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## Studies on the Varietal Preference of *Callosobruchus maculatus* on Soybean Genotypes

Saruchi Sharma and D.R. Thakur

Department of Biosciences, Laboratory of Parasitology and Entomology, Himachal Pradesh University, Shimla, 171005, India

*Corresponding Author: Saruchi Sharma, Department of Biosciences, Laboratory of Parasitology and Entomology, Himachal Pradesh University, Shimla, 171005, India*

### ABSTRACT

A comparative study on the varietal preference and developmental behaviour of *C. maculatus* on thirteen different soybean varieties has been done and results revealed that all the genotypes were highly preferred by *C. maculatus* for egg laying except harasoya which was with intermediate surface texture. On the basis of developmental behaviour among all the genotypes, bragg was totally resistant, Pb-1, shivalik, JS-9305, JS-9560 and harasoya were found relatively resistant while other varieties, JS-335, Him soya, P9-2-2, P2-2, Pk-472, P13-4 and Palam soya were found susceptible to *C. maculatus*.

**Key words:** *Callosobruchus maculatus*, soybean genotypes, seed coat texture

### INTRODUCTION

The cowpea weevil, *Callosobruchus maculatus* (Fabricius) (Coleoptera: Bruchidae) is a cosmopolitan polyphagous pest in tropic and subtropic areas. Knowledge of host, pest and environment interaction is important to know its host range, so that storage planning can be made to avoid infestation among susceptible legume seeds species when stored in one place which will prevent a heavy build of *C. maculatus* population.

It has been suggested that the development of bruchid species depends upon the nutritional value of the seeds. So, the various parameters of bruchid species such as ovipositional behaviour, developmental period and ability of newly hatched larvae to utilize the host for further growth, are affected by host attributes that could exist physically or chemically in nature.

Several commercial insecticides are available for controlling *C. maculatus* but are often too expensive for low resource farmers (Wolfson *et al.*, 1991) and can also contaminate food and pollute the environment. To reduce the over dependence on chemicals for control against bruchids in storage as well as in fields, the search for host plant resistance in legumes has become the option of choice against bruchid attack to reduce the loss. The development and use of resistant genotypes of different legumes offer a simple, cheap and significant alternative against bruchid damage.

Soybean, *G. max* described as "Gold from soil", is a rich source of protein and utilized as pulse, oil, milk and many more. The original home of soybean is China and it was introduced later into India and other countries (Anonymous, 2006). Soybean is grown globally in an area of about 91.0 m ha with the total production of 204 mt and 2297 kg h<sup>-1</sup> productivity. Though, it is comparatively a new crop to India, it occupies an area of 7.20 m ha with a production of 5.85 mt and productivity of 753 kg h<sup>-1</sup> (Jain, 2004).

The present study was undertaken to determine the susceptibility and hence the suitability of some genotypes of soybean against *C. maculatus* aiming at selecting genotypes with inherent resistance and recommend them to breeders and farmers.

## MATERIALS AND METHODS

Samples of thirteen genotypes of soybean genotypes viz., JS-335, JS-9305, JS-9560, bragg, palamsoya, P2-2, Pb-1, himsoya, P9-2-2, shivalik, harasoya, PK-472, P13-4 were obtained from CSK Himachal Pradesh Krishi Vishvavidalaya, Palampur. Experiments were undertaken under controlled conditions of temperature ( $28\pm 2^\circ\text{C}$ ) and relative humidity ( $65\pm 5\%$ ) in biological oxygen demand incubator (DB-2025, Decibel) with ten replications.

For the study of genotype preference, fifty weighed seeds of each soybean genotype were kept separately in petri dishes and two pairs of 1-2 days old adults (2 males and 2 females) of *C. maculatus* were released in them separately. The released insects were removed after 72 h with the expectation of maximum ovulation and oviposition during this period. The numbers of eggs laid on seeds of each genotype were recorded. The experiment was continued for next 60 days to observe the adult emergence and their percentage was recorded as:

$$\text{Adult emergence (\%)} = \frac{\text{No. of adults emerged}}{\text{Total No. of eggs laid}} \times 100$$

The period taken from oviposition to adult emergence was recorded as developmental period. The percent adult emergence divided by the developmental period in days was taken as growth index:

$$\text{Growth index} = \frac{N}{AV}$$

Where:

N = No. of adults emerged

AV = Developmental period

The reduction in weight loss in seed weight (g) was taken after the infestation and it was deducted from the initial weight recorded earlier, before infestation and percent loss in seed weight was calculated for each genotype:

$$\text{Weight loss (\%)} = \frac{\text{Initial weight} - \text{Weight of infected seeds}}{\text{Initial weight}} \times 100$$

Data analysis was done by one way ANOVA.

## RESULTS AND DISCUSSION

Host plant resistance is considered to be an important part of sustainable pest management strategy (Thomas and Waage, 1995). It is particularly effective in reducing post-harvest losses by *C. maculatus*. The data obtained for the present study revealed variations in egg laying and infestation level among soybean genotypes. From the recorded results (Table 1), all the genotypes

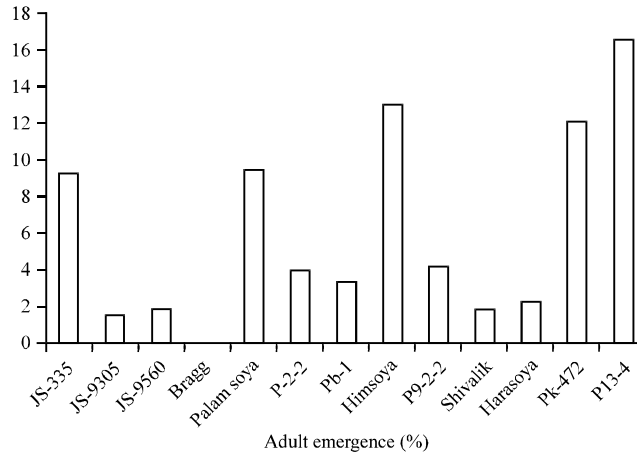


Fig. 1: Percentage adult emergence of *Callosobruchus maculatus* on soybean genotype

Table 1: Growth performance of *C. maculatus* on soybean genotypes

Genotypes	No. of eggs laid	Adult emergence (%)	Developmental period	Growth index	Weight loss (%)
JS-335	86.25±2.75	9.28	35.75±1.50	0.26	6.18
JS-9305	81.75±2.22	1.53	58.25±0.96	0.03	1.47
JS-9560	81.00±2.16	1.85	42.25±2.22	0.04	2.10
Bragg	71.00±2.83	0.00	0.00	0.00	0.00
Palam soya	81.50±1.91	9.51	47.50±1.29	0.20	5.42
P-2-2	80.50±2.38	4.04	54.75±1.71	0.07	3.42
Pb-1	80.75±2.50	3.41	55.00±1.63	0.06	3.41
Himssoya	78.75±1.71	13.02	49.50±1.00	0.26	10.38
P9-2-2	78.00±3.92	4.17	48.00±1.15	0.09	5.87
Shivalik	81.50±1.73	1.84	57.50±0.71	0.03	1.37
Harasoya	58.25±2.50	2.29	56.33±0.58	0.04	2.98
Pk-472	62.00±1.83	12.10	47.75±0.96	0.25	10.34
P13-4	74.00±3.16	16.55	46.00±0.82	0.36	11.22

of soybean were highly preferred by *C. maculatus* for egg laying except harasoya (58.25±2.50). The maximum number of eggs laid on genotype JS-335 (86.25±2.75) which was at par with JS-9305 (81.75±2.22), shivalik (81.5±1.73) and palam soya (81.5±1.91). The variation in egg laying can be attributed to seed coat texture and physical characteristics of the genotypes. In general, egg count have not been shown to be predictive enough in resistance studies as other variables such as percent adult emergence, TDT, growth (susceptibility) index and percent loss in weight (Redden and McGuire, 1983; Jackai and Asante, 2003).

The maximum percentage of adult emergence was recorded in genotype P13-4 (16.55%) followed by himsoya (13.02%), PK-472 (12.10%), palam soya (9.51%) and JS-335 (9.28%) and minimum adult emergence was reported in genotypes shivalik, harasoya and Pb-1 while, bragg genotype was reported to be highly resistant with no adult emergence, though reasonable egg laying was reported on it (Table 1 and Fig. 1).

The developmental period (Table 1) was highest recorded in genotype JS-9305 (58.25±2.96 days) which was on par with shivalik (57.5±0.71 days) followed by harasoya (56.33±0.58 days) and the lowest developmental period was recorded in JS-335 (35.75±1.50 days)

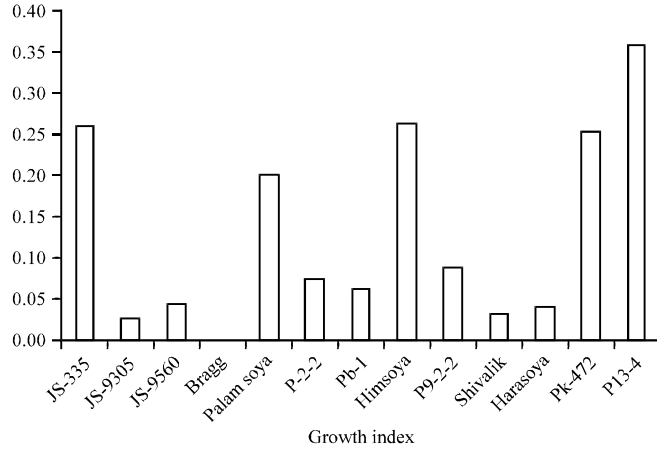


Fig. 2: Growth index of *Callosobruchus maculatus* on soybean genotype

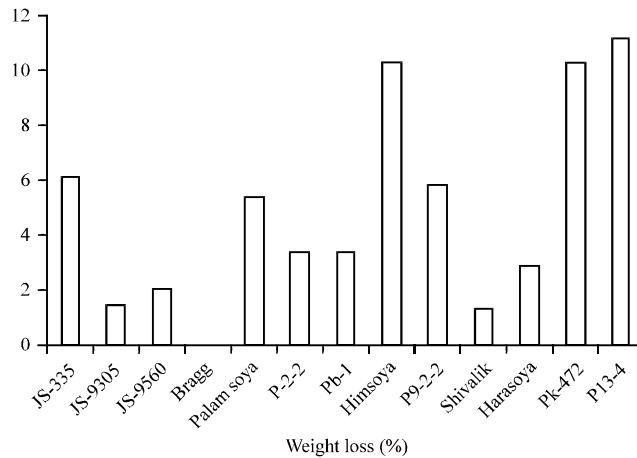


Fig. 3: Percentage weight loss of *Callosobruchus maculatus* on soybean genotype

and JS-9560 (42.25±2.22 days). Similar results were reported by Pessu and Umeozor (2004), who reported the developmental period for soybean as 58±1.0 days and Sharma *et al.* (2007) reported 40.0-50.0 days in JS-335.

The highest growth index was recorded for genotype P13-4 (0.36) (Table 1 and Fig. 2) which was at par with himsoya (0.26), JS-335 (0.26) and PK-472 (0.25) and least growth index was recorded in bragg (0%), shivalik (0.03) and harasoya (0.04).

Maximum percentage weight loss was recorded in genotype P13-4 (11.22%) and himsoya (10.38%) and least weight loss was recorded in genotype bragg (0%), shivalik (1.37%) (Table 1 and Fig. 3).

Among all the soybean genotypes recorded, results revealed that the genotype bragg was totally resistant, Pb-I, shivalik, JS-9305, JS-9560 and harasoya were moderately resistant and other JS-335, palam soya, P-2-2, himsoya, P9-2-2, PK-472 and P13-4 with high percentage of adult emergence and growth index as compared to resistant genotypes were highly susceptible to *C. maculatus*. Similar results for susceptibility, in soybean by *C. chinensis*, were reported by Rajguru *et al.* (2006). Nwanze and Horber (1976) reported that the larval survival during the

penetration is affected by surface texture and structure and larval development within depends on composition of the grain. In addition, in soybean, factors such as high proteins, high amount of fats and presence of antinutritional factor may have been responsible for the death of larvae after the penetration into cotyledons of soybean. Similar results were given by Mphuru (1981). In addition, factors such as poor nutrition, presence of growth deterrents or toxic substances may have been responsible for the death of all or most of the larvae after penetration into the cotyledons of soybean. Wijenayake *et al.* (1999) reported that the compactness of the seed cotyledon may cause difficulties for the larvae to feed resulting in their death due to starvation.

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