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Comparative studies on the susceptibility of various pulses to *Callosobruchus phaseoli* (Gyllenhal) (Insecta Coleoptera Bruchidae)

Abstract - Five species of different pulses were screened in the laboratory for their susceptibility to the bean beetle *Callosobruchus phaseoli* using choice and non-choice tests.The bruchid showed various responses to the seeds with regard to oviposition, larval development and adult emergence. Considering all aspects the insect appears to be adapted to the seeds of *Lablab purpureus* Medik., but did not develop in the seeds of *Phaseolus vulgaris* L. (two varieties).

Zusammenfassung - *Vergleichende Untersuchungen zur Akzeptanz verschiedener Hülsenfrüchte durch* Callosobruchus phaseoli *(Gyllenhal) (Insecta Coleoptera Bruchidae)*

In Wahl- und Nichtwahlversuchen wurde die Wirkung von fünf Arten von Hülsenfrüchten als Nahrung für den Bohnenkäfer *Callosobruchus phaseoli* unter Laborbedingungen geprüft. Die einzelnen Samenarten beeinflußten die Eiablage, larvale Entwicklung und imaginale Schlupfrate unterschiedlich.Unter Beachtung aller Aspekte scheint *C. phaseoli* am besten an die Samen von *Lablab purpureus* Medik. angepaßt zu sein. Der Käfer entwickelte sich nicht in Samen von *Phaseolus vulgaris* L. (zwei Varietäten).

Riassunto - *Esami comparativi sulla suscettibilità di vari legumi all'attacco di* Callosobruchus phaseoli *(Gyllenhal) (Insecta Coleoptera Bruchidae).*

In condizioni di laboratorio sono stati effettuati esperimenti di scelta e non scelta riguardo a cinque specie di legumi come alimento per *Callosobruchus phaseoli.* L'oviposizione, lo sviluppo larvale e la percentuale di schiusa degli adulti sono state influenzate in modo differente dalle diverse specie prese in esame. Nel complesso *Callosobruchus phaseoli* sembra essere più adattato ai semi di *Lablab purpureus* Medik.. Il coleottero non si è invece sviluppato nei semi di due varietà di *Phaseolus vulgaris* .

Key words: *Callosobruchus phaseoli*, susceptibility of various pulses, oviposition, adult emergence, *Lablab purpureus.*

INTRODUCTION

Pulses are the major source of phytoprotein in the human diet for developing countries. They are frequently attacked and damaged by a wide variety of pests, especially insects in the field and under storage conditions. The Bruchidae are an important group of seed infesting beetles (Williams, 1980). In the storage, the infestation causes loss of weight and quality leading to a reduction of the commercial value and seed germination. In the field, infestation reduces mass production. The bean beetle, *Callosobruchus phaseoli* (Gyllenhal), is one of the most injurious bruchid of various leguminous crops. In Bangladesh, it was recorded for the first time of the stored haricot bean, *Lablab purpureus* Medik.(syn. *Dolichos lablab* L.) as a serious pest. The insect is multivoltine in nature and known as an important pest of various kinds of pulses (Warui,1985; Calderon et al. 1988; Parasai & Rawat, 1987; Parsai et al. 1988; Toquena and Fujii, 1992 a, b; Pacheco et al. 1996).

The present investigations were undertaken to find out the susceptibility of different pulses to *C. phaseoli* and determine the most suitable host for culturing of this insect.

MATERIALS AND METHODS

Biological materials

Insect rearing and experiments were conducted in a dark incubator at 30±1°C and 65±5% RH using seeds of *Lablab purpureus* Medik. as normal food, with which larval and pupal periods durate 21-23 days. Five species of pulses were used for comparable studies. These included *Lablab purpureus*, *Vigna radiata* (L.) (Wilcz), *V. unguiculata* (L.) Wulf., *Vicia faba* L., and *Phaseolus vulgaris* L. (variety-1 and variety-2). The seeds were washed in tape water, dried and heated at 65°C for six hours before using for the experiments. *Lablab purpureus* seeds were obtained from Bangladesh and the other seeds were collected from different shops at Hannover, Germany.

The sexes of the beetle were identified and separated by pygidium coloration. In female, the pygidium has dark spots, which are absent in male.

Experimental procedure

To determine the oviposition preference of *C. phaseoli*, choice and non-choice tests were performed using the selected pulse species.

CHOICE TEST : Twenty five grams of seeds of either species were put in small plastic Petri dishes (6.5x1.2 cm diam) and kept in a glass Petri dish (19x5.3 cm diam). In each glass Petri dish, six plastic Petri dishes were placed containing the various species of pulses. Ten pairs of adult insects, up to 24 hours old, were added to the seeds in the Petri dish for laying eggs for a period of five days. After this oviposition period, the insects were removed and the total number of eggs were counted and

recorded. The seeds bearing eggs were transferred to a plastic tube (3.5 cm diam, 9 cm high) and incubated under the same conditions as mentioned before. The emerged adults were counted daily until no more emergence took place. The experiment was replicated four times.

NON-CHOICE TEST : Twenty five grams of either seed species were put in a glass Petri dish (19x5.3 cm diam) as oviposition substrate and ten pairs of insects up to 24 hours old were released for five days for egg laying. After this period, the total number of eggs was counted, recorded and incubated as mentioned before. Four replicates were performed.

In both cases, the percentage of adult emergence was calculated by using the following formula:

$$\text{Percentage of adult emergence} = \frac{\text{number of adults emerged}}{\text{number of eggs laid}} \times 100$$

RESULTS

The results of the choice tests are presented in Table 1. Oviposition was observed in all seeds of the pulse species but with high variation. The highest number (28) of eggs was laid on *Lablab purpureus* seed, the lowest number (<1) was recorded on *Vicia faba* seeds. In other seed species 2-10 eggs were deposited. Adult emergence was maximum (70%) on *Lablab purpureus* and zero (0%) on *Phaseolus vulgaris* (in both varieties). In the other seed species, adult emergence varied from 13-68%.

Results of the non-choice tests are presented in Table 2. The maximum number of eggs (46-47) was recorded on *Lablab purpureus* and both varieties of *Phaseolus vulgaris* and minimum (7) on *Vigna radiata* seeds. Highest emergent rate was quoted (69%) in both *L. purpureus* and *V. unguiculata* seeds. No beetle emerged from seeds of both varieties of *Phaseolus vulgaris*. In *Vigna radiata* and *Vicia faba* seeds emergence of 50 and 23%, respectively, were recorded.

Table 1 - Reproductive potential of Callosobruchus phaseoli *in different pulses using choice test.*

Pulse species	eggs laid/female (mean ± SE)	adults emerged (Mean ± SE)	(%)
Lablab purpureus	28.3 ± 2.3	19.8 ± 2.1	70
Vigna unguiculata	2.2 ± 1.0	1.5 ± 0.8	68
V. radiata	2.1 ± 1.4	0.8 ± 0.6	38
Vicia faba	0.8 ± 0.6	0.1 ± 0.1	13
Phaseolus vulgaris (V1)	10.8 ± 3.6	0	0
Ph. vulgaris (V2)	4.9 ± 1.8	0	0

Data represent means of four replicates.
In each replicate 10 pairs of insects were allowed to lay their eggs for five days.

Table 2 - Reproductive potential of Callosobruchus phaseoli *in different pulses using non-choice test.*

Pulse species	eggs laid/female (mean ± SE)	adults emerged (Mean ± SE)	(%)
Lablab purpureus	46.4 ± 4.6	32.1 ± 3.3	69
Vigna unguiculata	14.0 ± 3.4	9.6 ± 2.2	69
V. radiata	7.2 ± 2.8	3.6 ± 1.5	50
Vicia faba	11.5 ± 5.1	2.6 ± 2.3	23
Phaseolus vulgaris (V1)	46.5 ± 7.1	0	0
Ph. vulgaris (V2)	47.7 ± 6.4	0	0

Data represent means of four replicates.
In each replicate 10 pairs of insects were allowed to lay their eggs for five days.

DISCUSSION

In both choice and non-choice experiments, the results indicated that *Lablab purpureus* seeds were most susceptible to *C. phaseoli*. *Vigna unguiculata* seeds are considered as highly susceptible and *Vigna radiata* and *Vicia faba* seeds are found less susceptible, while both varities of *Phaseolus vulgaris* seeds were resistant. In the latter, no infestation and adult emergence were observed, although eggs were deposited.

Both tests showed that *C. phaseoli* preferred *Lablab purpureus* seed for oviposition. Thus, the beetle is adapted to the food in which its development is most successful. On the other hand, in non-choice tests oviposition was also very high on *Phaseolus vulgaris* seeds, in which no development took place showing that egg-laying is much less influenced by the seed species than development of the beetle.

Under field conditions, Parasai et al. (1988) studied the seasonal appearance of *C. phaseoli* and quoted the maximum of pod and seed damage being at 39.7 and 14.2%, respectively. Parasai and Rawat (1987) reported on the relative susceptibility of 16 varities of *Lablab purpureus* seeds to *C. phaseoli*. Pacheco et al. (1996) studied the resistance of six chickpea genotypes to *C. phaseoli, C. maculatus* (F.) and *Acanthoscelides obtectus* (Say) under storage conditions and found that either genotype can be infested by the beetle. However, in nature *C phaseoli* was found to be more or less host specific.

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