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Susceptibility of some Broad Bean Plant Varieties to the Infestation by Certain Piercing Sucking Insects in Dakahlia Governorate, Egypt

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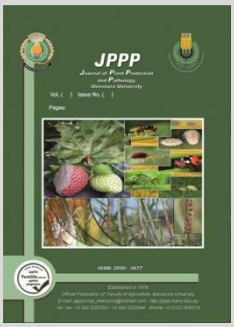

ABATRACT

At Faculty of Agriculture farm, Mansoura district, Dakahlia Governorate, field experiments were conducted with broad bean plants over the course of two seasons. (2020/2021 & 2021/2022). The consequences of different chemical compositions (protein, pH values, and carbohydrates) three different bean plant varieties were compared to types of broad bean plants and the insects that were evaluated for infestation. (Giza 716, Nubaria, and Giza 843) and their infestation with some whitefly, leafhopper, and aphid insects. According to results showed that that on broad bean plants, *Myzus persicae* (Sulzer) and *Aphis craccivora* (Koch) had two peaks. During the two growth seasons of the study, there was a single peak for *Empoasca decipiens* (Paoli) and *Empoasca decedens* (Paoli). The most common species of whitefly with two peaks was *Bemesia tabaci* (Genn), both in its juvenile and adult phases. The populations of specific piercing sucking insects were examined in relation to the effects of the maximum, minimum, and relative humidity. Based on the data gathered, it was possible to organise the broad bean varieties Nubaria, Giza 716, and Giza 843 in decreasing order of pest abundance. The findings of a chemical study revealed that while pH levels reduced the rate of infestation and the mean number of pests, increases in carbohydrate and protein contents increased the mean number of different insect pests that infesting these kinds.

Keywords: Broad bean, seasonal fluctuations, varieties, homopterous insects.

INTRODUCTION

Egypt is one of the numerous nations that cultivate the extremely important broad bean, Vicia faba L. It is significant for consumption by both humans and animals because of its usefulness as a source of protein. According to Ebadah *et al.* (2006), Mohamed (2021), El-Zoghby (2022), and Elghlan (2023), the plants are in the fields from October to the end of May. Broad bean plants are vulnerable to major insect pest infestations, including aphids, leafhoppers, and whiteflies. Because they eat directly on the plants, the aforementioned pests infest the plants and reduce productivity. The significance of homopterous insect species in the transmission of plant disease pathogens has been downplayed by several researchers (Al- Moaalem *et al*., 2005; Al-Habshy and Aml, 2018 and El Gindy, 2002). Egypt has conducted studies on the insect faunae of most field, graminaceous, and leguminous crops (Helal *et al*., 1997 and Malik *et al*., 2010). The main cause of the damage was the large populations of A. *craccivora*, which fed on immature leaf and stem tissue. Ebadah *et al*., (2006) mentioned the vulnerability of certain faba bean types to *A. craccivora* infestation. Nuessly *et al*., (2004); Youssef, 2006 and Abd-Elsamed *et al.*, (2013) recorded significant results on the whitefly, aphids and leafhoppers that infesting the bean plants. According to Helal *et al*., 1996 and Elissa *et al.*, 2014, the biology of the potato leafhopper, *E. fabae*, enveloped its mechanics of harm to host plants and its dispersion, development, and migration, lucerne damage According to Selem, Gamila *et al.* (2016), kidney bean plants have two peaks of *A. craccivora, B. tabaci* and *E. decipiens*. Regarding the effects of mean temperature and relative humidity in the air. AbdElsamed *et al.* (2018) observed that, a number of solanaceous plant species were susceptible to infection by specific piercing sucking pests. The current study looked at the relationships between broad bean plant pests such aphids, leafhoppers, and whiteflies and the weather, as well as the seasonal fluctuations in these pests. In order to ascertain the degree to which different varieties were vulnerable to particular piercing sucking insect pests that afflicted certain broad bean plants, as well as the relationship between the number of aphid, leafhopper, and whitefly insects and specific chemical compositions of broad bean varieties, the current study was necessary.

MATERIALS AND METHODS

Two growth seasons of broad bean plants (2020/2021 & 2021/2022) were used for these tests at the Faculty of Agriculture Farm in the Mansoura region of the Dakahlia Governorate. Three replicates of an area of roughly one and a half-faddan each were created. When the broad bean plants were between 21 and 28 days old, two sampling techniques were used to collect samples of each group of tested insect pests that were infesting the plants. These sampling techniques were carried out every two weeks until the fourth week of April, when the plants were still growing. Two methods of sampling were used: plant samples and randomly selected samples of twenty-five leaves. After being put in paper bags, the leaves were brought inside the laboratory. Aphids and whiteflies and their immature stages were counted individually using a hand lens, while the adult form of the whitefly was counted directly on plants. For this, a straightforward apparatus comprised a wooden desk, a piece of white cardboard paper cut into columns spaced 4 cm apart,

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and a glass plate placed on top. To minimise the movement of the counted aphids, the upper surface of the glass plate was allowed to become slightly damp with tiny drops of water. Abd Alla (1984) and Hegab *et al.*, (1987). Aphid insects on the plate were counted using a little brush in each column after the plants were gently shook. 100 double strokes were taken from each of the field's diagonal directions in a single sample using a sweepnet with a diameter of 35 cm and a depth of 60 cm. In order to eliminate the impact of specific meteorological parameters, such as relative humidity and temperature, on the population density of the insect pests under study. Meteorological Central Laboratory for Agricultural Climate, Agricultural Research Centre, supplied daily means of these parameters for the duration of the two broad bean growing seasons (2020/2021 & 2021/2022). Leaf samples were randomly selected from each variety during pest peak periods then dried at oven at 60°C until the leaf weight remained constant. This allowed determination of various chemical contents, including pH values, carbohydrate contents and total protein. Lastly, the dried broad bean leaves were pulverised then broken down using a 2:1 ratio of perchloric and nitric acid. Calculating the amount of protein Bremner and Mulvaney (1982) estimated the total nitrogen content in bean plants. The protein content was discovered by raising nitrogen content by 6.25. Finding the carbohydrate content of the bean plants was estimated calorimetrically using the anthrone reagent and also the color intensity was evaluated at 240 mμ using the method according to Dubois *et al.* (1956). PH value of the plant sap was determined using pH meters. Also, the chemical analysis of the wide bean varieties was conducted by Central Laboratory of the Agriculture Faculty, Mansoura University, in order to determine the pH value, total protein and carbohydrate contents.

Statistical Analysis:

Costat (2005) conducted a statistical analysis to ascertain the simple correlation coefficient between the density of homopterous insect populations and the chemical makeup of broad bean types. The multiple range tests developed by Duncan, Snedecor, and Cochran (1981) were used to compare the means.

RESULTS AND DISCUSSION

Two distinct sampling techniques were used on broad bean plants over the course of two consecutive growing seasons (2021–2022) to estimate the insect population density in the Mansoura district.

1) Seasonal population fluctuations of dominant insect species.

a) Aphid species, *Aphis craccivora* Koch and *Myzus persicae* (Sulzer).

A. craccivora infesting broad bean plants had seasonal population changes over the course of two successive seasons, as demonstrated by the data presented in Tables (1&2) and Figs. (1&2). In both seasons, the two aphid species first appeared in approximately small numbers, that recorded, (4–14 aphids / 25 leaves) during the beginning of 1st week of Dec. month. Two population peaks for *M. persicae* and *A. craccivora* were seen on broad bean plants in the 2020–2021 and 2021–2022 seasons. For both analysed seasons, the first experiment, conducted in 2nd week of Jan., employed total of 415 and 554 insects per 25 leaves of *A. craccivora*. However, the first peak of *M. persicae* was discovered in 3rd week of Jan., with a total of 199 and 256 insects/25 leaves for the two seasons, respectively. First and second weeks of March marked the second peak of *A. craccivora*, with a total of 185 and 247 insects/25 leaves for the two seasons, respectively. As though the total numbers of 117 and 153 insects/sample for the two seasons were reported during the second and first weeks of March, respectively, marking the second peak of *M. persicae*.

Table 1. Influence of different broad bean plant varieties on the population density of aphids, leafhoppers and white fly insects considering the resulted yield quantity during 2020/2021 season.

Broad bean varieties	Mean number of insects/sample										Mean yield kg/plot
	Aphid insects			Total	Leafhopper insects		Total	White fly insect		Total	
	A.carccivora	M.periscae	*A. pisum*		*E.descipiens*	E.decedence		Immatures	Adult		
Giza 716	78	70	68	216	90	88	178	19	105	124	15.9
Nubaria	89	76	73	238	96	93	189	28	126	154	13.8
Giza 843	96	87	79	265	102	97	199	35	127	162	10.5
F	33.6**	26.5**	19.3**	-----	17.2**	14.6**	----	10.6**	21.3**	----	7.4*
LSD 0.05%	10.22	4.18	4.36	-----	2.93	2.89	---	5.87	2.66	----	3.48

Table 2. Influence of different broad bean plant varieties on the population density of aphids, leafhoppers and white fly insects considering the resulted yield quantity during 2021/2022 season.

Broad bean varieties	Mean number of insects/sample										Mean yield kg/plot
	Aphid insects			Total	Leafhopper insects		Total	White fly insect		Total	
	A.carccivora	M.periscae	*A. pisum*		*E.descipiens*	E.decedence		Immatures	Adult		
Giza 716	80	75	66	221	95	82	177	18	110	128	16.8
Nubaria	93	81	76	250	93	86	179	22	121	143	13.1
Giza 843	98	90	83	271	100	93	193	45	133	178	9.7
F	42.5**	29.6**	25.8**	----	17.4**	15.3**	-----	11.03	23.4**	----	8.2*
LSD 0.05%	8.56	6.89	7.23	-----	2.58	2.36	----	3.44	3.54	---	4.31

The results were in agreement with the findings of Hassanein (1994); Nosser (1996); El-Gindy (2002); Hashem (2005); El-Zohairy and Hegab-Ola (2008); Awadalla *et. al.* (2011&2013); Hegab (2015); Badawy, 2019 and El-Zoghby *et al.*, 2022). They reported that the varieties of vegetable plants had a great effect on incidence of piercing - sucking insects.

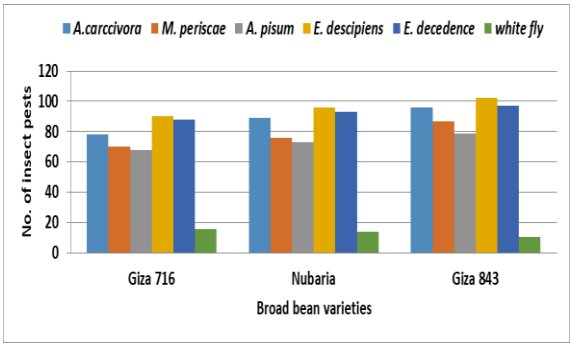

Fig. 1. Population density of different broad bean varieties insects during the first season of study 2020/21 in Mansoura region, Dakahlia Governorate.

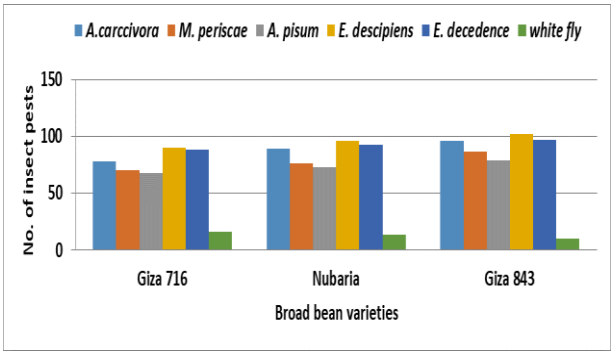

Fig. 2. Population density of different broad bean varieties insects during the second season of study 2021/22 in Mansoura region, Dakahlia Governorate.

Effect of some chemical constituents of certain broad bean varieties on the population density of some insects during 2021/22 seasons.

Chemical analyses were performed on a variety of broad bean plants, and the results are documented.

Presented date in Table (3) revealed that the three evaluated broad bean varieties' total protein content values varied from one another.

i) Aphid species:

The data presented in Table (3) demonstrated that, in the 2021–2022 season, there were statistically significant variations in the mean numbers of aphid insects on the three broad bean types that were evaluated (Improved Giza 716, Nubaria, and Giza 843).

By measuring the mean number of insects/sample, the intensity of the aphid insect infestation in the 2021–2022 season could be ranked as follows: Giza 716 (216.0 insects/sample with a total protein content of 20.2%), Giza 843 (265 insects/sample with a total protein content of 18.6%), and Nubaria (238.0 insects/sample with a total protein 23.8%). Several researches have observed difference in aphid populations including (Salem, 2005; Abdel-Samad; 2006; El-Samahy, 2008; Rizk, 2011; Awadalla *et al*., 2016; and El-Zoghby, 2022).

ii) Leafhopper insects

According to Table (3), there were statistically significant variations in the mean numbers of leafhopper insects on the previously evaluated broad bean varieties in the 2021–2022 season.

Table 3. Effect of certain chemical constituents of some broad bean plant varieties on the population density of aphids, leafhopper and white fly 2020/2021.

Varaities	Total protein%	Carbohydrates %	pH	N %	P %	K %	Ca %	Mean N. of aphid	Mean No. of leafhopper	Mean No. of white fly	Yield kg./plot
Giza 716	20.2	46.3	5.2	3.3	0.7	3.1	3.2	216	178	124	15.9
Nubaria	23.8	58.5	5.0	2.8	0.6	2.8	2.9	238	189	154	13.8
Giza 843	18.6	45.7	5.6	3.5	0.8	3.2	3.3	265	199	162	10.5
F.	8.7*	9.4*	6.1*	5.2*	n.s	n.s	n.s	51.6**	35.4**	43.6**	7.6*
LSD 0.05	3.45	8.36	1.18	---	----	----	---	11.15	25.12	36.12	-----

The data presented in Table (3) indicated that the Giza 716 and Improved Nubaria cultivars had the lowest mean number of infestations by leafhopper insects. Mahmoud (2011) and Awadalla *et al.* (2019).

iii) White fly insect

Table (3) confirmed that, in the 2021–2022 season, there were statistically significant variations between the mean numbers of immature and adult white fly insects on the aforementioned evaluated broad bean varieties.

Data also showed that Improved Nubaria and Giza 716 varieties recorded the lowest mean number of white fly insects infestation while in contrast Giza 843 variety recorded lowest significant in the two seasons. Abdou, *et al.*, (2019).

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حساسية بعض أصناف نباتات الفول الأخضر للإصابة ببعض الحشرات الثاقبة الماصة في محافظة الدقهلية، مصر

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الملخص

تم إجراء بعض التجارب الحقلية في مزرعة كلية الزراعة؛ بمنطقة المنصورة محافظة الدقهلية خلال موسمي زراعة (2020 / 2021 و 2021 / 2022) ثلاثة أصناف من نبات الفول الأخضروهي (الجيزة 716، النوبارية والجيزة 843) لمعرفه مدي حساسيتها للإصابة ببعض حشرات المن ونطاطات الأوراق والنبابة البيضاء وتأثير المحتوي الكيماوي للنبات من البروتين والكربوهيدرات وقيم الpH) على الإصابة ببعض الحشرات المختبرة. أوضحت النتائج التي تم الحصول عليها أن من البقوليات ومن الخوخ *Aphis craccivora* (Koch) و *Myzus persicae* (Sulzer) لهما قمتان في نبات الفول. وفي الوقت نفسه، حدثت ذروة واحدة لكل من نطاطات اوراق البطاطس ونطاطات الأوراق *Empoasca decipiens* (Paoli) و *Empoasca decedens* (Paoli) خلال موسمي الدراسة. بينما كانت النبابة البيضاء سواء الطور غير البالغ او الحشرة الكاملة *Bemesia tabaci* (Genn) هي أكثر الأنواع انتشاراً ولها قمتان. كما تمت دراسة تأثير كل من درجة الحرارة العظمى والصغرى والرطوبة النسبية على أعداد بعض الحشرات الثاقبة الماصة. أظهرت النتائج المتحصل عليها أنه يمكن ترتيب أصناف الفول تنازليا حسب عدد الآفات على النحو التالي: جيزة 843، النوبارية والجيزة 716. أوضحت نتائج التحليل الكيميائي أن زيادة محتوى البروتين والكربوهيدرات أدت إلى زيادة عدد بعض الآفات بالتالي زيادة الإصابة في هذه الأصناف، بينما أدت زيادة قيم ال pH إلى انخفاض عدد الآفات ومعدل الإصابة.