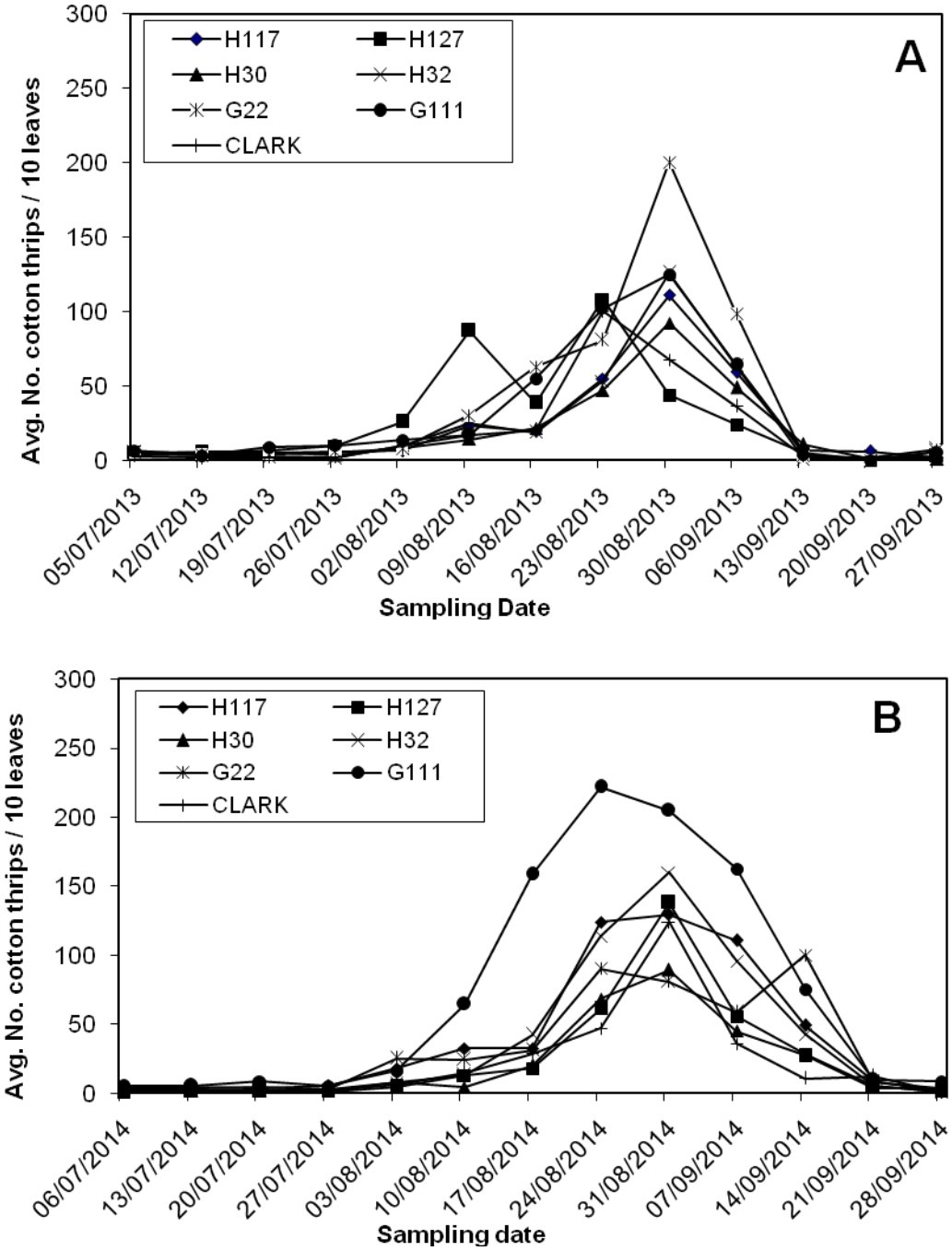

Figure (1): Seasonal abundance of cotton thrips associated with soybean cultivars during 2013 (A) and 2014 (B) seasons.

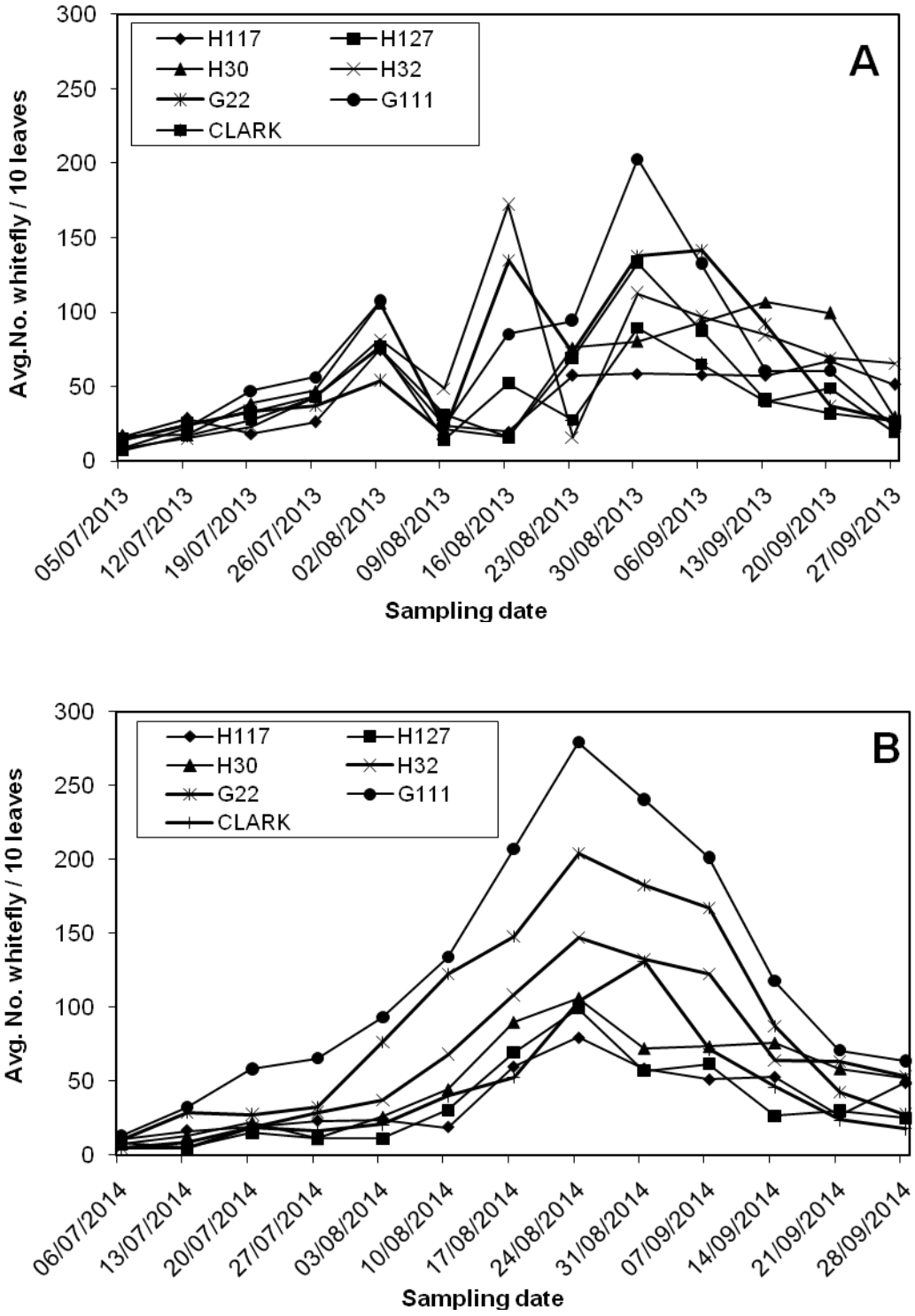

Figure (2): Seasonal abundance of whitefly associated with soybean cultivars during 2013 (A) and 2014 (B) seasons.

Table (1): Average numbers of *T. tabaci* and *B. tabaci* inhabiting some soybean varieties during 2013 and 2014 seasons, Assiut Governorate.

SV	LVL	Cotton thrips	Whitefly
Year	2013	26.656 b	55.440 b
	2014	36.139 a	63.077 a
F value		10.44	4.27
P		0.0013	0.0393
LSD		5.7664	7.2599
Variety	H 117	31.833 bc	40.397 d
	H 127	26.513 bcd	41.372 d
	H 30	20.769 d	53.769 cd
	H 32	31.013 bcd	65.051 cb
	G 22	36.179 b	76.333 b
	G 111	52.256 a	96.179 a
	Clark	21.218 cd	41.705 d
F value		7.72	18.84
P		0.0001	0.0001
LSD		10.788	13.582

3-Simultaneous impacts of certain abiotic and biotic factors on the populations of *T. tabaci* and *B. tabaci* inhabiting soybean plants:

Weather factors and predator numbers play a great role in population fluctuation of insect pests. Therefore, the predators as well as some weather factors, particularly maximum and minimum temperature and average relative humidity (RH) were investigated in the present study to find out the simultaneous effects on the population density of *T. tabaci* and *B. tabaci* inhabiting soybean varieties.

a) The cotton thrips, *T. tabaci*:

The relationship between the population of *T. tabaci* and the weather factors as well as the predator numbers are presented in Table (2). Simple correlation coefficient revealed that, the predators had significant positive effect on the population of thrips (r = 0.823), whereas maximum temperature and relative humidity had insignificant positive effects (r = 0.078 and 0.411). On the contrary, minimum temperature had insignificant negative effect on the pest population (r = - 0.037). However, the coefficient of determination (R^2 x 100) was 81.80 % indicating that the four mentioned variables were together responsible for 81.80 % of the changes in thrips populations. By dropping each variable (Decrease in R^2 ×100), step by step from the input the analysis data, to explain the gradual represented efficiency of each variable on the population changes of the

insect pest, the studied variables can be arranged in a descending order as follows: predators, temperature (min. and max.) and average relative humidity, where their efficiency were 67.70, 7.70, 5.10 and 1.30 %, respectively.

b) The whitefly, *B. tabaci*:

Data in Table (2) show the effect of some factors on the population of *B. tabaci* and some abiotic and biotic factors. Data indicated that the simple correlation coefficients of the predators and the average relative humidity were positive significant (r = 0.844 and 0.586), respectively, but the minimum and maximum temperature were negatively insignificant (r= 0.069 and 0.033), respectively. The multiple regression analysis revealed that the four studied variables were responsible for 87.10 % of the changes in the whitefly populations. Most of the changes in the pest populations however were due to the predators (71.20 %), the average relative humidity (9.30 %) and the minimum temperature (6.30 %).

Generally, the obtained results indicated that the four mentioned variables were together responsible for 81.80 and 87.10 % of the changes of the cotton thrips and the whitefly populations. Most of the changes of these insect pests depend mainly on the weather factors (mainly temperature and average relative humidity) and the predator numbers during the study period. The effectiveness of weather factors and the predators on the population density of sucking pests on different crops have been studied by several researchers (Ali and Rizk, 1980; Liu, 1993; Koleva *et. al.*, 1996; Abou-Elhagag and Abdel-Hafez, 1998). In addition, Dent (1991) reported that environmental conditions at any location influence the seasonal phenology of insect numbers, the number of generations and the level of insect abundance.

Table (2): Multi-regression analysis between the numbers of *T. tabaci* and *B. tabaci* infesting some soybean varieties and certain weather factors as well as predators during 2013 and 2014 seasons, Assiut Governorate.

Removed variable	Seasons									
	Cotton thrips					Whitefly				
	r	R	R2 × 100	Decrease in R2 × 100	E. V. %	r	R	R2 × 100	Decrease in R2 × 100	E. V. %
Non	-	0.905	81.8	-	-	-	0.933	87.1	-	-
Predators	0.823**	0.638	40.7	41.03	67.7	0.844**	0.761	57.9	29.2	71.2
Mini. Temp.	-0.037	0.904	81.7	0.1	7.7	-0.069	0.927	86.0	1.1	6.3
Max. Temp.	0.078	0.869	75.5	6.3	5.1	-0.033	0.920	84.7	2.4	0.3
Humidity	0.411	0.897	80.5	1.3	1.3	0.586*	0.882	77.8	9.3	9.3

4- Susceptibility degrees of certain soybean cultivars to *T. tabaci* and *B. tabaci*:

Data in Table (3) exhibit the average numbers and the susceptibility degrees of the soybean varieties to the cotton thrips and the whitefly collected during 2013 and 2014 growing seasons.

a) The cotton thrips, *T. tabaci*:

Statistical analysis of the data revealed highly significant differences between the mean numbers of this pest on the tested cultivars (F = 7.72 > 0.01). The soybean cultivars, G111, G22, H117 and H32 were suffer from highly infestations with an average of 52.26, 36.18, 31.83, and 31.01 individuals / 10 leaves, respectively. However, H127, Clark and H30 were infested by quietly low numbers with an average of 26.51, 21.22, and 20.77 individuals/10 leaves. In respect to the susceptibility degrees, the cultivars, H117, G22 and G111 appeared as susceptible (S) cultivars, whereas, they harbored high numbers of this pest. The other four cultivars, H 127, H30, H32 and Clark which harbored quietly low numbers showed some sort of resistance and appeared as low resistant (LR) cultivars. These variations in cultivars resistance degrees may be due to the presence of antibiosis (non-preference) and/or antibiosis characteristics. The use of resistant host plants has been recognized by several entomologists as a high desirable control tactic with excellent potential for regulating population of certain insect pests in integrated pest management (IPM). Sedaratian *et. al.* (2010) found that soybean varieties affect the population density and spatial distribution of *T. tabaci*. The mechanism of host plant resistance to insects included non-preference (antixenoses) and antibiosis tolerance as reported by Painter (1958) and Maxweel (1985). In this approach, Amro (2008) determined the resistance status of selected cucurbit varieties to the main sap-sucking pests in Upper Egypt.

a) The whitefly, *B. tabaci*:

Concerning the mean numbers and the degrees of infestation of the whitefly, B. tabaci, results in Table 3, also showed the existence of highly significant differences between the tested cultivars (F=18.84> 0.01). The lowest value was recorded on soybean cultivars, H30, Clark, H127 and H117 with an average of 53.80, 41.70, 41.40 and 40.40 individuals/10 leaves, respectively. The rest cultivars, G111, G22 and H32 recorded high infestation value with an average of 96.20, 76.30 and 65.10 individuals / 10 soybean leaves, respectively. According to the measurements of the susceptibility degrees, the obtained results indicated that, the cultivars, G111, G22 and H32 appeared as susceptible (S) cultivars, meanwhile, the cultivars, H30, Clark, H127 and H117 appeared as low susceptible (LR) cultivars, respectively. Therefore, it is an important to point out herein that the pest mean numbers must be refer to and / or agree with the resistant degree of each cultivar. These differences in infestation may be due to leaf characters of each soybean cultivar. McAuslane *et al.* (1995) and McAuslane (1996) who found that greater population of immature whiteflies occurred in pubescent and hirsute soybean than in either glabrous soybean or groundnut.

Table (3): Average numbers (a) and susceptibility degrees of certain soybean cultivars to *T .tabaci* and *B. tabhci* during 2013 and 2014 seasons, Assiut Governorate.

Soybean cultivar	Cotton thrips		Whitefly	
	Mean ± SD	Susceptibility degree	Mean ± SD	Susceptibility degree
H117	31.83±6.58 bc	S	40.4±0.62 d	LR
H127	26.51±6.38 bcd	LR	41.4±1.34 d	LR
H30	20.77±5.02 d	LR	53.8±3.05 cd	LR
H32	31.01±9.48 bcd	LR	65.1±3.99 cb	S
G 22	36.18±13.07 b	S	76.3±7.03 b	S
G 111	52.26±8.58 a	S	96.2±18.01 a	S
Clark	21.22±6.59 cd	LR	41.7±15.09 d	LR
Mean	31.4±12.4		59.3±21.6	
F-value	7.72**		18.84**	

(a) Based on 10 soybean leaves / plot.

F value: ** = Highly significant at 0.01 level probability.

Means followed by the same letter(s), in each column, are not significantly different at 0.05 level probability, by Duncan's multiple range test.

S= Susceptible LR= Relatively Resistant

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حساسية بعض أصناف فول الصويا للإصابة بحشرات الذبابة البيضاء و التربس فى أسيوط

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معهد بحوث وقاية النباتات – مركز البحوث الزراعية – جيزة – مصر.

الملخص العربي :

أجريت هذه الدراسة فى محطة البحوث الزراعية بعرب العوامر بمحافظة أسيوط خلال موسمى ٢٠١٣، ٢٠١٤ بهدف دراسة حساسية سبعة أصناف من فول الصويا (هجين١١٧، ١٢٧، ٣٢، ٣٠، جيزة٢٢، ١١١ بلإضافة الى الصنف كلارك) للإصابة بحشرات التربس و الذبابة البيضاء و قد كانت النتائج كما يلى :

بينت الدراسة أن كلا من حشرات التربس و الذبابة البيضاء تتواجد بأعداد قليلة على كل أصناف فول الصويا المختبرة خلال الأسبوع الأول من شهر يوليو و ذلك خلال موسمى الدراسة ، و قد تم تسجيل أعلى تعداد لهاتين الآفتين خلال شهرى أغسطس و سبتمبر و تراوح هذا التعداد العالى ما بين١ – ٣ ذروة بالنسبة لحشرة التربس فى حين كانت من ١ – ٢ ذروة بالنسبة الى حشرة الذبابة البيضاء و ذلك حسب كل صنف على حده.

كان التأثير المشترك لكل من العوامل الغير حيوية (حرارة عظمى – حرارة صغرى – متوسط الرطوبة النسبية) و العوامل الحيوية (المفترسات) مسئولا عن ٨١,٨٠ % ، ٨٧,١٠ % من التغيرات التى تحدث فى تعداد كلا من حشرات التربس و الذبابة البيضاء على الترتيب.

عند دراسة حساسية الأصناف المندرسة للأفات السابقة ، أظهرت الأصناف ١١٧ ، جيزة ٢٢ ، جيزة ١١١ كذلك الأصناف هجين ٣٢ ، جيزة ٢٢، جيزة ١١١ حساسية للإصابة بكل من حشرات التربس و الذبابة البيضاء على الترتيب ، فى حين أظهرت الأصناف هجين ١٢٧ ، هجين ٣٠ ، هجين ٣٢ و كلا من هجين ١١٧ ، هجين ١٢٧ ، هجين ٣٠ و الصنف كلارك درجة حساسية منخفضة لكل من حشرات التربس و الذبابة البيضاء على الترتيب.