

**SUSCEPTIBILITY OF SOME SOYBEAN
VARIETIES TO CERTAIN PIERCING-SUCKING INSECTS
UNDER THE FIELD CONDITIONS OF NORTH DELTA**

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Abstract

Tolerant varieties to insect species represent one of the simplest and important methods of insect pest control to minimize the insecticide hazards. Therefore, susceptibility of five soybean varieties to infestation with some piercing-sucking insects: aphids, *Aphis* spp.; whitefly, *Bemisia tabaci* (Genn.) and leafhoppers, *Empoasca* spp. were evaluated at Sakha Agric. Res. Station Farm, Kafr El-Sheikh Governorate during 2016 and 2017 seasons. The obtained results showed significant differences in susceptibility between the tested soybean varieties to the mentioned insects for every season and from season to another. In general, the population density of whitefly and aphids were higher in the first season than the second one, while the reverse was found for leafhoppers. Based on the grand mean number of the two study seasons, variety Crawford was significantly the most infested variety to infestation with leafhoppers and aphids, while the least infested variety for aphids was Giza35 and for leafhoppers was Hybrid30. As for the whitefly, Giza35 significantly was the most infested variety, while Crawford was the least infested one. In respect to the resistance status of the tested varieties to the insects, Crawford and Hybrid30 showed susceptibility to aphid infestation, while the other varieties exhibited low resistance. Giza111 and Giza35 appeared as susceptible for whitefly, Giza21 and Hybrid30 showed low resistance, while Crawford was moderately resistant. Concerning leafhoppers, Giza111 and Crawford were susceptible. Giza21 showed low resistance, while Hybrid30 was moderately resistant.

INTRODUCTION

Soybean, *Glycine max* (L.) is one of the most important legume crops in Egypt and the world as well. It is an excellent source of protein (30-50%) and oil (18-22%) (Abou-Attia, & Youssef, 2007 and Netam *et al.*, 2013). Soybean plants are attacked by many insect pests, among of which are the piercing-sucking insects such as aphids, *Aphis* spp.; leafhoppers, *Empoasca* spp. and whitefly, *Bemisia tabaci* (Genn.). Large population of these insects intensify sap sucking, favoring the development of sooty mold fungi (*Capnodium* sp.) resulting in reduced photosynthesis and yield either quantity or quality in addition to viral transmission (El-Samahy & Saad, 2010; Abd-El-Samad *et al.*, 2011; Khattab *et al.*, 2012 and Salem, 2016).

Nowadays, the control programs must be developed to control the insect pests of soybean without using insecticides which cause environmental pollution, destruction of beneficial insects and insect resistance to many insecticides. Therefore,

there is an urgent need to determine the sources of resistance existing within soybean breeding lines and cultivars, as the resistant plants are much better than use of chemicals for pest control. From the point of view of the farmers, entomologists and others, the use of resistant cultivars to insect species represents one of the simplest and most convenient method in insect pest control (Dent,1991), since they spread rapidly without much extension effort (Dyck,1974). Also, the resistant cultivars represent the inherent ability of crop plants to restrict, retard or overcome pest infestation and thereby to improve the yield and/ or quality of the harvestable crop product (Kumar, 1984).

So, the present work was undertaken to evaluate the relative susceptibility of five soybean varieties to infestation with certain piercing-sucking insects under field conditions of north delta.

MATERIALS AND METHODS

The experiment was conducted at Farm of Sakha Agric. Res. Station, Kafr El-Sheikh Governorate to evaluate the relative susceptibility of five soybean varieties to natural infestation with three piercing-sucking insects; whitefly, *Bemisia tabaci* (Genn.); leafhoppers, *Empoasca* spp. and aphids, *Aphis* spp. for two successive growing seasons; 2016 and 2017. The seeds of the tested varieties; Crawford, Giza21, Giza111, Giza35 and Hybrid30 were obtained from Food Legumes Research Section, Sakha Agric. Res. Station. In each season, 15 plots, each of 42 m² were prepared for sowing. The seeds were sown by mid-July in a complete randomized block design with three replicates for each variety. All normal agricultural practices were followed without pesticidal treatments throughout the growing season. To estimate the population density of whitefly (adults), leafhoppers (nymphs and adults) and aphids (nymphs and adults), 15 leaves were weekly sampled at random from each plot early in the morning from three different levels of the plant. The upper and lower surfaces of the chosen leaves were carefully examined using lens (8x) to count all individuals of the mentioned insects and the data were recorded in the field. The same leaves were picked up and transferred into paper bags to the laboratory for inspection of the whitefly (nymphs and pupae) using a binocular microscope. Sampling and counting started after one month of sowing till the end of the season.

The classification of the susceptibility degree (SD) of each variety was determined according to general mean (\bar{X}) of the insects and the standard deviation (sd) as reported by Chiang and Talekar (1980). The variety that had mean number of insects more than $\bar{X} + 2\text{sd}$ was considered (highly susceptible); between $\bar{X} + 2\text{sd}$ and \bar{X} (susceptible); between \bar{X} and $\bar{X} - 1\text{sd}$ (low resistant); between $\bar{X} - 1\text{sd}$ and $\bar{X} - 2\text{sd}$ (moderately resistant) and less than $\bar{X} - 2\text{sd}$ was highly resistant.

All the data collected were subjected to analysis of variance and the means of insects on the different varieties were compared according to Duncan's Multiple Range Test at $p = 0.05$ (Duncan, 1955).

RESULTS AND DISCUSSION

Five soybean varieties; Crawford, Giza21, Giza111, Giza35 and Hybrid30 were evaluated for their relative susceptibility to natural infestation with three piercing-sucking insects; whitefly, *Bemisia tabaci* (Genn.); leafhoppers, *Empoasca* spp. and aphids, *Aphis* spp. for 2016 and 2017 seasons.

The results in Table (1) show the seasonal mean numbers of three insects; whitefly, leafhoppers and aphids on the tested soybean varieties during 2016 and 2017 seasons. It was evident significant differences in susceptibility between the tested varieties and between seasons for the three mentioned insects. It is generally notable that the population density of whitefly and aphids were higher in the first season than in the second one, while the reverse was found for leafhoppers. In general, regardless of the seasons, Crawford was the most infested variety with leafhoppers and aphids. On the other hand, the least infested variety with leafhoppers was Giza21 in the first season and Hybrid30 in the second one. Also, Giza35 was the least infested variety with aphids in the first season and Giza111 in the second one. Giza35 was the most infested one with the whitefly, while Crawford was the least infested.

However, the differences in the insect population in the two seasons may be due to the differences in the environmental conditions and/or the abundance of the natural enemies as, they play a great role in regulating the population density and seasonal abundance of insect species on soybean plants as reported by Raupach *et al.*, (2002); Abd-Elsamed *et al.*, (2011) and Al-Habshy *et al.*, (2011).

Table 1. Seasonal mean numbers of three piercing-sucking insects on four soybean varieties and one Hybrid during 2016 and 2017 seasons at Kafr El-Sheikh governorate

Variety	Mean number of insect/15 leaves \pm SE*					
	<i>Bemisia tabaci</i>		<i>Empoasca</i> spp.		<i>Aphis</i> spp.	
	2016	2017	2016	2017	2016	2017
Giza 111	219.7 \pm 0.10b	259.4 \pm 0.06b	3.4 \pm 0.16ab	5.6 \pm 0.07bc	9.4 \pm 0.76bc	1.4 \pm 0.22e
Giza 35	343.2 \pm 0.18a	270.5 \pm 0.10a	3.2 \pm 0.08ab	5.8 \pm 0.04b	5.0 \pm 0.01c	4.6 \pm 0.08d
Giza 21	167.6 \pm 0.06c	166.0 \pm 0.17d	2.5 \pm 0.04b	5.9 \pm 0.08ab	6.9 \pm 0.37bc	5.6 \pm 0.04c
Crawford	144.6 \pm 0.10d	132.0 \pm 0.13e	3.9 \pm 0.12a	6.2 \pm 0.08a	27.9 \pm 0.71a	16.0 \pm 0.12a
Hybrid30	220.5 \pm 0.09b	186.7 \pm 0.22c	2.6 \pm 0.09b	5.3 \pm 0.09c	10.9 \pm 0.32b	8.3 \pm 0.30b
Mean	219.12	202.92	3.12	5.76	12.02	7.18

In each column, means followed by the same letter(s) are not significant by DMRT at 5% level SE* = standard error

Judging by the grand mean number of the two study seasons, the results in Table (2) showed significantly different levels of infestation with the considered insects. Variety Crawford was significantly the most susceptible variety to infestation

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with leafhoppers and aphids with means of 5.1 and 21.9 insects/ 15 leaves, respectively, while the least infested variety for aphids was Giza35 (4.8 insects) and for leafhoppers was Hybrid30 (3.9 insects). As for the whitefly, Variety Giza35 significantly the most infested varieties by mean of 306.8 insects, while Crawford was the least infested one (138.3 insects).

Table 2. Two-season means of numbers of three piercing-sucking insects and susceptibility degree (SD) of four soybean varieties and one Hybrid during 2016 and 2017 seasons at Kafr El-Sheikh governorate

Variety	<i>Bemisia tabaci</i>		<i>Empoasca</i> spp.		<i>Aphis</i> spp.	
	General mean± SE*	SD	General mean± SE*	SD	General mean± SE*	SD
Giza 111	239.6+0.054b	S	4.5+0.113ab	S	5.4+0.453c	LR
Giza 35	306.8+0.127a	S	4.5+0.058ab	S	4.8+0.042c	LR
Giza 21	166.8+0.081d	LR	4.2+0.058ab	LR	6.2+0.184bc	LR
Crawford	138.3+0.063e	MR	5.1+0.090a	S	21.9+0.399a	S
Hybrid30	203.6+0.075c	LR	3.9+0.090b	MR	9.6+0.253b	S

In each column, means followed by the same letter(s) are not significant by DMRT at 5% level. SE*= standard error S= susceptible LR=low resistant MR= moderate resistant

However, many authors evaluated the relative susceptibility of some soybean varieties to the piercing-sucking insects under field conditions in Egypt (Hegab, 2001; Salman *et al.*, 2002; Al-Habshy *et al.*, 2011; Abd-Elsamed *et al.*, 2011; Khattab *et al.*, 2012; El-Sarand, 2013; Abdallah *et al.*, 2015 and Salem, 2016). They mentioned significant differences in susceptibility between soybean varieties and between seasons for these insects under field conditions.

In respect to the resistance status of the tested varieties to the insects, the results in Table (2) showed different susceptibility degrees to the insects. Crawford and Hybrid30 appeared as susceptible to aphid infestation, while the other varieties exhibited low resistance. As for whitefly, Giza111 and Giza35 appeared as susceptible, Giza21 and Hybrid30 showed low resistance, while Crawford was moderately resistant. Concerning jassids, Giza111 and Crawford were susceptible. Giza21 showed low resistance, while Hybrid30 was moderately resistant. However, it is an important to point out herein that the insect mean numbers must be refer to and/ or agree with the resistance degree of each variety.

From the mentioned results, it can be noted that the tested varieties differed in their susceptibility to infestation with the mentioned insects from one season to another. However, Metcalf and Luckmann (1975) reported that biochemical characteristics of plants affect the behavior and/or metabolism of insects, while morphological factors mostly influence the mechanisms of locomotion, feeding, oviposition, ingestion and digestion of the pest. Also, Kumar (1984) reported that environmental conditions affect the ability of plants to resist pest attack in addition to fundamental physiological processes of the plant as well as the pest. Thus, a variety

that exhibits resistance in one locality or environment may be susceptible in another. Van Emden (1987) reported that the variations in varietal susceptibility to insect pest infestation may be due to the presence of antixenosis and/or antibiosis phenomena. Dent (1991) mentioned that antixenosis (non-preference) is a resistance mechanism employed by the plant to deter colonization by an insect thereby morphological and/or biochemical characteristics of the plant. Thus, plants that exhibit antixenotic resistance would be expected to have reduced initial infestation and/or a higher emigration rate of the pest than susceptible ones. On the other hand, antibiosis is a contrast to antixenosis because it has an adverse effect on insect development, reproduction and survival. Thus, these antibiotic effects may result in a decline in insect size or weight, an increased restlessness, poor accumulation of food reserves affecting the survival of hibernating or aestivating stages, or have an indirect by increasing the exposure of the insect to its natural enemies (Singh, 1986).

Finally, it can be concluded that the current results may enable growers of soybean and plant breeders to select tolerant or resistant varieties to the mentioned insects to cultivate under field conditions of North Delta to minimize the use of insecticides in integrated pest management programs.

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حساسية بعض أصناف فول الصويا لبعض الحشرات الثاقبة الماصة تحت الظروف الحقلية لشمال الدلتا

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تمثل مقاومة أو تحمل الأصناف للإصابة بالحشرات واحدة من الطرق السهلة والهامة في مكافحة الآفات الحشرية لتقليل مخاطر المبيدات ، ولذا تم تقييم حساسية خمسة أصناف لفول الصويا للإصابة ببعض الحشرات الثاقبة الماصة وهي المن والذبابة البيضاء ونطاطات الأوراق في مزرعة محطة البحوث الزراعية بسخا - كفر الشيخ خلال موسمي 2016، 2017 م.

أوضحت النتائج المتحصل عليها وجود فروق معنوية في الحساسية بين الأصناف في كل موسم ومن موسم لآخر. وبصفة عامة كان تعداد الذبابة البيضاء والمن أعلى في الموسم الأول عن الموسم الثاني بينما وُجد العكس لنطاطات الأوراق. وبناءً على متوسط تعداد الحشرات خلال موسمي الدراسة كان الصنف كراوفورد أكثر إصابة بنطاطات الأوراق والمن بينما كان الصنف جيزة 35 أقل إصابة بالمن وكان الهجين 3 أقل إصابة بنطاطات الأوراق. وبالنسبة للذبابة البيضاء كان الصنف جيزة 35 أكثر إصابة بينما كان الصنف كراوفورد أقل إصابة. وبناءً على تقدير درجة حساسية الأصناف المختبرة للإصابة بالحشرات المذكورة أظهر الصنف كراوفورد والهجين 30 حساسية للإصابة بالمن بينما الأصناف الأخرى كانت ذات مقاومة منخفضة. وأظهر الصنف جيزة 111 وجيزة 35 حساسية للذبابة البيضاء بينما أوضح الصنف جيزة 21 والهجين 30 مقاومة منخفضة وأظهر الصنف كراوفورد مقاومة متوسطة. وبالنسبة لنطاطات الأوراق كان جيزة 111 وكراوفورد ذات حساسية للإصابة والصنف جيزة 21 ذات مقاومة منخفضة وكان الهجين 30 ذات مقاومة متوسطة.

