

حساسية بعض أصناف نباتات الفاصوليا للإصابة بمن البقوليات *Aphis craccivora* وعلاقته بالأمراض الفيروسية

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المخلص العربي

أجريت دراسة حقلية لتقييم قابلية خمسة أصناف من الفاصوليا: برونكو، نارينا، إكزيرا، سافانا واليكانت للإصابة بمن البقوليات *Aphis craccivora* وتأثيره علي الإصابة الفيروسية لأصناف الفاصوليا والمحصول الأخضر الناتج.

أظهرت الدراسة الحالية خلال الموسمين الصيفي والنبلي (٢٠١٠، ٢٠١١) أن هناك تأثير معنوي بين أصناف الفاصوليا المختبرة ومعدلات الإصابة بالمن. كما أوضحت النتائج أن الصنف اليكانت كان أكثر الأصناف تحملا للإصابة بالمن بينما كان الصنف برونكو أكثرها إصابة بحشرة المن.

أما بالنسبة للإصابة الفيروسية فقد أظهرت النتائج أن الصنف اليكانت أقل الأصناف إصابة بفيروس الموزايك العادي وفيروس الموزايك الأصفر بينما الصنفين برونكو ونارينا كانا أكثر الأصناف قابلية للإصابة بالأمراض الفيروسية.

أظهر التحليل الاحصائي للنتائج وجود ارتباط معنوي بين معدل الإصابة بحشرات المن والعدوى بفيروس الموزايك العادي وفيروس الموزايك الأصفر.

أوضحت النتائج أن صنف برونكو واليكانت اعطيا اعلى إنتاجية للمحصول الأخضر ، بينما الصنف إكزيرا كان أقلهم إنتاجية . بصفة عامة يمكن القول ان الصنف اليكانت كان أفضل الأصناف حيث كان الأقل في مستوى الإصابة بحشرة المن والإصابة الفيروسية وأعطى أعلى محصول من القرون الخضراء.

SUSCEPTIBILITY OF SOME COMMON BEAN VARIETIES TO INFESTATION WITH LEGUMES APHID, *APHIS CRACCIVORA* (KOCH) AND ITS RELATION TO VIRUS DISEASES

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ABSTRACT: Field studies were carried out to evaluate susceptibility of five varieties of *Phaseolus vulgaris* L., (Bronco, Nerina, Xera, Savana and Alicante) to infestation with legumes aphid, *Aphis craccivora* as one of the main pests causing a great damage to bean plants and subsequently with virus diseases and its effect on the resultant yields. This work was conducted during summer and nili plantation seasons of 2010 and 2011. The results revealed that, tested common bean varieties showed significant differences between means of their infestation levels by *A. craccivora*. Alicante variety was the most tolerant to aphid infestation, while Bronco variety was the highest susceptible. Concerning virus diseases (yellow mosaic virus "BYMV" and common mosaic virus "BCMV"), Alicante variety was almost immune, while Bronco and Nerina varieties were highly susceptible to infection. So, Bronco and Alicante varieties gave the highest green yield, while Xera variety gave the lowest weight of green pods. Therefore, it was conclude that, Alicante variety recorded the least infestation, more tolerant to virus infestation and heaviest green pods yield.

Key words: *Aphis craccivora*, bean, varieties, virus.

INTRODUCTION

Common bean, *Phaseolus vulgaris* L. is considered one of the most important leguminous vegetable crops in Egypt. The cultivated area of this crop was estimated as 55540 feddans for green pods and 75010 feddans for dry seed yield (according to Agriculture Economic Reports, Ministry of Agriculture, 2008). Almost it is cultivated in all Governorates for local consumption and exportation. It contains high percentages of protein, carbohydrates, vitamins and mineral salts, which are essential for human nutrition.

Aphid is considered the main insect pest infesting bean and cause great losses either in the quantity or in the quality of bean. Aphid is a group of sucking-sap insects causing serious damages to various vegetable crops and they also play an important role as vectors of many plant viruses.

Many authors reported *Aphis craccivora* (Koch) as one of the major pests causing considerable damage to legumes (El-Kifl *et al.*, 1974; Hamid *et al.*, 1977; Attia *et al.*,

1987; El-Lakwah *et al.*, 1999 and Mohamed 2002).

Bean mosaic virus is correlated with leguminous plants. The disease is transmitted by insect vectors of more than 20 species including *A. craccivora*. It is transmitted in a non-persistent manner by mechanical inoculation. Symptoms on *P. vulgaris* appear as a necrotic or chlorotic local lesions and systemic mosaic (Smith 1972; Bos *et al.*, 1974; Jurik & Zahorova 1992 and Gray & Gildow 2003).

The main objective of this work is to search for *P. vulgaris* varieties tolerant to aphids as well as to virus infection in relation to yield.

MATERIALS AND METHODS

Field experiments were carried out throughout two successive seasons (2010 and 2011) during summer and nili seasons in El-Kanater El-Khaireia, Qualubia Governorate.

This experiment was conducted to evaluate the susceptibility of five different varieties of common bean, *Phaseolus*

vulgaris L., (Bronco, Nerina, Xera, Savana and Alicante) to the infestation of *Aphis craccivora* (Koch). The experimental area was divided into 20 plots each of 9 rows and 6 meter long. Each variety was cultivated in four randomized plots in February and September of each year. Normal agriculture practices were followed expect for keeping the whole area free from any pesticides. The green pods of common bean of each variety were collected and weighted to estimate the final yield.

Sampling started four weeks after sowing and continued weekly for 10 weeks in four experiments. Estimation of infestation was conducted by weekly counts of aphids on 10 compounds leaves picked at random from the three levels of plants in each plot. Data were recorded and statistical treatments of data were analyzed according to SAS (1988).

The plants were also examined for suffering of infection by bean yellow mosaic virus (BYMV) and bean common mosaic virus (BCMV). Visual inspection based on disease symptoms was used as a monitor of disease. Plants showing virus symptoms were marked with label in two different stages, the first was on the second trifoliolate stage, while the second was at the end of the blooming stage. Numbers of infested plants were recorded in each stage. Plants showing mosaic virus were transferred to the laboratory of ELISA test and the percentage virus infection was estimated. Identification was based on host range and symptomatology, physical properties, mode of transmission and serological assay.

RESULTS AND DISCUSSION

Effect of common bean varieties on infestation rates of *Aphis craccivora*:

Data in Table (1) showed that the differences in infestation rates by *Aphis craccivora* individuals to the tested common bean varieties during summer and nili plantation seasons of 2010 and 2011. Results indicated that some kidney bean varieties were susceptible to aphid infestation, while some others showed some tolerance. Statistical analysis of the obtained data revealed significant differences

between infestation rates of the bean varieties through the same cultivated period were noticed. During summer plantation season of 2010 and 2011, Alicante cultivar was the more tolerant to aphid infestation with mean number of 2.10 and 1.86 aphids/leaf, respectively. While Bronco cultivar was the highest susceptible with mean number of 12.40 and 9.75 aphids/leaf, respectively. The rest of varieties had various tolerances to aphid infestations, which can be arranged in a descending order as follows: Savana, Xera, Nerina and Bronco, showing a seasonal mean (3.35 and 3.10; 4.95 and 3.82; 7.80 and 7.50 aphids/leaf) through 2010 and 2011 seasons, respectively. During the nili plantations of both years, Bronco variety was the highly infested variety by *A. craccivora*, as it harboured throughout the whole season mean numbers were 10.67 and 10.25 aphids/leaf during 2010 and 2011, respectively. On the contrary, Alicante variety was the lowest one, its aggregated numbers showing an overall seasonal means 1.85 and 0.95 aphids/leaf during 2010 and 2011, respectively. It was quite evident from 2010 and 2011 seasons that Bronco was the heaviest infested variety in contrast to Alicante variety, which was the highest infested one. It could be concluded that the tested common bean varieties showed different susceptible degree to *A. craccivora*.

Effect of viral infection to common bean varieties:

Data obtained in Tables (2&3) showed that the percentage of virus infection of the five bean varieties cultivated in summer and nili plantation seasons of 2010 and 2011 years. Statistical analysis of data show significant differences between five common bean varieties with viral infection. Alicante variety was the more tolerant to virus infection with general mean percentage of 2.37 and 0.99% throughout summer and nili seasons, respectively. While Bronco variety was the highest susceptible to virus infection with general mean percentage of 4.54 and 3.61% during summer and nili seasons, respectively.

Table (1): Susceptibility of bean varieties on infestation rates by *Aphis craccivora* (Koch) individuals during summer and nili plantation seasons 2010 and 2011 at Qualubia Governorate.

Varieties	Mean No. of aphids/leaf/season					
	Summer			Nili		
	2010	2011	General mean	2010	2011	General mean
Bronco	12.40	9.75	11.08	10.67	10.25	10.46
Nerina	7.80	7.50	7.65	8.25	7.80	8.03
Xera	4.95	3.82	4.39	4.60	3.15	3.88
Savana	3.35	3.10	3.23	3.12	2.80	2.96
Alicante	2.10	1.86	1.98	1.85	0.95	1.40
L.S.D. at 0.05	1.14	0.80	-	1.06	0.25	-

Table (2): Percentages of virus infection to five bean varieties during summer and nili plantation seasons 2010 and 2011 at Qualubia Governorate.

Varieties	Mean of infection (%)					
	Summer			Nili		
	2010	2011	General mean	2010	2011	General mean
Bronco	4.75	4.33	4.54	4.20	3.01	3.61
Nerina	5.30	4.10	4.70	4.65	3.90	4.28
Xera	3.85	2.96	3.41	3.50	2.55	3.03
Savana	3.14	2.38	2.76	2.91	1.88	2.40
Alicante	2.59	2.15	2.37	1.22	0.75	0.99
L.S.D. at 0.05	0.35	0.13	-	0.22	0.86	-

Table (3): Percentage of early and late virus infection to five bean varieties during summer and nili plantation seasons 2010 and 2011 at Qualubia Governorate.

Varieties	Mean of infection (%)							
	Summer				Nili			
	2010		2011		2010		2011	
	Early infection	Late infection	Early infection	Late infection	Early infection	Late infection	Early infection	Late infection
Bronco	1.65	3.10	1.13	3.20	1.18	3.02	0.99	2.02
Nerina	2.11	3.19	1.02	3.08	1.45	3.20	1.23	2.67
Xera	1.17	2.68	0.71	2.25	1.03	2.47	0.67	1.88
Savana	0.98	2.16	0.49	1.89	0.78	2.13	0.25	1.63
Alicante	0.56	2.03	0.33	1.82	0.19	1.03	0.10	0.65

L.S.D. at 0.05	1.29	2.63	0.74	2.45	0.93	2.37	0.65	1.77
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Sings of infection appeared gradually parallel to the plant age. The lowest percentage of infection was recorded in early plant age and the highest percentage occurred in late age during summer and nili plantation seasons, 2010 and 2011. The virus diseases infecting bean varieties during summer more than during nili plantation seasons.

Data in Table (4), show that the simple correlation between bean varieties and infestation rates by *A. craccivora* were significant ($r = 0.95, 0.97$ and 0.91) and ($r = 0.92, 0.93$ and 0.94) during summer and nili plantation seasons 2010, 2011 and general mean at Qualubia Governorate, respectively.

Also, results in Table (4), show that the simple regression for changing the population of infestation rates by *A. craccivora* and bean varieties and infestation were significant ($b = 0.96, 0.98$ and 0.97) and ($b = 0.97, 0.95$ and 0.99) during

summer and nili plantation seasons 2010, 2011 and general mean at Qualubia Governorate, respectively.

Effect of resultant yield:

Data recorded in Table (5) show that the means of common bean yield produced by different varieties cultivated during summer and nili plantation seasons of 2010 and 2011. Bronco and Alicante varieties resulted the heaviest green pods yield were 5.33, 5.52 and 5.39, 5.48 ton/fed. during summer and nili plantation seasons, respectively, followed by Nerina and Savana varieties, while Xera variety yielded the lowest weight of green pods of 2.54 and 2.17 ton/fed. for the same previous seasons, respectively. Statistical analysis revealed significant effect on the resultant yield of five tested varieties during summer and nili plantation seasons in 2010 and 2011 years.

Table (4): Simple correlation and regression values between infestation rates by *Aphis craccivora* and virus infection during summer and nili plantation seasons 2010 and 2011 at Qualubia Governorate.

Variable		Simple correlation "r"	Probability "P"	Regression	Probability "P"	
Varieties	Summer	2010	0.95	*	0.96	*
		2011	0.97	**	0.98	**
		General mean	0.91	*	0.97	*
	Nili	2010	0.92	*	0.97	*
		2011	0.93	*	0.95	*
		General mean	0.94	*	0.99	***

Table (5): Mean weight of green pods yield (ton/fed.) of five different bean varieties during summer and nili plantation seasons 2010 and 2011 at Qualubia Governorate.

Varieties	Weight of green pods (ton/fed.)					
	Summer			Nili		
	2010	2011	General mean	2010	2011	General mean
Bronco	4.89	5.76	5.33	5.24	5.80	5.52
Nerina	3.41	4.15	3.78	3.63	3.95	3.79
Xera	2.25	2.83	2.54	2.00	2.83	2.17
Savana	3.00	2.95	2.98	2.86	3.11	2.99

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Alicante	4.90	5.87	5.39	5.00	5.95	5.48
L.S.D. at 0.05	0.51	0.10	-	0.23	0.31	-

The present results agree with those obtained by El-Lakwah *et al.* (1999), Shalaby (2004), Yassin (2008), Abd El-Karim (2010) and El-Lakwah *et al.* (2010), as all reported that there were difference between infestation levels of *A. craccivora* to the tested common bean varieties. Also, the highest mean number of aphid infestation occurred on Bronco cultivar.

Moreover, *A. craccivora* was reported as a main vector of mosaic virus and able to transmit the virus along their life span (Guo *et al.*, 1989; Zhang *et al.*, 1993; El-Defrawi *et al.*, 2000 and Mohamed 2002). Also, Doss *et al.* (1985) and Guo *et al.* (1989) found that the population of *A. craccivora* was associated with spreading of mosaic disease.

REFERENCES

- Abd El-Karim, H. S. (2010). Studies on some arthropods inhabiting bean plants, *Phaseolus vulgaris* L. in Fayoum Governorate. Ph.D. Fac. Agric., Fayoum Univ., 113 pp.
- Attia, A. A., A. H. El-Heneiday and E. A. El-Kady (1987). Studies on the aphid, *Aphis craccivora* Koch (Homoptera : Aphidiidae) in Egypt. Bull. Soc. ent. Egypte', 66: 319-324.
- Bos, L., C. Z. Kowalska and D. Z. Maat (1974). The identification of bean mosaic, pea yellow mosaic and pea necrosis strains of bean yellow mosaic virus. Neth. J. Pl. Path., 80 : 173-191. Doss, S. A.; M. L. Wahba; M. K. Nakhla and F. Sawires (1985): Effect of aphids and virus diseases cowpea cultivars. 1st Nat. Conf. of Pest and Dis. Of Veg. in Egypt, pp 78.
- El-Defrawi, G. M., A. K. Emam, I. A. Marzouk and I. Rizkallah (2000). Population dynamics and seasonal distribution of *Aphis craccivora* Koch and associated natural enemies in relation to virus disease incidence in faba bean fields Egypt. J. Agric. Res., 78(2):627-641.
- El-Kifl, A. H., A. E. A. Wahab, M. A. Assem and A.A. Metwally (1974). List of insects, mites and pests associated with leguminous crops in Egypt. Bull. Soc. Ent. Egypt, 58: 297-302.
- El-Lakwah, F. A. O., E. F. El-Khayat, A. A. Hafez and H. H. Shalaby (1999). Susceptibility of three varieties of bean *Phaseolus vulgaris* L. to infestation with whitefly and aphid. Annals of Agric. Sci., Moshtohor, 37 (1): 585-603.
- El-Lakwah, F. A., E. F. El-Khayat, G. H. H. Rady, M. M. A. Ghallab and B. S. Wahba (2010). Impact of varieties on infestation of common bean plants with pests. Egypt. J. Agric. Res., 88 (4): 1121-1140.
- Gray, S. M. and F. Gildow (2003). Luteovirus-Aphid interactions. Ann. Rev. Phytopathol., 41: 539-566.
- Guo, J. R., Y. X. Chen and Z. D. Fang (1989). Relationship between aphids and incidence of luteovirus infecting *Vicia faba*. J. Nanjing Agric. Univ., 12 (4): 53-57.
- Hamid, S. M. A., A. Shah and A. M. Anwar (1977). Some ecological and behavioural studies on *Aphis craccivora* Koch (Homoptera : Aphidiidae). Tech Bull. Commonwealth, 18: 99-111.
- Jurik, M. and Z. Zahorova (1992). Separation and transmission of two legume viruses from mixed infection by aphid. Ochrana-Rostlin, Slovakia, 28 (2): 95-100.
- Mohamed, M. A. (2002). Studies on legumes aphid, *Aphis craccivora* Koch and its relation to the yellow mosaic virus disease in bean plant. Ph. D. Fac. Sci., Ain-Shams Univ., 89 pp.
- SAS Institute (1988): SAS/STAT User's Guide, Ver. 6.03. SAS Institute Inc., Cary, North Carolina.
- Shalaby, H. H. S. (2004). Studies on the efficiency of some new pests control measures against certain pests of common bean. Ph. D. Thesis, Fac. Agric., Moshtohor, Zagazig Univ., 193 pp.
- Smith, K. M. (1972). A text book of plant virus diseases. Longman, Groups Ltd., London, 684 pp. Yassin, S. A. F. (2008): Study of integrated pest management on some pests of common bean plant. Ph. D. Fac. Sci., Al-Azhar Univ., 409 pp.
- Zhang, H., X. U. Zhigang and H. B. Zhang (1993). Identification of BYMV, a viral disease on the spring sown broadbean in Gansu Province. J. Nanjing Agric. Univ., 16 (1): 55-59.

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أظهرت الدراسة الحالية خلال الموسمين الصيفي والنبلي (٢٠١٠، ٢٠١١) أن هناك تأثير معنوي بين أصناف الفاصوليا المختبرة ومعدلات الإصابة بالمن. كما أوضحت النتائج أن الصنف اليكانت كان أكثر الأصناف تحملا للإصابة بالمن بينما كان الصنف برونكو أكثرها إصابة بحشرة المن.

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أظهر التحليل الاحصائي للنتائج وجود ارتباط معنوي بين معدل الإصابة بحشرات المن والعدوى بفيروس الموزايك العادي وفيروس الموزايك الأصفر.

أوضحت النتائج أن صنف برونكو واليكانت اعطيا اعلى إنتاجية للمحصول الأخضر ، بينما الصنف إكزيرا كان أقلهم إنتاجية . بصفة عامة يمكن القول ان الصنف اليكانت كان أفضل الأصناف حيث كان الأقل في مستوى الإصابة بحشرة المن والإصابة الفيروسية وأعطى أعلي محصول من القرون الخضراء.