

SUSCEPTIBILITY OF SIX FABA BEAN VARIETIES TO CERTAIN HOMOPTEROUS INSECTS INFESTATION AND TRANSMISSION EFFICIENCY OF FABA BEAN NECROTIC YELLOW VIRUS

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ABSTRACT

The present investigation aimed to study the effects of some faba bean varieties (Giza429, Line 69, Giza3, Giza461, Giza 4 and Giza22) on the population density of aphids, leafhoppers and whitefly insects. The obtained results show pronounced differences in the population density of the aforementioned insects under tested varieties. The tested six varieties of faba bean can be arranged descendingly according to the degree of infestation with insects as follows: Giza 22; Giza4; Giza461; Giza 3; Line69 and Giza429. Chemical analysis results showed a positive relationship between protein, carbohydrate contents and pH values with aphids, leafhoppers and whitefly infestation in all faba bean varieties, while reverse relationship between pH values and insect infestation. Negative relationship between insect infestations and quantity of yield was also recorded.

Therefore, it could be recommended that using suitable plant variety must be included in the integrated pest management programs.

Transmission experiments of faba bean necrotic yellow virus (FBNYV) by aphid insects *Aphis craccivora* Koch and *Myzus persicae* Sulz. confirmed the ability of these aphid species to transmit the FBNYV.

The results of virus transmission could be summarized as follows:

- i) The acquisition access feeding periods ranged between 10 hrs and 7 days for *A craccivora* and 16 hrs to 9 days for *M persicae*.
- ii) Latent periods in aphid insect vectors ranged between 4 and 6 days.
- iii) Inoculation access feeding periods ranged between 2 hrs and 5 hrs.
- iv) Latent period of virus in host plants ranged from 6 to 8 days in celery plants and 12 to 18 days in faba bean plants.
- v) Retention periods of the virus in the infective aphid vector ranged between 24 - 28 days.

INTRODUCTION

Faba bean crop is one of the most important leguminous crops used as human and animal food in Egypt, the crop is adversely infected by different homopterous insects throughout the growing season. Aphids, leafhoppers and whitefly insects are among the most important insect pests which cause serious damage either directly by sucking plant juice or indirectly as insect vectors of plant pathogenic diseases (Makkouk, 2001).

Faba bean varieties exhibited different susceptibility to the aforementioned homopterous insects infestation, so the resistance varieties could be used as an item in integrated pest management programs. Faba bean necrotic yellow virus occurs in several faba bean cultivations in Sharkia Governorate. Therefore, relative susceptibility of different faba bean cultivars to some homopterous insect's infestation and transmission efficiency of faba bean necrotic yellow virus (FBNYV) by aphid insects were studied.

MATERIAL AND METHODS

I- Survey and seasonal abundance of certain homopterous insects on faba bean plants

An area of about 1200 m² was chosen to carry out this study in Hehya district, Sharkia Governorate during 2005/2006 and 2006/2007 seasons. The experimental design used in all growing seasons of faba bean varieties was a completely randomized block design with three replications. Treatments were distributed as split plot within replication, each sub plot consisted four ridges (10 meters wide and 6 meters long). The experimental area were divided into 18 lines, the space between holes 20-30 cm.

The following two procedures of sampling were used:

1) **Plant samples:** Stem and terminal growth were taken weekly from randomly chosen ten plants of each variety. These samples were placed in paper bags, transferred to the laboratory for inspection using a binocular microscope and the total number of existing whitefly (immature and adult stages) and aphid individuals on both surfaces of the leaves and stems were recorded.

2) **Sweeping net,** 30 cm diameter and 60 cm deep. Each sample consisted of 100 strokes were taken from both diagonal directions of the experimental area. The collected insects were kept in a tight closed paper bag, transferred to the laboratory for inspection by binocular microscope and the collected leafhoppers were killed by cyanide, sorted into species and identified according to the work of Nielson (1968) and Hegab et.al.(1989a). Counts of captured leafhoppers were done for each sample.

Daily records of both maximum and minimum temperatures along with relative humidity were obtained from the Agrometeorological station at Zagazig city which is located closely to the experimental areas during 2005/2006 and 2006/2007 seasons.

II-Effect of different faba bean varieties on the population density of aphids, leafhoppers and whitefly insects and the resulted yield quantity

The following six faba bean varieties were used (Giza429, Line 69, Giza3, Giza461, Giza 4 and Giza22). The sowing date was during the 2nd week of November in 2005 and 2006 seasons. The normal agricultural practices were followed in due time and all plots were kept free of any insecticide treatments.

Sampling started when the age of the plants reached about 21-28 days after seedling and continued at weekly intervals throughout the growing seasons (until 2nd week of April, 2006 & 2007).

The effects between of different faba bean plant varieties on the population density of the aforementioned homopterous insects along with resulted yield were statistically analyzed according to completely randomized block design (Little and Hills 1975).

III- Relationship between certain chemical constituents of faba bean plant varieties and infestation with aphids, leafhoppers and whitefly insects

To confirm the relationship between certain chemical constituents of the different varieties of host and the infestation with aphids, leafhoppers and whitefly insects, chemical analyses of different faba bean varieties leaves were carried out in central laboratory, Faculty of Agriculture, Moshtohour, Banha University to determine the total protein, carbohydrate contents, pH value, Phosphorous, Calcium and Potassium contents. According to Dubois *et al.* 1956; Barrowes and Simpson (1962); Bremner and Mulvaney 1982.

IV-Transmission of Faba Bean Necrotic Yellow Virus (FBNYV) by aphid insects *A craccivora* and *M persicae*

Specimens of aphids *Aphis craccivora* Koch and *Myzus persicae* Sulz. were collected from faba bean cultivations in different regions at Sharkia Governorate. The collected aphid insects were critically examined to be free from any contaminating pathogen before using in test by placing them directly after collection from field on healthy celery plants for 24-28 days (the experimental period and the test plants were kept under observation in the laboratory for symptoms development. Micro isolators were especially constructed to ensure the continuous stay of the aphid insects on the host plant throughout the periods of acquisition and inoculation feeding (Hegab, 1981 and El Sharkawy 1996).

The used aphid insects were classified into different groups according to the length of the acquisition feeding period on infected plants with faba bean necrotic yellow virus (FBNYV).

In both acquisition and inoculation feeding periods, 10-12 individuals of aphid insects were placed on each plant, using ten plants for each test. The acquisition feeding period ranged from 1 hr to 12 days, while inoculation feeding period lasted for 24-28 days, during which aphids were transferred to new indicator celery plants one after the other and the plants were kept under observation in the laboratory for symptoms development.

To determine the length of the pathogen latent period in the insects after acquiring the pathogen, the insects were transferred daily to new healthy celery plant and the plants were kept under observation in laboratory for symptoms development.

In order to confirm the ability and the efficiency of the tested aphid species as important insect vectors of this pathogen in faba bean cultivations, subsequent transmission experiments were carried out from artificially infected celery plants (showing clear symptoms) to healthy ones and retransmission experiments were also carried out to transmit this pathogen from infected celery plants to healthy faba bean seedling as a principle host plants.

RESULTS AND DISCUSSION

I- Survey and seasonal abundance of certain homopterous insects on faba bean plants

i) Aphids

Survey study on the plants of the all six faba bean varieties revealed the occurrence of the following two aphid species *Aphis craccivora* Koch and *Myzus persicae* Sulz..As shown in Tables (1 and 2) *A craccivora* proved to be the most dominant aphid on the all six faba bean varieties.

The mean of weekly numbers of aphids *A craccivora* and *M persicae* collected from faba bean plants during 2005/2006 and 2006/2007 seasons are shown in Tables 1 and 2 .

Table (1): The total number of certain homopterous insects infesting faba bean plants at Hehya district, Sharkia Governorate during 2005/2006 season .

| Date of inspection (weeks) | Number of insects/sample | | | | | Means of weather factors | |
|----------------------------|--------------------------|-------------------|-------------------|--------------------|-----------------|--------------------------|-------|
| | <i>A craccivora</i> | <i>M persicae</i> | <i>E decedens</i> | <i>E decipiens</i> | <i>B tabaci</i> | Temp.C° | R.H.% |
| 1Dec. | 0 | 0 | 0 | 0 | 0 | 21.3 | 68.1 |
| 2 | 4 | 0 | 0 | 0 | 0 | 19.6 | 73.4 |
| 3 | 24 | 0 | 2. | 2 | 0 | 17.9 | 64.7 |
| 4 | 54 | 3 | 8 | 14 | 26 | 15.5 | 64.7 |
| 1 Jan. | 82 | 12 | 13 | 19 | 74 | 18.4 | 66.0 |
| 2 | 145 | 24 | 19 | 25 | 181 | 13.2 | 68.0 |
| 3 | 240 | 33 | 25 | 32 | 295 | 14.2 | 67.1 |
| 4 | 389 | 47 | 31 | 39 | 533 | 14.8 | 62.9 |
| 1Feb. | 215 | 39 | 36 | 47 | 664 | 16.4 | 58.0 |
| 2 | 121 | 30 | 41 | 54 | 558 | 16.5 | 66.7 |
| 3 | 76 | 15 | 46 | 61 | 491 | 16.3 | 66.7 |
| 4 | 101 | 29 | 51 | 68 | 325 | 18.8 | 64.0 |
| 1Mar. | 175 | 39 | 58 | 76 | 175 | 18.5 | 65.6 |
| 2 | 368 | 54 | 49 | 68 | 103 | 19.1 | 58.3 |
| 3 | 455 | 77 | 42 | 59 | 37 | 20.7 | 57.9 |
| 4 | 109 | 36 | 36 | 50 | 0 | 21.8 | 54.8 |
| 1Apr. | 18 | 14 | 27 | 40 | 0 | 20.8 | 58.3 |
| 2 | 7 | 2 | 14 | 25 | 0 | 22.0 | 57.0 |
| Total | 2583 | 454 | 498 | 679 | 3462 | | |

Data indicated that the population density of aphid insects had two peaks, the first one occurred in the 4th week of January with a mean number of 389.0&412.0 insects /sample for *A craccivora* and 47.0&52.0 insects /sample for *M persicae* at 14.8C° ,16.4C° with 62.9% and 60.3%R.H.for the two seasons ,respectively .the second peak was obtained in 3rd week of March with a mean number of 455.0&460.0 insects /sample for *A craccivora* and 77.0&90.0 insects /sample for *M persicae* at 20.7C° ,18.3C° with 57.9% and 61.9%R.H.for the two seasons ,respectively. These results are agreement with the findings of (Cammell & Way 1983 and Baker 2001) who

mentioned that *Aphis craccivora* (Koch) and green peach aphids *Myzus persicae* (Sulzer) feed mostly on the youngest leaf and stem tissue resulting in stunted terminal growth and distorted leaves. They are known as faba bean pests throughout the Mediterranean and some subtropical and tropical areas where they cause damage from both direct feeding and virus transmission. And disagreed with the findings of Helaly, 1982; Nosser, 1996 and El Gindy, 2002 who mentioned that *Aphis craccivora* and *Myzus persicae* had three peaks of population activity on pea and broad bean plants in Mansoura region. This difference may be attributed to locality, crop rotation, agricultural practices and environmental conditions prevailing during execution of these experiments.

Table (2): The total number of certain homopterous insects infesting faba bean plants at Hehya district, Sharkia Governorate during 2006/2007 season.

| Date of inspection (weeks) | Number of insects/sample | | | | | Mean of weather factors | |
|----------------------------|--------------------------|-------------------|-------------------|--------------------|-----------------|-------------------------|-------|
| | <i>A craccivora</i> | <i>M persicae</i> | <i>E decedens</i> | <i>E decipiens</i> | <i>B tabaci</i> | Temp.C° | R.H.% |
| 1Dec. | 0 | 0 | 0 | 0 | 0 | 19.2 | 63.6 |
| 2 | 6 | 0 | 0 | 0 | 0 | 18.9 | 64.3 |
| 3 | 14 | 0 | 2 | 3 | 15 | 18.1 | 62.7 |
| 4 | 58 | 2 | 10 | 16 | 34 | 15.7 | 65.0 |
| 1 Jan. | 83 | 14 | 16 | 24 | 83 | 15.8 | 66.4 |
| 2 | 150 | 22 | 24 | 32 | 189 | 16.3 | 64.7 |
| 3 | 290 | 38 | 30 | 41 | 483 | 16.3 | 63.3 |
| 4 | 412 | 52 | 37 | 48 | 556 | 16.4 | 60.3 |
| 1Feb. | 220 | 40 | 42 | 56 | 748 | 13.6 | 67.7 |
| 2 | 142 | 32 | 49 | 63 | 621 | 16.0 | 67.0 |
| 3 | 66 | 12 | 55 | 72 | 514 | 18.6 | 63.9 |
| 4 | 95 | 24 | 60 | 78 | 370 | 20.0 | 61.4 |
| 1Mar. | 186 | 48 | 68 | 86 | 221 | 19.0 | 63.7 |
| 2 | 322 | 68 | 59 | 78 | 113 | 19.3 | 62.1 |
| 3 | 460 | 90 | 54 | 68 | 56 | 18.3 | 61.9 |
| 4 | 118 | 32 | 42 | 57 | 0 | 20.4 | 56.9 |
| 1Apr. | 20 | 16 | 33 | 47 | 0 | 22.1 | 59.7 |
| 2 | 4 | 0 | 17 | 30 | 0 | 21.5 | 58.9 |
| Total | 2646 | 490 | 598 | 799 | 4003 | | |

ii) Leafhoppers insects

Survey study on the aforementioned faba bean varieties showed the occurrence of *Empoasca decedens* Paoli and *E decipiens* Paoli. It is clear that *E decipiens* proved to be the most dominant leafhoppers on the all six faba bean varieties.

The mean of weekly numbers of the leafhoppers *E decedens* and *E decipiens* collected from bean plants in 2005/2006 and 2006/2007 seasons are recorded in Tables 1 and 2. One peak of *E decedens* and *E decipiens* occurred at the 1st week of March with a mean number of 58.0 & 68.0 insects/sample for *E decedens* and 76.0 & 86.0 insects / sample for *E decipiens* at 18.5°C, 19.0°C with 65.6% and 63.7% R.H. for the two seasons,

respectively The results agreed with the findings of Nuessly ,(2005) who mention that two species of leafhoppers feed mostly on leaf of faba bean in southern Florida and these results disagreed with the findings of El Gindy(2002)who mentioned that the *E decedens* and *E decipiens* population density were record two peaks on pea and broad bean cultivations in Mansoura region. This difference may be attributed to locality, crop rotation, agricultural practices and environmental conditions prevailing during execution of these experiments.

iii) Whitefly

The mean of weekly number of *Bimisia tabaci* Genn. collected from the six varieties of faba bean plants during 2005/2006 and 2006/2007 seasons are presented in Tables 1 and 2. The population density of *B tabaci* insects indicated that one peak was noticed at the 1st week of February with a mean number of 664.0&748.0 insects/sample at a mean temperature of 16.4C°,13.6C° with 58.0% and 67.7 % R.H. for the two season, respectively. After that the whitefly insect numbers tended to decline until reached its minimal number at the end of March.

These results are disagreement with the findings of Hegab *et. al.*, (1989b); Hashem, (1997) and El Gindy (2002) who mentioned that *B tabaci* has two peaks on faba bean plantations . This difference may be attributed to locality, crop rotation, agricultural practices and environmental conditions prevailing during execution of these experiments.

Regarding the weekly mean counts of aphids, leafhoppers and whitefly insects it is clear that this insect was more abundant during 2006/2007 than 2005/2006 season.

II-Effect of different faba bean varieties on the population density of aphids, leafhoppers and whitefly insects and the resulted yield quantity

a) population density

i) Aphid insects

As shown in Tables 3 and 4 *A craccivora* proved to be the most dominant aphid species on the six faba bean varieties.

It is worth to mention that from the results given in Tables 3 and 4 the difference between the mean number of aphid insects (*A craccivora* and *M persicae*) infested the tested six varieties of faba bean plants were highly significant during 2005/2006 and 2006/2007 seasons .

The tested six varieties of faba bean can be arranged descendingly according to the degree of infestation with aphids (*A craccivora* and *M persicae*) as follows Giza 22 variety (infested with a total number of 486.2&581.6insect/sample) ;Giza4 variety (infested with a total number of 449.2&541.6 insects/ sample) ;Giza461 variety (infested with a total number of 396.4& 491.8 insects/sample); Giza 3variety (infested with a total number of 348.4 &446.2insect/sample) ;Line69 variety(infested with a total number of 308.6&386.4)and Giza429 variety (infested with a total number of 273.8&313.6 insects/sample) for both seasons ,respectively .

Table (3): Susceptibility of different faba bean varieties to infestation with aphids, leafhoppers and whitefly insects considering the resulted yield quantity at Hehya district, Sharkia Governorate during 2005/2006 season.

| Varieties | Mean number of insects/sample | | | | | | Mean of seed yield kg/plot | |
|-----------|-------------------------------|-------------------|-------|-------------------|--------------------|-------|----------------------------|----------|
| | aphids | | Total | Leafhoppers | | Total | | Whitefly |
| | <i>A craccivora</i> | <i>M persicae</i> | | <i>E decedens</i> | <i>E decipiens</i> | | | |
| Giza429 | 232.2 | 41.6 | 273.8 | 4.6 | 9.2 | 13.8 | 54.2 | 37.2 |
| Line69 | 260.4 | 48.2 | 308.6 | 6.2 | 10.8 | 17.0 | 72.8 | 35.2 |
| Giza3 | 289.2 | 59.2 | 348.4 | 10.4 | 12.8 | 23.2 | 84.4 | 30.6 |
| Giza461 | 326.0 | 70.4 | 396.4 | 11.6 | 16.4 | 28.0 | 100.0 | 29.2 |
| Giza4 | 360.8 | 88.4 | 449.2 | 14.8 | 17.2 | 32.0 | 132.2 | 23.8 |
| Giza22 | 384.4 | 101.8 | 486.2 | 16.4 | 19.4 | 35.8 | 133.8 | 21.2 |
| F | ** | ** | ** | * | * | * | ** | * |

Table (4): Susceptibility of different faba bean varieties to infestation with aphids, leafhoppers and whitefly insects considering the resulted yield quantity at Hehya district, Sharkia Governorate during 2006/2007 season

| Varieties | Mean number of insects/sample | | | | | | Mean of seed yield kg/plot | |
|-----------|-------------------------------|-------------------|-------|-------------------|--------------------|-------|----------------------------|--------------------------|
| | Aphids | | Total | Leafhoppers | | Total | | Whitefly <i>B tabaci</i> |
| | <i>A craccivora</i> | <i>M persicae</i> | | <i>E decedens</i> | <i>E decipiens</i> | | | |
| Giza429 | 280.4 | 53.2 | 313.6 | 6.16 | 11.4 | 18.0 | 68.8 | 23.4 |
| Line69 | 326.2 | 60.2 | 386.4 | 9.2 | 13.6 | 22.8 | 80.2 | 21.6 |
| Giza3 | 373.4 | 72.8 | 446.2 | 12.2 | 16.4 | 28.6 | 96.6 | 20.4 |
| Giza461 | 404.2 | 87.6 | 491.8 | 13.4 | 18.8 | 32.2 | 115.4 | 18.4 |
| Giza4 | 428.4 | 113.2 | 541.6 | 15.8 | 20.6 | 36.4 | 137.2 | 17.8 |
| Giza22 | 450.8 | 130.8 | 581.6 | 19.6 | 22.0 | 41.6 | 140.8 | 16.6 |
| F | ** | ** | ** | * | * | * | ** | * |

ii) Leafhoppers insects

From results given in Tables 3 and 4 indicated that the tested six varieties could be arranged in descendingly order to the population density of leafhoppers insects on faba bean as follows: Giza22 variety infested with a total number of 35.8&41.6 insects/sample ;Giza 4 variety infested with a total number of 32.0&36.4 insects/sample ;Giza461 variety infested with a total number of 28.0&32.2 insects/sample;Giza 3 variety infested with a total number of 23.2&28.6 insects /sample;Line 69 variety infested with a total number of 17.0&22.8 insects/sample and Giza 429 variety with a total number of 13.8&18.0 insects/sample for both seasons ,respectively .

Statistical analysis indicated that the difference between the mean numbers of leafhoppers on the six faba bean varieties were highly significant during 2005/2006 and 2006/2007 seasons, respectively.

iii) Whitefly insects

As seen in Tables 3 and 4 the highest mean number of white fly insects was recorded on Giza 22 variety infested with a total number of 133.8&140.8 insects/sample for both seasons, respectively .followed by Giza4(132.2&137.2insects/sample); Giza461(100.0&115.4insects/sample);

Giza3(84.4&96.6insects/sample)and Line 69 (72.8&80.2 insects/sample) ,whereas the lowest population density was recorded on Giza 429 variety infested by 54.2&68.8 insects /sample for both seasons ,respectively.The results agreed with the findings of Nosser (1996) ; El Komy (1999); El- Gindy (2002) ; Youssef (2006) and Hegab (2007) who mentioned that varieties of leguminous plants had a great effect on incidence of some homopterous insects.

b) Mean yield quantity (kg seeds/plot)

With regard to the influence of faba bean plants cultivars on faba bean yield ,data presented in Tables 3 and 4 show that Giza 429variety yielded the highest mean of 37.2&23.4 kg/plot in 2005/2006 and 2006/2007 seasons, respectively.Followed by Line 69variety cultivars (yield mean of 35.2&21.6 kg seed/plot);Giza3variety (30.6&20.4 seed kg/plot); Giza461variety (29.2&18.4kg seed/plot); Giza 4variety (23.8&17.8 kg seed/plot) and Giza 22 variety (21.2&16.6kg seed/plot) in the two seasons ,respectively .

Generally, from the obtained results it could be concluded that Giza 429 and Line 69 varieties were infested with the least number of aphids, leafhoppers and whitefly insects and produced a high yield, Giza22 and Giza4varieties showed the highest number of aforementioned insects infestation and produced the least yield, while Giza3 and Giza 461 faba bean varieties proved to be moderately susceptible to aphids; leafhoppers and whitefly insects. Therefore Giza429 and Line 69 varieties could be recommended to be cultivated in Sharkia Governorate.

The results agreed with the findings of Nuessly 2005 who mention that aphids insects cause damage to faba bean and reduce the growth and reproduction of the crop

III- Relationship between certain chemical constituents of faba bean plant varieties and infestation with aphids, leafhoppers and whitefly insects

Data given in Table (5) indicated that the effect of different chemical constituents of the tested six faba bean varieties on aphids, leafhoppers and whitefly insects infestation were significant.

a) Protien, Carbohydrates contents "C.C." and pH values.

The results showed positive relationship between protein and carbohydrate contents and aphids, leafhoppers and whitefly insects infestation in all faba bean varieties ,while reverse relationship between pH values and insect infestation was also shown.

Data in Table (5) show that, the highest mean number of aphid, leafhopper and whitefly insects had been recorded on Giza 22variety (581.6aphids/sample, 41.6leafhoppers/sample and 140.8whitefly /sample) with 21.1protein, 60.4C.C. and4.0 pH, followed by Giza 4 variety (541.6for aphids, 36.4for leafhoppers and 137.2for whitefly) with 20.2 protein, 58.3 C.C and 4.2pH, while the lowest mean number of the aforementioned insects was observed in Giza 429variety with 11.5protein, 45.0C.C.and 5.7pH (313.6

aphids/sample, 18.0 leafhoppers /sample and 68.8whitefly/sample) followed by line 69variety (386.4aphids/sample, 22.8leafhoppers /sample and 80.2whitefly /sample) with14.25 protein; 49.1C.C.and 5.5pH. Giza3 and Giza 461varieties were recorded as moderately susceptible faba bean varieties (446.2&491.8 aphids /sample ,28.6&32.2 leafhoppers /sample and 96.6&115.4 whitefly /sample)for the two varieties, respectively with 16.0&18.5 protein ,51.0&53.2C.C and pH 5.0&4.8for the two varieties ,respectively.

From the obtained results Giza 429 and Line69 faba bean varieties were the lowest total protein, carbohydrate contents and the highest pH values, the least susceptible to the aforementioned insect infestation and the highest yield production.

Table (5): Effect of certain chemical constituents of different faba bean varieties on the population density of aphids, leafhoppers and whitefly insects and the resulted yield quantity at Hehya district, Sharkia Governorate during 2007 season

| varieties | Total protein % | Total carbohy drate% | pH | P% | K% | Ca% | Mean number of aphids | Mean number of leafhoppers | Mean number of whitefly <i>B tabaci</i> | Mean of seed yield kg/plot |
|----------------|-----------------|----------------------|-----|------|-----|------|-----------------------|----------------------------|---|----------------------------|
| Giza429 | 11.5 | 45.0 | 5.7 | 0.82 | 3.2 | 3.12 | 313.6 | 18.0 | 68.8 | 23.4 |
| Line69 | 14.25 | 49.1 | 5.5 | 0.75 | 3.1 | 3.05 | 386.4 | 22.8 | 80.2 | 21.6 |
| Giza3 | 16.0 | 51.0 | 5.0 | 0.72 | 2.9 | 3.9 | 446.2 | 28.6 | 96.6 | 20.4 |
| Giza461 | 18.5 | 53.2 | 4.8 | 0.69 | 3.0 | 3.2 | 491.8 | 32.2 | 115.4 | 18.4 |
| Giza4 | 20.2 | 58.3 | 4.2 | 0.65 | 2.3 | 2.91 | 541.6 | 36.4 | 137.2 | 17.8 |
| Giza22 | 21.1 | 60.4 | 4.0 | 0.64 | 3.5 | 2.8 | 581.6 | 41.6 | 140.8 | 16.6 |
| F | ** | ** | * | ns | ns | ns | ** | * | ** | * |

b) Phosphorous (P), Potassium and Calcium:

Statistical analysis of obtained data showed that effect of phosphorous, potassium and calcium percentage in faba bean plant varieties was not significant (Table 5).

Generally it is worth to mention that aphids, leafhoppers and whitefly insects infestation was correlated with the chemical constituents of the used faba bean varieties and with quantity of yield.

IV-Transmission of Faba Bean Necrotic Yellow Virus (FBNYV) by aphid insects *A craccivora* and *M persicae*

Tables 6 and 7 include data on the ability of *A craccivora* and *M persicae* to transmit the faba bean necrotic yellow virus from infected faba bean seedlings to healthy celery plants, from infected celery plants to healthy ones and from infected celery plants to healthy faba bean plants.

The result obtained showed that the ability of these insects to acquire the virus from different host plants seems to be different whereas the minimum acquisition feeding periods ranged between 4hrs.to 7days for *A craccivora* and 16hrs 9 days for *M persicae* .This may be attributed to palatability of the host plants for the insect vectors or a low concentration or disappearance of virus from phloem tissue seems to be the best explanation for this phenomenon.

Aphid insects were able to transmit the virus of faba bean necrotic yellow disease after a latent period of 4-6days. The viruliferous insects remained infective as long as they were alive (24-28 days). A minimum inoculation feeding period of 2-5 hours required for virus transmission. Symptoms appeared on celery plants within 6-8days and on faba bean plants within 12-18 days after inoculation the virus. In comparison with their control, the leaves of diseased plants were smaller in size; their number per plant was much higher. The petioles were shorter and horizontally positioned .In addition; infected plants were unable to flower.

According to the results obtained in the present work, it can be concluded that the virus of faba bean necrotic yellow disease was successfully transmitted by aphid *A craccivora* and *M persicae* from infected faba bean plants to healthy celery plants and from infected celery plants to healthy ones and from infected celery plants to healthy faba bean plants.

Table (6): Transmission of faba bean necrotic yellow virus by aphid insect vectors *A craccivora* and *M persicae*

| Acquisition access feeding "A.A.P" | Efficiency of transmission% | | | | | |
|------------------------------------|--|-------------------|---|-------------------|--|-------------------|
| | From infected faba bean to healthy celery plants | | From infected celery plants to healthy ones | | Retransmission from infected celery Plants to faba bean plants | |
| | <i>A craccivora</i> | <i>M persicae</i> | <i>A craccivora</i> | <i>M persicae</i> | <i>A craccivora</i> | <i>M persicae</i> |
| 00 | 00 | 00 | 00 | 00 | 00 | 00 |
| 2hr. | 00 | 00 | 00 | 00 | 00 | 00 |
| 4 | 00 | 00 | 00 | 00 | 00 | 00 |
| 6 | 00 | 00 | 00 | 00 | 00 | 00 |
| 8 | 00 | 00 | 00 | 00 | 00 | 00 |
| 9 | 00 | 00 | 00 | 00 | 00 | 00 |
| 10 | 10 | 00 | 10 | 00 | 00 | 00 |
| 12 | 10 | 00 | 10 | 00 | 10 | 00 |
| 14 | 10 | 00 | 10 | 00 | 10 | 00 |
| 15 | 10 | 00 | 20 | 00 | 10 | 00 |
| 16 | 10 | 10 | 20 | 10 | 10 | 10 |
| 20 | 20 | 10 | 30 | 10 | 10 | 10 |
| 24hr. | 20 | 10 | 30 | 20 | 20 | 10 |
| 2 day | 30 | 20 | 40 | 20 | 20 | 10 |
| 3 | 30 | 20 | 40 | 30 | 20 | 10 |
| 4 | 40 | 20 | 40 | 30 | 30 | 20 |
| 5 | 40 | 30 | 40 | 40 | 30 | 20 |
| 6 | 50 | 30 | 50 | 40 | 40 | 30 |
| 7 | 50 | 40 | 50 | 40 | 50 | 30 |
| 8 | 50 | 40 | 60 | 40 | 50 | 30 |
| 9 | 50 | 50 | 60 | 50 | 50 | 40 |
| 10 | 50 | 50 | 60 | 50 | 50 | 40 |
| 11 | 60 | 50 | 60 | 60 | 50 | 40 |
| 12 | 60 | 50 | 60 | 60 | 50 | 40 |

Table (7) : Transmission of faba bean necrotic yellow virus from infected faba bean plants to healthy celery plants by aphid insects *A craccivora* and *M persicae* .

| Inoculation access period "I.A.P" | Efficiency of virus transmission % by aphid insects | |
|-----------------------------------|---|-------------------|
| | <i>A craccivora</i> | <i>M persicae</i> |
| 10 min. | 00 | 00 |
| 20 | 00 | 00 |
| 30 | 00 | 00 |
| 45 | 00 | 00 |
| 1hr. | 00 | 00 |
| 1.25 | 00 | 00 |
| 1.5 | 00 | 00 |
| 2.0 | 10 | 10 |
| 2.5 | 20 | 10 |
| 3.0 | 20 | 10 |
| 3.5 | 30 | 20 |
| 4.0 | 40 | 30 |
| 4.5 | 40 | 30 |
| 5.0 | 40 | 40 |
| 5.5 | 50 | 40 |
| 6.0 | 50 | 40 |

These results agree with those obtained by Katul 1993; Franz ,1999 and Timchenko , 2006 who mentioned that *A craccivora* and *M persicae* are efficient aphid vectors of phytopathogenic viruses.

REFERENCES

- Baker, C. A.; R. N. Raid and B. T. Scully (2001): Natural infection of *Vicia faba* by Bidens mottle virus in Florida. Plant disease. 85 (12): 1290.
- Barrowes, L.H. and E.C. Simpson (1962): A method for the direct routine determination of calcium and magnesium in soil and plant tissues. Soil Soc. Amr. Proc. 26: 443-445.
- Bremner, J.M. and C.S. Mulvaney (1982): Total Nitrogen (c.i page, A.L.; R.H. Miller and D.R. Keeney (Eds)) Methods of Soil Analysis, part 2 Amer. Soc., Agron. Madison. WI. W.S.A. Pp. 595-624.
- Cammell, M. E. and M. J. Way (1983): Aphid pests, pp. 315-346. In Hebblethwaite, P. D. (ed.), The Faba Bean (*Vicia faba* L.) A Basis for Improvement. Butterworths, London.
- Dubois, M.; K. Giles; J. K. Hamilton; P.A. Rebus and F. Smith (1956): Colorimetric method for determination of sugars and related compounds. Anal. Chem., (28): 350-356.
- El Gindy, M.A. (2002): Studies on certain homopterous insect vectors of plant pathogenic diseases Ph.D Thesis Fac. Agric. Zagazig Univ.
- El Komy, S.O.O. (1999): Inter relationships among some aphids and their host plants Ph.D. Thesis, Fac. Agric. Menoufia Univ.

Hegab, Ola I. M.

- El-Sharkawy, H. M.(1996):Studies on certain hemipterous insects infesting some fruit plantations in Salhia district, Sharkia Governorate,Egypt .Ph.D. Thesis .Fac.Agric.,Zagazig Univ.
- Franz, A. W. E.; F. van der Wilk; M.Verbeek; A. M.Dullemans and J. F. J. M. van den Heuvel (1999): Faba bean necrotic yellows virus (genus *Nanovirus*) requires a helper factor for its aphid transmission. *Virology* 262, 210–219.[CrossRef][Medline]
- Hashem,M.S.(1997):Studies on certain insects infesting some vegetable plants in Sharkia Governorate .M.Sc.Thesis ,Fac.Agric.Zagazig Univ.
- Hegab,A.M.(1981):Potential leafhoppers vectors of plant pathogenic mycoplasma in Hungarian fruit plantations Ph.D.Thesis ,Hung.Acad.Science.
- Hegab, A. M.; M. M. El-Zohairy; M. M. Helaly and H. M. El- Sharkawy (1989a) : Survey and seasonal abundance of leafhoppers infesting certain solanaceous vegetable plants in newly reclaimed sandy areas at Salhia district, Egypt. *Zagazig J. Agric. Res.*, 16(2): 175-187.
- Hegab,A.M.;M.M.Helaly and M.M.El Zohairy (1989b):Occurrence and seasonal abundance of the whitefly ,*Bemisia tabaci* (Genn.)infesting certain solanaceous vegetable plants in newly reclaimed sand areas at salhia district,Egypt, *Zagazig J.Agric.Res.Vol16(2)*.
- Hegab ,A. M.; Ola. I. Hegab ; W.M.H. Desuky and Fatma. A.I.,Abou-Alnour(2007): Susceptibility of some leguminous vegetable plants varieties to infestation with leafhopper and planthopper insects with regard to their seasonal abundance .*Egypt.J.of Appl.Sci.*,22(10B)703-719.
- Helaly, M.M; A.E. Ibrahim and M.R.A. Saleh (1982):Fluctuation of population densities of *Empoasca sp.*, *Aphis craccivora* Koch. and *Tetranychus arabis* Attiah. attacking cowpea plants at Zagazig. *Egypt. Bull. Soc. Ent.*, Egypt, 64: 35 - 43.
- Katul, L.; H. J.Vetten; E.Maiss; K. M.Makkouk; D. E Lesemann and Casper, R. (1993): Characterisation and serology of virus- like particles associated with faba bean necrotic yellows. *Ann Appl Biol* 123, 629–647.
- Little,T.M.and F.J.Hills(1975):Statistical methods in agricultural research .Ued Book store University of California ,Davis 242p.
- Makkouk,K.M.;M.Bashir;R.A.C.Jones and S.G. Kumari(2001):Survey for viruses in lentil and chickpea crops in Pakistan.*Zeit schrift fur Pflanzenkheiten und Pflanzenschutz* 108:3,258-268
- Neilson,M.W.(1968):The leafhopper vectors of phytopathogenic viruses(Homoptera:Cecadellidae) taxonomy, biology and virus transmission .Agric .Ser .M.S.Dept.Agr.89.386p.
- Nosser, M.A. (1996) : Mechanism of resistance in bean and cowpea varieties to certain sucking insects infestation. M. Sc. Thesis. Fac. of Agric. Cairo Univ.

- Nuessly ,G.C.;M.G.Hentz; R. Beiriger ; B.T. Scully; S. E. Halbert; M. C. Thomas; L. A. Stange; G. B. Edwards; J. B. Heppner; G. S. Hodges and G. J. Steck (2005): Insects that feed on faba bean in southern florida. The EDIS website at <http://edis.ifas.ufl.edu>.
- Timchenko, T.; L. Katul; M. Aronson ; J. C. Vega-Arreguín; B. C. Ramirez; H. J. Vetten and B. Gronenborn(2006): Infectivity of nanovirus DNAs: induction of disease by cloned genome components of *Faba bean necrotic yellows virus* J Gen Virol 87,1735-1743
- Youssef,A.A.A.(2006): Studies on some homopterous insect vectors of plant disease. Ph.D Thesis, Fac.of Agric.Zagazig Univ.

حساسية ستة أصناف من الفول البلدي للإصابة ببعض الحشرات المتشابهة الأجنحة وكفاءة نقل فيروس البقع الصفراء الميتة في الفول

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- أجري هذا البحث في منطقة ههيا محافظة الشرقية خلال موسمي الدراسة ٢٠٠٦/٢٠٠٥ و ٢٠٠٧/٢٠٠٦ في هذه الدراسة تم اختبار حساسية ٦ أصناف من الفول البلدي هي (جيزة ٤٢٩، لاين ٦٩، جيزة ٣، جيزة ٤٦١، جيزة ٤، جيزة ٢٢) للإصابة بحشرات المن ونطاطات الأوراق والذبابة البيضاء. وقد سجلت النتائج الآتية:
- ١- تواجد نوعين من المن وهما من البقوليات ومن الخوخ الأخضر وقد سجلت كثافة المجموع لكل منهما قمتى نشاط على الأصناف المختبرة قمة النشاط الأولي في الأسبوع الرابع من يناير والثانية في الأسبوع الثالث من مارس خلال موسمي الدراسة.
 - ٢- وقد سجل تعداد نطاطات الأوراق *E decedens* and *E decipiens* قمة نشاط واحدة في الأسبوع الأول من مارس خلال موسمي الدراسة.
 - ٣- تواجد ذبابة القطن البيضاء بأعداد كبيرة وقد سجلت قمة نشاط واحدة في الأسبوع الأول من فبراير خلال موسمي الدراسة.
 - ٤- وقد أظهر الصنفين جيزة ٤٢٩، لاين ٦٩ أنهما أقل حساسية للإصابة بالحشرات السابقة وكذلك صاحبهما أعلى محصول بينما أظهر الصنف جيزة ٤، جيزة ٢٢ أنهما أكثر الأصناف حساسية للإصابة بالحشرات السابقة وصاحبهما أقل محصول وقد أظهر الصنفين جيزة ٣ وجيزة ٤٦١ درجة متوسطة من الحساسية للإصابة بهذه الحشرات.
- كذلك درست العلاقة بين المحتوى الكيميائي للأصناف المختبرة وبين درجة الإصابة بالحشرات السابقة الذكر وقد وجد انه يوجد علاقة طردية بين نسبة البروتين ونسبة الكربوهيدرات في الأصناف المختبرة وبين تعداد حشرات المن ونطاطات الأوراق والذبابة البيضاء التي تصيبها. وكذلك وجدت علاقة عكسية بين قيمة pH وتعداد تلك الحشرات.
- وقد أجريت تجربة نقل الفيروس الذى يسبب مرض البقع الصفراء الميتة في الفول البلدي وقد ظهرت النتائج الآتية:
- الحشرات الناقلة لهذا الفيروس هي حشرات من البقوليات ومن الخوخ الأخضر كانت فترة التغذية اللازمة لإكتساب المسبب المرضى من النباتات المصابة تتراوح من ١٠ ساعات إلى ٧ أيام لحشرة من البقوليات و ١٦ ساعة إلى ٩ أيام لحشرة من الخوخ الأخضر.
- فترة الحضانة داخل الحشرات الناقلة تتراوح من ٤ إلى ٦ أيام .
- فترة التغذية اللازمة لحقن المسبب المرضى تراوحت من ٢ إلى ٥ ساعات .
- فترة الحضانة داخل النبات تراوحت من ٦ إلى ٨ أيام في نباتات الكرفس ومن ١٢- إلى ١٨ يوما في نباتات الفول البلدي .
- كانت فترة بقاء الفيروس داخل الحشرات الناقلة تتراوح من ٢٤ إلى ٢٨ يوما .

