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Relative Susceptibility of Greengram Cultivars to Pulse Beetle, Callosobruchus chinensis (Bruchidae: Coleoptera)

Key words : *Callosobruchus chinensis*, Greengram, Susceptibility

Grain legumes have important roles in food and nutritional security and sustainable crop production (Sharma *et al.,* 2008). Greengram [Vigna radiata (L.) Wilczek] is one of the important pulses grown in Andhra Pradesh throughout the year. During storage, greengram suffers quantitative and qualitative losses from the attack of pulse beetle, Callosobruchus chinensis (L.) (Bruchidae: Coleoptera). The reaction of many of the commonly cultivated greengram varieties to *C. chinensis* following long storage is not known. Hence, a laboratory experiment was conducted to find out the relative susceptibility of different varieties of greengram to pulse beetle at Agricultural Research Station, Ghantasala, Andhra Pradesh during 2009.

The seed was obtained from the Regional Agricultural Research Station, Lam and multiplied during Rabi, 2008. A total of 6 cultivars namely; LGG 407, LGG 410, LGG 450, LGG 460, TM 96-2 and Neelalu (local variety) were taken for the study. Adult beetles of C. chinensis were obtained from the stock culture maintained in plastic jars of one litre capacity containing greengram seed. The mouth of the jar was covered with muslin cloth and fastened tightly with the help of a rubber band. The insects emerged from this culture were used for the experiment.

Infestation free, sound and healthy greengram seeds of each variety were sun dried for 3 days. Seed (200 g) of each variety was taken in a glass jar and infested with 5 mated pairs of *C. chinensis.* While collecting the adults from stock culture, they were kept in deep freeze for few minutes in order to inactivate and count. After introducing the bruchids, the mouth of the jar was covered with muslin cloth and tightly secured with rubber band. Such jars were replicated four times under normal room temperature. Simultaneously, another set of jars with 100 g of seed of all the test varieties was maintained under protected conditions without infestation in similar conditions to observe per cent germination and 100 seed weight of each sample at the end of the experiment.

After allowing seven days for oviposition, the number of eggs laid 10 seeds^{-1} was observed. Later, per cent grain damage, population build up, loss in grain weight and loss in germination was observed after 90 days. Damaged seeds were counted for each treatment by drawing a sample of 100 seeds at random, three times from each jar and adults were counted from 100 g of sample by deep freezing for about five minutes and sieved. Loss in seed weight was computed using the formula as suggested by Harris and Limblad (1978).

$$\text{Per cent weight loss} = \frac{\text{O.W.-C.W.}}{\text{O.W.}} \times 100$$

Where; O.W. = Original weight on dry weight basis
C.W. = Current weight on dry weight basis.

Similarly, germination test was also conducted at the end of the experiment for both infested and uninfested seed and loss of germination was computed. The relative infestation of C. chinensis among the varieties was analysed and the means were compared based on least significant difference (LSD) at P= 0.05.

Significant differences were noticed in the oviposition by *C. chinensis* among different greengram varieties (Table 1). The TM 96-2 (30.00 eggs 10 seeds^{-1}) received the highest number of eggs followed by LGG 450 (19.25 eggs 10 seeds^{-1}). The local variety Neelalu (10.25 eggs 10 seeds^{-1}) recorded the least number of eggs among all the varieties. Similarly the number of adults emerged from 100 g of grain was also the lowest in case of Neelalu (224.0) and the highest in TM 96-2 (443.25). Among all the varieties, TM 96-2 (42.00 %) suffered highest grain damage and Neelalu (16.75 %) suffered the least. Per cent loss in grain weight was highest in TM 96-2 (25.49) while it was least in Neelalu (8.11). Loss in germination due to bruchid infestation was also highest in TM 96-2 (60.28 %). LGG 460 (20.06 %) had lowest germination loss followed by Neelalu (22.22%), LGG 450 (27.90%), LGG 407 (34.67%), and LGG 410 (45.15%). To know the influence of seed size on reaction of C. chinensis, 100-grain weight of each variety was also taken. Among the varieties, TM 96-2 (4.03 g) had the highest

Table 1. Reaction of certain greengram cultivars to *Callosobruchus chinensis*

Variety	No. of eggs 10 seeds^{-1}	No. of adults emerged 100g^{-1}	Grain damage (%)	Loss in weight (%)	Loss in germination (%)	100 grain wt (gm)
LGG 407	25.25	313.00	30.00	16.75	34.67	3.48
	(5.07)	(20.85)	(33.20)	(24.10)	(35.93)	
LGG 450	19.25	249.00	18.00	10.15	27.90	3.28
	(4.43)	(18.24)	(25.10)	(18.53)	(31.85)	
LGG 410	22.75	276.25	28.75	9.74	45.15	3.60
	(4.82)	(19.51)	(32.35)	(18.10)	(42.20)	
LGG 460	24.25	276.75	28.25	12.20	20.06	3.53
	(4.97)	(19.34)	(32.08)	(20.40)	(26.46)	
TM 96-2	30.00	443.25	42.00	25.49	60.28	4.03
	(5.52)	(24.33)	(40.40)	(30.25)	(50.98)	
Neelalu	10.25	224.00	16.75	8.11	22.22	2.63
	(3.28)	(17.54)	(24.15)	(16.43)	(28.20)	
F test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
SEm±	0.098	0.558	0.851	0.628	1.707	0.048
L S D (0.05%)	0.295	1.680	2.566	1.894	5.145	0.144

*Values in parentheses are transformed values

value for 100 seed weight indicating its largest size compared to other varieties, while Neelalu had the least value (2.63 g).

TM 96-2 was highly susceptible to *C.chinensis*. The bruchids preferred TM 96-2 for oviposition (30.00 eggs 10 seeds^{-1}) and could produce more number of adults (443.25 100 g seed^{-1}) through damaging more number of grains (42.00 %). The damage resulted in highest loss in grain weight (25.49) as well as germination (60.28). The local variety Neelalu was found to be resistant based on the lowest values recorded for oviposition preference (10.25 eggs 10 seeds^{-1}), adult emergence (224.0 100 g seed^{-1}), grain damage (16.75%), weight (8.11%) and germination (22.22%) losses. Similarly, Srinivasan and Durairaj (2007) found greengram accessions; PLS 308, LM 103, COGG 912 and IC 39412 to be highly resistant to *C. maculatus* with prolonged developmental period and adult longevity coupled with lesser adult weight and percentage seed loss. While Srinivasan (2008) identified greengram lines, EC 98674 and PLM 209 as resistant to *C. maculatus* in terms of respective low survival percentage (33.93 and 40.58%), prolonged developmental period (29.60 and 29.28 days) and less index of suitability (0.0517 and 0.0550).

In the present study, the seed size showed a positive correlation with oviposition preference and grain damage. The results are in conformity with Dharmasena and Subasinghe (1986) and Lambrides and Imrie (2000). Seed size has been shown to influence infestation by insect pests as large grain legumes provide more surface area for oviposition and larval development than small-size grains (Dharmasena and Subasinghe, 1986). Lambrides and Imrie (2000) found wild mung bean characteristics of small seed size and the presence of a well-formed texture layer on the seed, which act as oviposition deterrents in resistant mung bean accessions. While screening cowpea accessions, Lattanzio *et al.,* (2005) suggested that seed coat tannins must also be considered in biochemical defence mechanisms. However, slight variations in the emergence of bruchids, weight loss and germination loss in grain may be due to variations in the presence of biochemical constituents that influence the development of the grub in the cotyledons (Somta *et al.,* 2008). Similarly, Misal *et al.,* (2008) observed a positive correlation of alpha -amylase inhibitor, trypsin inhibitor, total phenols and tannic acid with resistance to C. chinensis in mung bean, urd bean and rice bean seeds.

Among the four cultivars released from Regional Agricultural Research Station, Lam; LGG 450 was found to be less susceptible with lower oviposition (19.25 eggs 10 seeds^{-1}), adult emergence (249 100 g seed^{-1}), and grain damage (18.00%) compared to other Lam cultivars. Though Jaydeep *et al.,* (2006) reported that the cultivar LGG 450 was highly susceptible to spotted pod borer, Maruca vitrata (Geyer), due to presence of higher amounts of total sugar, reducing sugar, non-reducing sugar, amino acids and protein; non-preference of *C. chinensis* in this study may be due to smaller grain size. The TM 96-2 has all desirable characters such as bold shiny grain, long pods and uniform maturity and terminal bearing amicable for easy harvesting, resistance to powdery mildew disease and high yield potential. However, it was found to be highly susceptible to bruchid pests that can cause extensive losses during post-harvest storage.

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Agricultural Research Station
Ghantasala 521 133
Krishna District
Andhra Pradesh

S V S Gopala Swamy
M V Ramana
Y Radha Krishna

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