SUSCEPTIBILITY OF SOME SOYBEAN VARIETIES AND EFFECT OF PLANTING DATES ON INFESTATION WITH WHITE FLY, *BEMISIA TABACI* (GENN.) IN KAFRELSHEIKH REGION

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Abstract

The present studies were carried out at the experimental farm of the Faculty of Agriculture, Kafrelsheikh, University, during two successive seasons; 2011 and 2012 to study the susceptibility of five soybean varieties under three planting dates, 1st May, 15th May and 1st June to the infestation with the whitefly, *Bemisia tabaci* (Genn.). In respect to relative susceptibility, Giza 21 appeared susceptible to nymphs of *B. tabaci* during the two successive seasons while, Giza 35 was the least infested one. Statistical analysis revealed significant differences among soybean varieties and the average number of *B. tabaci* during the two seasons of study. As for planting dates, the varieties sown on the early planting date had higher population of *B. tabaci* than those sown on the late ones. Statistical analysis show significant differences between the three planting dates. In the recommended planting date, *B. tabaci* recorded highly significant positive correlation with nitrogen, zinc, manganese, crude protein, total lipids and silica but had negative significant or highly significant correlation with each of phosphorus, potassium, iron, total carbohydrates and total phenols. As a conclusion Giza 35 was the least infested variety by *B. tabaci* which had the highest value of carbohydrates, phenols, iron, phosphorus and potassium.

INTRODUCTION

Soybean, *Glycine max* L., is one of the important leguminous crop all over the world. Seeds of soybean have high nutritional value for human, animal, fish and birds, being the most important source of protein concentrate from essential amino acids and vegetable oils.

Under field conditions, soybean plants are subjected to be attacked by many insect pests, among the most common and important insects, the whitefly *Bemisia tabaci* (Genn.) which causes serious damage on soybean plants, either directly by sucking plant juice or indirectly by viral diseases transmition (El-Samahy and Saad, 2010).

In general, the control strategies must be developed to control the pests of soybean without using the conventional pesticides which cause environmental pollution, distraction of beneficial insects and pest resistance to many pesticides (John *et al.,* 1986). For all these reasons there is always a need to develop an integrated pest management (IPM) programs (Marlin and Matt, 2007) such select tolerant or resistant varieties as one of the simplest useful tactics in the (IPM) programs (Dent, 1991) and one of the most effective and economical mean of controlling plant pests, and also the first line of defense against pests (El-Komy and Aly, 2004).

Varieties of soybean exhibit variable reactions to the piercing sucking pests infestation depending on plant physical properties or chemical components of plant leaf (Mc Auslane, 1996) as biochemical factors, to a large extent, affect the behaviour and metabolic processes of pest, while morphological factors mostly influence the mechanisms of locomotion, feeding, oviposition, ingestion and digestion of the pest (Kumar, 1984).

So, the present study was carried out to shed light on the effectiveness of varieties and planting dates on the population density of *B. tabaci* on soybean plants during two successive seasons, 2011 and 2012 and relation between leaves components of soybean varieties and infestation with *B. tabaci.*

MATERIALS AND METHODS

The present experiments were carried out at the experimental farm of the Faculty of Agriculture, Kafr Elsheikh, University, during two successive seasons, 2011 and 2012 to study the susceptibility of some soybean varieties and effect of planting dates on infestation with whitefly, *Bemisia tabaci* (Genn.).

The five tested soybean varieties namely; Crawford, Giza 21, Giza 22, Giza 111 and Giza 35 were obtained from Food legumes Research Section, Field Crops Research Institute, Agricultural Research Center. The varieties were cultivated in three planting dates; 1st May (early); 15th May (recommended) and 1st June (late).The experimental area about ½ feddan was divided into 45 plots each about of 42 m^2 (5 varieties × 3 replicates for each planting date) and replicates arranged at Randomized Complete Block Design. The normal agricultural practices were followed normally without insecticidal treatments throughout the growing season. The investigation started three weeks after planting and continued weekly until the end of the season. To estimate the population density of *B. tabaci* (nymphs) on the involved varieties, weekly samples of 90 leaflets (30 leaflets from each replicate representing upper, middle and lower levels of the plant) from each variety of each planting date were chosen at random in the morning and were placed in paper bags, then closed and transferred to the laboratory, where the number of nymphs were counted and recorded by the aid of binocular microscope.

Chemical analyses of soybean varieties were conducted at Mansoura Laboratory, Soil, Water and Environment Research. Institute, Agric. Res. Center Egypt. leaves samples were taken at the recommended planting date (15th May) 60 days after planting to determine the concentrations of N, P , K and micro-elements (Zn, Fe and Mn) as described by Jones *et al.,* (1991), Jackson (1973), Peterburgski (1968) and Chapman and Pratt (1982), respectively. Crude protein was calculated by multiplying the total nitrogen by 6.25.

Total carbohydrates, total lipids, relative silica and total phenol were estimated using the method of Hedge and Hofreiter (1962), Anon. (1984), APHA (1992) and Malick and Singh (1980), respectively.

Statistical analysis was done using the least significant differences (LSD) at 5% level, according to Duncan's multiple range test (1955) were used and simple correlation.

RESULTS AND DISCUSSION

A. Relative susceptibility of soybean varieties to infestation with *B. tabaci* at three planting dates:

Results in Table summarized the relative susceptibility of five soybean varieties, planted at three planting dates. Mean numbers of *B. tabaci* nymphs showed highly significant differences among the tested soybean varieties during the two seasons. Giza 21 & Giza 111 were the most susceptible varieties with the highest mean nymph numbers (19.39 & 18.48 and 17.95 & 17.36 nymphs/30 leaflets, respectively). However, Giza 35 was the most tolerant variety to the infestation in both seasons, harboring the lowest mean numbers of nymphs (10.47 and 9.79 nymphs/30 leaflets, respectively).

However, many authors evaluated soybean varieties to infestation with whitefly. Taha *et al.* (2001) showed that Giza 35 and Giza 21 soybean varieties were less susceptible to whitefly. Gameih and El-Basouny (2001) who mentioned that Giza 21 was the most susceptible variety to natural infestation with whitefly nymphs (*B. tabaci*). El-Naggar *et al.* (2006) reported that Giza 21 was the most susceptible variety for *B. tabaci* infestation followed by Giza 35 during the two seasons of study (2001 and 2002). Magouz *et al.* (2006) recorded the highest number of whitefly on Giza 21 and Giza 111, while the least number was existed on Giza 22. Khattab *et al.* (2012) found that Giza 111 and Giza 22 appeared susceptible to whitefly.

On the other hand, Salman *et al.* (2002) who worked his experiments in Sohag (Upper Egypt) found that Giza 35 and Crawford were susceptible to *B. tabaci* ,while Giza 111 and Giza 21 were low resistant to the infestation of the pest.

This variation in susceptibility may be due to the differences in environmental factors that affect the ability of branches to resist pest attack. Thus, a variety that exhibits resistance in one locality or environment may be susceptible in another, since those factors influence fundamental physiological processes of the plant as well as the pest that might interact to make plant resistant or non resistant temporarily (Kumar,1984). Also, Metcalf and Luckmann (1975) mentioned that certain environmental conditions may alter the physiology of the plant to the extent that it becomes unsuitable as a host for a certain pest.

In general, the variations in genotypes susceptibility to the insect infestation are rarely dependent totally on a single mechanism. Van Emden (1987) reported that the variations in genotypes susceptibility to the insect infestation may be due to the presence of antixenosis and/or antibiosis phenomena. Dent (1991) mentioned that antixenosis is a resistance mechanism employed by the plant to deter colonization by an insect thereby morphological and/or biochemical characteristics of the plant. Thus, branches 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, 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 effect by increasing the exposure of the insect to its natural enemies (Singh, 1986).

Concerning the effect of planting dates, means of *B. tabaci* nymphs showed highly significant differences among the three planting dates during the two seasons. The maximum mean of nymphs was recorded, on the plants of different soybean varieties planted at 1st May planting date followed significantly by 15th May plantation. The minimum mean of nymphs was found on 1st June plantation.

The above mentioned results are in harmony with those of El-Srand (2014) who found that in 2010 season, the plants of the first date (1st May) significantly received the highest number of the population of *B. tabaci* (nymphs and adults) while those of the mid-May and first of June exhibited the lowest number without significant among them. El-khayat *et al.* (2010) who found that lately planting date of cowpea harbored the lowest infestation by different stages of *B. tabaci*.

In contrary Chandel and Gupta (1995), Gad Elrab (1997) and Slman *et al.* (2012) found that infestation of *B. tabaci* increased with the later planting.

However, varying the planting time of crops works as a mean of cultural control by creating asynchrony between crop phenology and the insect pest's phenology which can retard the rate of colonization (Ferro, 1987) or means that the pest fails to coincide with a critical crop growth stage (Dent,1991). Also, such methods have a major impact if the planting times were synchronized between farms within a region to reduce the variation in available crop stages. The variation in crop stages gives the insect an advantage to reproduce for longer periods. However, the differences in the insect population from one season to another may be due to the differences in the prevailing weather factors and/or the existed natural enemies.

Thus, it could be concluded that the current results might enable plant breeders to select cultivars or breeding lines that have a resistance level high enough for breeding purposes in addition to the knowledge on the relative resistance of cultivars and on the impact of cultural practices (i.e. planting dates and fertilization). The fact of great usefulness in the design of integrated management programs in an area.

Table 1. Mean number of nymphs/ 30 leaflets induced by *B. tabaci* on soybean varieties planted at three planting dates during 2011 and 2012 seasons.

Soybean varieties	Season 2011				Season 2012			
	Planting dates			Mean	planting dates			mean
	1st May	15th May	1st June		1st May	15th May	1st June	
Crawford	20.40c	15.36c	8.06c	14.61c	19.64c	14.71c	7.44c	13.93c
Giza 22	17.38d	12.96d	6.82d	12.39d	16.96d	11.78d	5.13d	11.29d
Giza 21	32.38a	16.80b	8.99b	19.39a	30.51a	16.02b	8.91b	18.48a
Giza 111	26.05b	18.15a	9.66a	17.95b	25.09b	17.38a	9.62a	17.36b
Giza 35	14.53e	11.04e	5.83e	10.47e	14.13e	10.58e	4.67e	9.79e
Mean	22.15a	14.86b	7.87c		21.27a	14.09b	7.15c	
L.S.D at 5%	0.24	0.22	0.20		0.23	0.30	0.26	

L.S.D at 5%: season 2011 Variety =1.04, Planting date =0.44 season 2012 Variety= 1.4 , Planting date =0.42

In the same column, means followed by the same letter are not significantly different at 5% level.

B. The relationships between leaves chemical components of soybean varieties and infestation with *B. tabaci* :

In the second planting date, the leaf chemical analysis of the five tested varieties planted at planting date of 15th May differed significantly in their contents of macro-elements; nitrogen, phosphorus and potassium and micro-elements; zinc, iron and manganese (Table 2).

As regarding to macro-elements, Giza 111 exhibited the highest percentage of nitrogen, but had the lowest percentage in phosphorus and potassium, while Giza 35 had the least percentage of nitrogen and the highest percentage of phosphorus and potassium. Concerning to the leaf contents of micro-elements, the highest content of leaves zinc and manganese were recorded on Giza 111 (57.53 and 105.93 ppm), while the lowest contents of both were recorded on Giza 35 variety (44.37 and 82.97 ppm). On the other hand, the highest iron content was detected on leaves of Giza 35, while Giza 111 had the lowest one.

A negative significant correlation was evident between the population density of *B. tabaci* (nymphs) and phosphorus, while high significant negative correlation was observed between density of *B. tabaci* and potassium and iron, but high positive significant correlation was recorded with nitrogen and manganese, and high positive significant correlation with zinc.

Statistical analysis (Table 2) revealed significant differences in leaf content of; total carbohydrates, crude protein, total lipids, silica and total phenols among the tested five soybean varieties. Leaf carbohydrate content of different soybean varieties varied significantly. The highest percentage of total carbohydrates recorded in Giza 35 (31.73%) and the lowest percentage was recorded in Giza 111 (28.07%). As for, the percentage of crude protein and total lipids, the highest percentages of both were recorded in Giza 111 variety (25.93% and 15.80%), while the lowest percentages were recorded in Giza 35 (19.90% and 12.20%). Regarding to silica, the highest percentage was recorded in Giza 111 (2.91%) and the lowest one was found in Giza 35 (2.04%). The highest percentage of total phenols was recorded on Giza 35 (0.780%), while the lowest percentage was recorded on Giza111 (0.703%).

The population density of whitefly nymphs, were correlated with highly significant negative correlation with total carbohydrates and total phenols and highly significant positive correlation with both of crude protein and total lipids. A positive highly significant correlation was obtained between whitefly density and silica.

Results obtained in the present work are in accordance with Gamieh and El-Bsiony, 2001. They reported that the soybean leaves content of nitrogen was positively correlated with *B. tabaci* nymphs, while negative correlation was detected between leaves content of potassium and *B. tabaci* nymphs. Magouz *et al.* (2006) found insignificant positive correlation between infestation of soybean with *B. tabaci* nymphs and the leaves content of nitrogen and manganese, but a negative correlation was evident between *B. tabaci* and phenols content.

Also, Hegab (2008) reported that chemical analysis results showed a positive relationship between protein with aphids and leafhoppers infestation in the faba bean varieties. Hatem (2014) reported that *Aphis spp*. correlated positive insignificant values with, total lipids, silica, Mn ppm., but it was negative with total phenol. *Empoasca spp*. population density correlated negatively insignificantly with total carbohydrates and Fe, but positively with total lipids and silica.

Table 2. The relationships between leaves chemical components of some soybean varieties and the infestation with *B. tabaci*.

Variety	**Macro- elements (%)**			**Micro- elements (ppm)**			**Total carbohydrates %**	**Crude protein %**	**Total lipids %**	**Silica %**	**Total phenols %**
	N	**P**	**K**	**Zn**	**Fe**	**Mn**					
Crawford	3.69c	0.375b	2.10b	53.03b	116.83b	99.60b	29.80bc	23.07c	13.60bc	2.53c	0.734c
Giza 22	3.42d	0.379b	2.13b	48.43c	121.17a	92.43c	30.73ab	21.37d	13.00cd	2.26d	0.758b
Giza 21	4.05b	0.357c	1.98c	56.33a	114.47b	103.80ab	28.80cd	25.27b	14.47b	2.74b	0.720d
Giza 111	4.15a	0.348d	1.93c	57.53a	108.77c	105.93a	28.07d	25.93a	15.80a	2.91a	0.703e
Giza 35	3.18e	0.387a	2.21a	44.37d	122.97a	82.97d	31.73a	19.90e	12.20d	2.04e	0.780a
LSD $at_{5\%}$	**0.09**	**0.007**	**0.06**	**1.84**	**3.47**	**5.67**	**1.20**	**0.56**	**0.94**	**0.10**	**0.011**
Correlation coefficient values											
Whitefly	$+0.9893^{**}$	-0.9514^{*}	-0.9654^{**}	$+0.9936^{***}$	-0.9724^{**}	$+0.9805^{**}$	-0.9939^{***}	$+0.9901^{**}$	$+0.9651^{**}$	$+0.9981^{***}$	-0.9973^{***}

Means followed by the same letter are not significantly different at 5% level. * (Significant at P≤ 0.05) and ** (Significant at P≤ 0.01)

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حساسية بعض أصناف فول الصويا وتأثير مواعيد الزراعة على الإصابة بالذبابة البيضاء فى منطقة كفر الشيخ

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أجريت هذه الدراسة في المزرعة البحثية لكلية الزراعة جامعة كفر الشيخ خلال موسمي٢٠١١ و ٢٠١٢بهدف تقييم حساسية خمسة أصناف من فول الصويا (كرافورد – جيزة٢١ – جيزة٢٢ – جيزة ١١١– جيزة ٣٥) للإصابة بالذبابة البيضاء خلال ثلاث مواعيد زراعة مختلفة (١مايو، ١٥مايو، ١يونيو).

بالنسبة لحساسية الأصناف كان صنف جيزة ٢١ الأعلى حساسية لحوريات الذبابة البيضاء خلال موسمي الدراسة، بينما كان صنف جيزة ٣٥ الأقل إصابة بهذه الحشرة.

اظهر التحليل الاحصائى وجود فروق معنوية في متوسط عدد حوريات الذبابة البيضاء وبين أصناف فول الصويا خلال موسمي الدراسة .

و بالنسبة لتأثير مواعيد الزراعة فقد أوضحت النتائج أن الميعاد المبكر كان أكثر المواعيد إصابة يليه الميعاد الموصى به ثم الميعاد المتأخر خلال موسمي الدراسة. اظهر التحليل الاحصائى وجود فروق معنوية بين مواعيد الزراعة الثلاثة.

في الميعاد الموصى به (١٥ مايو) ارتبطت الكثافة العددية للذبابة البيضاء بعلاقة موجبة عالية المعنوية مع النيتروجين والزنك والمنجنيز والبروتين والدهون والسيلكا، على العكس كانت هذه العلاقة سالبة معنوية أو عالية المعنوية مع الفسفور والبوتاسيوم والحديد والكربوهيدرات والفينولات.

ومما سبق يمكن استنتاج أن صنف جيزة ٣٥ هو اقل الأصناف إصابة بالذبابة البيضاء مقارنة بالأصناف السابقة محل الدراسة وذلك لاحتواء أوراقه على نسبة عالية من الكربوهيدرات والفينولات والحديد والفوسفور والبوتاسيوم.