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FEEDING AND OVIPOSITION PREFERENCE OF PULSE BEETLE, *CALLOSOBRUCHUS CHINENSIS* L. ON DIFFERENT GENOTYPES OF BEAN AND ITS CONTROL

N. Akhtari, M. A. Sardar, M. H. Rahman[1], S. M. Z. Abedin and A. K. M. M. Rahman

Department of Entomology
Bangladesh Agricultural University
Mymensingh, Bangladesh

Abstract

Callosobruchus chinensis **had less preference for oviposition on seeds of the small sized bean genotypes with increased egg deposition on medium to large seeded beans. The damage caused by this insect to small seeded genotype was below 10% and 23-31% to medium and large seeded beans. Infested bean seeds without holes but with eggs germinated as nearly close as those of healthy seeds and produced normal seedlings. Of the three insecticides applied on seeds with freshly laid eggs, Diazinon reduced adult emergence substantially at all doses. Malathion and Sevin were found ineffective as ovicidal agents.**

Key words : Bean seeds, Pulse beetle, Ovicidal action.

Introduction

A large number of genotypes of bean (*Lablab purpureus* Linn.) are grown in Bangladesh. *Callosobruchus chinensis* Linnaeus commonly known as pulse beetle is causing heavy damage to stored pulses including this bean (Alam, 1971; Singh *et al.*, 1984; Singal, 1987). The oval shaped and greyish white eggs of the beetles laid on the seed manifest the infestation of *C. chinensis*. Studies on the relative suitability of different pulses for oviposition and development of *C. maculatus* Fabricius and *C. chinensis* have been reported. The varietal susceptibility of pulses like pigeonpea and red gram to *C. chinensis* have been reported by Raghupathy and Rathinswamy (1970) and Singh *et al.* (1984). Recent work on the genotypic diversity of *Lablab purpureus* seeds to *C. maculatus* in India provides information of varietal resistance of this pulse (Vir, 1990).

The chemical control measure against *C. chinensis* is inadequate to protect pulse seeds in the store. Application of dust formulation of insecticides is made as preventive measure against this pest. The present study was carried

1 *Scientific Officer, Entomology Division, Bangladesh Agricultural Research Institute, Gazipur 1701, Bangladesh.*

out to evaluate the feeding and oviposition preference of this pulse beetle on different genotypes of bean and efficacy of some insecticides applied on seeds with eggs as a method of control.

Materials and Methods

Three experiments of pulse beetle, *C. chinensis* using seeds of fifteen bean genotypes (JR-108, DS-112, DS-102, DS-119, DS-65, DS-81, DS-30, DS-136, DS-77, DS-39, DS-52, DS-22, DS-86, DS-45 and DS-20/C) collected from different parts of Bangladesh were conducted in the laboratory of Bangladesh Agricultural University, Mymensingh during May to November, 1990. One of the experiments dealt with the preference of beetle for oviposition on the bean seeds and its subsequent development. The other studies included germination of infested seeds and ovicidal action of some insecticides on the eggs of this insect. Bean seeds of fifteen genotypes were different in respect of shape, size, colour and texture. These characteristics were examined in order to show the variation in beetle infestation. A slide caliper was used to measure the length and breadth of the seeds. The colour was determined visually while the texture which included two grades namely roughness and smoothness was determined by the feeling of touch and eye estimation.

Thirty gramme seeds for each genotype with about 13% moisture were divided into three equal quantities and placed in three different Petri dishes (8.5 cm X 1.50 cm). Fifteen dishes of each genotype were then placed randomly surrounding a large circular tin tray (60 cm X 6 cm) and left without lids. Several newly emerged adults were released in the centre of tin tray and covered the top with a piece of cloth and left free for choice oviposition. There were three such trays were employed to serve as three replications of fifteen genotypes. The dishes were kept undisturbed for a fortnight after which observations were made on the egg deposition on the seeds of the respective dishes. All the released beetles died after laying eggs on the seeds. Dead beetles were removed from the dishes and the top was covered with lids. The number of eggs laid was separately counted for the fifteen genotypes, taking 10 seeds sample at random per replicate. The entire seeds exposed to preference study were used to determine the damage and weight loss. Among the 15 genotypes three genotypes DS-112, DS-30 and DS Assini were tested to examine the effects of beetle infestation on seed germination. Seeds with single hole, with eggs but without hole(s) and normal seeds were used for germination test in the polythene bags.

To determine the ovicidal action on the eggs of *C. chinensis* Sevin 85WP, Diazinon 60EC and Malathion 57EC at 0.075, 0.050 and 0.025% active ingredient (AI) were chosen. Before setting this experiment 10 seeds of DS Assini were placed in a petri dish replicated thrice and five pairs of *C. chinensis* adults were released per dish for oviposition. After two days of oviposition three aforesaid doses of each of the insecticides were sprayed on seeds with eggs in the dishes separately with a mini hand sprayer (Hudson Comet). Water was sprayed in separate dishes containing seeds with eggs of the beetle as control. Emergence of pulse beetle was recorded daily for a month from October 13 to November 11.

Results and Discussion

Oviposition preference of pulse beetle on bean genotypes

The morphological aspects of bean seeds of fifteen genotypes considered for the infestation of *C. chinensis* included the length, breadth, colour and surface smoothness (texture) of seeds. The bean seeds of genotype DS 81 was the largest among the genotypes followed by

DS 52 and 45 (Table 1). Compared to these three genotypes the seeds of DS 136, 30, 86, 22, and 77 were medium and those of remaining seven genotypes were smaller. The female beetles laid small, whitish, oval shaped eggs on the surface of the bean seed. The number of eggs laid per seed ranged from 3 to 33. The smaller seeds of DS 20/C and 119 were found to be the least preferred bean for oviposition, the mean number of eggs per seed being 5.4 and 8.1 (Table 1), respectively. Other smaller genotypes had 11.7-17.2 eggs per seed. The medium and larger genotypes received 12.8-17.4 and 13.8-18.9 eggs per seed, respectively and these categories were highly preferred for egg deposition. This was because the fecundity of *C. chinensis* depended upon the size and quality of seeds. The bigger surface of the large and medium category seeds offered advantages for oviposition of greater number of eggs and the colour of the seed had no definite relation to the oviposition preference of this beetle. The bruchids prefer large and heavy seeds to small seeds (Epino and Regesus, 1983). Booker (1967) pointed out that bruchids have a choice of smooth texture over rough but they seemed to have no colour preference. In *C. maculatus* the factors like weight, volume, colour and texture of the seed coat were responsible for the oviposition preference on eight Indian bean genotypes (Vir, 1990).

Seed damage in different genotypes

The damage caused by the pulse beetle was manifested by egg deposition on seed larval emergence, larval boring into the seed and their subsequent feeding inside. Immediately after hatching the whitish minute larvae moved on

Table 1. Morphological characteristics of bean seeds and oviposition of *Callosobruchus chinensis* on different genotypes.

Genotypes*	Seed size		Seed colour	Seed texture	Eggs laid
	Length (cm)	Breadth (cm)			$\bar{X} \pm SE$ (n=10)
DS 81	1.46	1.26	Brown	Slightly rough	17.7 ± 6.89
DS 52	1.43	1.11	Black	Smooth	17.9 ± 8.01
DS 45	1.42	0.99	Black	Slightly rough	13.8 ± 6.55
DS 136	1.37	1.08	Black	Smooth	15.8 ± 1.91
DS 30	1.34	0.80	Black	Smooth	12.5 ± 5.61
DS 86	1.34	0.98	Brown	Slightly rough	17.4 ± 2.06
DS 22	1.29	1.04	Brown	Smooth	13.7 ± 2.15
DS 77	1.25	0.98	Brown	Smooth	15.3 ± 1.69
DS 20/C	1.18	0.94	Black	Smooth	5.4 ± 7.93
DS 102	1.13	0.94	White	Smooth	11.9 ± 2.89
DS 65	1.09	0.90	Black	Smooth	17.2 ± 8.31
DS 39	1.08	0.78	Black	Slightly rough	12.0 ± 1.85
JR 108	1.02	0.83	Brown	Slightly rough	12.1 ± 3.08
DS 112	0.96	0.71	Brown	Slightly rough	11.7 ± 1.64
DS 119	0.99	0.64	Black	Smooth	8.1 ± 5.24

* DS = Deshi Shim Accession number of genotypes, Department of Genetics & Plant Breeding, Bangladesh Agricultural University, Mymensingh; JR = Japanese Red

the surface of seeds. Observation showed that there were 2-3 larvae found moving on a seed at a time. This was noticed for 1 or 2 days after which the larvae bored into the seeds by making minute holes on the seed surface. The larvae fed on the internal contents of the seed and finally emerged as adult through the holes. The number of holes per seed ranged from 1-4; but single hole per seed was the most frequent phenomenon. Two to three holes recorded in less than one-third of the damaged seeds and as many as 4 holes in few seeds particularly in the largest genotype, DS 81. Heavy infestation by pulse beetle with more than one holes resulted empty seeds. Infestation with single hole per seed could not entirely damage the grain but left then as 'Partially damaged Seed'.

The seed damage of fifteen genotypes ranged from 4.64 to 47.68 per cent and it differed significantly ($P<0.05$) among the genotypes (Table 2). Seed damage in four smaller genotypes (JR 108, DS 112, 102 and 119) was below 10% and considered to be less susceptible to pulse beetle. The damage varied from 14.29 to 18.03% in genotypes, DS 65, 81, 30 and 136 was categorised as moderately susceptible. The higher damage ranging from 23.07 to 47.68% in other seven genotypes was grouped as susceptible. The loss in weight of the bean seeds showed more or less similar trend as the per cent damage. Results indicated that most of the smaller genotypes except DS 20/C were less liable to be attacked by the pulse beetle compared to medium and larger ones. The larger seeds containing higher number of

Table 2. The mean damage of bean seeds in different genotypes by *Callosobruchus chinensis.*

Genotypes	No. of seeds per 30 g	Damaged seeds (no.)	Damaged seeds (%)	Total weight loss (g)	Weight loss (%)
JR 108	194	3.00 bc	4.64 e	1.80 c	6.00 d
DS 112	103	2.33 bc	6.80 d	2.42 c	8.07 d
DS 102	138	4.00 bc	8.70 d	1.95 c	6.50 d
DS 119	140	4.33 bc	9.29 d	2.01 c	6.70 d
DS 65	70	3.33 bc	14.29 bcd	3.80 bc	12.67 cd
DS 81	76	4.00 bc	15.79 bcd	6.70 bc	22.33 c
DS 30	160	9.33 ab	17.50 bcd	4.75 bc	15.83 bc
DS 136	61	3.66 bc	18.03 bcd	5.41 bc	18.03 bc
DS 77	65	5.00 bc	23.07 bc	6.20 bc	20.66 bc
DS 39	167	13.00 abc	23.35 bc	5.18 bc	17.27 bc
DS 52	78	6.33 bc	24.36 bc	7.90 bc	26.33 b
DS 22	88	7.66 bc	26.13 bc	7.33 bc	24.43 abc
DS 86	61	3.66 c	29.50 ab	8.20 bc	27.33 b
DS 45	59	6.00 bc	30.50 ab	9.15 ab	30.50 ab
DS 20/C	151	24.00 a	47.68 a	12.70 a	42.33 a

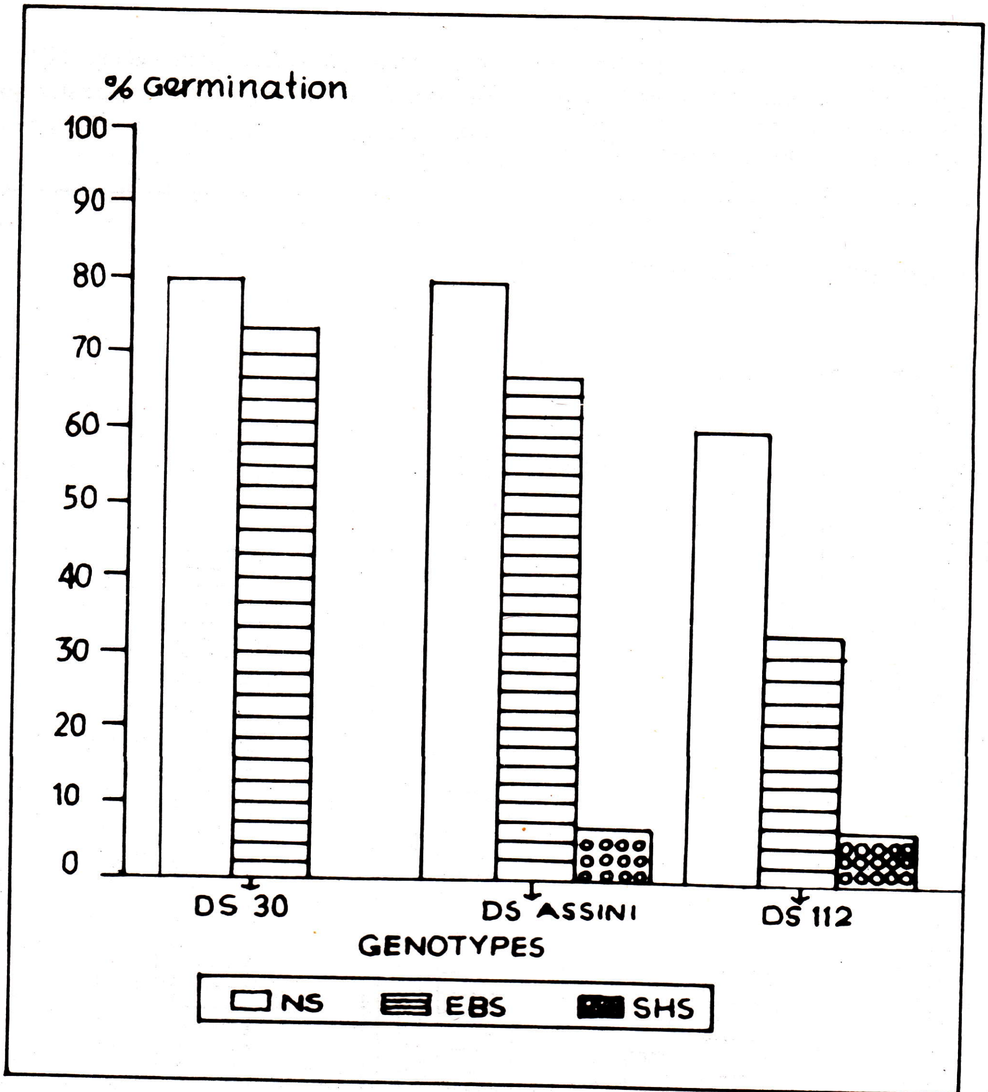

Fig. 1. Germination of normal seed (NS), egg bearing seed (EBS) and single holed seed (SHS) of three bean genotypes.

eggs could cause extensive damage to the seeds compared to small seeded genotypes. This was might be due to normal larval feeding and development inside the larger seeds.

Effect of beetle infestation on seed germination

Sixty to eighty per cent seed germination was recorded in healthy seeds of three genotypes, DS 30, DS Assini and DS 112 (Fig. 1). The germination of seeds with eggs but without holes were 33-73 per cent in these genotypes. This was because all the eggs on the seeds did not hatch and a few larvae reached the adult stage. The undamaged seeds as evident from the absence of holes on the seed coat seemed to be as normal seed and had as much as 70 per cent germination compared to 80 per cent in normal seeds. Thus, the infested seeds without hole might be closed to the normal seeds in quality for planting and consumption. The seeds with single hole had only 6.7% germination in two genotypes except DS 30 which did not have any germination. All the germinated seeds developed apparently as normal seedlings.

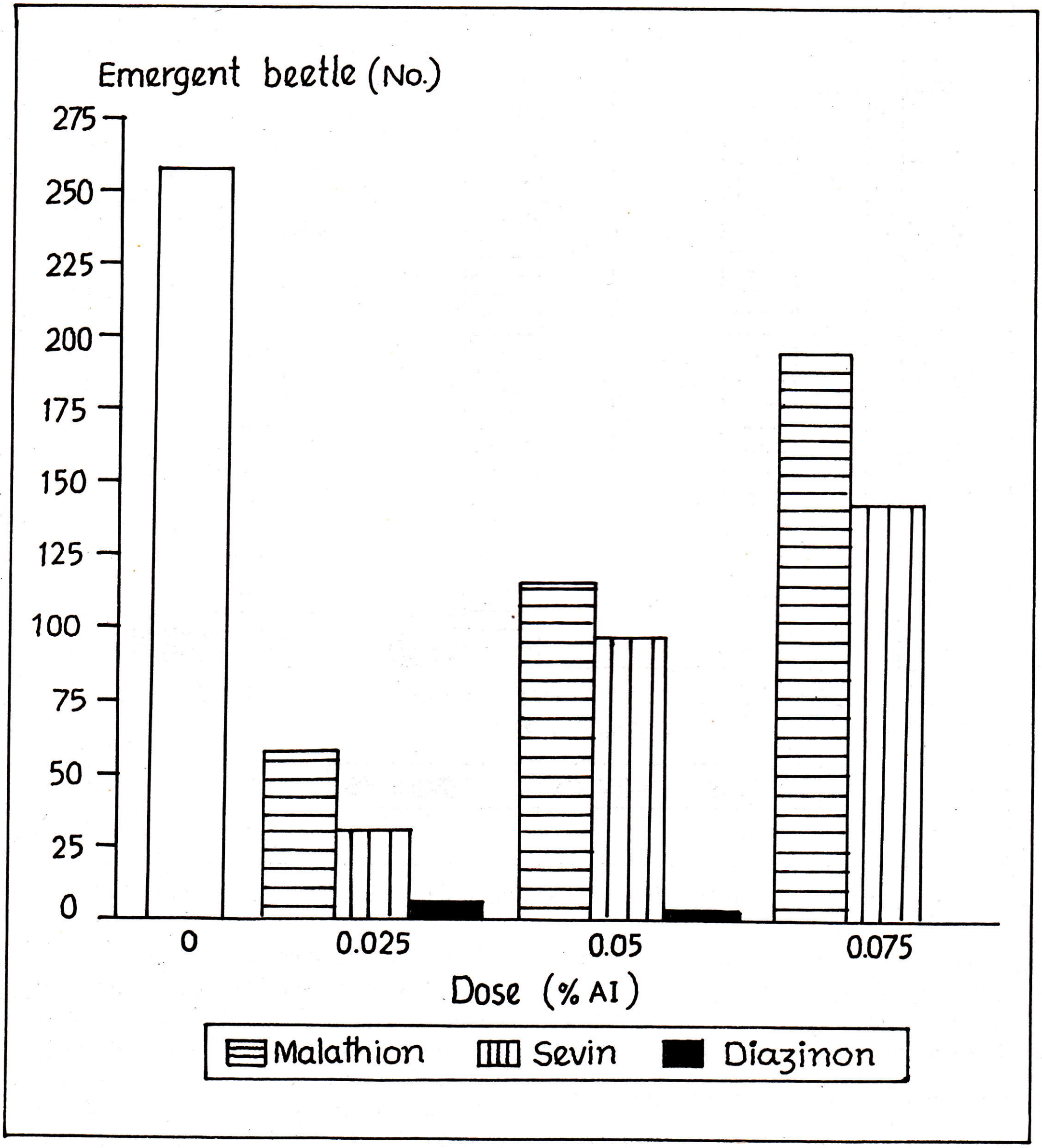

Fig. 2. Ovicidal action of diazinon, sevin and malathion on eggs of *Callosobruchus chinensis* laid on bean seeds.

Ovicidal action on pulse beetle

Diazinon, Malathion and Sevin presumed to have different ovicidal action on the eggs of *C. chinensis.* Based on the data of the adult emergence from the treated bean seeds, it was found that no beetle was emerged from the seeds exposed to Diazinon at 0.075% AI. Only 2 and 4 bettles emerged from seeds exposed to 0.05 and 0.025% AI of Diazinon, respectively (Fig. 2). On the other hand Malathion and Sevin had no ovicidal properties and showed a similar trend of higher emergence of the beetles at higher doses. The number of beetles emerged from Malathion treated seeds was greater than those emerged from Sevin treated ones.

The results indicated that Diazinon was the most effective insecticide in respect of ovicidal action. Malathion and Sevin did not produce ovicidal action thus the number of beetles which emerged from the untreated seeds was close to that of Malathion and Sevin treated seeds (Table 2). Rahman (1990) found very small percentage of egg mortality (2.17%) of *C. chinensis* in Sevin and Malathion treated green gram. The results of the above author did indicate that Malathion and Sevin might have little ovicidal action on *C. chinensis* as compared to Diazinon.

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