SOURCE OF FIELD INFESTATION BY BROAD BEAN BEETLE, *BRUCHUS RUFIMANUS* BOH. (COLEOPTERA: BRUCHIDAE) IN EGYPT

By **EZZ EL DIN A. EL-SHAZLY**

Depart. of Econ. Entomol. and pesticides Fac. of Agric . Cairo Univ.Giza, Egypt

(Received 1-11-2003)

INTRODUCTION

Broad bean, *Vicia faba* L. is widely grown in Egypt and is a main source of dietary protein for citizens. Certain destructive bruchid beetles attack broad bean either, before or during harvest as well as in storage and cause serious economic damage (El-kady and Hekal 1991; Blaszczak *et al.*, 1995 and Sharf El-Din *et al.*, 1999). The broad bean beetle, *B.rufimanus* Boh. (Coleoptera: Bruchidae) is one of the most important pests on broad bean seeds in Egypt and other parts of the world. This beetle is an univoltine species start infestation on broad bean pods in the field, and after harvesting the infestation is transferred inside seeds to stores where development is completed (Darquenne *et. al.*, 1993, Boughadad and Louge, 1997). Two strains of *B.rufimanus* were studied before, European and Meekness. European strain emerges from the harvested infested seeds, which hibernates in seeds or somewhere in the field (under the bark of trees, in lichens, or in cracks in the soil, (Dupont & Huignard, 1990 and Tran & Huignard, 1992). During the following spring adults leave the hibernation sites where they have spent the cooler months and consume pollen and honey, then begin its reproduction, and eggs are deposited on green pods (El-shazly, 1993) thus they have only one generation a year (Yao and Yang, 1985). The infestation behavior and the cause of prolonged of emerged period in Meekness strain (Morocco) were studied by Darquenne *et al,* 1993 and Boughdad &Louge, 1997). In Egypt *B.rufimanus* has attended by very limited investigators e.g. (Bishara *et al.*, 1967, Mostafa *et al,* 1986 and El-kady & Hekal, 1991). Sharf El-Din *et al.*, (1999) did not find any adults inside the storage containers during storage period from May until December. Thus the present work aimed to add some knowledge about this important beetle, particularly: Emergence from infested seeds, mortality inside infested seeds and source of field infestation.

MATERIAL AND METHODS

An area of about 1/25 feddan was sown with recommended commercial cultivar (G2) in the farm of the Faculty of Agriculture-Cairo University. Four replicates, each of 0.01 feddan (42 m2) .the recommended agriculture practices were achieved and no chemical control measures were applied in all treatments. Broad bean cultievar was sown on November 20, during the first season (2000) and Novamber, 27, during the second season (2001). Fifty green pods were collected randomly from each replicate when pods were formed on host plants and until harvest every week. Seeds were examined in the laboratory and divided into two groups infested and none infested seeds.

Emergence of *B.rufimanus* from infested seeds:

About 2 KG infested seeds after harvest in late May were equally divided into 4 replicates of 500 gm. each. They were put in dark glass jars (1L) closed tightly by plastic covers provided with glass tubes to receive any emerging adults. Glass jars were put under light in the laboratory at conditions of 30 + 2 C and 60+5 % R.H., the glass tubes were examined daily to record any emerged adults. This work continued until mid October. Then seeds were dissected weekly and alive beetles were recorded. This work continued to the next late March (about 6 months).

Mortality of *B.rufimanus* inside seeds:

Twenty infested seeds were dissected weekly to determine the percentage of mortality starting from mid October until late March. Seeds were soaked in water one hour before dissection. Insect stages (larvae &adult) inside seeds were counted and recorded.

Source of field infestation:

Two experiments were carried to determine the source of the field infestation. In the first experiment infested broad bean seeds (5 seeds) were seeded in 20 cm plastic pots containing different kinds of soils, (sand, clay, equal parts of sand & clay). Each type of soil was repeated 3 times and pots planted with healthy seeds were included as control. Each pot was covered with muslin cloth to prevent emerged adults from escape. Pots were observed daily to calculate adult emergence. In the second experiment, five infested seeds were placed on a piece of cotton saturated with water inside a Petri dish. Seeds were observed daily and emerged insects were recorded for 10 days. All germinated and none germinated seeds were dissected and *B. rufimanus* adults were recorded. The experiment was repeated 4 times and a cheek.

RESULTS AND DISCUSSION

Emergence of adult beetles:

Fig, (1) illustrates emergence of adults from infested seeds since harvesting and until the end of next March. No insects emerged naturally in laboratory from harvested seeds from May until mid October. After that, (from mid October to late March) insects were observed by dissecting infested seeds except few numbers of beetles which emerged naturally in the last week of January and in the first week of February. The high number of emerged beetles was, from November to February and reached its maximum in December. During this period pods of broad bean are formed on plants in the field. Darquenne *et al.*, (1993) in their study on Meekness strain of *B.rufimanus* returned long time of emergence to climatic factors, in Meekness region (Morocco).Also,Train and Huignard, (1990) found positive relation between plant phonology and *B.rufimanus* activity. Sharf El-Din *et al.*, (1999) did not find any adults inside the storage containers during storage period from May until December. May be condition play a similar role of those in Meekness. These results may be useful in insect control programs.

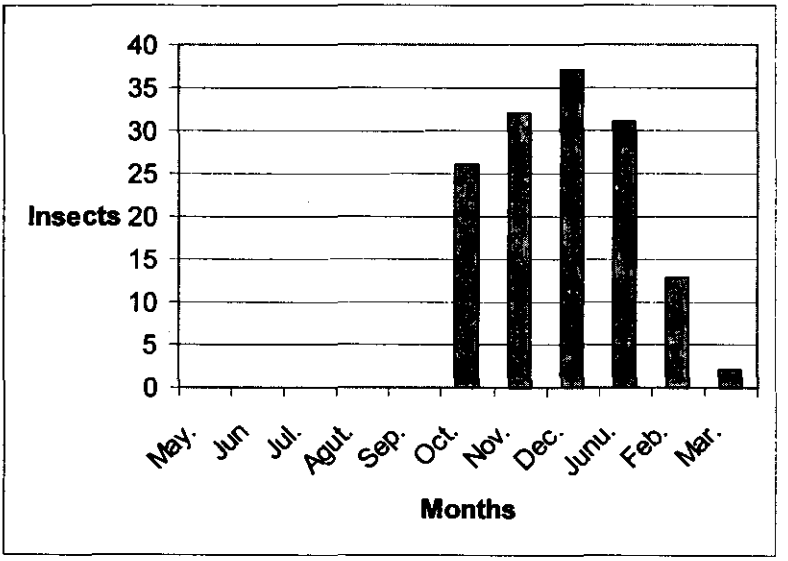

Fig. (1): Emergence of *B .rufimanus* from infested broad bean seeds

Mortality of *B.rufimanus* inside seeds:

Data presented in Table (1) show the number and percentage of larval and adult stages inside seeds. In general high ratios of adults were found alive, while few

of them were dead. Mortality ranged between 0.0 to 35.71%. Mortality mean rates were, 8.42%, 4.37%, 4.16%, 1.39 %, 20.65% and 14.53% during October, November, December January February and March, respectively. Larval stage mortality ranged between 25% to 90.48% and the monthly mean rates were 44.66%, 35.92%, 62.54%, 64.00%, 47.37% and 65.33% respectively during the same period.

TABLE (I)

Mortality of larval and adult stages of *B. rufimanus* inside infested broad bean seeds.

Date	No. pentrated larvae	Mortality				Survival %
		No. larvae	%	No. adult	%	
15.10	22	8	36.36	2	14.28	49.36
22.10	18	9	50.0	1	11.11	38.89
29.10	21	10	47.61	0.0	0.0	52.39
5.11	24	6	25.0	0.0	0.0	75.0
12.11	19	7	36.84	1	8.33	54.83
19.11	19	7	36.84	0.0	0.0	63.16
26.11	20	9	45.0	1	9.09	54.09
1.12	21	10	47.16	0.0	0.0	52.39
9.12	21	13	61.9	0.0	0.0	38.09
16.12	24	12	50.0	5	20.8	29.16
23.12	19	12	63.16	0.0	0.0	36.84
30.12	21	19	90.48	0.0	0.0	9.52
3.01	17	13	76.47	0.0	0.0	23.52
12.01	17	9	52.94	0.0	0.0	47.05
19.01	18	12	66.6	1.0	5.56	27.7
25.01	15	9	60.00	0.0	0.0	40.0
5.02	18	7	38.88	1.0	5.56	55.5
12.02	14	4	28.75	5.0	35.71	35.71
19.02	20	17	85.0	3.0	15	0.0
26.02	19	7	36.84	5.0	26.31	15.78
6.03	18	15	83.33	2.0	11.11	5.55
13.03	25	17	68.00	3.0	12.0	20.0
21.03	20	7	35.0	5.0	25.0	15.0
28.03	20	15	75.0	2.0	10	5.0
Sum.	470	254	--	37	--	--
Mean	1 ,	1 , 8	54.02	1.54	--	--

%Larval mortality (L.M) = number of dead larvae / number larvae x 100
% Adult mortality (A.M.) = number of dead adults / number of adult x 100
% Survival = number of alive larvae + number of alive adults / number pentrated larvae X 100

For larval stage, it was clear that the majority of counted larvae were dead during experiment with general mean of 54.02%, but no alive larvae were recorded. Adult survival was around 50 % from October until January, while it decreased after that to reach 15-20% during March. These results revealed that *B.rufimanus*

complete its development in the seeds to adult stage and remain inside them till the next season. El-Kady and Hekel (1991) mentioned that, the adult of some insects hibernate inside the seeds in the store where only 12.3 5% of them die.

Infestation Source:

Table (2) indicated that emergence from seeds placed on wet cotton started as follows: 25% on the first day and 15%, 30%, and 10% stayed in the infested seeds after 2, 3, and 4 days, respectively; while no other insects were found until the 10th day. After dissecting seeds, the adults were found dead inside them, (about 20 %.)

TABLE (II)

Percentage of *B.rufimanus* adults emerged from seeds grown in wet cotton and three kinds of soil.

Tested materials	Days									
	1	2	3	4	5	6	7	8	9	10
Cotton wet	25%	15%	30%	10%	0.0	0.0	0.0	0.0	0.0	0.0
Sand	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
clay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
clay & sand	0.0	0.0	0.0	0.0	5.0	0.0	0.0	0.0	0.0	0.0

No adults emerged from seeds planted in different soils except 5% only, which left the infested seeds on the 5th. day of planting in clay and sand mixture, (1:1) .When dissecting seeds after this period all adults were found dead. Kamel, (1967) noted that, the adult is formed during September, but stays inside infested seed until plantation in November and emerge when seed becomes wet and the cotyledons separate. Also Darquenne *et al,* (1993) observed beetles (Meekness strain) inside infested seeds and emerged only when seeds were exposed to moisture. While Mostafa *et al,* (1986) mentioned that the main source of field infestation is the infested sown beans .The difference between these results may be due to experimental conditions.

The high ratios of emerged adults are found during November, December, January and February, (the time of mature pods). Train and Huignard, (1992) found clear relation between broad bean plant phenology and *B.rufimanus* infestation in the field. Darquenne *et al,* (1993) indicated that the seeds water content seems to be the main factor inducing adult emergence. These results indicated that *B.rufimanus* adults are not able to emerge from seeds under laboratory conditions, although all adults inside seeds were found alive.

This finding explains why the adult stage did not emerge naturally under laboratory conditions. El- shazly, (1993) found that, the European strain emerged during one month after harvest, then emergence started by the end of July and continued till the begining of September. While in Meekness strain this period lasted a longer time from (September till March). Darquenne *et al,* (1993) observed that, beetles emergence of Meekness strain, Morocco, was only observed after seed exposure to moist atmosphere (70% RH). But in, the European strain emergence took place naturally. The difference between emergence of *B. rufimanus* in Egypt and the other two strains may be due to different weather factors in the mentioned regions. In general complementary studies on *B. rufimanus* in the field are necessary to demonstrate *B. rufimanus* life history under Egyptian conditions also the role of seed hygrometry in its emergence.

SUMMARY

The broad bean beetles, *Bruchus rufimanus* Boh. (Col.: Bruchidae) is one of the most important pests of broad bean in Egypt and other parts of the world. It is an univoltine species, which starts infestation in the field and develops inside infested seeds. Beetles emergence was observed in infested seeds to determine the source of field infestation. No insects emerged naturally under laboratory conditions except few numbers in the last week of January and in the first week of February, although adults were found by dissecting inside seeds. While the majority of larvae were found dead during the experimental period. In the pot experiments only 5% of them emerged from a mixture of sand and clay soil. But when seeds were planted over wet cotton, 80% of adults left infested seeds during the first 4 days. Comparison of data indicate that *B. rufimanus* may have three strains (Egyptian, European and Meekness).

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