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Varietal Susceptibility of Mungbean Genotypes to Pulse Beetle, *Callosobruchus analis* (Fabricius) (Coleoptera: Bruchidae)

FARHEEN DEEBA, MOHAMMAD SARWAR AND RAB DINO KHUHRO

Faculty of Crop Protection, Sindh Agriculture University, Tandojam-70060 (FD, RDK) and Nuclear Institute of Agriculture, Tandojam-70060, Pakistan (MS)

Abstract. - The susceptibility of 5 mungbean (*Vigna radiata* Wilczed) genotypes to pulse beetle, *Callosobruchus analis,* were studied under laboratory conditions. No mungbean genotype was found immune to pest infestation, and they showed different magnitude of weight loss. Based on the criteria of mean pest population and weight loss, genotype No. 25/20 appeared more susceptible, whereas AEM-6/20 was more tolerant/ resistant to bruchids infestation than other genotypes. The peak population of insect and % weight loss were in No. 25/20, followed by L1 P5/5/89, No. 30/5/8/90, AEM-96 and AEM-6/20. The mean grain moisture ranged from 9.94 to 11.37% that was found conducive for pest multiplication. Consequently the insect resistant and high yielding varieties are a gift for alleviation of storage losses and should be used in future breeding programmes.

Key words: Pulse beetle, *Callosobruchus,* mungbean grain, pest resistance.

INTRODUCTION

Pulses are important source of protein and help to meet the most important nutritional need of people. Nutritional scientists in recent years have not recommended the intake of large amounts of foods of animal origin. They have stressed the value of grain legumes as source of protein and fiber, and drawn attention to the complementary nature of their amino acid composition that of the lysine deficient cereal grains. Malik (1994) reported that pulses are good source of proteins; they are good substitute for meat, fish and eggs. Besides proteins, pulses also contain vitamins and minerals and constitute an important article of daily diets for both poor and rich people. In our country, pulses continue to be in short supply; this calls for a review of agricultural policy at national level with some change in emphasis and approach, through which the production of pulses can be greatly increased. Insects destroy at least 5% of the world production of all cereal grains after they are harvested and while they are in storage, on the farms, in elevators or in warehouses. These losses consist of lowered weight and food value, insect adulteration, heating of grains, mould spoilage and low germination of seed.

Mungbean, *Vigna radiata* Wilczed, is extensively grown in Southeast Asia, where it is stockpiled by producers or consumers from the season to season. Pulse beetle, *Callosobruchus analis* (Fabricius) is a major pest of mungbean and other pulses. These beetles are primary pests of this pulse, and if severely infest make the pulse unsuitable for human consumption and planting. Ishimoto *et al.* (1996) recorded various species of bruchids including *C. chinensis, C. maculates* and C. *analis* causing post-harvest damage to important East Asian grain legumes. Singh and Sharma (1982) estimated 47.53-79.60% loss of germination due to damaged grains by the beetle. Raghvani *et al.* (2001) and Patil *et al.* (2003) conducted laboratory experiments using *C. analis* and observations on seeds germination percentage were recorded. Significantly the highest germination percentage of 93.46% was recorded where no pulse beetle was released. A germination level of 61.0% was recorded for seeds stored with 8 pairs of adult beetles. Chakraborty *et al.* (2004) studied the correlation between pest susceptibility and different seed parameters that were significantly and positively correlated with seed weight, but were negatively and significantly correlated with seed coat width. The coefficients of variation for seed weight and seed coat width were less than 20%; thus, both characters may be used as indirect selection criteria for resistance to *Callosobruchus* in mungbean.

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According to some workers, accessions appeared to have bruchid resistance, typically wild mungbean have characteristics of small seed and the presence of a well-formed texture layer on the seed. These characters may act as oviposition deterrents. Consequently, these assays for determining resistance to bruchid infestation may not be suitable for identifying biochemical resistance of some mungbean (Khattak *et al.,* 1987). Since the use of synthetic insecticides or fumigants against this insect is not practicable due to undesirable residues, alternate methods for beetle control are needed. Keeping in view the importance of mungbean grain and damage by pest, studies were carried out on the susceptibility of different mungbean genotypes to *C. analis* under laboratory conditions.

MATERIALS AND METHODS

Five different mungbean genotypes *viz.* 25/20, 30/5/8/90, AEM-96, AEM-6/20 and LIP 5/5/89 were tested against *Callosobruchus analis* from July to October 2004. The culture of *C. analis* and the samples of pure and healthy seeds were obtained from the Agriculture Research Institute, Tandojam. Green gram seed sample, 100 g of each genotypes in 5 replicates, were placed in a 250 ml glass jar, to which 5 pairs of 1–24 hours old, adult pulse beetles (male and female in equivalent proportion) were released. The jars were covered with muslin cloth to facilitate aeration. The sensitivity of these genotypes was appraised by considering the following parameters:

1. All the adults emerged during the entire course of study within the grains of each replicate were counted.
2. The grains of each genotype with powder (frass) were weighed to record the quantity of grain consumed by pest.
3. Grains of each genotype were sieved through 20 mesh sieve, and the frass material was collected and weighed to record total frass weight for each genotype.
4. The grains left over the sieve were weighed to analyze the final grain weight following infestation.
5. Percentage weight losses were calculated by deducting the value of infested grains from the original weight.
6. Moisture contents in grain of each genotype prior to and after the completion of experiments were determined.

The experiment comprising five treatments was replicated five times, observations on adult emergence was recorded at weekly intervals during this process. The prevailing laboratory temperature and relative humidity during the experimental period were 29±2°C and 65±5%, respectively. The data collected were subjected to statistical analysis by using Least Significant Difference Test through computer programming.

RESULTS AND DISCUSSION

Multiple comparisons of different parameters of pulse beetle infestation in different test genotypes of mungbean have been presented in Tables I and II. During present finding no mungbean variety was found completely immune to pest attack. The data in Table I indicates that although overall pest population was non-significant yet their mean values varied in different genotypes. The mean population of adults was high in genotype 25/20 (243), followed by L1 P5/5/89 (198), 30/5/8/90 (196), AEM-96 (195) and AEM-6/20 (186). Hence, genotype AEM-6/20 was observed as tolerant, and 25/20 as susceptible. Seed weight due to pulse beetle infestation on genotype AEM-6/20 was significantly high (50.18 g) followed by AEM-96, 30/5/8/90, L1 P5/5/89, and 25/20 (47.86, 47.40, 46.80 and 44.02 g, respectively. This finding denoted that the least seed consumption occurred in (AEM-6/20, while the highest in case of 25/20.

Quantity of frass weight was the least (1.242 gm) in AEM-6/20, while 1.858 in case of 25/20. Rest of genotypes were in-between these two genotypes ranging from 1.463 to 1.677 g. Final seed weight of AEM-6/20 (48.94 g) was significantly high followed by AEM-96, 30/5/8/90, L1 P5/5/89 and 25/20 showing 46.39, 45.83, 45.13 and 42.17 g, respectively. These results showed that mean population of pulse beetle significantly increased in susceptible pulse grains. Borikar and Pawar (1996) determined the rate of multiplication of *Callosobruchus chinensis,* which was 11.34 times

Table I.- Comparison of different parameters of diverse genotypes of mungbean due to pulse beetle infestation.

Sr.No.	Name of genotypes	Total number of adults emerged	Damaged seed weight (g)	Quantity of frass (g)	Final seed weight (g)
1.	25120	243 A	44.02 B	1.858 A	42.17 E
2.	L1 P5/5/89	198 A	46.80 AB	1.677 B	45.13 D
3.	30/5/8190	196A	47.40 AB	1.577 C	45.83 C
4.	AEM- 96	195A	47.86 AB	1.463 D	46.39 B
5.	AEM- 6/20	186A	50.18 A	1.242 E	48.94 A
	LSD values at alpha 0.050	68.59	4.943	0.059	0.059

Table II. Comparison of percent weight loss and moisture contents (%) of different genotypes of mungbean due to pulse beetle infestation.

Sr.No.	Name of genotypes	Percent weight loss	Initial moisture	Final moisture	Mean moisture
1.	25120	55.98 A	10.84	11.9	11.37 A
2.	L1 P5/5/89	53.20 B	9.97	11.7	10.83 A
3.	30/5/8190	52.60 C	9.94	10.9	10.42 A
4.	AEM- 96	52.14 C	9.82	10.2	10.01 A
5.	AEM- 6/20	49.82 D	9.78	10.1	9.94 A
	LSD values at alpha 0.050	0.4763			1.357

between 2 successive generations in mungbean. Data in Table II shows that mean percentage weight loss was higher in genotype 25/20 (55.98%) and lowest in AEM-6/20 (49.82 %). Rest of genotypes showed intermediate weight loss – AEM-96 52.14%, 30/5/8/90 52.60% and L1 P5/5/89 53.20%. The test genotypes showed different magnitude of weight toss, this could be due to varietal behaviour of genotypes. Further, results revealed that 25/20 produced maximum pest population resulting in maximum loss and appeared to be more susceptible to pest attack than other genotypes. The genotype AEM-6/20 had least overall mean population and comparatively least loss of weight.

Husain *et al*. (1997) carried out laboratory experiments to evaluate 8 different strains/varieties of mungbean for susceptibility to *C. chinensis,* there were13.6% loss in weight of seeds. The size, colour protein content of the seeds had no influence on the susceptibility of mungbean seeds to *C. analis.* Liu *et al*. (1998) carried out experiment on the both artificial and natural infestation of *Callosobruchus.* The rate of damaged mungbean seeds was used as an evaluation index. The green house performance was similar to that in field. Raghvani *et al*. (2001) conducted laboratory experiment using *C. analis,* significantly low (4.70%) damage was observed, where a pair of *C. analis* released. Seed damage was highest (28.14 %) when 8 pairs of pulse beetle were released. Shafique and Ahmad (2002) and Khattak *et al*. (1987) revealed that oviposition, adult progeny development and grain weight loss varied significantly among cultivars/promising lines of various pulses. Sadozai *et al*. (2003) determined the shortest developmental period of 19.2 days, while the longest (23 days) of pulse beetle, *C. maculatus.* Adult emergence, percent damage and percent weight loss were highest in green mungbean (28.6, 79.55 and 36.64%). Our conclusions are more or less identical to the above researchers.

The data indicated that moisture % in all genotypes at the beginning of experiment ranged between 9.78 to 10.84%, and at the end, it was between 10.1 to 11.9%. The highest moisture content (1.37%) was in 25/20 that demonstrated comparatively more susceptibility (55.98% weight loss). The minimum moisture content (9.94%) was however, noted in AEM-6/20 that showed tolerance

(49.82%) against pest. The results indicated that the moisture contents of grains in different genotypes definitely played some role in the susceptibility to insect pest.

The present genotypic response observations are in conformity with most of the previous workers (Khattak *et al.,* 1987; Ranganath and Ram, 1992; Shafique and Ahmad, 2002). This vital information will assist in devising the control procedures against this legendary pest of mungbean as well as other pulses. The expansion of insect resistance and high yielding varieties having moderate to high levels of resistance is a promising approach for exploration of integrated pest management strategy.

REFERENCES

BORIKAR, P. S. AND PAWAR, V. M., 1996. Life fecundity tables for pulse beetle, *Callosobruchus chinensis* (Linnaeus) infesting mungbean, *Vigna radiate* (L.) Wilczek. *J. entomol. Res*., **20**: 59-65.

CHAKRABORTY, S., CHAUDHURI, N. AND SENAPATI, S. K., 2004. Correlation between seed parameters and relative susceptibility of mungbean *(Vigna radiata* L.) genotypes to *Callosobruchus chinensis* L. during storage. *Annls Plant Protect. Sci*., **1**: 48-50.

HUSSAIN, M., ROY, G. C. AND HUSAIN, M., 1997. Laboratory evaluation of some mungbean strains for susceptibility to pulse beetle, *Callosobruchus analis* (F.). *Bangladesh J. Ent.*, **7**: 211-216.

ISHIMTO, M., SATO, T., CHRISPEELS, M. J. AND KITMURA, K., 1996. Bruchid resistance of transgenic azuki bean expressing seed alpha-mylase inhibitor of common bean. *Ent. Exp. Appl*., **79**: 309-315.

KHATTAK, S.U.K., HAMED, M., KHATOON, R. AND MOHAMMAD, T., 1987. Relative susceptibility of different mungbean varieties to *Callosobruchus maculatus* (F.) (Coleoptera: Bruchidae). *J. Stored Prod. Res*., **23**: 139-142.

LIU-XUMING, JIN-DASHENG, CHENG-XUZHEN, WU-XIAOFEI, WANG-SUHUA, X.M., LIU, D. S., JIN, X. Z., CHENG, X. F. W. AND WANG, S. H., 1998. Primary evaluation on their resistance to *C. chinensis* in mungbean germplasm. *Crop Genet. Resour.*, **2**: 35-37.

MALIK, B.A., 1994. *Grain legumes*. National Book Foundation, Islamabad, pp. 227-326.

PATIL, S.K., TANPURE, S.V. AND MATE, S.N., 2003. Effects of different levels of pulse beetle [*Callosobruchus maculatus* (Fab.)] infestation on chickpea during storage. *Seed Res*., **31**: 119-120.

RAGHVANI, K. L., JUNEJA, R. P., BUHECHA, K. V., GODHANI, B. G. AND MAKWANA, P. M., 2001. Relationship between insect population of *Callosobruchus analis* F. and level of infestation in green gram. *Insect Environ*., **6**: 83-84.

RANGANATH, H.R. AND RAM, T., 1992. Relative susceptibility of mungbean to the pulse beetle *Callosobruchus maculatus* (F.). *J. Andaman Sci. Assoc*., **8**: 103-105.

SADOZAI, A., INAYATULLAH, M. N., SHAH, M. AND ALI, A., 2003. Host preference of pulse beetle *(Callosobruchus maculates)* (F.) (Coleoptera: Bruchidae) in different legumes. *Sarhad J. Agric*., **19**: 557-561.

SHAFIQUE, M. AND AHMAD, M., 2002. Screening of pulse grains for resistance to *Callosobruchus analis* (F.) (Coleoptera: Bruchidae). *Pakistan J. Zool*., **34**: 293-296.

SINGH, D.P. AND SHARMA, S.S., 1982. Studies on grain damage and germination loss caused by *Callosobruchus maculatus* (F.) in different varieties of moong and mash during storage. *Bull. Grain Technol.,* **20**: 20-24.

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