

SUSCEPTIBILITY OF SOME BEAN VARIETIES; *PHASEOLUS VULGARIS* (L.) TO *APHIS CRACCIVORA* AND *TETRANYCUS URTICAE* PESTS INFESTATION , WITH REFERENCE TO THEIR NATURAL ENIMIES IN FAYOUM GOVERNORATE

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ABSTRACT

The present investigation was carried out at El-Kasmia village, Etsa district, El-Fayoum Governorate during two growing season 2009 and 2010 to study susceptibility of four bean varieties, Branco, Narina, Giza 4 and Nbrasca to *Aphis craccivora* Koch and *Tetranychus urticae* Koch infestation with reference to their natural enemies ; *Coccinella undecimpunctata* and *Chrysoperla carnea* .

The obtained results indicated that Branco and Narina varieties more susceptible to *A. craccivora* which recorded (11.5 & 4.7) and 10.4& 4.0) individuals/20 leaves during the two growing seasons 2009 and 2010, respectively. On the other hand the less variety was Nbrasca which recorded numbers of *A. craccivora* 6.8 and 2.3 individuals/20 leaves at 2009 and 2010 seasons respectively.

The results show that Giza 4 and Nbrasca varieties were more susceptible to mite infestation *T. urticae* which recorded mean numbers (171.6 and 140.4) ; (128.5 and 119.2) individuals/20 leaves respectively; than Branco varieties which recorded (125.3 and 112.2) during the two seasons. On the other hand Narina variety was the last degree by mean 108.5 and 106.2 individuals/20 leaves at the same trend.

Two peaks of *C. undecimpunctata* during two seasons in April and May which recorded 7.25 and 9.0 individuals/20 leaves during 2009 and 9.5 and 10.25 individuals/20 leaves during 2010. On contract *C. carnea* was low during two seasons which recorded, 4.75 and 5.0 individuals/20 leaves at May of two seasons.

Key words: Susceptibility, bean, varieties, Branco, Narina, Giza 4, Nbrasca ,*Aphis craccivora*, *Tetranychus urticae*, infestation, natural enemies, *Coccinella undecimpunctata* and *Chrysoperla carnea*.

INTRODUCTION

The common bean , *Phaseolus vulgaris* L. is considered one of the most important leguminous vegetable crop in many parts of the world as it contains a complete protein compared with the other vegetables .In Egypt, this crop has been subjected to attack by several pests and affect the quality and quantity of green pods and dry seeds production (**Abdel-karim 2010 and Magouz et al., 2011**).

Aphids, thrips , whitefly and leafminers are usually infested bean plant and cause losses at about 50% of this crop by feeding on the plant in addition to plant viruses transmission (**Omar and Faris 2000; Helaly et al.,1983, Wahba et al .,1986 ; Metwally,1989 and Metwally and Mahgoub 1991 and Pena Rojas et al.,1992**)

Also, phytophagous mites cause extensive damage to vegetable crops ,especially *Tetranychus urticae* L. widely spread and considered the main pest of vegetables, causing great losses in the yield , the effect of which is reduce

photosynthesis, transpiration leaf chlorophyll content ; leaf nitrogen, and increase transpiration (Golam,2002).

In general, the chemical control of these pests creates several problems i.e., environmental pollution ,destruction of beneficial insects and pest resistance to many pesticides (John *et al.*, 1986). Therefore , it is necessary to select the tolerant or resistant varieties as one of the simplest and useful tactics in the integrated pest management programs (Dent, 1991). However , plant resistance to insects is generally derived from certain biochemical and / or the metabolism of insects influencing the relative degrees of damage caused by these insects (Metcalf and Luckmann, 1975) .

The present work carried out to study the relative susceptibility of some common bean varieties to *A. craccivora* and *T. urticae* infestation with reference to their natural enemies in Fayoum Governorate .

MATERIAL AND METHODS

Experiments were carried out in El- Kasmia village, Etsa District, Fayoum Governorate, during 2009 and 2010 seasons. Four varieties involved in this study were Branco, Narina, Giza 4 and Nbrasca. The experimental area of about 1/4 feddan were divided into 36 plots, each of 24m² (6 m length X 4m width). The tested varieties were sown in first February during two successive seasons respectively in a complete randomized blok design with three replicates for each. The regular agricultural practices were followed without any insecticidal treatments throughout the growing season of bean. Weekly samples of 20 bean compound leaves was collected at random from each plot till the end of growing seasons. The collected leaves were picked randomly, kept in paper bags and transferred to the laboratory to count individuals of cowpea aphid, spider mite, *C. undecimpunctata* and *C. carnea* by the aid of stereomicroscope.

Classification of the susceptibility degree of each bean cultivar infestation was determined according to the general mean of number (x) of each pest and the standard deviation (SD) as reported by Chiang and Talekar(1980). The variety that had mean numbers of aphids and spider mite less than X-2SD were considered to be highly resistant (HR); between X-1SD to X-2SD were moderately resistant (MR); between X and X-1SD were low resistant (LR); between X and X+2SD were susceptible(S) and more than X+2SD were highly susceptible(HS).

The obtained data were statistically analyzed using F-test and the mean numbers of the two pests were compared according to Duncan's multiple rang test (Duncan, 1955).

RESULTS AND DISCUSSIONS

Data presented in (Table,1) indicated that the variety of bean, Nbrasca less susceptible to *A. craccivora* during two growing seasons. The mean numbers of *A. craccivora* were 6.8 and 2.3 individuals/20 leaves.

While, Branco variety was high susceptible to *A. craccivora*. The mean numbers were 11.5 and 4.7 individuals/20 leaves during 2009 and 2010, respectively.

During 2009 season data in (Table,1) revealed that first peak of infestation with *A. craccivora* was recorded in March, 10, 17 for Branco and Narina being 25.7 and 20.5 individuals/20 leaves for two varieties, respectively. The second peak for the same varieties were recorded in April

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21, 28 for Narina and Branco being 22.6 and 23.7 individuals/20 leaves, respectively.

As shown in table (1) Branco and Narina varieties were more susceptible to infestation with aphids. The numbers of aphids were ranged between 3.5 to 23.7 individuals/20 leaves during the period between February and first June for Branco cv., while it ranged between 5.0 and 22.6 individuals/20 leaves for Narina cv. in the same period.

On the other hand, the mean numbers of aphid ranged between 1.7 to 22.1 individuals/20 leaves and 0.0 to 22.9 individuals/10 leaves for the two varieties, i.e., Giza 4 and Nbrasca, respectively.

Statistical analysis of the data showed highly significant differences ($P < 0.01$) between the four varieties as shown in (Table 1).

During 2010 growing season, data in (Table 1) indicated that the mean numbers of aphid insects in the fall season were very low as compared with 2009 season in the four varieties.

The peak was recorded in March, 17 for Giza 4 and Nbrasca variety being 6.7 and 4.6 individuals/20 leaves. While, it was recorded in March, 24 for Branco and Narina varieties being 10.0 and 7.5 individuals/20 leaves.

The lowest infestations with aphid insects on the four varieties were recorded in June in the two growing seasons as shown in (Table 1).

Generally, data in (Table 1) revealed that variety of Branco and Narina were more sensitive to infestation with aphid than Giza 4 and Nbrasca cv. during two successive seasons.

These results agree with the finding of **Wahba et al., (1986)** indicated that some bean cultivars were susceptible to *A. craccivora* infestation, while others showed some tolerance. Processor cv. was more tolerant to aphid infestation with mean numbers 0.95 and 1.80 aphids/leaf, respectively, while Catue cv. was the highest susceptible with mean number 7.60 and 10.30 aphids/leaf, respectively, during summer periods of 1983 and 1984. The cultivars can be arranged in a descending order as follows: Slankette, Giza 6, Giza 3, Varandonon, Giza 4, and Rometto. **Bequer-Hernandes and Ferrandiz-Puga (1981)** found that the population dynamics of aphids (*A. craccivora*) on beans (*Phaseolus vulgaris*) were generally low throughout the year, the largest numbers being recorded in November. **Abdel-Karim (2010)**, who found that there was no significant differences between Branco and Paulista (2.64 and 1.36 individuals/20 leaves) infected by aphids during summer plantation.

Data presented in (Table, 2) indicated that the variety of bean, Narina was less susceptible to *T. urticae* during two growing seasons. The mean numbers of *T. urticae* were 108.5 and 106.2 individuals/20 leaves in 2009 and 2010, respectively, while Giza 4 variety was high susceptible to *T. urticae* in two seasons. The mean numbers were 171.6 and 128.5 individuals/20 leaves, at the same trend.

During 2009 season data in (Table, 2) revealed that the first peak of infestation with *T. urticae* was recorded in March, 17 for Branco and Narina being 93.0 and 125.5 individuals/20 leaves for two varieties, respectively. The second peak for the same varieties were recorded in April, 28 (391.4 and 312.6) individuals/20 leaves for Branco and Narina, respectively.

Table(1):Weekly mean numbers of cowpea aphid, *Aphis craccivora* Koch on four varieties / 20 leaves for each cultivar under field conditions in Fayoum Governorate during 2009/2010 seasons.

Sampling dates	First season				Second season			
	Branco	Narina	Giza 4	Nbrasca	Branco	Narina	Giza 4	Nbrasca
Feb., 17	3.5	5	1.7	0	5.5	2.7	0.9	0.4
24	6.8	7.7	2.9	0	3.1	2.8	1.7	1.5
March, 3	19.9	11	3.8	1.1	1.7	3.7	2.8	2.6
10	25.7	13.7	5.9	3.1	6.3	5.4	3.4	3.9
17	18.4	20.5	7.3	7.7	8.4	6.4	6.7	4.6
24	11.2	15.4	10.4	9.6	10	7.5	4.5	2.1
31	9.4	10.1	22.1	6.4	6.6	3.9	3.2	1
April, 7	5.5	9.5	15.4	3.7	4.8	9.7	2.5	0.7
14	10	18.2	9.3	2.5	3.2	4.9	1.9	1.3
21	15.3	22.6	5.6	6.6	2.4	3.2	3.2	2.1
28	23.7	10.7	7.1	9.6	2.1	3	6.7	3.4
May, 5	11.4	5.6	10.3	14.7	4.6	5.1	7.2	8.3
12	9.8	7.4	12.7	22.9	8.2	2.7	4.3	2.9
19	7.7	5.1	19.5	11.8	3.7	1.9	2.6	0.9
26	3.5	3.3	9	7.9	3	1	1.2	0.4
June, 2	1.4	1	2.5	1.2	1.2	0.5	0.8	0
Total	183.2	166.8	145.5	108.8	74.8	64.4	53.6	36.1
Mean	11.5 ^a	10.4 ^b	9.1 ^c	6.8 ^d	4.7 ^a	4.0 ^a	3.4 ^a	2.3 ^a

Duncan's Multiple Rang Test P<0.01

Table(2): Weekly mean numbers of spider mite, *Tetranychus urticae* Koch on four varieties / 20 leaves for each cultivar under field conditions in Fayoum Governorate during 2009/2010 season.

Sampling dates	First season				Second season			
	Branco	Narina	Giza 4	Nbrasca	Branco	Narina	Giza 4	Nbrasca
Feb.,17	10	13.2	25.6	15.3	15.4	7.7	14.5	3.3
24	21.2	40.3	47.9	26.4	61.2	24.5	33.3	15.4
March,3	60.3	75.1	88.4	78.5	50.1	42.1	57.4	27.8
10	81.5	108.5	105.1	183.5	83.3	65.3	52.1	44.5
17	93	125.5	144.5	77.6	34.9	71.7	50	76.8
24	88.5	65.5	211.4	91.6	121.7	37.6	118.1	105.7
31	108.5	105.7	134.1	183.5	165.6	111.5	212.5	142.1
April,7	190.2	299.5	196.7	265.2	248.6	174.4	232.5	184.2
14	213.3	120.8	278.6	294.5	358.2	216.6	265.7	339.9
21	365.5	164.5	399.2	319.5	217.4	297.8	320.2	280.6
28	391.4	312.6	485.1	266	183.4	256.4	167.7	210.4
May,5	185.5	143.2	320.3	175.2	100.6	183.4	225.4	227.2
12	93.1	85.9	135	129	78.1	100.9	147.3	109.1
19	66.3	52.4	95.8	91.6	45.6	75.1	80.2	80.4
26	25.6	20.5	61.7	38.5	22.3	22.5	59.3	46.7
June,2	10.4	3.4	15.6	11.2	8.8	11.2	20.4	12.5
Total	2004.3	1736.6	2745	2247.1	1795.2	1698.7	2056.6	1906.6
Mean	125.3 ^{bc}	108.5 ^c	171.6 ^a	140.4 ^b	112.2 ^{bc}	106.2 ^c	128.5 ^a	119.2 ^{ab}

Duncan's Multiple Rang Test P<0.01

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The second peak recorded in April, 14 for Branco and Nbrasca being 358.2 and 339.9 individuals/20 leaves, respectively. While, it recorded in April, 21 for Narina and Giza 4 being 297.8 and 320.2 individuals/10 leaves, respectively.

The lowest infestations with *T. urticae* on the four varieties were recorded at June in the two growing seasons as shown in (Table, 2).

Generally, data in (Table, 2) revealed that the two varieties of Giza 4 and Nbrasca cv were highly susceptible than the two others varieties Branco and Narina were less sensitive to infestation with *T. urticae* during two successive seasons. The numbers of *T. urticae* were very high in April on all varieties.

Statistical analysis of the data showed highly significant differences $P < 0.01$ between the four varieties as shown in (Table, 2).

These results are in agreement with the finding of, **Abdel-Karim (2010)**, found that the Branco cultivar more susceptible to *T. urticae* infestation than Paulista cultivar. Also, the infestation was intensively in this season 2006 on the contrary to the infestation in summer season. **Wahba et al., (1986)** reported that the mean numbers of *T. urticae* of different bean varieties did not show any significant differences in summer and fall plantation of both years. The average numbers ranged between 1.12 on Giza 4 cv. and 4.08 on Giza 5 cv. But agreement with the finding of, **Magouz et al., (2011)** recorded that the highest numbers during the third week of July in the first season but in the second season the highest numbers recorded in the fourth week of July. Based on the mean numbers of the two study seasons, variety Polesta harbored significantly the highest population of *T. urticae* followed by French bean and the breeding line F1 hybrid, R1655 was the lowest infested.

From the above mentioned results in Tables (1 & 2) its may be due to the decreasing and increasing population of aphids and spider mites, depend on climatic factors and/ or the abundance of the natural enemies as mentioned by **Kumar (1984)** who reported that the certain environmental conditions influence fundamental physiological processes of the plant as well as the pest. Thus, a variety that exhibits resistance in one locality or environmental may susceptible in another. Also, **Metcalf and Luckmann (1975)** recorded that certain environmental conditions may later the physiology of the plant to the extent that it becomes unsuitable as a host for certain pest. Also, plant resistant to insects is generally derived from certain biochemical and /or the metabolism of insects influencing the relative degrees of damage caused by aphids, spider mites and whitefly.

In respect to the susceptibility degree (SD) to the two pests, results in (Table 3) revealed that, two groups of susceptibility of bean varieties regarding infestation with the two pests in this experimental according to **Chiang and Talekar (1980)**, are as follows: Branco and Narina were susceptible (S) to cowpea aphid but low resistant (LR) to spider mite. While, Giza 4 and Nbrasca were low resistant (LR) to spider mite but susceptible (S) to cowpea aphid, as shown in (Table 3).

From the foregoing results in Tables (1 and 2), it could be concluded that the population of the spider mite was more abundant than cowpea aphid during the two seasons. Also, Branco and Narina appeared susceptible to cowpea aphid, but Giza 4 and Nbrasca were susceptible to spider mite. While, Giza 4 and Nbrasca appeared low infested by cowpea aphid, but Branco and Narina appeared low resistant, respectively during two seasons.

Table(3): Susceptibility of bean varieties to infestation with cowpea aphid, *Aphis craccivora* Koch and spider mite, *Tetranychus urticae* Koch on four varieties under field conditions in Fayoum Governorate during two seasons.

Varieties	<i>Aphis craccivora</i>	SD	<i>Tetranychus urticae</i>	SD
Branco	8.1	S	118.8	LR
Narina	7.2	S	107.4	LR
Giza 4	6.3	LR	150.1	S
Nbrasca	4.6	LR	129.8	S
	X= 6.6 SD*= 1.80		X= 126.5 SD*= 44.6	

SD: Susceptibility degree.

SD*: Standard deviation

Table(4): Weekly mean numbers of predators / 20 leaves under field conditions in Fayoum Governorate during 2009/2010 seasons.

Sampling dates	First season		Second season	
	<i>C. u.</i>	<i>C. c.</i>	<i>C. u.</i>	<i>C. c.</i>
Feb.,17	2.25	0	3.00	0
24	2.50	0	3.00	0
March,3	3.00	0	4.00	0
10	4.50	0	5.00	0
17	5.25	0	5.50	0
24	5.50	0	6.00	0
31	6.00	0	3.00	0
April,7	4.00	1.25	3.25	1.00
14	4.25	1.25	3.50	1.25
21	4.50	1.00	6.25	0.00
28	7.25	1.50	9.50	1.00
May,5	6.00	2.50	7.25	3.00
12	6.50	3.50	7.50	3.25
19	7.00	3.50	7.25	4.00
26	9.00	4.75	10.25	5.00
June,2	5.00	1.50	7.00	2.00
9	4.75	1.25	6.50	1.50
16	4.00	1.00	4.25	1.25
23	2.25	0.00	2.50	0.25
Total	93.50	24.50	104.50	23.5
Mean	4.96	1.29	5.50	1.24

C. u.: *Coccinella undecimpunctata*

C. c.: *Chrysoperla carnea*

In (Table, 4), the data revealed that means numbers of *C. undecimpunctata* during two seasons 4.96 and 5.50 as compared with 1.29 and 1.24 for *C. carnea* individuals/20 leaves, respectively.

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Concerning (Table, 4) the presented data show that the numbers of *C. carnea* during two seasons were 0.0 till the end of March as compared with the numbers of *C. undecimpunctata* which recorded means ranged between (2-6) and (3-6) individuals/20 leaves in the two seasons 2009 and 2010, respectively.

Data in the same table indicated that there were two peaks of *C. undecimpunctata* during first season i.e., 7.25 and 9.0 individuals/20 leaves at April,28 and May,26, respectively.

On the other hand there were also two peaks in the numbers of *C. undecimpunctata* at 2010 season being 9.5 and 10.25 individuals/20 leaves in the same dates, respectively.

In general, the data presented in (Table, 4) show that the numbers of *C. carnea* were low during two seasons except one peak in the two seasons in May,26 (4.75 and 5.00) individuals/20 leaves.

Finally, the highly numbers of *C. undecimpunctata* and *C. carnea* were recorded at the end of May during two seasons.

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قابلية بعض أصناف الفاصوليا للإصابة بمن اللوبيا والعنكبوت الأحمر مع الإشارة إلى أعدائها الحيوية بمحافظة الفيوم

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أجريت هذه التجارب في قرية القاسمية مركز اطسا محافظة الفيوم وذلك خلال موسمي ٢٠٠٩؛ ٢٠١٠ بغرض تقييم أربعة أصناف من الفاصوليا وهي برا نكو و نارينا و جيزة ٤ و نبرا سكا للإصابة بمن اللوبيا والعنكبوت الأحمر وتمت دراسة الكثافة العددية للمفترسين أبو العيد ذي الـ ١١ نقطة وأسد المن وذلك خلال موسمي الدراسة.

أظهرت النتائج المتحصل عليها الآتي:

- ١- أكثر الأصناف إصابة بمن اللوبيا هما برا نكو و نارينا خلال الموسم الأول بمتوسط ١١.٥ و ١٠.٤ و متوسط ٤.٧ و ٤.٠ للموسم الثاني بينما احتل الصنف نبراسكا المرتبة الأخيرة للحساسية والذي سجل متوسط لأعداد المن في العام الأول ٦.٨ و الثاني ٢.٣ فردا.
- ٢- أوضحت النتائج أن أكثر الأصناف قابلية للإصابة بالعنكبوت الأحمر هو الصنف جيزة ٤ ونبراسكا ثم برا نكو وأخيرا نارينا وذلك خلال الموسمين ٢٠٠٩ و ٢٠١٠ بمتوسطات ١٧١.٦ و ١٤٠.٤ و ١٢٥.٣ و ١٠٨.٥ للموسم الأول بينما انخفضت تلك المتوسطات في الموسم الثاني فكانت ١٢٨.٥ و ١١٩.٢ و ١١٢.٢ و ١٠٦.٢ بنفس الترتيب.
- ٣- أظهرت النتائج أيضا أن مستويات الإصابة بلغت ذروتها شهري مارس وأبريل خلال موسمي الدراسة.
- ٤- وأوضحت النتائج أن أكبر كثافة لحشرة أبو العيد خلال موسمي الدراسة كانت في شهر أبريل ومايو حيث بلغت الأعداد ذروتها وسجلت ٧.٢٥ و ٩.٠٠ في موسم ٢٠٠٩ بينما كانت تلك الأعداد ٩.٥٠ و ١٠.٠٠ خلال الموسم الثاني ٢٠١٠.
- ٥- أظهرت النتائج المتحصل عليها أيضا أن أعداد أسد المن كانت منخفضة طوال الموسمين باستثناء ذروتين تم تسجيلهما هما ٤.٧٥ و ٥.٠٠ وذلك خلال شهر مايو من الموسمين تحت الدراسة. من النتائج المتحصل عليها يجب الأخذ في الاعتبار الكثافة العددية لكلا الأفتين تحت الدراسة والمفترسات المصاحبة لهما وذلك أثناء وضع برامج المكافحة المتكاملة لهذه الأصناف.