POPULATION DYNAMICS AND SEASONAL DISTRIBUTION OF *APHIS CRACCIVORA* KOCH AND ASSOCIATED NATURAL ENEMIES IN RELATION TO VIRUS DISEASE INCIDENCE IN FABA BEAN FIELDS

EL-DEFRAWI[1], G.M., AZZA K. EMAM[2], I.A. MARZOUK[1] AND L.RIZKALLA[3]

1 Plant Protection Research Institute, Agricultural Research Centre, Dokki, Giza, Egypt.

2 Plant Protection Department, Faculty of Agricultural , Ain Shams University, Cairo, Egypt.

3 Plant Pathology Research Institute, Agricultural Research Centre, Giza, Egypt.

(Manuscript received 18 August, 1998)

Abstract

The population density of the cowpea aphid, *Aphis craccivora* and its associated natural enemies in faba bean fields were studied at Sids Agric. Exp. Stat., ARC, Beni Suef Governorate, Middle Egypt in 1995/96 and 1996/97 seasons. The occurrece and status of aphid in relation to virus disease incidence on faba bean plants was also investigated. *A.craccivora* had two main periods of activity with maximum counts during the 3rd week of December and in February in 1995/96 season and the 4th. week of December and the 3rd week of March in 1996/97. The common predators observed in faba bean fields were : *C.undecimpunctata* L.; *C.carnea* Steph.; *S.corollae* F., *Ph.aphidivora* Rubs., *S.interruptus* Goeze. The minor predators were *C.septempunctata L., L.riparia* Pall., *P.alfierii* Kock, *Orius* spp., and certain true spiders. Three endoparasites namely *Aphidius matricariae, Lysiphlebus* sp. and *Trioxys angelicae* were also observed. The population of alate forms of *Acraccivora* was significantly and positively correlated with virus disease incidence within faba bean plants. Viruliferous aphid attack to faba bean

INTRODUCTION

Faba bean, *Vicia faba* L. is an essential food crop that provides a major source of protein for humans and domestic animals. It is attacked with several insect pests including *Aphis craccivora* Koch which is a key pest in Middle Egypt (Salim *et al.*, 1987 and El-Defrawi *et al.*, 1994). *A.craccivora* infests several other leguminous crops, e.g. peas, *Pisum sativum* L., lentil *Lens culinaris,* Med., chickpea, *Cicer arietinum* L. and fenugreek, *Trigonella foenum-graceum* L. in winter (El-Defrawi, 1987 and Abdou-Mowafy, 1988) and migrates to cowpea, *Vigna unguiculata* L. (Attia *et al,* 1986); beans, *Phaseolus vulgaris* L., citrus, *Citrus sinensis* Osbek and cotton seedlings, *Gossypium* spp. (Salim *et al.*, 1987) in summer. In Egypt, the peaks of aphid population normally occur during March on faba bean (El-Defrawi, 1987 and Abdou-Mowafy, 1988) and in August on

cowpea (Attia *et al.*, 1986). Since 1991/92 season, faba bean fields has been subjected to heavy infestation with aphids at the early stage of plant growth accompanied by high incidence of a complex of virus diseases. Aphid and disease attack alltogether inflicted extreme heavy damage and severe yield losses in Middle Egypt (El-Defrawi *et al.*, 1994 and Makkouk *et al.*, 1994).

The present work was conducted in Middle Egypt with the aim of providing information on the dynamics of aphid population in faba bean fields and its associated natural enemies in relation to the incidence of Faba Bean Necrotic Yellows Virus (FBNYV)-disease and certain weather factors.

MATERIALS AND METHODS

Work was carried out at Sids Agricultural Research Station, Beni-Suef Governorate. An area of about one feddan was sown with Giza 2 faba bean variety during the last week of October in both 1995 and 1996. Normal agricultural practices were followed and no insecticidal treatments were applied.

The activity and abundance of *Aphis craccivora* alate and apterae and their associated natural enemies were recorded weekly from Nov. 7 in 1995 and Nov. 16 in 1996 until the end of the season in March 19, 1996 and April 12, 1997. At any sampling date, 10 plants were randomly chosen and replicated 4 times at each of the East, West, North, South and Middle of the experimental field. Aphids on the upper most two-thirds of the plants (one central shoot /plant) were checked using the inverse binomial sampling technique (El-Defrawi, 1987). The mean of the 4 replicates was worked out to represent population density.

Adults and larvae of predator species on 100 random plants were counted. Weekly percentage of parasitism were determined on samples collected from the field and transferred to the laboratory confining parasitized individuals in where kept into Petri dishes. Daily records of temperature and relative humidity were also taken.

To determine the role of *A.craccivor*a in the spread of FBNYV-disease in faba bean fields, infection was monitored by visual inspection based on disease symptoms (Katul *et al.* 1993). Estimation was made weekly on 100 plants randomly chosen, and replicated four times and at each of the 5 considered sampling sites. Plants showing FBNYV-disease were transferred to the laboratory to confirm the presence of the pathogen using aphid inoculation and ELISA tests as described by Katul *et al.* (1993).

Alate and apterous forms of *A.craccivora* that had developed on plants naturally infected with FBNYV were collected and transferred to the laboratory in the same day, once every two-weeks, to test their infectivity. Aphids were starved for 2 hours before testing those allowed to feed for 2 days (access feeding period) on healthy 15-days old single seedlings. Aphids were then removed and the plants kept in a greenhouse under screened cages (80 x 80 x 80 cm) at 18±2°C, 50±5% R.H. and daily 16:8 light/dark day cycle photoperiodic regime. Plants showing disease symptoms were confirmed by ELISA-test and the percentage of viruliferous aphids was estimated.

At harvest, seed yield in a naturally infected area of 100 m2 with FBNYV-disease determined at eight sites and compared with similar eight sites in a neighbouring faba bean aphid and virus disease-free field, sprayed periodically at 2-weeks intervals with Pirimor at a rate of 0.75 gm/lit.

RESULTS AND DISCUSSION

1. Aphid abundance in relation to plant growth stage

Tables 1 and 2 show that faba bean plants were infested with *A.craccivora* early during seedling establishments in the 1st and 2nd weeks of November 1995 and 1996, respectively. Population density increased gradually to reach maximum during the 3rd and 4th weeks of December 1995 and 1996 in concidence with the beginning of the flowering stage (2473.2 and 5016.4 insects/10 shoots), respectively. Prevailing weather conditions at that time (13.3 & 12.3°C and 65.0 & 58.7% R.H.) seemed to be quite favourable for aphid infestation. Thereafter, density of aphids tended to decrease to reach the minimum by the 3rd week of January in 1996 (216.2 insects) and the 1st week of February in 1997 (182.4 insects/10 shoots), where plants were in pod-formation stage. Aphids population increased again and recorded another activity period with a maximum infestation by the 3rd week of February in 1996 and around mid-March in 1997 (833.2 and 773.4 insects/10 shoots, respectively). As the faba bean plants reached the ripening stage, aphids began to migrate to other wild hosts, [e.g. Rigla, *Portulaca oleraceae* L., El-Nafal *Medicago hispida* G. and Gilban, *Vicia Sativa* L.] (Megahed *et al.*, 1979). Highly significant differences in the abundance of aphids were noticed at the different parts of the field at the various dates of sampling, Tables 1 and 2. This observation agrees with the findings of El-Defrawi *et al.* (1994).

The percentage of plants infested with aphids varied from 1.2% to 0.4% by emergence during November to almost 100% in December and January.

2. Abundance and distribution of Alate forms

The first winged inividuals *A. craccivora* immigrants from the late summer crops and wild plants landed on faba bean plants during the first half of November.In 1995/96, alate forms had three main periods of activity: 1st. week of November-3rd. week of January, 4th week of January-the2nd week of February and 4th week of February-3rd week of March. The maximum count of alate forms was recorded during the 2nd week of December, the last week of January and the 1st week of March (141.4, 54.0 and 69.0 aphids/10 shoots, respecttively). In 1996/97 season, alate individuals showed only two main activity periods: 3rd week of November-the 3rd week of February with a peak during the 1st week of December (380.0 insects), and 4th week of February-2nd week of April with a peak during the last week of March (72.8 aphids/10 shoots), Tables 1 & 2.

Statistical analyses revealed a highly significant relationship with the abundance of winged forms within sampling dates in both seasons. Also, differences between the mean counts of alate forms in the different parts of the fields were highly significant in 1995/96, Table 1, but, insignificant in 1996/97, Table 2.

3. Abundance and distribution of apterous forms

Wingless forms of *A.craccivora* had two main periods of activity. In 1995/96, these periods took place from the 1st week of November to the 3rd week of January, and from the 4th week of January to the 3rd week of March, with maximum counts during the 3rd week of December and the 3rd week of February (2368.4 and 792.6 insects/10 shoots, respectively, Table 1. In 1996/97, activity periods occurred from the 3rd week of November to the 1st week of February and from the 2nd week of February to the 2nd week of April with peak counts during the 4th week of December (4777.8 insects) and the 3rd week of March (705.8 insects/10 shoots). Statistical analyses showed highly significant difference in the abundance of wingless aphids in the different parts of the field as well as within the successive sampling dates, Tables 1 and 2.

Crowding of *A.craccivora* was rather evident on the growing tips of plants, flowers and immature seed pods, and represented a major factor in the production of alate forms. On the other hand, a high proportion of alate aphids occurred even at the low population densities. This phenomenon was observed by Gutierrez *et al.* (1971) who reported that *A.craccivora* may not survive mild winter or hot dry summer. A stimulation model of *A.craccivora* populations in temperate pastures had been developed by

Table 1. Weekly mean numbers of *Aphis craccivora* per 10 faba bean shoots and associated natural enemies on 100 plants at Sids region, Beni Suef Governorate, in 1995/96 season.

Date of Sampling	Plant Growth Stage	Mean No. of aphids/ 10 shoots			% plants infested with aphids	Natural Enemies/100 plant		Weather factors*	
		Alate	Apterae	Total		Predators	% Parasitism	Temp. °C	R.H. %
Nov. 7, 1995	Seedling	9.4	282.6	292.0	1.2	0	0.0	23.8	55.0
14	Establish-	19.6	353.4	373.0	2 .8	2	0.0	20.1	46.0
21	ment	113.6	449.8	563.4	13.6	6	0.0	18.1	60.0
28	Tillering	139.2	678.2	817.4	36.4	17	0.0	14.9	58.5
Dec., 5		129.6	1379.8	1509.4	66.2	22	0.0	15.0	59.8
12	Shooting	141.4	2305.4	2446.8	100.0	25	0.0	15.9	61.0
19	Elongation	104.8	2368.4	2473.2	100.0	77	0.0	13.3	65.0
26		77.0	2138.0	2215.0	100.0	103	0.0	13.9	72.5
Jan. 2, 1996	Flowering	65.6	1248.6	1314.2	87.3	112	0.0	13.3	68.8
9	And	63.6	597.8	661.4	82.4	87	0.0	15.3	53.5
16		22.8	193.8	216.2	56.3	15	0.0	12.8	59.0
23	Pod-	39.6	366.4	406.0	53.2	13	0.0	14.2	57.0
30	Setting	54.0	335.4	389.4	50.0	9	0.0	13.2	58.0
Feb., 6		22.8	426.0	448.8	53.0	36	0.0	14.9	53.3
13		13.4	620.6	634.0	64.2	52	2.0	16.2	49.5
20	Pod-	40.6	792.6	833.2	62.8	86	2.1	15.2	59.0
27	Formation	58.6	591.8	650.4	37 .6	103	5.2	15.8	56.2
Mar., 5		69.0	402.2	471.2	22.8	114	7.3	16.4	50.0
12	Ripening	34.2	219.0	253.2	14.2	122	6.8	19.0	52.5
19		9.8	53.8	63.6	3.5	92	4.2	18.4	49.5
Mean		61.4	790.0	851.6	50.0	54.7	1.4	16.0	57.2

F" values for winged forms:
Within fields 24 (P = 0.001), L.S.D. 5 % = 18.22
Within dates 11.23 (P = 0.001), L.S.D. 5 % = 36.44
F" values for wingless forms:
Within fields 6.67 (P = 0.001), L.S.D. 5 % = 221.3
Within dates 20.5 (P = 0.001), L.S.D. 5 % = 442.6
* One week earlier

Table 2. Weekly mean numbers of *Aphis craccivora* per 10 faba bean shoots and associated natural enemies on 100 plants at Sids region, Beni Suef Governorate, in 1996/97 season.

Date of Sampling	Plant Growth Stage	Mean No. of aphids/ 10 shoots			% plants infested with aphids	Natural Enemies/100 plant		Weather factors*	
		Alate	Apterae	Total		Predators	% Parasitism	Temp. °C	R.H. %
Nov. 7, 1996	Seedling Establishment	25.6	3.4	29.0	0.4	0	0.0	18.4	59.3
23		44.0	32.8	76.8	1.8	0	0.0	17.8	60.2
30	Tillering	99.0	61.6	160.6	17.2	14	0.0	15.6	60.0
Dec., 7		380.0	105.2	485.2	22.4	19	1.6	13.4	62.00
14	Shooting	316.3	441.4	757.7	27.3	37	2.8	13.1	60.7
21	Elongation	288.4	622.8	911.2	44.6	58	4.4	12.8	59.9
28	Flowering	238.6	4777.8	5016.4	85.2	106	7.2	12.3	58.7
Jan. 2, 1997		166.8	3264.0	3430.8	88.4	124	3.2	11.9	58.5
11	And	163.0	1171.8	1334.8	86.5	67	0.8	11.8	58.0
18		50.0	447.2	497.2	93.2	15	0.0	11.0	64.5
25	Pod-Setting	57.4	211.0	268.4	80.6	13	0.0	10.2	63.5
Feb., 1		25.6	150.4	182.4	77.4	5	0.0	8.5	63.5
8		44.0	375.0	399.6	58.3	5	0.0	10.5	64.5
15	Pod-	18.8	450.0	468.8	53.4	3	0.0	9.2	60.6
22	Formation	51.2	345.6	396.8	64.2	26	0.0	9.4	62.1
Mar., 1		44.2	395.2	439.4	62.5	78	0.0	12.9	62.4
8		55.0	514.0	569.0	66.4	163	1.2	10.6	63.6
15	Ripening	67.6	705.8	773.4	75.2	207	3.2	13.0	61.0
22		54.8	644.0	698.8	70.2	200	3.6	11.9	56.5
29		72.8	353.0	425.8	34.6	87	6.2	12.8	59.5
April, 5		59.8	131.2	191.0	27.2	113	2.8	15.8	61.3
12		12.0	59.4	71.4	20.8	56	0.2	16.8	71.0
Mean		105.5	693.8	799.3	52.6	63.5	1.7	12.7	61.5

F" values for winged forms:
Within fields 2.39 (NS)
Within dates 16.64 (P = 0.001), L.S.D. 5 % = 35.22
F" values for wingless forms:
Within fields 9.47 (P = 0.001), L.S.D. 5 % = 472
Within dates 46.22 (P = 0.001), L.S.D. 5 % = 225
* One week earlier

Gutierrez *et al.* (1974) indicating that aphid survived throughout most of its overall range because of its ability to migrate from one ephemerally suitable habitat to another. They further demonstrated the major role of climate in the developing *A.craccivora* populations which may provide basis for predicting potential outbreak areas. Although El-Defrawi (1987) and Abdou-Mowafy (1988) mentioned that the main peak of aphid infestation occur by late March, the present study contributed that it may take place earlier in December or early January with a possible small second peak in March.

4. Natural enemies associated with *A.craccivora* in faba bean fields

Tables 1 and 2 show the numbers of aphidophagous predators and parasites observed in faba bean field. The common predators were : *Coccinella undecimpunctata* L. (Coccinellidae : Coleoptera); *Chrysoperla carnea* Steph. (Chrysopidae: Neuroptera); *Syrphus corollae* F. (Syrphidae : Diptera); *Phaenobremia aphidivora* Rubs. (Cecidomyiidae: Diptera); *Scymnus interruptus* Goeze (Coccinellidae: Coleoptera). The minor predators were *C.septempunctata* L. (Coccinellidae: Coleoptera); *Labidura riparia* Pall., (Labiduridae: Dermaptera), *Paederus alfierii* Koch (Staphylinidae: Coleoptera), *Orius* spp. (Anthocoridae : Hemiptera), and certain true spiders (Acarina). Such predaceous species were relatively more abundant during the second season. They prevailed in two main activity periods; 2nd week of November to the last week of January and the 1st week of February to the 3rd week of March for the first season, and the last week of November to 3 rd week of February, and 4th week of February to the 2 nd week of April for the second season. Peaks of predator population occurred by the 1st week of January and mid-March (112 and 122 individuals/100 plants, respectively) and 1st week of January and 3rd week of March (124 and 207 individuals/100 plants) for the first and second seasons, respectively, Table 1 & 2.

Three endoparasites namely, *Aphidius matricariae, Lysiphlebus* sp. and *Trioxys angelicae* were observed. Generally, the percentages of parasitism were very low and parasitism reached its maximum between the 2nd week of February and the 3rd week of March for the first season (7.3%), and from the 1st week of December to the 2nd week of January (7.2%) then again from the 2nd week of March to the 2nd week of April (6.2%) for the second season.

The role of natural enemies in regulating aphid population had been extensively reviewed (Salim *et al.*, 1987; Srikanth, 1987 and Ibrahim & Fayed, 1984). Milne (1971) mentioned that *A.fabae* was attacked by parasites, mainly the braconid, *Trioxys* sp.

Table 3. Distribution of natural infection with FBNYV-disease in faba bean field at Sids, Beni-Suef Governorate, in 1995/96 seasons.

Date of Sampling	Plant Age (week)	% Diseased plants					Cumulat -ive % infected plants	Mean % of infection
		East	West	North	South	Middle		
Nov. 28, 1995	4	1	0	0	0	0	0.2	0.2
Dec., 5	5	2	0	0	0	0	0.4	0.2
12	6	5	2	3	2	0	2.4	2.0
19	7	8	4	7	5	1	5.0	2.6
26	8	12	7	13	6	5	8.6	3.6
Jan. 2, 1996	9	18	12	17	9	8	12.8	4.2
9	10	24	15	20	17	10	17.2	4.4
16	11	28	16	28	20	12	20.8	3.6
23	12	30	17	33	23	17	24.0	3.2
30	13	36	20	35	28	18	27.4	3.4
Feb., 6	14	40	27	45	32	20	32.8	5.4
13	15	47	33	52	55	27	42.8	10.0
20	16	59	42	60	58	40	51.8	9.0
27	17	63	54	75	63	47	60.4	8.6
Mar., 5	18	65	58	80	68	55	65.2	4.8
12	19	70	63	82	87	58	72.0	6.8
19	20	75	68	82	87	62	74.8	2.8
26	21	77	70	83	90	65	77.0	2.2
Total	-	660	508	715	650	445	595.6	77
Mean	-	36.7	28.2	39.7	36.1	24.7	33.1	4.3

F" values for virus infections within:
Field sites = 13.47 (P= 0.001), L.S.D. (P = 0.05) = 9.23
Dates = 70.71 (P= 0.001), L.S.D. (P = 0.05) = 4.87

and *Praon volucre* in England. According to Ibrahim and Fayad (1984), the percentages of parasitism on *A.craccivora* were 3.2, 4.1 and 8.1% in 1976, 1977 and 1978 seasons, respectively, in upper Egypt compared to 0.5, 4.0 and 19.8%, respectively, in lower Egypt. Salim *et al.* (1987) mentioned that in Egypt *A.craccivora* adults ocurred on broad beans by the last week of December and reached a peak on the 27th of January, then declined rapidly during March. They added that the highest rate of parasitism with *Lysiphlebus fabarum* (M.) reached 5% on the 16th of March.

5. Role of *A.craccivora* in the spread of FBNYV-disease in faba bean fields

The virus disease infecting *Vicia faba* in the different parts of Egypt recently has been identified as Bean Necrotic Yellows Virus (FBNYV). It infects faba bean as well as leguminous crops (El-Defrawi *et al.*, 1994 and Makkouk *et al.*, 1994), and causes serious loss to cool-season food legumes in different countries (Katul *et al.*, 1993 and El-Defrawi, 1994). The main vector of this disease is *A.craccivora* (El-Defrawi, 1994). However, information on the epidemiology of this particular virus is still scarce.

The external symptoms of FBNYV-disease as previously described by katul *et al.* (1993) were evidently observed during both seasons of this investigation. Symptoms produced by aphid inoculation tests in the greenhouse and assayed by ELISA technique were quite similar to natural symptoms. It was assumed, therefore, that the symptoms observed in the field were most probably due to a pathogen of FBNYV-disease mainly transmitted by the cowpea aphid, *A.craccivora*. Results showed that, the minimum acquisition access feeding period (AAp min.) for *A.craccivora* nymphs was 30 min. and the minimum inoculation access feeding period (IAP min.) was 2 days. Thereafter, *A.craccivora* was able to transmit FBNYV and inoculate the pathogen successfully after 15 min. feeding on healthy plants. Aphids live for a mean of 28 days and are able to transmit the virus along their life span. Such deduction goes in line with the findings of katul *et al.* (1993), El-Defrawi *et al.* (1994) and Makkouk *et al.* (1994).

Table 3 and 4 show the weekly mean percentages of virus infected faba bean plants during both seasons of invesigation. FBNYV-disease did not appear in the fields until the plants were 4-6 weeks old. Signs of infection gradually increased parallel to increase of plant age ($r = 0.5369$ and 0.9941 in 1995/96 and 1996/97, respectively). The highest percentage of infection was recorded when plants were 15-17 weeks old.

Data further showed that in agreement with Gutierrez *et al.* (1974); El-Defrawi (1987 & 1994) and Makkouk *et al.* (1994) the main period of alate and apterae activity in spreading the disease agents (FBNYV) was apparently early during seedling estab-

Table 4. Distribution of natural infection with FBNYV-disease in faba bean field at Sids, Beni-Suef Governorate, in 1996/97 seasons.

Date of Sampling	Plant Age (week)	% Diseased plants					Cumulat -ive % infected plants	Mean % of infection
		East	West	North	South	Middle		
Dec. 14, 1996	6	0	0	1	0	1	0.4	0.4
21	7	2	3	1	1	1	1.6	1.2
28	8	5	4	2	2	3	3.2	1.6
Jan. 4, 1997	9	12	5	8	7	5	7.4	4.2
11	10	15	9	10	8	7	9.8	2.4
18	11	17	10	11	8	8	10.8	1.0
25	12	20	12	13	11	17	14.6	3.8
Feb., 1	13	22	17	15	12	20	17.2	2.6
8	14	25	18	17	15	26	20.2	3.0
15	15	37	23	25	15	28	25.6	5.4
22	16	47	30	38	17	29	32.2	6.6
Mar., 1	17	52	33	42	17	32	35.2	3.0
8	18	53	34	49	18	34	37.6	2.4
15	19	60	37	55	21	37	42.0	4.4
22	20	64	39	57	26	36	44.4	2.4
29	21	68	40	60	25	38	46.2	1.8
April, 5	22	77	43	60	27	40	49.4	3.2
12	23	79	48	61	29	43	52.0	2.6
Total		655	405	525	259	405	449.8	52.0
Mean		36.4	22.5	29.2	14.4	22.5	24.99	2.89

F" values for virus infections within:
Field sites = 1.39 (N.S.)
Dates = 1.77 (P = 0.05), L.S.D. (P = 0.05) = 19.8

Table 5. Effect of the viruliferous aphid *A.craccivora* on seed yield of faba bean compared to neighbouring aphid-free fields at Sids Agric. Exp. Stat., ARC, Beni-Suef Governorate, during 1995/96 and 1996/97 seasons.

Samlping Sites	Seed weight (kg/100 m2)					
	1995/96			1996/1997		
	Field A	Field B	% Reduction in seed wt.	Field A	Field B	% Reduction in seed wt.
1	8.04	45.34	82.27	13.16	40.18	67.25
2	5.18	38.26	86.46	13.59	36.26	62.52
3	7.80	47.12	83.45	14.18	33.48	57.65
4	5.79	33.47	82.70	11.37	40.95	72.23
5	13.08	37.30	64.93	14.74	37.13	60.30
6	13.12	40.26	67.41	14.23	30.15	52.80
7	8.60	42.99	80.00	10.83	40.06	72.97
8	4.22	37.52	88.75	4.33	45.18	90.42
mean	8.23	40.28	79.57	12.05	37.92	68.21
"t" value	15.96			12.58		
P	0.001					

Field A: Faba bean field naturally infested with *A.craccivora.*
Field B: Neighbouring aphid-free faba bean field (sprayed with insecticides periodically at 2-week intervals).

lishments in November-January. The relationship between the weekly mean number of alate forms two weeks before virus disease incidence and the associated percentage of infected plants was positive and statistically significant correlation (r = 0.3956 and 0.3700). As for apterous forms, this relationship was insignificantly negative to virus disease incidence (r = - 0.0702 and - 0.1917).

6. Distribution of FBNYV-infection in faba bean field

The rate of virus incidence within faba bean field was significantly different according to location in the field. "F" value was significant in 1995/96 season (13.47**), but insignificant in 1996/97 season (1.39). Table 5 indicates that there was a significant variation in seed yield of faba bean naturally infested with viruliferous aphids during 1995/96 and 1996/97 seasons. Reduction in seed yield ranged 64.93-88.75% in 1995/96 and 52.8-90.42% in 1996/97 season, thus emphasizing the economic importance of FBNYV-disease as a threat to faba bean plantations and for the complexity governing the natural spread and field survival of viruliferous aphid in Egypt. Better knowledge and understanding of the epidemiology of such disease (mainly transmitted by aphids) may provide sound basis for developing appropriate control measures, leading to reduction of infection sources, including hosts, weeds as well as interrupting aphid activity and spread throughout the successive cropping seasons, forecasting vectors, and altering sowing or harvest dates to avoid high vector populations.

ACKNOWLEDGEMENT

Thanks are due to Dr. Petr stary, Institute of Entomology, the Czechoslovak Academy of Science, Czechoslovakia, for confirming the identification of the emerged parasites.

REFERENCES

1. Abdou Mowafy, K. 1988. Studies on insect pests attacking leguminous field crops in Egypt. Ph. D. Thesis, Fac. Agric., Moshtohor, Zagazig Univ.

2. Attia, A.A., A.H. El-Heneidy and E.A. El-Kady. 1986. Studies on the cowpea aphid, *Aphis craccivora* Koch (Homoptera: Aphididae) in Egypt. Bull. Soc. Ent. Egypte, 66:319-324.

3. El-Defrawi, G.M. 1987. Studies on insect vectors of plant virus diseases infesting legumes in Egypt. Ph.D. Thesis, Fac. Agric., Ain Shams Univ., Cairo, Egypt.

4. El-Defrawi, G.M., M. Abdel-Azim, I.M. Marzouk and L.Rizkalla. 1994. The flight activity of winged forms of the cowpea aphid, *Aphis craccivora* Koch in relation to Necrotic Yellows Virus disease incidence within faba bean fields. Al-Azhar J. Agric. Res., 20: 283-297.

5. Gutierrez, A.P., D.J. Morgan and D.E. Havenstein. 1971. The ecology of *Aphis craccivora* Koch and subterranean clovr stunt virus. I-The phenology of aphid populations and the epidemiology of virus in pastures in southeast Australia. J. appl. Ecol., 8:699-721.

6. Gutierrez, A.P., D.E. Havenstein, H.A. Nix and P.S. Moore. 1974. The ecology of *Aphis craccivora* Koch and subterranean clover stunt virus in southeast Australia. J. appl. Ecol., 11:1-35.

7. Ibrahim, A.A. and Y.H. Fayad. 1984. Rate of parasitism in certain species of aphids infesting some cultivated and uncultivated plants in Egypt. Ann. Agric. Sc., Moshtohor, 21: 1079-1085.

8. Katul, L., H.J. Vetten, E. Maiss, K.M. Makkouk, D.E. Lesemann and R.Casper. 1993. Characteristics and serology of virus-like particles associated with faba bean necrotic yellows. Ann. appl. Biol., 123: 629-647.

9. Makkouk, K.M., L. Rizkallah, M.Madkour, M. El-Sherbeiny, S.G. Kumari, A.W. Amriti and M.B. Solh. 1994. Survey of faba bean. *Vicia faba* L. for viruses in Egypt. Phytophatologia Mediterranea, 33: 207-211.

10. Megahed, M.M., S. El-Nagar and A.H. Amin. 1979. Seasonal abundance of certain aphid species on wild plants in Giza, Egypt. Bull. Soc. Ent. Egypte, 62:279-284.

11. Milne, W.M. 1971. Factors affecting aphid populations on broad beans. Ph.D. Thesis, Univ. London, Brit., 279 p.

12. Salim, A.A., S.A. El-Refai and A.El-Gantiry. 1987. Seasonal fluctuations in the population of *Aphis craccivora* Koch, *Myzus persicae* (Sulz.), *Aphis gossypii* (Glov.) and their parasites. Ann. Agric. Sci., Ain Shams Univ., 32 (3): 1837-1848.

13. Srikanth, J. 1987. Studies on cowpea aphid, *Aphis craccivora* Koch (Hemiptera: Aphididae) and its predators. Mysore J. Agric. Sci., 21, pp. 6.

ديناميكية تعداد حشرة من اللوبيا *Aphis craccivora* koch وبعض أعدائها الطبيعية وعلاقة ذلك بإحداث الأصابة بالأمراض الفيروسية في حقول الفول البلدي

جودة محمد الدفراوي١، عزة كمال إمام٢، إبراهيم علي مرزق١، لطيف رزق الله ٣

١ معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقى - الجيزة .
٢ كلية الزراعة، جامعة عين شمس، شبرا الخيمة - القاهرة ، مصر.
٣ معهد بحوث أمراض النباتات ، مركز البحوث الزراعية ، الجيزة ، مصر.

تعتبر حشرة من اللوبيا *Aphis craccivora* من عائلة Aphididae ورتبة نصفية الأجنحة أحد أهم وأخطر أنواع المن التى تصيب الفول البلدى فى مصر . ومنذ موسم ٩١ / ١٩٩٢ حدث تغير مفاجئ فى تعداد من اللوبيا وتوقيت بدء الإصابة به أدى الى خسارة شبه كاملة لمحصول الفول البلدى فى المحافظات المختلفة. وقد أجريت هذه الدراسة بمحطة البحوث الزراعية بسدس-بمحافظة بنى سويف، خلال الموسمين الزراعيين ١٩٩٥ / ١٩٩٦ و ١٩٩٦ / ١٩٩٧ للتعرف على ديناميكية تعداد حشرة من اللوبيا *Aphis craccivora koch* وبعض أعدائها الطبيعية وعلاقة ذلك بإحداث الإصابة بالامراض الفيروسية فى حقول الفول البلدى.

أوضحت النتائج أن من اللوبيا ,*A.phis craccivora* يصيب الفول البلدى مبكرا بعد الهجرة وانتقاله من عوائله الصيفية التى تمتد نموها الخضرى فى مصر الوسطى حتى اقتراب موعد زراعة الفول البلدى ، وقد سجل لهذا المن فترتان للنشاط ووصل تعداده أقصاه خلال الأسبوع الثالث من شهرى ديسمبر ١٩٩٥ وفبراير ١٩٩٦ فى الموسم الاول ، وخلال الأسبوع الرابع من شهر ديسمبر ١٩٩٦ والأسبوع الثالث من شهر مارس ١٩٩٧ فى الموسم الثانى.

أظهرت الدراسة أن لكل من المتوسط الأسبوعى لدرجة الحرارة والرطوبة النسبية خلال الاسبوع السابق تأثير معنوى على نشاطوتعداد الحشرات . كذلك جرى حصر عشرة أنواع من الحشرات المفترسة المصاحبة للمن فى حقول الفول البلدى والتى تؤثر بشكل معنوى على تطور وسير الاصابة بالمن ، إضافة الى ثلاثة أنواع من الطفيليات نسبة تطفلها منخفضة . وبدراسة علاقة انتشار من اللوبيا فى حقول الفول البلدى بنشر المرض الفيروسى المسبب لاصفرار وموت الفول البلدى FBNYV وجد أن للطور المجنح تأثير معنوى فى نقل ونشر المرض، بينما كان دور الطور غير المجنح فى ذلك محدودا وغير معنوى مما يبين أهمية مقاومة الأطوار المجنحة خاصة فى بداية ونهاية الموسم لتجنب انتشار المرض الفيروسى. وقد سببت الاصابة بالمن الحامل للفيروس المسبب للمرض خفضا فى وزن محصول الفول البلدى نسبته ٢,٦٨٪-٦,٧٩٪.