

FIELD PRELIMINARY STUDY ON RESISTANCE OF *Vicia faba* BREDDING LINES TO ATTACK BY COWPEA APHID *Aphis craccivora* IN EGYPT

Shalaby, F. H. * and G. M. El-Defrawi **

* Food Legume Crops Res. Dept., Field Crops Research Institute, ARC, Giza, Egypt.

** Entomologist, Piercing & Sucking Insects Res. Dept., Plant Protection Research Institute, ARC, Dokki, Egypt.

ABSTRACT

Sixty-five F₆ faba bean (*Vicia faba* L.) Egyptian breeding lines, were evaluated for resistance to cowpea aphid, *Aphis craccivora* Koch infestation throughout three successive seasons 1998/99 to 2000/2001 under field conditions. Results showed that the two entries 818/923/92 and 857/1574/92 were found to be resistant/tolerant to aphid infestation, in spite of the severe infestation seasons of faba bean plantation in Middle Egypt. These two lines also tended to combine high yielding ability.

Most of the variations in yield components of faba bean varieties was attributable to the size of *A. craccivora* infestation. Resistant entries outyielded susceptible varieties and also much less affected by the presence of large numbers of aphids.

INTRODUCTION

Yields of field faba beans fluctuate widely and attacks with cowpea aphid, *Aphis craccivora* Koch are one of the most important factors limiting yield. Efficient insecticides are available but varietal resistance is desirable both in helping to stabilize yields where chemicals cannot be applied, and to reduce production costs and hazards to beneficial insects, notably bees. Davidson & Fisher (1922) found varietal differences in aphid infestation and Müller (1953), after testing large numbers of German faba bean varieties (1953), studied the behaviour and performance of *A. fabae* on the varieties Rastatt (resistant) and Schlanstedt (susceptible) (1958 a,b). Rastatt was tested by the National Institute of Agricultural Botany in the period 1954-61 (Smith & Aldrich, 1967) but was not recommended for British conditions because yields were, on average, less than those of control varieties in the absence of *A. fabae*. Thus, if the resistance found in Rastatt were to be employed, crosses had to be made with British varieties and selections obtained which combined resistance to *A. fabae* with high yield under British conditions. Acceptable levels of resistance have been detected in few faba bean landraces (El-Defrawi *et al.*, 1998) and in some breeding lines (El-Defrawi & Bishara, 1992 and El-Defrawi & Omar, 1998). More recent studies have shown that fewer aphid individuals settled on resistant plants and multiplied more slowly than susceptible (Tahhan & Hariri, 1981; Holt, 1982 and El-Defrawi *et al.*, 1998). Resistant varieties had a smaller proportion of the aphid population (El-Defrawi & Bishara, 1992). Severe infestation still

caused considerable loss of yield on resistant cultivars (Bond & Lowe, 1975). Recently in Egypt, aphid populations on faba bean fields have increased steadily during the last decade, most probably due to change in climatic conditions, rise in soil water level and to crop off-rotation. Hence, the use of resistant varieties serves as an effective, safe economical method to save the crop from ravages of the pest.

This study aims to evaluate resistance of certain faba bean entries, at seedling, flowering and pod-setting stages, to attack by cowpea aphid and selecting the most antibiologically resistant ones to be incorporated in the breeding programme for producing insect resistant and high yielding varieties.

MATERIALS AND METHODS

Sixty-five F_6 faba bean (*Vicia faba* L.) breeding lines derived from 19 crosses selected from breeding nurseries of 1992 Egyptian breeding program of Food Legume Research Department, Field Crops Research Institute ARC, were chosen to evaluate their susceptibility to aphid infestation (Table, 1). The investigation was carried out under natural field conditions at Sids Agricultural Research Station during 1998 to 2001. Two faba bean cultivars, i.e. Giza 2 and Giza 674 were also used in all experiments as susceptible standard checks.

Table (1): Faba bean F_6 breeding lines selected for testing their relative resistance against the cowpea aphid, *Aphis craccivora*.Koch.

Cross No.	Parents	No. of tested lines
811	561/2077/85 Sak. x 461/845/83	5
812	561/2077/85 Nub. x 461/845/83	2
813	G. 402 x {R.C. 39/80 x ILB 938}	2
815	561/2076/85 x 461/847B/83	7
816	561/2090/85 x 461/845/83	2
817	561/2082/85 x 461/837A/83	2
818	561/2077/85 x 461/847B/83	4
820	561/2090/85 x {249/802/80 x ILB 938}	8
822	561/2077/85 x {249/801/80 x ILB 938}	3
826	561/2082/85 x 461/847/83	2
827	561/2077/85 x {249/802/80 x ILB 938}	2
836	561/2082/85 x {249/801/80 x ILB 938}	3
838	561/2077/85 x {249/802/80 x ILB 938}	2
840	561/2077/85 x { R.C. 39/80 x ILB 938}	5
843	561/2076/85 x 461/845/83	4
846	G. 402 x 461/837/83	3
847	561/2090/85 x { 249/801/80 x ILB 938}	2
855	561/2090/85 x { R.C. 39/80 x ILB 938}	3
857	561/2076/85 x { 249/801/80 x ILB 938}	4
Total		65

Field experiments :

(A) Preliminary screening trial :

Experiment was carried out in 1st. November 1998 includes 65 faba bean-breeding genotypes as well as the 2 checks. A randomized complete block design with four replications was used, the planting took place in ridges 60 cm apart, in double rows with 20 cm between hills along each row and two seeds per hill. Two commercial cultivars Giza 2 and Giza 674 were regularly repeated every 10 tested lines. Aphid infestation was assessed in each line at seedling, flowering and pod-setting stages 30, 65 and 105 days after planting according to the field rating scale. Tolerance to aphid infestation was estimated in each genotype based on seed yield (gram/plant).

(B) Advanced screening trials :

Two experiments were carried out at Sids Agricultural Research Station as a hot spot area for cowpea aphid, *Aphis craccivara* Koch, during the two successive seasons 1999/2000 and 2000/2001. An area of one feddan was divided into two equal parts. One area was sprayed periodically at 2-weeks intervals (full protection) on infestation build up during the last week of November with Aphox DG 50% aphicide (Pirimicarb) at the rate of 0.5 g/L. The other area was not sprayed with any insecticide to allow natural build up of aphid infestation.

A randomized complete block design with four replications was used. Each plot consist of 5 rows, 3.5 m length, separated by 1.0 m strip of uncultivated land. Seeds of all genotypes were sown on November 15 in both seasons. Normal cultural practices were done as recommended.

Twenty-eight entries with different levels of resistance were selected from the previous preliminary field experiment (1998/99) to test their resistance / tolerance to natural infestation; meanwhile only eight promising lines were cultivated in 2000/2001 season to confirmed the previously results obtained. The two varieties Giza 2 and Giza 674 were acted as susceptible standard check cultivars were regularly repeated every 5 tested entries in both tested seasons. The faba bean genotypes were checked by counting the number of aphids setting on the plants in each plot at 2-weekly intervals. This reveals resistance due to non-preference. Data were transferred to a score of 1 to 5 categories, where the first signify a highly resistant line and the fifth are as highly susceptible line according to the following classes according to Bond & Lowe (1975) and El-Defrawi and Bishara (1992).

aphid infestation index: Twenty-five to fifty plants of a given promising line, from each of the four replications, were taken at random are to be observed and the degree of infestation level recorded and categorized as 1, 2, 3, 4 and 5 according to the symptoms given as under:

Rating scale	Designation	Class
1	up to 20 aphids / plant shoot and no apparent sign of injury.	Highly resistant
2	20-50 aphids / plant shoot, plants damaged less than the untreated control.	Resistant/tolerant
3	51-100 aphids / plant shoot and plants showing as same damage as untreated control.	Moderately Susceptible
4	101-500 aphids / plant shoot, plants showing as much damage as the control.	Susceptible
5	> 500 aphids / plant shoot, plants showing greater damage than the control)	Highly susceptible

Infestation index was calculated by totaling each of the average grades. The variety with the highest index was considered highly susceptible to aphid attack and vice versa. These tests were carried out in an isolated area at Sids ARC.

Aphid Injury: Measure of tolerance of cultivars to aphid infestation was estimated in each entry based on yield parameters in treated plots (T) naturally infested with aphids, compared to non-infested healthy plants in sprayed plots "C". Percentage of reduction in seed yield and its components due to aphids was calculated.

RESULTS AND DISCUSSION

Field screening :

(I) Preliminary screening trials :

Results in Table (2) show the existence of significant difference between aphid population infesting all tested breeding lines during 1998/99. However, fourteen genotypes : 840/1259/92, 811/696/92, 857/1574/92, 818/923/92, 840/1264/92, 822/1097/92, 811/720/92, 818/910/92, 827/1140/92, 846/1388/92, 815/840/92, 822/1075/92, 847/1421/92 and 855/1525/92 were significantly harboured lower aphid populations during different growth stages (score < 2) than the others, and considered comparatively resistant/tolerant compared with the two check cultivars, which were characterized heavily infested and seriously damaged by the aphid outbreak during this season and gave the high indices of 2.73 to 4.13. The remaining cultivars with indices of 2.2 to 2.67 were considered moderately resistant.

It is clearly noticed that breeding lines 840/1259/92, 811/696/92, 857/1574/92, 846/1388/92, 815/840/92, and 822/1075/92 were the most promising lines and tended to combine high yielding potential beside harbouring lower aphid infestations.

The high level of infestation of faba bean plantations with aphids in this season acted as a severe selective agent for aphid resistant/tolerant lines. About 100-150 single plants exhibited appreciable level of tolerance from best progeny were individually selected and harvested separately for further study and each progeny /plant maintained under saran germplasm cages at Sids ARC, for seed multiplication and maintenance. These plants can be regarded as an essential part of breeding work.

(B). Advanced screening trials :

Twenty-eight faba bean breeding lines in addition two check cultivars were evaluated for their susceptibility to aphid infestation under field conditions during 1999/2000 season.

Table (2): Mean aphid infestation index of *Aphis craccivora* on 65 faba bean breeding lines and two check cultivars at three plant growth stages and their seed yield (g. / plant) under field conditions, Sids ARS, Beni-Suef Gov., during 1998/99 season.

E. N.	Entries	Mean aphid infestation index at				Seed yield (g / plant)
		Seedling 30-days	Flowering 65-days	Pod-setting 105-days	Mean	
1	811 / 692 / 92	2.4	2.8	3.0	2.73	20.40
2	811 / 696 / 92	1.7	1.8	1.6	1.70	36.21
3	811 / 700 / 92	2.8	3.0	3.4	3.07	33.80
4	811 / 710 / 92	3.0	3.2	4.0	3.40	34.24
5	811 / 720 / 92	1.6	2.2	2.2	2.00	22.45
6	812 / 727 / 92	2.4	2.6	3.0	2.67	24.23
7	812 / 736 / 92	2.4	2.8	3.6	2.93	33.10
8	813 / 744 / 92	2.0	2.6	3.2	2.60	25.92
9	813 / 751 / 92	2.0	2.6	2.4	2.33	17.66
10	815 / 774 / 92	3.0	3.4	4.2	3.53	16.30
11	815 / 788 / 92	3.0	3.6	3.8	3.47	30.22
12	815 / 799 / 92	2.2	3.0	3.2	2.80	23.75
13	815 / 823 / 92	3.0	3.2	3.2	3.13	28.60
14	815 / 831 / 92	2.6	3.0	3.0	2.87	25.80
15	815 / 840 / 92	1.6	2.2	2.6	2.13	36.00
16	815 / 853 / 92	3.0	3.6	3.8	3.47	17.46
17	816 / 875 / 92	2.4	4.0	4.2	3.53	10.65
18	816 / 888 / 92	3.0	3.8	4.0	3.60	10.84
19	817 / 893 / 92	2.4	3.0	3.0	2.80	22.50
20	817 / 904 / 92	3.0	3.8	4.2	3.67	40.22
21	818 / 905 / 92	2.2	3.0	3.4	2.87	17.47
22	818 / 909 / 92	3.0	3.8	4.0	3.60	11.62
23	818 / 910 / 92	2.2	2.0	1.8	2.00	15.00
24	818 / 923 / 92	1.6	1.8	2.2	1.87	18.12
25	820 / 966 / 92	3.0	3.2	3.2	3.13	38.40
26	820 / 976 / 92	2.6	3.8	3.4	3.27	12.42
27	820 / 990 / 92	1.6	3.0	2.2	2.27	30.95
28	820 / 1002 / 92	2.2	3.2	2.6	2.67	17.80
29	820 / 1003 / 92	2.4	2.6	2.6	2.53	22.44
30	820 / 1022 / 92	2.0	2.4	3.0	2.47	20.80
31	820 / 1044 / 92	2.0	3.2	3.6	2.93	22.90
32	820 / 1046 / 92	2.0	2.2	2.4	2.20	23.40
33	822 / 1075 / 92	2.0	2.2	2.2	2.13	31.11
34	822 / 1095 / 92	2.0	2.2	2.4	2.20	28.60
35	822 / 1097 / 92	1.8	1.8	2.0	1.87	17.60
36	826 / 1117 / 92	3.0	3.2	3.2	3.13	33.50
37	826 / 1128 / 92	2.2	2.6	2.2	2.33	23.50
38	827 / 1139 / 92	3.0	3.6	4.4	3.67	25.40

Table (2), cont'd.

39	827 / 1140 / 92	1.8	2.0	2.4	2.07	19.65
40	836 / 1200 / 92	2.2	2.4	3.0	2.53	16.40
41	836 / 1221 / 92	3.0	3.4	3.2	3.20	25.84
42	836 / 1232 / 92	3.0	3.0	3.4	3.13	25.22
43	838 / 1240 / 92	2.8	3.2	3.2	3.07	30.20
44	838 / 1244 / 92	3.2	4.2	4.0	3.80	16.40
45	840 / 1253 / 92	3.2	4.8	4.4	4.13	13.22
46	840 / 1255 / 92	3.0	4.2	4.0	3.73	11.40
47	840 / 1259 / 92	1.4	2.0	1.6	1.67	30.20
48	840 / 1264 / 92	1.6	1.8	2.2	1.87	27.55
49	840 / 1274 / 92	3.0	3.2	3.2	3.13	20.60
50	843 / 1333 / 92	2.2	2.8	2.0	2.33	25.25
51	843 / 1335 / 92	3.0	4.4	4.2	3.87	13.80
52	843 / 1361 / 92	3.0	3.2	3.0	3.07	16.80
53	843 / 1374 / 92	2.8	3.4	3.6	3.27	14.35
54	846 / 1382 / 92	3.0	3.4	4.2	3.53	20.64
55	846 / 1388 / 92	2.0	2.2	2.0	2.07	28.75
56	846 / 1390 / 92	1.9	2.8	3.0	2.57	21.90
57	847 / 1414 / 92	3.0	3.4	3.6	3.33	15.20
58	847 / 1421 / 92	2.0	2.2	2.2	2.13	22.80
59	855 / 1524 / 92	3.2	4.0	3.8	3.67	15.30
60	855 / 1525 / 92	2.0	2.2	2.2	2.13	24.30
61	855 / 1531 / 92	3.0	3.4	3.8	3.40	18.60
62	857 / 1548 / 92	3.0	3.2	3.6	3.27	18.65
63	857 / 1559 / 92	2.4	3.6	3.4	3.13	24.90
64	857 / 1567 / 92	2.6	3.2	3.2	3.00	10.90
65	857 / 1574 / 92	1.4	1.6	2.2	1.73	34.64
66	Giza 2	3.0	3.2	4.4	3.53	12.80
67	Giza 674	2.8	3.2	3.0	3.00	28.20

"F" value for genotypes for seed yield= 13.85 ($P < 0.001$).

L.S.D. at 5% = 0.48

1% = 0.64

Although aphids were observed at the beginig of December 1999 in small numbers colonizing on faba beans, yet signs of distinct infestation were detected on late-December when plants were over 30 days old. Most of the entries showed different acceptable of aphid set-up which averaged between 1-3 grades. However, nine entries exhibited a good degree of tolerance and attended the grade > 1, which refer to *no apparent sign of injury*. These entries were 811/696/92, 813/751/92, 818/923/92, 820/990/92, 820/1003/92, 822/1097/92, 826/1128/92, 840/1259/92, and 857/1574/92, whereas the mea. infestation were 0.8, 1.0, 0.4, 0.6, 1.0, 1.0, 1.0, 0.6, and 1.0, respectively (Table, 3). Five entries 818/923/92, 840/1259/92, 857/1574/92, 822/1097/92 and 811/696/92 were noticed harbouring lower aphid populations than the others, and can therefore be considered comparatively resistant. Moreover, they showed a good vegetative growth and nicely filled large pods compared to the adjacent entries in the same field trials which were heavily infested and seriously damaged by the aphids.

According to L.S.D. value the different genotypes under test can therefore be arranged according to the aphid infestation levels they harboured during the whole season in the following categories:

Entry / category	Rating aphid population	Entry / category	Rating aphid population
a. Resistant:		b. Resistant / tolerant	
818/923/92	1.20	818/910/92	1.60
840/1259/92	1.33	855/1525/92	1.73
857/1574/92	1.43	811/720/92	1.77
811/696/92	1.47	820/990/92	1.97
822/1097/92	1.57		
c. Moderately susceptible:		d. Highly susceptible:	
840/1264/92	2.03	815/774/92	3.00
846/1390/92	2.03	820/1046/92	3.23
847/1421/92	2.03	822/1075/92	3.23
820/1003/92	2.07	Giza 2	3.37
815/840/92	2.10	843/1335/92	3.57
813/751/92	2.23	840/1253/92	3.67
826/1128/92	2.23	838/1244/92	3.63
827/1140/92	2.27		
846/1388/92	2.30		
843/1333/92	2.40		
820/1022/92	2.67		
822/1095/92	2.87		
836/1200/92	2.97		

These findings more or less confirm the previous results achieved in 1998/99 season with some differences in the serial arrangement of the genotypes according to their levels of resistance and that none of the entries was completely resistant but tolerant to aphid infestation. Field observations deals the colonies of aphids drain away the cell sap by feeding on different plant parts. The cowpea aphid injury results in the discoloration, curling and crinkling of the leaves. Flower buds become distorted and fail to develop into flowers. The attacked flowers fail to set pods. The attacked pods get twisted and shrivelled. Plants remain stunted and fail to produce flowers, or may be killed because of severe infestation by aphids.

On the basis of the injury resulted as a reduction in faba bean yield components due to aphid attack data obtained during 1999/2000 are given in Table (4). From these results, it was clear that the two breeding lines 818/923/92 and 857/1574/92 which exhibited appreciable levels of resistance to cowpea aphid infestation, bear also the character of tolerance. The percentage of reduction in seed yield was 3.64 and 4.77 %, and in seeds weight /plant was 5.56 and 1.81 % and in weight of 100-seeds weight was 1.05 and 2.09 %, respectively. The percentage reduction in yield parameters due to aphids in the other genotypes tested ranged between 6.41-66.20 %, 6.78-65.24 % and 2.13-33.62 % in seed yield / fed., seed weight /plant and 100 seeds weight, respectively.

Data in Table (5) shows the correlation between the population density of *A. craccivora* and the corresponding percentage of reduction in yield components of faba bean tested entries. Results obtained were positive and statistically highly significantly correlated in each of yield parameters comonents i.e., seed yield (Ardab /fed.), seeds weight /plant and mean

weight of 100 seeds. Mean seeds weight per plant was highly correlated to aphid infestation with 61.83 % an explained variance variation in aphid and its associated percentage reduction. Also, seeds yield per fed., and 100 seeds weight being 13.53 and 34.28 % variation, as an explained variance respectively.

It is worth to mention that the character of tolerance to aphid infestation does not necessarily mean that the cultivar gives the highest yield, but mainly exhibited less damage, through unsuitability for build- up of aphid population as in case of breeding line 818/910/92, 820/990/92 and 840/1259/92 which gave 8.2, 7.87 and 9.74 % reduction in seed yield and combined highly resistances. This ability is most probably due to chemical factor (s) which may be incorporated in breeding experiments.

Table (3): Mean aphid infestation index of faba bean promising lines under field conditions at Sids ARC, Beni-Suef Governorate during 1999/2000 season.

S.N.	Entries	Mean aphid infestation as indicated at inspection dates						Total	Mean
		15 Dec.	1 Jan.	15 Jan.	1 Feb.	15 Feb.	1 Mar.		
1	811 / 696 / 92	0.8	1.0	1.2	1.6	2.0	2.2	8.8	1.47
2	811 / 720 / 92	1.2	1.4	1.8	2.0	2.2	2.0	10.6	1.77
3	813 / 751 / 92	1.0	1.4	2.6	3.0	2.8	2.6	13.4	2.23
4	815 / 774 / 92	2.0	2.2	2.8	3.2	3.8	4.0	18.0	3.00
5	815 / 840 / 92	1.4	1.8	2.2	2.2	2.4	2.6	12.6	2.10
6	818 / 910 / 92	1.2	1.4	1.4	1.6	2.0	2.0	9.6	1.60
7	818 / 923 / 92	0.4	1.0	1.2	1.4	1.6	1.6	7.2	1.20
8	820 / 990 / 92	0.6	1.0	2.0	2.4	2.8	3.0	11.8	1.97
9	820 / 1003 / 92	1.0	1.4	1.8	2.4	2.8	3.0	12.4	2.07
10	820 / 1022 / 92	1.4	2.0	2.8	3.0	3.2	3.6	16.0	2.67
11	820 / 1046 / 92	2.0	2.4	3.0	3.4	4.2	4.4	19.4	3.23
12	822 / 1075 / 92	2.4	2.8	3.0	3.4	3.8	4.0	19.4	3.23
13	822 / 1096 / 92	1.4	2.2	2.8	3.4	3.6	3.8	17.2	2.87
14	822 / 1097 / 92	1.0	1.4	1.6	1.6	1.8	2.0	9.4	1.57
15	826 / 1128 / 92	1.0	1.2	2.0	2.6	3.2	3.4	13.4	2.23
16	827 / 1140 / 92	1.6	1.8	2.0	2.4	2.8	3.0	13.6	2.27
17	836 / 1200 / 92	1.4	2.2	2.6	3.4	4.0	4.2	17.8	2.97
18	838 / 1244 / 92	2.8	3.4	4.0	4.2	4.4	4.2	23.0	3.83
19	840 / 1253 / 92	2.8	3.2	3.8	4.2	4.0	4.0	22.0	3.67
20	840 / 1259 / 92	0.6	0.8	1.2	1.6	2.0	1.8	8.0	1.33
21	840 / 1264 / 92	1.6	1.8	2.0	2.2	2.2	2.4	12.2	2.03
22	843 / 1333 / 92	1.2	2.0	2.4	2.2	3.0	3.6	14.4	2.40
23	843 / 1335 / 92	2.0	3.2	3.6	4.0	4.2	4.4	21.4	3.57
24	846 / 1388 / 92	1.4	2.0	2.4	2.6	2.8	2.6	13.8	2.30
25	846 / 1390 / 92	1.0	1.4	2.0	2.6	2.8	2.4	12.2	2.03
26	847 / 1421 / 92	1.6	2.0	2.4	2.2	2.0	2.0	12.2	2.03
27	855 / 1525 / 92	1.2	1.4	2.0	2.0	2.0	1.8	10.4	1.73
28	857 / 1574 / 92	1.0	1.0	1.2	1.4	2.0	2.0	8.6	1.43
29	Giza 2	2.2	3.0	3.2	3.6	4.0	4.2	20.2	3.37
30	Giza 674	2.0	2.2	2.4	3.0	3.4	4.0	17.0	2.83
Total		43.2	56.0	69.4	78.8	87.8	90.8	426.0	71.0
Mean		1.44	1.87	2.31	2.63	2.93	3.03	14.2	2.37

"F" value for entries = 36.1 ($P < 0.0001$)

L.S.D. for:

	5%	1%
Inspection date:	0.16	0.21
Entries :	0.36	0.48

Table (4): Comparative reduction of 30 faba bean genotypes resulting from aphid infestation under field exposed as percentages of loss in yield and its components at Sids ARC, Beni-Suef Governorate during 1999/2000 season.

S.N.	Entries	Seed yield (Ard./fed.)			Seeds weight /plant (gm.)			100 seed weight (gm.)		
		C	T	R%	C	T	R%	C	T	R%
1	811 / 696 / 92	8.09	7.56	6.56	33.9	31.6	6.78	70.4	66.9	4.97
2	811 / 720 / 92	7.14	6.43	9.94	28.3	22.5	20.50	65.3	63.4	2.91
3	813 / 751 / 92	8.60	6.25	27.33	35.8	25.8	27.93	79.4	74.5	6.17
4	815 / 774 / 92	7.53	6.48	13.94	31.8	28.6	10.06	70.5	63.5	9.93
5	815 / 840 / 92	9.05	7.44	17.79	38.0	27.8	26.84	79.8	70.6	11.53
6	818 / 910 / 92	9.15	8.40	8.20	36.2	30.4	16.02	80.2	66.4	17.21
7	818 / 923 / 92	9.34	9.00	3.64	32.4	30.6	5.56	85.4	84.5	1.05
8	820 / 990 / 92	8.77	8.08	7.87	33.0	29.4	10.91	83.2	80.0	3.85
9	820 / 1003 / 92	6.40	4.65	27.34	34.8	26.7	23.28	75.6	62.4	17.46
10	820 / 1022 / 92	8.05	7.14	11.30	33.0	30.2	8.49	70.2	66.8	4.84
11	820 / 1046 / 92	6.45	2.56	60.31	28.4	16.7	41.20	66.8	60.0	10.18
12	822 / 1075 / 92	7.00	3.84	45.14	29.6	20.8	29.73	72.5	63.0	13.10
13	822 / 1095 / 92	8.13	6.24	23.25	27.4	24.5	10.58	80.0	78.3	2.13
14	822 / 1097 / 92	8.34	7.58	9.11	33.9	31.0	8.56	70.4	67.4	4.26
15	826 / 1128 / 92	7.44	4.45	40.19	30.6	20.6	32.68	80.5	60.8	24.47
16	827 / 1140 / 92	9.64	7.86	18.47	36.5	31.8	12.88	78.4	71.2	9.18
17	836 / 1200 / 92	7.80	5.13	34.23	30.5	17.8	41.64	80.6	74.2	7.94
18	838 / 1244 / 92	7.16	2.42	66.20	30.1	15.3	49.17	80.2	65.8	17.96
19	840 / 1253 / 92	8.64	3.26	62.27	32.8	11.4	65.24	84.3	67.2	20.28
20	840 / 1259 / 92	9.04	8.16	9.74	36.2	33.4	7.74	77.6	75.4	2.84
21	840 / 1264 / 92	7.68	6.42	16.41	28.4	24.6	13.38	70.4	64.6	8.24
22	843 / 1333 / 92	8.42	7.24	14.01	40.2	34.6	13.93	75.3	62.8	16.60
23	843 / 1335 / 92	6.14	2.55	58.47	32.8	11.6	64.63	70.3	53.4	24.04
24	846 / 1388 / 92	6.35	5.43	14.49	22.4	20.5	8.48	62.7	60.0	4.31
25	846 / 1390 / 92	8.74	6.02	31.12	33.5	26.4	21.19	79.4	71.8	9.57
26	847 / 1421 / 92	7.64	7.15	6.41	30.2	28.0	7.29	71.3	66.4	6.87
27	855 / 1525 / 92	8.34	7.36	11.75	40.0	34.3	14.25	75.0	68.7	8.40
28	857 / 1574 / 92	8.18	7.79	4.77	33.1	32.5	1.81	86.3	84.5	2.09
29	Giza 2	6.75	2.67	60.44	26.2	12.8	51.14	70.2	46.6	33.62
30	Giza 674	9.08	5.70	37.22	27.8	15.9	42.81	75.2	58.6	22.07

C: in field plots insect-free plants (sprayed with insecticide).

T: in field plots naturally infested with aphids.

%R: Percentage of reduction.

Klingauf (1982) reported that the best chances for resistance breeding are by interfering with host-selection stimuli, such as leaf shape and size, though he noted that cv. Rastatt has a low amino acids content. Jordan (1977) found that varieties with a low L-dopa content have decreased aphid infestation. Holt (1982) found that the resistant lines to *Aphis fabae* was characterized rare amino acids in its seeds.

Tolerance, which was defined by Horber (1980) to include all plant responses resulting in the ability to withstand infestation and to support insect populations that would severely damage susceptible plants is usually identified by comparing the yields from test genotypes with those of appropriate controls.

Table (5): Relationship between the population density of *A. craccivora* and the reduction in yield components in different faba bean breeding lines in 1999/2000 season.

Yield and yield components	Simple correlation		Simple regression (b)	% of explained variance r^2
	(r)	P		
Seed yield (Ardab / fed.)	0.3678	< 0.01	9.82	13.53 %
Seeds weight / plant (gm.)	0.7863	< 0.001	18.95	61.83 %
100-seeds weight (gm.)	0.5855	> 0.001	6.42	34.28 %

Aphid numbers on eight promising lines compared with two check cultivar during the three successive seasons are presented in Table (6). Results showed entry 857/1574/92 and 818/923/92 had significantly lower aphids level which recorded 1.73, 1.43 and 1.05 for the first entry and 1.87, 1.20 and 1.13 for the second entry, respectively. Also data indicated that seed yield (gm /plant) of the first entry exceeded the other tested entries.

Table (6): Mean scores for *Aphis craccivora* infestation and yields of promising breeding lines of *Vicia faba* in the field during three successive seasons at Sids, Beni-Suef.

Entry	Year					
	1998/99		1999/2000		2000/2001	
	Aphids	Seed yield gm /plant	Aphids	Seed yield gm /plant	Aphids	Seed yield gm /plant
1 840/1259/92	1.67	30.20	1.33	33.4	1.77	35.87
2 811/896/92	1.70	36.21	1.47	31.6	1.65	27.62
3 857/1574/92	1.73	34.64	1.43	32.5	1.05	37.62
4 818/923/92	1.87	18.12	1.20	30.6	1.13	32.55
5 822/1097/92	1.87	17.60	1.57	31.00	1.68	24.82
6 818/910/92	2.00	15.00	1.60	30.4	2.07	19.45
7 827/1140/92	2.07	19.65	2.27	31.8	2.54	20.60
8 847/1421/92	2.13	22.80	2.03	28.0	2.56	23.14
Giza 2	3.53	12.80	3.37	12.80	3.52	17.40
Giza 674	3.00	28.20	2.83	15.90	3.04	20.84
L.S.D. (P = 0.05)	0.48		0.36		0.32	

From the previously mentioned results, it could be concluded that some of *V. faba* Egyptian breeding lines gave better performance and can be considered resistant or tolerant to the aphid infestation. This view corroborates with the earlier findings of El-Defrawi and Omar (1998). Although other lines did show some tolerant reaction to aphid infestation, yet their yield levels were extremely low owing to the inherent low potentials. On the basis of overall performance, the breeding lines 857/1574/92 and 818/923/92 demonstrates the ability to find sources for aphid resistance through screening methods and it seems likely that further selection by single plant selection method could improved resistant levels.

The breeding lines reported to be resistant in this work should be explored for direct introduction into the faba bean growing areas, known as hot-spot for aphid outbreaks in middle Egypt. So that, the cultivation of susceptible varieties was given up. Such resistant genotypes should be used extensively in cross breeding programs, using well-adapted varieties of the respective regions for the incorporation of resistance into them.

REFERENCES

- Bond, D.A. and H.J.B. Lowe (1975). Tests for resistance to *Aphis fabae* in field beans (*Vicia faba*). *Ann. appl. Biol.*, 81 : 21-32.
- Davidson, J. and R. A. Fisher (1922). Biological studies of *Aphis rumicis* L. Reproduction on varieties of *Vicia faba*. *Annals of Applied Biology*, 9: 135-139.
- El-Defrawi, G.M. and S.I. Bishara (1992). Resistance to *Aphis craccivora* Koch in faba bean. *Zagazig J. Agric. Res.*, 19 (6) : 2647-2655.
- El-Defrawi, G.M. and M. A. Omar (1998). Performance of some faba bean breeding lines for resistance to the cowpea aphid, *Aphis craccivora* Koch. *Proc. 8th. Conf. Agron., Suez Canal Univ., Ismailia, Egypt*, 28-29 Nov., 1998: 280-289.
- El-Defrawi, G.M. ; S. A. Mahmoud and F.H. Shalaby (1998). Resistance to cowpea aphid in faba bean (*Vicia faba* L.) Egyptian landraces. *Proc. 8th. Conf. Agron., Suez Canal Univ., Ismailia, Egypt*. 28-29 Nov., 1998: 290-299.
- Holt, J. (1982). Aphid resistance in faba beans. Ph.D. Thesis, Fac. Science Biology, Southampton Univ., England.
- Holt, J. and N. Birch (1984). Taxonomy, evaluation and demonstration of *Vicia* in relation to aphid resistance. *Ann. appl. Biol.*, 105 : 547-557.
- Horber, E. (1980). Types and classification of resistance. in : *Breeding Plants Resistance to Insects* (Eds. F.G. Maxwell and R. Jennings), John Wiley & Sons, New York, 15-22 pp.
- Jorden, D. (1977). Zur Wirkung pflanzlicher Oberflächen-substanzen auf den primärbefall durch die schwarze Bohnenblattlaus, *Aphis fabae* Scop. (Homoptera : Aphididae). *Diss. Fac. Agric., Univ. Bonn.*, 130-135 (in German).
- Klingauf, F.A.J. (1982). Breeding for resistance to aphids. In : "Faba Bean Improvement", G. Hawtin and C. Webb (Eds.), 1982 ICARDA, ISBN 90 247 2593 3 : pp. 285-295.
- Müller, H. J. (1953). über die Ursachen der unterschiedlichen Resistenz von *Vicia faba* L. gegenüber der Bohnenblattlaus *Doralis fabae* Scop. IV. Das Zustandekommen des unterschiedlichen Initialbefalls. *Züchter* 23, 176-189.
- Müller, H. J. (1958 a). The behaviour of *Aphis fabae* in selecting its host especially different varieties of *Vicia faba* L. *Entomologia experimentalis et applicata* 1, 66-72.
- Müller, H. J. (1958 b). über die Ursachen der unterschiedlichen Resistenz von *Vicia faba* L. gegenüber der Bohnenblattlaus *Aphis (Doralis) fabae*

- Scop. V. Antibiotische Wirkungen auf die Vehrmechrungskraft. Entomologia experimentalis et applicata 1, 181-190..
- Smith, B.F. and D.T.A. Aldrich (1967). Spring bean variety trials 1954-65. J. of the National Institute of Agric. Botany, 11 : 114-132.
- Tahhan, O. and G. Hariri (1981). Screening of aphid resistance in faba bean lines. Faba Bean Information Service Newsletter (FABIS), No. 3 : 57.

دراسة أولية لبعض التراكيب الوراثية من الفول البلدى لصفة المقاومة للإصابة بحشرة من اللوبيبا *Aphis craccivora* Koch فى مصر

فروق حامد شلبي^١ و جودة محمد الدفراوى^٢

١- معهد بحوث المحاصيل الحقلية - قسم بحوث المحاصيل البقولية - مركز البحوث الزراعية بمصر

٢- معهد بحوث وقاية النباتات - قسم بحوث الحشرات الناقية الماصة - مركز البحوث الزراعية بمصر

حشرة من اللوبيبا *Aphis craccivora* من أهم الآفات التى تصيب الفول البلدى فى مصر وتسبب خسائر فادحة فى المحصول سنويا. ويعتبر استنباط أصناف مقاومة للإصابة بحشرات المن من أهم الطرق فى برامج مكافحة المنكاملة.

وهذا البحث تم تنفيذه فى محطة البحوث الزراعية بسدس - بنى سويف بالاشتراك مع معهد بحوث وقاية النباتات و معهد بحوث المحاصيل الحقلية فى تقدير مدى حساسية بعض التراكيب الوراثية لصفة المقاومة للإصابة بحشرات المن حيث تم تقييم ٦٥ تركيب وراثى مبشرة ناتج عن ١٩ هجين من الجيل السادس من الفول البلدى خلال ثلاث مواسم متتالية من ١٩٩٨/٩٩ حتى ٢٠٠٠/٢٠٠١ تحت الظروف الحقلية. وتشير النتائج أن السلالتين ٩٢/٩٢٣/٨١٨ و ٩٢/١٥٧٤/٨٥٧ أظهرتا صفة المقاومة وتحمل للإصابة بحشرات المن بالرغم من شدة الإصابة خلال مواسم التقييم. وقد تطابقت النتائج المعملية مع النتائج الحقلية.

وهذه التراكيب الوراثية أثبتت تفوقها فى إنتاج محصول عالى مع ثبات قدرتها على مقاومة الحشرة مقارنة بالصنفين المحليين جيزة ٢ وجيزة ٦٧٤.

ويمكن بواسطة إجراء المزيد من الدراسات ادخال مثل هذه السلالات فى برامج التربية لإنتاج أصناف تتحمل الإصابة العالية من حشرات المن ولها صفة الانتاجية العالية من المحصول.