# FIELD EVALUATION OF CERTAIN FABA BEAN VARIETIES UNDER NATURAL INFESTATION WITH *BRUCHUS RUFIMANUS* BOHMAN (COLEOPTERA, BRUCHIDAE).

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## INTRODUCTION

The bean beetle, *Bruchus rufimanus* Bohman is considered one of the most economic insects infesting faba been in Egypt. Infestation affects the quality of the bean which is widely used for human consumption. The females lay their eggs on the green pods during the spring; the hatched larvae penetrate the pods and later on the seeds. Infestation is transferred through the seeds to subsequent crop. The faba been harvested in April and may is infested by small larvae which feed and pupate in late August. The adult is formed during September but remain inside the seeds until sowing in November, then the beetle emerge and hibernate in the field waiting for the green pods to lay their eggs. Campell (1920) and Bishara *et al.* (1967) found that emerged adults could remain in the testa of the plant or hiding between petals of faba bean flowers for about three months. When the weather becomes favorable, the insects fly and begin to lay their eggs. Kamel (1982) found that the field infestation by *B. rufimanus* was started in February or March. He added that the percentage of infestation decreases towards the south of Egypt. Mostafa *et al.* (1986) reported that the mian source of field infestation by B. *rufimanus* is the infested sown beans by bruchid beetles which hibernate in the soil until the appearance of blossoms. The adult eats pollen and honey, and begins its reproduction, thus, it produces only one generation a year (Dupont and Huignard 1991; El- Shazly, 1993; Tran and Huignard, 1992 and Wojciechowicz, 2001).

The present study aimed to determine the beginning of faba beans infestation in the field by *B. rufimanus*, developing of its infestation and effect of the weather factors on the percentages of infestation.

## MATERIAL AND METHOD

The experiment was conducted in the fields of the Experimental Farm of the Faculty of Agriculture, Cairo University, at Giza region during 2000-2001 season.

The selected faba bean varieties were imposed on the recommended commercial varieties. These varieties were Giza 716, Giza 429, Giza 40, Cairo 375 and Cairo 241.

The experiment included four replicates. The area of each replicate was 12 rows, 4 m long (30 $m^2$ for each replicate). Sowing date was 15$^{th}$ of November, the normal agriculture practices and no insecticide treatments were applied. Samples were taken weekly, started after 90 days of plantation date (15$^{th}$ of February) and continued up to harvest. Samples consisting of 25 green pods collected randomly from each replicate. The green pods were kept in a paper bag then transferred to the laboratory to be examined to determine the following:

1. Mean percentages of infestation by establishing the number of infested seeds showing the dark brown dots in the place of the neonate larval penetration (Ismail *et al.*, 2004) from the total number of seeds in 100 green pods. As the result of penetration the neonatal larvae entered through the pod will go into the developing seeds leaving dark brown dots in the place of penetration (Ismail *et al.*, 2004).

2. Effect of the weather factors on the percentages of infestation. Meteroroloical data on the daily mean minimum and daily mean maximum temperatures (D. Mn.T. and D.Mx. T) as well as daily mean relative humidity (D.R.H %) throughout 2000/2001 season, were obtained from the library of plant Protection Research Institute, Dokki, Giza. Simple correlation (r), simple regression (b) and partial regression (p. reg.) analysis were estimated to determine the effect of the main weather factors on the mean number of infested seeds for each variety, also the explained variance (E. V. %) and "F value" of the combined weather factors were calculated to determine the amount of variability of the mean number of infested seeds.

## RESULTS AND DICUSSION

**1- Field infestation:**

The total weekly counts of *B. rufimanus*, in addition to the weekly mean of the weather factors; (Daily mean Maximum Temperature (D. Mx. T.), Daily mean Minimum Temperature (D.Mn. T.) and Daily mean Relative humidity % (D.R.H.) were

taken in consideration to estimate the infested seeds and the effect of previous weather factors on the development of this insect during 2000 – 2001 season. Counts started after about 75-80 days of planting (in early March) and reaching its maximum population throughout March. This may be also due to the high natural mortality of neonat larvae of *B. rufimanus* during the pre- pod stage of plant, in which a few numbers of seeds develop earlier. Seed development was accompanied with infestation increment.

The results obtained and presented in Table (1) and Fig. (1) revealed the first sign of infestation in early March and lasted for 7 weeks. Two peaks of infestation were noticed. The first peak was recorded in 5th week of March with number of infested seeds of 1.76, 1.08, 1.20 1.24 and 1.32 for Giza 716, Giza 429, Giza 40, Cairo 375, and Cairo 241, respectively at D.Mx.T. 35.61 °C, D.Mn. T. 16.06°C and D.R.H. 43%.

A drop in infestation level was noticed during the next week, then increased towards the second peak during the 2nd week of April. The records were 1.52, 0.84, 1.00, 1.16 and 0.68 for the five varieties, respectively at D.Mx.T. 30.10°C, D.Mn. T. 14.33 °C and D.R. H. 42%.

**TABLE (I)**

Mean no. of infested seeds with *B. rufimanus* in faba bean green pod varieties at weekly averages of temperature and relative humidity in Giza region during 2000 – 2001 season.

| Sampling Dates | Mean no. of infested seeds /100 green pods | | | | | Weather factors | | |
|---|---|---|---|---|---|---|---|---|
| | Giza 716 | Giza 429 | Giza 40 | Cairo 375 | Cairo 241 | D. Max. T. | D. Mn. T. | D.R. H. % |
| 15-02-2001 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 26.01 | 8.67 | 43 |
| 22-02-2001 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 23.00 | 8.14 | 46 |
| 01-03-2001 | 0.12 | 0.00 | 0.16 | 0.20 | 0.16 | 29.41 | 8.51 | 41 |
| 08-03-2001 | 0.20 | 0.12 | 0.24 | 0.28 | 0.36 | 29.16 | 13.34 | 46 |
| 15-03-2001 | 0.40 | 0.12 | 0.52 | 0.36 | 0.76 | 28.11 | 15.24 | 49 |
| 22-03-2001 | 1.16 | 0.24 | 0.64 | 0.60 | 0.88 | 29.73 | 15.99 | 45 |
| 29-03-2001 | 1.76 | 1.08 | 1.20 | 1.24 | 1.32 | 35.61 | 16.06 | 43 |
| 05-04-2001 | 1.12 | 0.48 | 0.60 | 1.00 | 0.40 | 32.69 | 19.94 | 46 |
| 12-04-2001 | 1.52 | 0.84 | 1.00 | 1.16 | 0.68 | 30.10 | 14.33 | 42 |
| 19-04-2001 | 0.92 | 0.64 | 0.70 | 0.84 | 0.48 | 33.86 | 16.23 | 41 |
| Mean | 0.27 | 0.35 | 0.51 | 0.57 | 0.54 | - | - | - |

D. Max. = Daily mean maximum temperatures
D. Mn. = Daily mean minimum temperatures
D.R.H. = Relative humidity

Data presented in Table (2) and illustrated in Fig. (2) showed that the susceptibility of different varieties to infestation by *B. rufimanus* was varied

according to the field infestation. In general, the cultivated varieties vary in their infestation rate by *B. rufimanus*, which clearly demonstrated that Cairo 375 and Giza 716 were more susceptible than the other varieties. The seasonal averages were 4.69, 2.66, 3.92, 4.72 and 3.49 on Giza 716, Giza 429, Giza 40, Cairo 375 and Cairo 241, respectively. This may be due to their profuse branching and profuse flowering and this agrees with the result obtained by Darwish and Abdalla (1994) and Abdalla and Darwish (1996) or attributed to both prevailing weather factors.

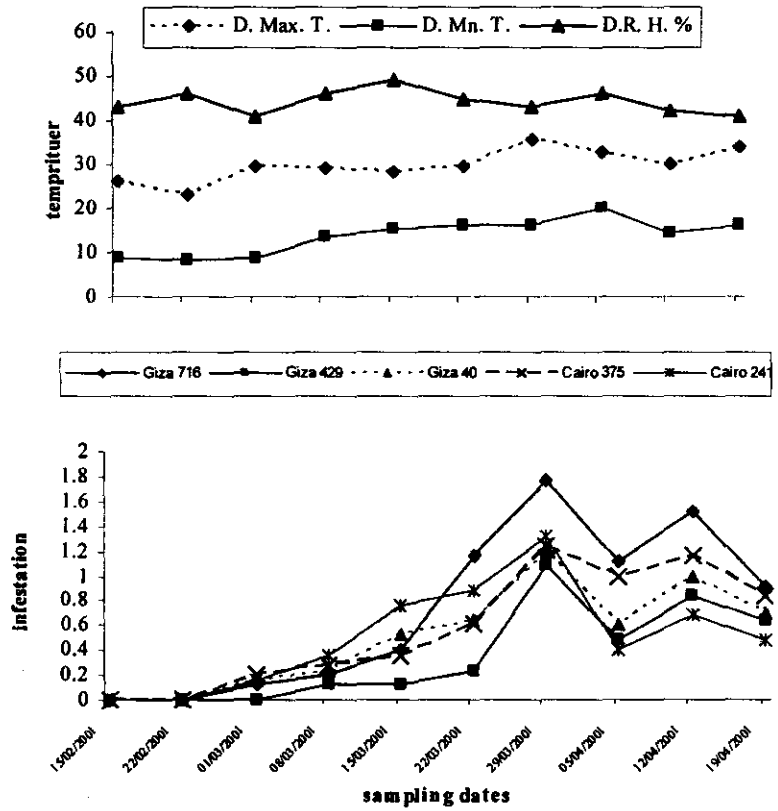


Fig. (1): Mean number of infested seeds with B. rufimanus in faba bean green pod varieties at weekly averages of temperature and relative humidity in Giza region during 2000 – 2001 season.

The obtained results are relatively in accordance with Boughdad and Lauge (1997) who studied the percentage of infestation and losses due to *B. rufimanus* on *Vicia faba* in Morocco. Their results revealed that the apparent infestation rate varied from 4 to 60% according to the area and field studied. The average infestation

rate of *V. faba* seeds was close to 33%. The infestation intensity was 3 adults per seed in 49% of the 152 fields studied. However, in 60% of the seeds examined only one adult developed per seed.

**TABLE (II)**

Mean of % infestation by *B. reufimanus* in the different faba bean varieties green pods at Giza region during 2000 – 2001 season.

| Sampling Dates | % Infestation seed | | | | |
|---|---|---|---|---|---|
| | Giza 716 | Giza 429 | Giza 40 | Ciaro 375 | Cairo 241 |
| 15-02-2001 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 22-02-2001 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 01-03-2001 | 0.72 | 0.00 | 1.30 | 1.72 | 1.26 |
| 08-03-2001 | 1.19 | 0.91 | 1.86 | 2.22 | 1.44 |
| 15-03-2001 | 2.58 | 0.95 | 4.30 | 2.86 | 5.78 |
| 22-03-2001 | 7.29 | 1.69 | 4.73 | 4.48 | 6.59 |
| 29-03-2001 | 12.43 | 8.06 | 8.60 | 10.10 | 7.72 |
| 05-04-2001 | 6.97 | 3.69 | 4.63 | 8.77 | 3.18 |
| 12-04-2001 | 9.55 | 6.29 | 8.33 | 9.67 | 5.23 |
| 19-04-2001 | 6.17 | 4.97 | 5.47 | 7.5 | 3.73 |
| Mean | 4.69 b | 2.66 e | 3.92 c | 4.72 a | 3.49 d |

F value = 22.5**
L.S>D.=

Matlosz (1997) studied susceptibility of 10 faba bean cultivars to injuries caused by *B. rufimanus* Boh. in Poland. He found that none of the cultivars under study was completely resistant to the pest. The most susceptible cultivar was Tim, with an average of 61.2 % of bean seeds damaged.

Sharaf El-Din *et al.*, (1999) found that field infestation with *B. rufimanus* started after 80-90 days of planting and lasted about 8-9 weeks at Sakha locality and 9-10 weeks at Sids locality. At Sakha locality, one peak of infestation was recorded in the 4th week of March during the first season, while infestation rate recorded two peaks in the second season; the first peak took place throughout late March or early April and second peak appeared on the 3rd week of April.

**2- Effect of the weather factors on the percentages of infestation by *B. rufimanus***

**A. Effect of the mean maximum Temperature (D.Mx.T.):**

Statistical analysis in Table (3) showed that the simple correlation (r) and regression (b) were positive and highly significant in Giza 716, Giza 429, Giza 40 and Cairo 375 varieties, while positive significant in Cairo 241 variety. Partial regression was positive insignificant in all faba bean varieties for relation between D.Mx.T and infested seeds with *B. rufimanus*.

**B. Effect of the daily mean minimum temperature (D.Mn.T.):**

Data in Table (3) indicated that the simple correlation and regression values of daily mean minimum temperature on the weekly infested seeds with *B. rufimanus* were positive and highly significant in Cairo 375 variety, while they were positive significant in Giza 716, Giza 429, Giza 40 and Cairo 241 varieties. On the other hand the partial regression was positively insignificant relation in all varieties but it was negatively insignificant in Cairo 241 variety.

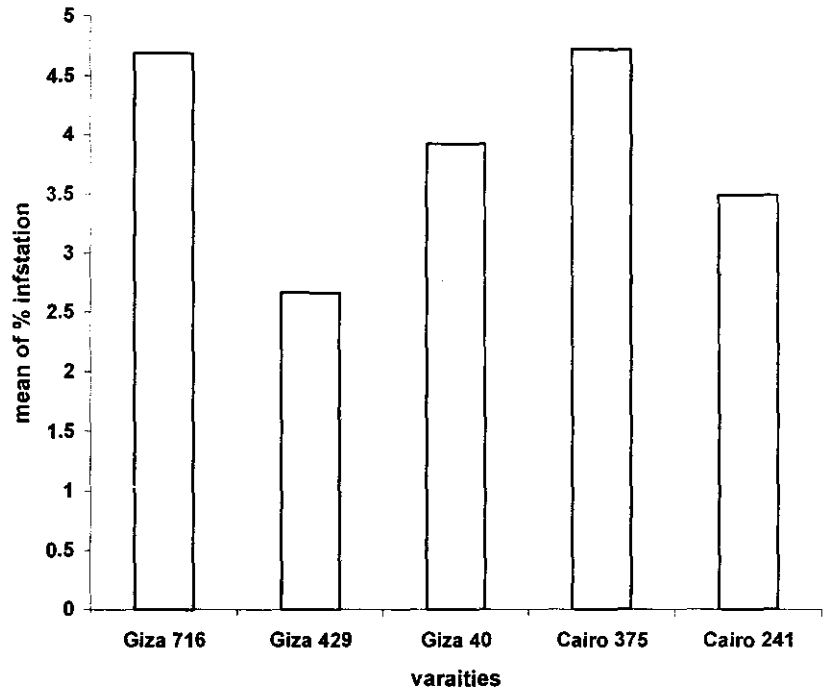


Fig. (2): Mean of % infestation by *B. rufimanus* in the different faba bean varieties green pods at Giza region during 2000 – 2001 season.

**C. Effect of the daily mean relative humidity (D. R. H.):**

The simple correlation and simple regression between daily mean relative humidity and infested seeds of Giza 716, Giza 429, Giza 40and Cairo 375 varieties with *B. rufimanus* were negatively insignificant. In case of Cairo 241, where correlation was negatively insignificant. The partial regression was negatively insignificant in all varieties but positive insignificant in Cairo 241 variety (Table, 3).

Data in Table (3) showed that the combined effect of the three factors on the infestation rate of seeds of Giza 716 , Giza 429, Giza 40 and Cairo 375 variety were significant. Explained of variances (E.V.) were 70.81, 66.98, 68.79 and 81.11 %, respectively. In case of Cairo 241 variety the effect was insignificant. From the previous data, it was clear that, the infestation with *B. rufimanus* was affected with the weather factors, as the moderate temperature was suitable for increasing the infested seeds with B. *rufimanus*. The infested seeds were mostly influenced by the combined action of the three weather factors than the single effect of each weather factors separately. The results are in agree with the results obtained by: - Sharaf El- Din *et al.*, (1999) who reported that the infestation with *B. rufimanus* was mostly influenced by the combined action of daily–maximum temperature, night-minimum temperature and daily mean relative humidity% rather than the single effect of each weather factor separately.

## Summary

This study was carried out at experimental farm Faculty of Agriculture throughout 2000-2001 season to determine the percentage of infestation on faba bean varieties considering the effect of the daily mean maximum temperature (D.Mx.T), daily mean minimum temperature (D.Mn. T.) daily mean relative humidity (D.R.H %) on the infested seeds with *B. rufimanus*

Results obtained indicated that:

- The first sign of infestation was recorded on early March and lasted for 7 weeks. *B. rufimanus* recorded a more infestation in Giza 716 and Cairo 375 varieties than other varieties. The seasonal averages of infestation were 4.69, 2.66, 3.92, 4.72 and 3.49 % on Giza 716 Giza 429, Giza 40, Cairo 375 and Cairo 241, respectively.
- Infestation of *B. rufimanus* recorded two peaks as follows: - the first peak was in 4$^{th}$ week of March, while the second peak was in 2$^{nd}$ week of April.
- Thee depressive periods in 1$^{st}$ week of April and the second peak in 3$^{rd}$ week of April.
- It was clear that, the effect of D.Mx.T. was positive highly significant in Giza 716, Giza 429, Giza 40 and Cairo 375 varieties and positive significant in Cairo 241 faba bean verities. While D.Mn.T. was positively highly significant in Cairo 375 variety, positive significant in Giza 716 , Giza 429 , Giza 40 and Cairo 241 faba bean varieties with significant effect to the combined weather factors with explained variance ( E.V.) 70.81 , 66.98 , 68.79 and 81.11 for Giza 716 , Giza 429 , Giza 40 and Cairo 375 faba bean varieties.

**TABLE (III)**

Simple correlation (r), simple regression (b) and partial regression (P.reg.) analysis of variance between the mean number of infested seeds with *Bruchus rufimanus* and the mean weather factors on faba bean varieties at Giza region throughout 2000 – 2001 season.

| Variety | D.Max. T. | | | | | D. Mn. T. | | | | | D.R.H % | | | | | Analysis of variance | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Simple | | | Partial | | Simple | | | Partial | | Simple | | | Partial | | | |
| | r | b | t | P.reg. | t | r | b | t | P.reg. | t | r | b | t | P.reg. | t | F | E.V. % |
| Giza 716 | 0.776 | 0.138 | 3.485** | 0.013 | 0.135 | 0.74 | 0.122* | 3.116* | 0.126 | 1.452 | -0.230 | -0.057 | -0.669 | -0.092 | -0.980 | 4.852* | 70.81 |
| Giza 429 | 0.799 | 0.084 | 3.768** | 0.045 | 0.725 | 0.617 | 0.060 | 2.217* | 0.035 | 0.648 | -0.365 | -0.054 | -1.110 | -0.043 | -0.729 | 4.057* | 66.98 |
| Giza 40 | 0.803 | 0.089 | 3.813** | 0. 47 | 0.751 | 0.725 | 0.074 | 3.003* | .045 | 0.808 | -0.195 | -0.030 | -0.563 | -0.021 | -0.353 | 4.428* | 68.79 |
| Cairo 375 | 0.844 | 0.106 | 4.455** | 0.021 | 0.368 | 0.784 | 0.092 | 3.574** | 0.087 | 1.748 | -0.259 | -0.046 | -0.759 | -0.064 | -1.192 | 8.586* | 81.11 |
| Cairo 241 | 0.686 | 0.077 | 2.668* | 0.108 | 1.457 | 0.655 | 0.069 | 2.450* | -0.016 | -0.246 | 0.060 | 0.009 | 0.171 | 0.069 | 0.975 | 2.795 | 58.29 |

* Significant at 5% probability.

** Highly Significant at 1% probability

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