

# A CONTRIBUTION TO THE BIOLOGY OF *BRUCHUS RUFIMANUS* BOHEMAN (COLEOPTERA:BRUCHIDAE)

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## INTRODUCTION

Faba bean, *Vicia faba* L. has gained a particular importance as the most available winter legume crop in Egypt. This is due to its high content of protein and it is considered one of the most used public food in Egypt. Faba bean is a host of several insect pests. The beetle, *Bruchus rufimanus* could remain inside the test plant for about two or three months, adults hiding during the daytime between petals of faba bean flowers. When weather becomes favorable, adults fly from their shelter and begin to lay eggs after mating (Bishara *et al.*, 1967). Insect infestation affects the quality and causes weight losses of seeds (Wojciechowicz, 2001, and Dietrych *et al.* 2002).

The available information related to this insect is few and, therefore the present study is directed to contribute more the information to the biology of *B. rufimanus*

## MATERIAL AND METHODS

The experiments were conducted in the field of the Experimental Farm, Faculty of Agriculture, Cairo University at Giza region throughout (2000/2001) season. An area of about (120 m<sup>2</sup>) was cultivated with Cairo 375 variety. The area was divided into 4 plots. Sowing date was in mid November, normal agriculture practices were followed and no insecticide treatment were applied. Two sampling methods were applied as follows:

A- Weekly field samples of 25 green pods were collected randomly from each plot of replicates until harvest. The green pods were put in paper bags then transferred to the laboratory to be examined by the aid of a stereomicroscope.

B- During storage, samples were taken weekly. The infested seeds with larval penetration symptoms (small brown spots) were kept in the laboratory under room temperature of  $29.9 \pm 3$  °C and  $65 \pm 5\%$  R.H.

Continuous daily dissections of infested seeds from the cultures were made and the larvae were examined in order to determine the different instars(Howe and Currie,1964) . The criteria used to determine the larval instars were observing the larval exuviae, their head capsule measurements and size of the body.

The development of pre-pupal and pupal stages were defined as the time from the pupation commences until the emergence of adults. Seeds containing pre-pupae and pupae were examined, then pre-pupae and pupae were put in the same infested seeds and observed daily until beetle emergence.

Longevity of *B. rufimanus* adults was estimated by storing the infested faba bean samples in glass jars covered with muslin. The longevity was determined by confining the newly emerged adults in glass jars and examined daily until their mortality.

Analysis of variance (ANOVA) and Duncan's multiple range were done as described by Snedecor (1970).

## RESULTS AND DISCUSSION

### The egg stage:

The egg is oval in shape and has light creamy color. The female lays its eggs singly on the green pods. The eggs are adhered on the pods.

### The larval stage:

The larva of *B. rufimanus* has five instars according to the measurements of larval head capsule. Upon hatching, the neonatal larvae entered through the pod wall into the developing seeds leaving dark brown dots in the place of penetration. Larvae feed and bite causing a circular hole inside the seeds very near to the seed surface, these infestation symptoms are shown in Fig.(1).

In general, larva has curved small body with dark brown head capsule and chewing mouthparts. Larva and pupa have light creamy color. The larva is apodous type, The head length is less than the head width.

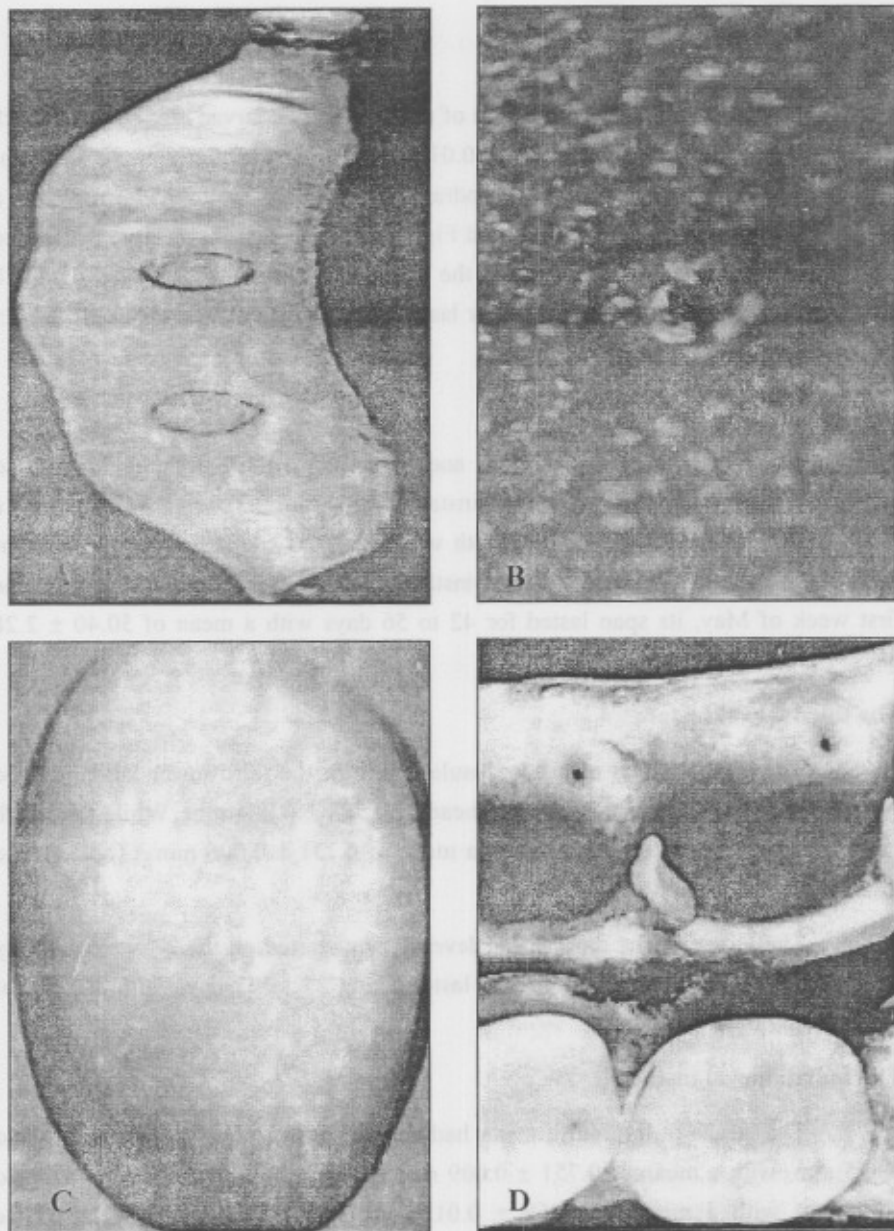


Fig. (1): Different symptoms of broad bean beetles *B. rufimanus* infestation.

- A- Small enter holes on pod bean.
- B- High magnification of small brown dots.
- C- Four dark brown dots on the seed.
- D- Bores inside the bean pod and seeds.

### **The first larval instar:**

The length of the head capsule of newly emerged larvae ranged from 0.128 to 0.256 mm. With a mean of  $0.230 \pm 0.012$  mm. It is interesting that the length of head capsule was smaller than width, and ranged between 0.256 to 0.576 mm. with a mean of  $0.439 \pm 0.025$  mm (Table, 1 and Figs, 2&3). The first instar larva penetrated the bean pods through the period from the 1<sup>st</sup> week of March till 3<sup>rd</sup> week of April, the developing time for this larval instar lasted 14 to 30 days with a mean of  $22.00 \pm 2.67$  days (Table, 2).

### **The second larval instar:**

As shown in Tables (1 & 2) and Figs (2&3), the length of larval head capsule of *B. rufimanus* in the second instar ranged from 0.320 to 0.448 mm with a mean of  $0.336 \pm 0.007$ . While the width was from 0.512 to 0.768 with a mean of  $0.608 \pm 0.014$  mm. The second larval instar started from 1<sup>st</sup> week of April till the first week of May, its span lasted for 42 to 56 days with a mean of  $50.40 \pm 2.28$  days.

### **The third larval instar:**

The measurement of head capsule length of the third instar larvae ranged between 0.512 and 0.675 mm. with a mean of  $0.585 \pm 0.004$  mm. While the width ranged from 0.567 to 0.875 mm. with a mean of  $0.731 \pm 0.006$  mm. (Table, 1 and Figs 2&3).

The larvae of the third instar development started on the 2<sup>nd</sup> week of May continue until the 4<sup>th</sup> week of June, it lasted about 35 to 42 days with a mean of  $38.29 \pm 0.87$  days (Table, 2).

### **The fourth larval instar:**

The larvae of the fourth instar had head length ranging between 0.700 and 0.875 mm. with a mean of  $0.751 \pm 0.009$  mm. The width, ranged from 0.704 to 1.00 mm. with a mean of  $0.869 \pm 0.012$  mm. (Table, 1 and Figs 2&3). The developed time for the fourth larval instar was 42–44 days with a mean of  $43.20 \pm 0.33$  days. It appeared in the 3<sup>rd</sup> week of June till 2<sup>nd</sup> week of August (Table, 2).

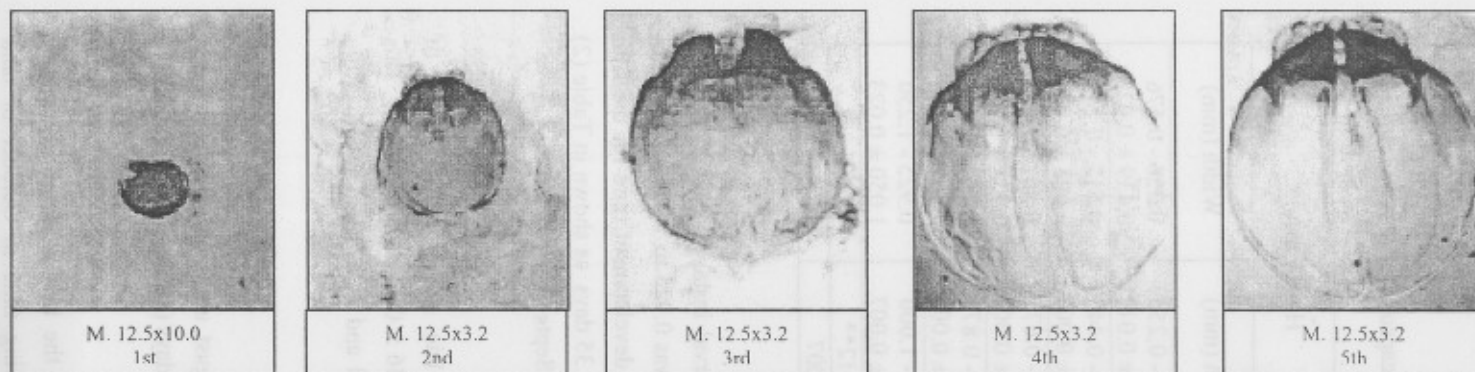


Fig. (2): The head capsules of the five larval instars of *B. rufimanus*

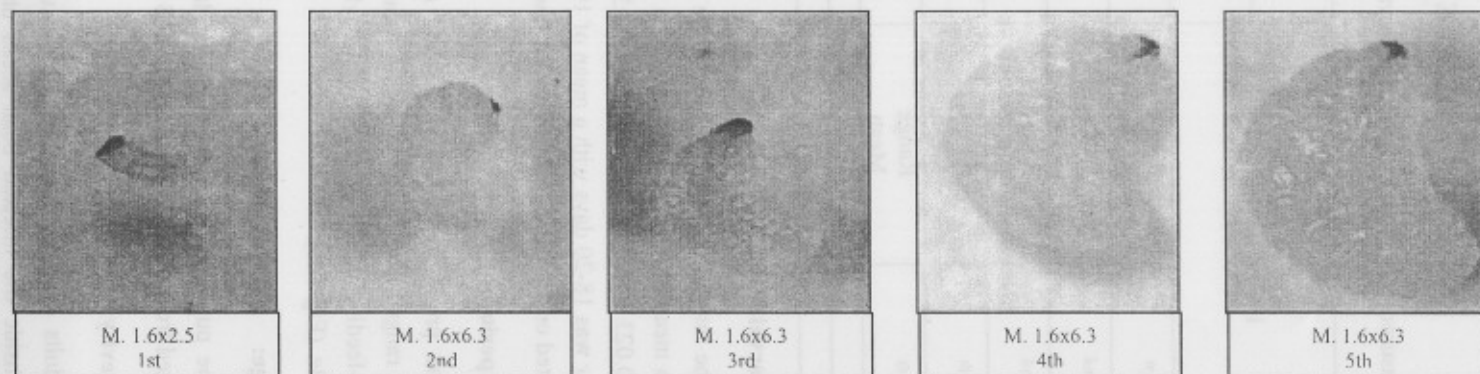


Fig. (3): General view of the five larval instars of *B. rufimanus*

**TABLE (I)**Mean measurements (m.m.) of different larval head capsules of *Bruchus rufimanus*

Larval instars		Head capsule	
		Length (mm)	Width (mm)
1 <sup>st</sup>	Range	0.128 - 0.256	0.256 - 0.576
	Mean	0.230 ± 0.012	0.439 ± 0.025
2 <sup>nd</sup>	Range	0.320 - 0.448	0.512 - 0.768
	Mean	0.336 ± 0.007	0.608 ± 0.014
3 <sup>rd</sup>	Range	0.512 - 0.675	0.567 - 0.875
	Mean	0.585 ± 0.004	0.731 ± 0.006
4 <sup>th</sup>	Range	0.700 - 0.875	0.704 - 1.000
	Mean	0.751 ± 0.009	0.869 ± 0.012
5 <sup>th</sup>	Range	0.900 - 1.000	0.925 - 1.250
	Mean	0.931 ± 0.007	1.050 ± 0.023
F		617.12**	-
L.S.D. 0.05		0.007	-

**The fifth larval instar:**

The lengths of head capsule of the fifth larval instar was 0.900 to 1.000 mm. with a mean of  $0.931 \pm 0.007$  mm. The width was 0.925 to 1.250 with a mean of  $1.05 \pm 0.023$  mm. (Table ,1 and Figs 2&3). The development time for the fifth larval instar was 18-20 days with a mean of  $19.11 \pm 0.35$  days as shown in Table (2) which started on 1<sup>st</sup> week of August till 4<sup>th</sup> week of September .

**Pre-pupal period:**

The pre-pupal period was found during late August till 1<sup>st</sup> week of October. It ranged from 1-2 days with a mean of  $1.46 \pm 0.13$  days (Table, 2). This stage (non-feeding stage) is almost quite cylindrical and pale in color with a big head capsule (Fig 4-A).

**Pupal stage:**

The pupal stage appeared during late August until mid October. Pupal period ranged from 4-6 days with a mean of  $5 \pm 0.22$  days (Table, 2 and Fig 4-B).

**Adult longevity:**

Adults emerged from the pupal exuvia on the first week of September, remained inside the infested bean seeds until sowing time in October or /and

November. Adult stage duration ranged from 169 to 196 days with a mean of  $180.5 \pm 2.99$  days.

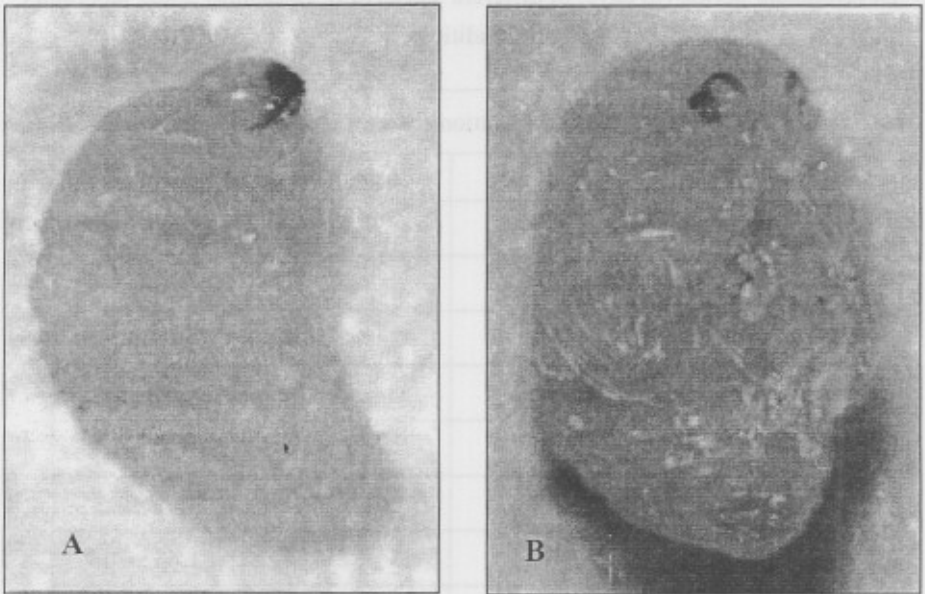


Fig. (4): Lateral view of *B. rufimanus* A- Pre-pupa, B- Pupa. (M.1.0x6.3)

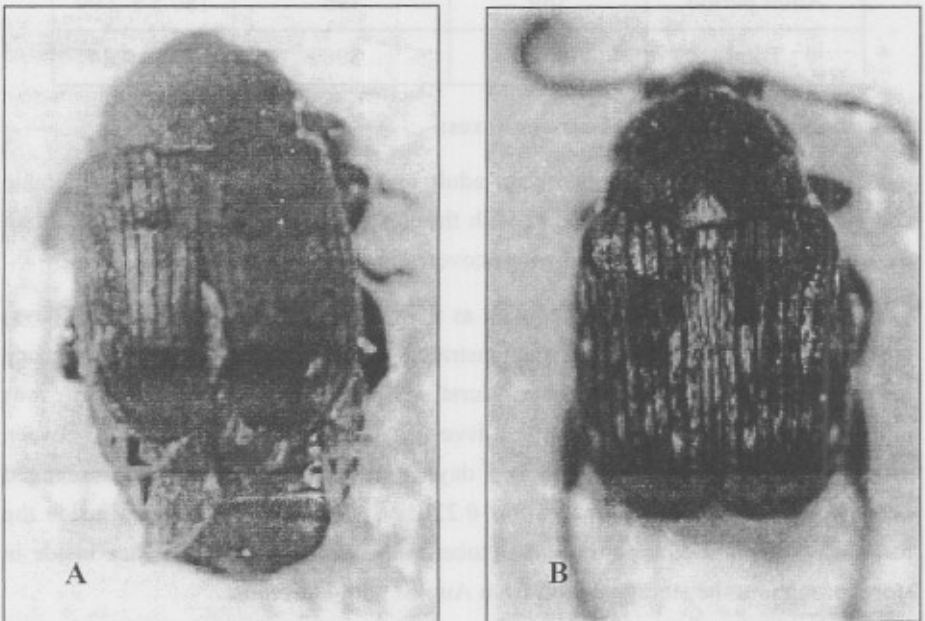


Fig. (5): Dorsal view of the adult of *B. rufimanus* A- the female, B- The male

**TABLE (II)**

Development period (in days) of different stages of *B. rufimanus* under laboratory conditions.

Stages	Duration (in day)		Mean $\pm$ SE
	Minimum	Maximum	
1 <sup>st</sup> larval instar	14	30	22.00 $\pm$ 2.67
2 <sup>nd</sup> larval instar	42	56	50.40 $\pm$ 2.28
3 <sup>rd</sup> larval instar	35	42	38.29 $\pm$ 0.87
4 <sup>th</sup> larval instar	42	44	43.20 $\pm$ 0.33
5 <sup>th</sup> larval instar	18	20	19.11 $\pm$ 0.35
Larval period	151	192	173 $\pm$ 6.5
Pre-pupal period	1	2	1.46 $\pm$ 0.13
Pupal period	4	6	5.00 $\pm$ 0.22
Adult period	169	196	180.5 $\pm$ 2.99
Total	325	396	359 $\pm$ 9.84

#### Morphological differences between sexes:

Adult female is bigger than adult male. In addition, the end of female abdomen is circular and uncovered with the wings because wings are shorter than the abdomen. While in the male, wings covered the whole abdomen (Fig, 5).

Duration of each stage as well as the total developmental period (in days) are shown in Table (2). Data demonstrated that *B. rufimanus* had only one generation per year. The total larval duration, as represented in Table (2), was much longer than the other immature developmental stages which ranged between 151 -192 days with a mean of  $173 \pm 6.5$  days. While the pupal stage duration ranged between 4-6 days with a mean of  $5 \pm 0.22$  days. The beetles remained inside the infested seeds until sowing time in October and November or emergence inside in store throughout the storage period from August until December.

These results are in agreement with those obtained by Mostafa *et al.*, (1986) who indicated that, *B. rufimanus* life span lasted for about  $377.55 \pm 12.2$  days. The



larval stage lasted from 144-155 days with an average of  $149.8 \pm 13.6$  days, while the pupal stage  $12.5 \pm 1.2$  days. The adult stage lasted from 191 to 213 days with an average of  $206.5 \pm 5.2$  days.

El-Shazly (1992) found that the larval and pupal periods were  $164.35 \pm 3.05$  and  $162.85 \pm 4.9$  days on Feve 111 and Alfred bean varieties, respectively.

These results disagree with those obtained by Boughdad and Lauge (1997) who reported that *B. rufimanus* had 4 larval instars. They recorded the pupal stage but the prepupal stage was not mentioned. The duration of larval and pupal periods were about 4 months.

## SUMMARY

Biological aspects of the bean seed beetle *Bruchus rufimanus* were studied in the field and under laboratory conditions for one season (2000/2001).

The total larval duration ranged between 151-192 days with a mean of  $173 \pm 6.5$  days. The pre-pupal period was 1-2 days with a mean of  $1.46 \pm 0.13$  days. The pupal stage ranged between 4-6 days with a mean of  $5 \pm 0.22$  days. Adult stage ranged between 169-196 days with a mean of  $180.5 \pm 2.99$  days. The data demonstrated that the *B. rufimanus* had only one generation per year, and its life cycle lasted for about  $359 \pm 9.84$  days.

## REFERENCES

- BISHARA, S.I.; Y.M.Y. MAGGAG and A.A. RIAD** (1967). Field infestation of broad beans by *Bruchus* in U.R.A. (*Agric. Res. Rev.*, 45 (2): 33-39).
- BOUGHDAD, A. and G. LAUGE** (1997). Life cycle of *Bruchus rufimanus* Boh. (Coleoptera:Bruchidae) on *Vicia faba* var. minor L. (Leguminosae) in Morocco. (*International conference on pests in agriculture*, 6 : 8 January at le corum, Montpellier, France, 3: 793-801).
- DIETRYCH, S.D.; I. MATLOSZ and W. OLESZEKI** (2002). The influence of damages induced by insects of Bruchidae family on some secondary metabolites in faba bean and peas seeds. (*Prog. in Plant Protection*, 42 (2): 706-708).
- EI-SHAZLY, E.A.** (1992). Studies on the relationship between two bruchids, *Bruchus rufimanus* Boh. and *Callosbruchus chinensis* (L.) (Coleoptera : Bruchidae) and their host plant, *Vicia faba* L. (*Unpublished Ph. D. Thesis, Cairo Univ. Egypt*, 165pp.).

- HOWE, R. W. and J. E. CURRIE** (1964): Some laboratory observations on the rates of development, mortality and oviposition of several species of Bruchidae breeding in stored pulses. (*Bull. Ent. Res.*, 55 (3): 437-477).
- MOSTAFA, R.N.; E.A. MOFIAH and M.S. FOUAD** (1986). Field studies on the bionomics of broad bean weevil, *Bruchus rufimanus* Boh. in middle Egypt. Minia (*J. Agric. Res. & Dev.*, 8 (2): 635-644).
- SNEDECOR, G.W** (1970). Statistical method applied to experiments in Agriculture and biology. (*Iowa State Press, U.S.A.*, 534pp).
- WOICIECHOWICZ, Z.E.** (2001). The effect of broad bean cultivars sowing time on the seeds infestation by *Bruchus rufimanus* Boh. (*Veg. Crops Res. Bull.*, 54 (1): 153-158).