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Varietal Susceptibility and Assessment of Losses Caused by Pulse Beetle *Callosobruchus Chinensis* (L.) in Green Gram Under Laboratory Conditions

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The susceptibility of six green gram (*Vigna radiata* W.) varieties and quantitative losses due to pulse beetle, *Callosobruchus chinensis* L., were studied under laboratory conditions. No green gram varieties were found immune. They showed different magnitude of weight loss. The lowest weight loss was observed in variety HUM-12, HUM-1 with 30.20, 31.83, respectively and lowest percent germination loss was observed in variety HUM-2, HUM-16 with 2.50, 2.70, respectively. The mean seed damage and weight loss was 8.98 and 8.26 per cent, respectively after 30 days. This was increased with the storage duration resulting in 99.99 and 48.62 per cent, respectively after 120 days of storage. The population of pulse beetle and Percent germination losses was increases with increasing storage duration.

Keywords: Green gram, pulse beetle, quantitative losses, seed damage and weight loss.

A number of insect-pests attack the stored grains, seeds and other products. Among the important insect pests of stored grain, the pulse beetle, *Callosobruchus chinensis* L. (Bruchidae: Coleoptera), causes substantial losses to the pulses in the storage (Alam, 1971 and Righi-Assia et al., 2010) though the initial infestation occurs in the field itself. It causes weight

loss, decreased germination potential and reduction in commercial value of the seed (Booker, 1967 and Okunola, 2003). It is a serious pest of peas, mung beans, cowpeas and lentil (Ahmed *et al.*, 2003). In India, there are about 200 species of pest insects which cause damage to stored grains and grain products in storage. *Callosobruchus chinensis* L. *is a major* economically important pest of all pulses and causes 40-50% in losses of pulses storage (Gosh *et al.*, 2003). Resistant cultivars/ varieties have become a crucial element in the success of many on-going insect pest management programmes. One of the most promising ways to reduce dependence on pesticides in agriculture is to plant insect resistant cultivars, which is one of the most effective, feasible, economical and environmentally safe pest management tactics (Pedigo, 1996) and fully justifies the upcoming WTO regulations. The present study was undertaken to find out green gram cultivars having resistance against pulse beetle and quantitative losses caused by pulse beetle at different storage intervals.

MATERIALS AND METHODS

Test insects and maintenance

The nucleus culture of the test insect was obtained from storage laboratory, Department of

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Entomology and Agricultural Zoology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The Pulse beetle, *Callosobruchus chinensis* L. was used for the present experiment. A small population of *C. chinensis* beetle was reared and breed under laboratory conditions, on diet of the green gram seed. Initially 50 pairs of 1-2 days old adults were placed in a jar containing green gram seeds. Jars were sealed and allowed for mating and oviposition. The subsequent progenies of the beetles were used for all experiment.

Varietal Susceptibility

To study the varietal susceptibility of green gram varieties *viz.*, HUM-1, HUM-2, HUM-6, HUM-12, HUM-16, and HUM-27 were obtained from the Department of Genetics and Plant Breeding Institute of Agricultural Sciences, BHU, Varanasi. The pulse beetle infestation is compared with local variety of green gram.

Quantitative losses

Quantitative losses caused by the pulse beetle in stored green gram were determined. The details are given as under.

Experimentation

The seeds of green gram were disinfected and cleaned. A lot of 500 g seeds were taken in glass jar of 2 kg capacity for observation of per cent seed damage, Weight loss, population build up. Four set of jars in three replications were prepared with 500 g seed in each. These jars were covered with muslin cloth.

Five pair of 0-24 hour's old adults of *C. chinensis* was released in each glass jar. Adults were allowed to lay eggs for multiplication. The jars were placed at the room temperature in the storage laboratory. The observations were taken at an interval of 30, 60, 90 and 120 days.

Seed Damage

Ten gram seeds were taken from the jar of each replicate. The damaged seeds were separated out from the total number of seeds taken for observation in each replication. The data taken were used for calculating the percentage of damaged seed. The following formula was used for determination of per cent damage as described by Adams and Schuten (1978).

$$\text{Percent seed damage} = \frac{\text{Number of holed seeds}}{\text{Total number of seeds counted}} \text{ X } 100$$

Weight Loss

After removing the beetles from each jar the weight of seeds were taken separately on weighing balance from each replicate after one, two, three and four months. The per cent loss in weight was calculated by the following formula.

$$\text{Percent weight loss} = \frac{I-F}{I} \text{ X } 100$$

Where,

I = Initial weight of seeds

F = Final weight of seeds

Population Build up of the Beetles

Adults in the experimental containers were anaesthetized with chloroform and separated from experimental jars with the help of camel hair brush in an enamel tray. The adults inside the seeds were removed with the help of a needle. The total number of adults so obtained was recorded.

Germination Loss

The viability of seeds was tested after four months of storage. Each set was replicated three times. Seeds were placed on moist filter paper in Petri dishes and observed the germination of seeds. From the each set 50 seeds was collected randomly and placed in Petri dish lined with blotting paper. These Petri dishes were kept at room temperature for six days to allow sufficient time for all the seeds to germinate. Water was poured regularly to prevent drying. The number of unsprouted seeds was counted and the per cent germination loss was calculated by the formula.

$$\text{Per cent germination loss} = \frac{\text{Number of unsprouted seeds}}{\text{Number ofseeds kept for germination}} \text{X}100$$

RESULTS AND DISCUSSION

Varietal Susceptibility of green gram against *C. chinensis*

Weight losses

The per cent weight loss among different mungbean varieties was statistically significant over local varieties. The weight losses in different varieties were ranged in between30.20 to 46.06 per cent. Lowest weight loss (30.20%) was observed in HUM -12 followed by HUM -1 (31.83%) as shown in (table 1). The maximum net weight loss observed in variety HUM -16, 46.06 per cent as compare to local variety 48.60 per cent.

Germination losses

The screening of green gram varieties shows lowest per cent germination loss in HUM-2

(2.50%) and HUM-16 (2.70%). The rest of the varieties per cent germination losses were ranged between 12.33 to 30.43 per cent as compare to local variety (95.52%) after four months of storage period

Quantitative losses

Seed Damage

The results of seed damage (table 2) depicted that the insect infestation caused 8.98 per cent damage after 30 days of release which increased with the storage duration resulting in almost per cent after 120 days. All the observations were found highly significant to each other. A substantial increase in damage was observed after 60 days of storage (56.58 %), whereas, it reached 90.68 per cent after 90 days of storage and in 120 days it reaches upto 99.99 per cent. The results are in conformity with Doharey *et al.* (1987) also observed the same trend in seed loss by *C. chinensis* with an initial loss of 1.35 per cent, gradually increasing to 99.91 per cent after 120 days of storage period. Similar result was found by Venkatesham *et al.* (2014).

Weight Loss

The per cent loss in weight of green gram increased with the advancement of storage period because of relative increase in the population of insects. The result (table 2) revealed that 8.26, 18.04, 40.25 and 48.62 per cent weight loss of grains was inflicted after 30 days, 60 days, 90 days and 120 days of insect infestation, respectively. Increase in per cent loss between 1-2 and 3-4 months was 9.78 and 8.37 per cent respectively. A highly significant variation was observed in weight loss after 30, 60, 90 and 120 days of storage. Doharey *et al.* (1987) reported that weight loss caused by *C. chinensis* was 0.62, 16.74, 25.56, and 43.26 per cent after 30, 60, 90 and 120 days of storage period, respectively. Similar results were

Table 1: Screening of different green gram varieties per cent weight losses and germination losses after four months of storage

Green gram varieties	Per cent weight loss after four months**	Per cent germination loss after four months**
HUM -1	31.83 (34.31)	24.10 (29.38)
HUM-2	44.00 (41.53)	2.50 (8.96)
HUM-6	34.30 (35.81)	16.33 (23.82)
HUM-12	30.20 (33.32)	30.43 (34.56)
HUM-16	46.06 (42.72)	2.70 (9.25)
HUM-27	42.06 (40.41)	12.33 (20.54)
LOCAL VARIETY	48.60 (44.18)	95.52 (78.13)
SEm±	0.76	1.181
CD at 5%	2.33	3.618

** mean of three replications; Figures in parenthesis are arc sine values

Table 2: Effect of the pulse beetle infestation under different storage period on seed damage and weight loss in green gram.

Storage period (Days)	Per cent seed damage**	Per cent weight loss**
30	8.98 (11.01)	8.26 (9.62)
60	56.58 (48.26)	18.04 (15.91)
90	90.68 (72.39)	40.25 (31.80)
120	99.99 (77.20)	48.62 (33.65)
SEm±	0.865	0.822
CD at 5%	2.696	2.562

** mean of three replications; Figures in parenthesis are arc sine values

observed by Anandhi *et al*. (2008) and Venkatesham *et al.* (2014).

Population buildup of Beetles

The mean number of pulse beetles observed at different period after infestation in green gram is presented in table 3. Significant differences in population of pulse beetles at different time interval during storage in green gram was observed. The no of beetles varied from 164.86 to 3011.12 during 30 to 120 days of storage after initial infestation. The population grading increased in green gram and reached the peak level 120 days after initial infestation. Maximum beetle were 3011.12 in green gram during the fourth month storage of infested grains. Thus it showed 164.84, 1286.15, 2013.57 and 3011.12 fold increase in beetle population after 30, 60, 90, and 120 days of storage in green gram. Daniel *et al***.** (1977) have reported greater population buildup of *C. chinensis* in chickpea as compared to pigeon pea.

Table 3: Population buildup of C. chinensis and germination losses in green gram after different storage periods

Storage period (Days)	Mean number of pulse beetles**	Per cent germination loss**
30	164.84 (6.10)	28.45 (31.97)
60	1286.15 (8.15)	76.02 (63.43)
90	2013.57 (6.60)	93.45 (76.22)
120	3011.12 (9.00)	99.73 (77.01)
SEm±	4.897	1.067
CD at 5%	19.304	3.325

** mean of three replications
Figures in parenthesis are arc sine values

Germination Losses

The data on germination loss (table 3) depicted that there was adverse effect of insect infestation on germination percentage of green gram seeds after different storage periods. The loss in germination was 28.45, 76.02, 93.45 and 99.73 in green gram after 30, 60, 90 and 120 days of storage period, respectively showing a very high variation of significance. On an average 47.57 per cent germination loss was experienced between first and second month. During the subsequent two months storage period, the rate of loss in germination percentage had decreased to 17.43 and 0.28 per cent. Thereafter, almost cent per cent loss was observed in the fourth month of storage. Similarly, Doharey *et al.* (1987) observed 5.0, 26.0, 98.0 and 100.0 per cent loss in germination by *C. chinensis* in black gram seeds after 30, 60, 90 and 120 days of storage period respectively. Jotwani and Sircar (1964) recorded that the germination per cent loss in 1, 2, 3 and 4 grubs developed in seeds after one two four months were 39.9, 79.5, 94.5 and 100 per cent, respectively.

REFERENCES

1. Adams, J.M., Schuten, G.G.M. Post harvest grain loss assessment method. American Association of Cereal chemist, 1978; 193.
2. Ahmed, K.S., Itino, T., Ichikawa, T. 2003. Duration of developmental stages of *Callosobruchus chinensis* L. (Coleoptera: Bruchidae) on azuki bean and the effects of neem and sesame oils at different stages of their development. *Pakistan Journal of Biological Sciences*, 2003; **6**: 932-35.
3. Alam, M.Z. Pests of stored grain and other stored products and their control, Bangladesh: 1971; pp 361.
4. Anandhi, P., Varma, S., Sarvanan, L. Estimation of losses and evaluation of different storage containers against pulse beetle, *Callosobruchus chinensis* Linnaeus in Bengal gram. *J. Insect Science*, 2008; **21**(1)**;** 40-43.
5. Booker, R.H. Observation on three bruchids associated with cowpea in Northern Nigeria. *Journal of Stored Product Research*, 1967; **3**: 1-15
6. Daniel, V.A., Rajan, P., Sanjeevarayappa, K.V., Srinivasan, S.K., Swaminathan, M. (1977). Effect of insect infestation on the chemical composition and protein efficiency ratio of the protein of bengal gram and red gram. *Indian J. Nutri. Dielet*., 1977; **14**: 70-73.
7. Doharey, R.B., Katiyar, R.N., Singh, K.M. Studies on the seed damage, weight and germination loss caused by pulse beetle in green gram *Vigna radiata (L.)*Wilczek. *Bull Grain Tech.*, 1987; **20**(1): 12-16.
8. Gosh, S.K., Durbey, S.L. Integrated management of stored grain pests. International book distribution company, 2003; 263.
9. Jotwani, K., Sircar, A. Studied the extent of

damage and germination loss caused by *C. maculatus*. *Stored Product Journal*, 1964; **37**(6): 334-34.

10. Okunola, C.O. Use of melon oil for the control of bruchid damage in cowpea. *Proceedings of African Crop Science Society,* Ondo State Nigeria, 2003; **6**: 238-40.
11. Pedigo, L.P. *Entomology and Pest Management*. Prentice-Hall Inc., 1996; pp 679.
12. Righi-Assia, A.F., Khelil, M.A., Medjdoub, B.F., Righi, K. Efficacy of oils and powders of some medicinal plants in biological control of the pea weevil (*Callosobruchus chinensis* L.). *African Journal of Agricultural Research*, 2010; **5**: 1474-81.
13. Venkatesham, V., Meena, R.S. Laichattiwar, M.A. Efficacy of some botanicals against pulse beetle, *Callosobruchus chinensis* (L.) in chickpea. *The Ecoscan* (Special issue), 2014; **VI**: 403-406.