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Study the screen the green gram varieties against pulse beetle (*Callosobruchus chinensis* L.)

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Abstract

The screening of green gram varieties against the pulse beetle viz. Virat, Shikha, Pusa Ratna, Pusa Vishal, Pusa 1431, TJM 3, PDM 139, IPM 99-125, IPM 2-14, IPM 2-3 and MH 421 were studied against the pulse beetle. The varieties, Pusa Vishal and TJM 3 was the most preferred host for egg-laying, while the least preferred variety was MH 421. The maximum mean adult emergence was in Pusa Vishal and the minimum in MH 421. The maximum seed damage up to (68.33%) was observed in Pusa Vishal, while minimum (33.33%) damage occurred in MH 421. The weight loss was highest in Pusa Vishal with 27.03 percent and was lowest in MH 421 and IPM 2-3 with 12.90 and 16.23 percent. Germination percent recorded in varieties MH 421 showed the average highest infected seed germination (17.77%), while variety Pusa Vishal showed the lowest infected seed germination (5.33%). And Germination percent recorded in varieties Virat showed the average highest Healthy seed germination (93.33%), while variety IPM 2-3 showed the lowest Healthy seed germination (78.67%).

Keywords: screening, Pusa Vishal, TJM 3, Pusa 1431, IPM 99-125 and pulse beetle

1. Introduction

Pulses being is a vital source of protein and form a major constituent of the vegetarian diet for a majority of the rural and urban population in India, where the consumption of animal protein except milk is still considered a religious and social taboo. Among the pulse crops, green gram, *Vigna radiata* (L) is an important pulse crop as it is widely used as a whole grain or as a split pulse on account of its easy digestibility. It contains 24 percent protein, 56.7 percent carbohydrates, 3.5 percent fibre and 1.3 percent fat. India's area under green gram is 43.05 lakh hectares with a production of 20.70 lakh tonnes and productivity of 481 kg/ha. In Madhya Pradesh, green gram is cultivated in 2.51 lakh hectares with an annual production of 1.16 lakh tonnes and productivity of 464 kg/ha (Anonymous, 2016-17) [4]. The availability of pulses may godown considerably due to heavy losses caused by insects during storage. The pulse beetle alone under storage conditions requires special attention, as in India about 8.5 percent losses have been reported in post-harvest handling of pulses (FAO, 1997) [6]. Post-harvest losses of pulses other than a gram are 5 percent due to insects, 2.5 percent due to rodents and 0.5 percent due to transportation, bird damage and moisture loss (Anonymous, 1996) [3]. Apart from quantity, the quality and nutritional value of pulses get deteriorate during storage.

2. Material and Methods

Freshly harvested seeds of green gram varieties viz; of Eleven green gram varieties, Virat, Shikha, Pusa Ratna, Pusa Vishal, Pusa 1431, TJM 3, PDM 139, IPM 99-125, IPM 2-14, IPM 2-3 and MH 421 collected from the Department of Plant Breeding and Genetics, College of Agriculture Jabalpur. Sound seeds of each variety were kept in a hot air oven for six hours at 50°C to eliminate insect pest infestation, if any. Seeds of each variety weighing 100g were kept in plastic containers of 250 ml capacity separately to evaluate the preference of variety by pulse beetle. Five pairs of healthy, one-day-old emerged adult bruchids were introduced into each plastic jar and the top was covered with a muslin cloth, tightened by rubber bands. The observation was taken from each plastic jar regularly for the following parameters:

1. Preference for egg-laying based on numbers of eggs laid per grain at 3, 7 and 10 days after release.

2. Adult emergence (%) at 30, 60 and 90 days of storage.
3. Grain damage (%), weight loss (%) and germination (%) at 90 days of storage.

3. Results and Discussion

Eleven varieties of green gram were screened to know their preference for pulse beetle up to 90 days of storage. The observations on preference for egg-laying, adult emergence (%), weight loss (%), grain damage (%) and germination (%) were taken to decide the preference of green gram varieties against pulse beetle.

3.1. Preference of egg-laying

The maximum mean number of eggs laid after 3, 7 and 10 days were on the variety Pusa Vishal with the respective fecundity being 49.33, 53.33 and 55.33, while the minimum mean number of eggs laid after 3, 7 and 10 days were on the variety MH 421 with the respective fecundity being 21.33, 25.33 and 25.67 (Table 1).

3.2. Adult emergence (%)

The emergence of adults began after 30 days. The maximum number of adults that emerged after 30, 60 and 90 days were 75.33, 89.33 and 91.33 on variety Pusa Vishal; whereas, the minimum number of adults that emerged after 30, 60 and 90 days were 39.33, 56.67 and 61.33 on variety MH 421 (Table 2).

3.3. Grain damage (%)

A perusal of (table-3) showed that the lowest mean damage was caused in variety MH 421 (33.33%); whereas, the maximum mean damage (68.33%) was recorded on variety Pusa Vishal.

3.4. Weight loss (%)

The average weight loss due to the insect's feeding was recorded as low as 12.90 percent on variety MH 421 and as high as 27.03 percent on Pusa Vishal. The average net weight loss recorded in the varieties TJM 3, Shikha, Pusa Ratna, PDM 139, IPM 99-125, Pusa 1431, IPM 2-14, IPM 2-3, and Virat were 23.43, 21.50, 20.03, 19.63, 18.30, 17.60, 16.73, 16.23 and 15.07 per cent, respectively (Table-3).

3.5. Infected seed germination (%)

The results in Table-(3) indicate that varieties MH 421 showed the average highest Infected seed germination (17.77%), while variety Pusa Vishal showed the lowest Infected seed germination (5.33%). The average infected seed germination recorded on the varieties Virat, PDM 139, IPM 99-125, Pusa 1431, Shikha, IPM 2-3 and Pusa Ratna was 13.33, 12.67, 11.33, 10.33, 10.00 9.33, and 8.67 percent, respectively.

3.6. Healthy seed germination (%)

The results in Table-(3) indicate that varieties Virat showed the average highest healthy seed germination (93.33%), while variety IPM 2-3 showed the lowest healthy seed germination (78.67%). The average healthy seed germination recorded on the varieties MH 421, Pusa 1431, IPM 2-14, Shikha, PDM 139, Pusa Ratna, Pusa Vishal, TJM 3, and IPM 99-125 was 92.67, 91.33, 90.67, 89.33, 88.67, 87.33, 86.67, 85.33, and 84.67 percent, respectively.

3.7. Screening different green gram varieties against pulse beetle

The experiment was conducted to determine the preference of green gram varieties by the pulse beetle based on preference

for egg-laying, adult emergence, grain damage, weight loss, germination.

3.7.1. Preference for egg-laying

The pulse beetle laid the maximum average numbers of eggs on Pusa Vishal variety of green gram and minimum eggs were laid on variety MH 421 after 3, 7 and 10 days of time intervals. The varieties Pusa Vishal, TJM 3, PDM 139, Virat, IPM 2-14, Pusa Ratna, IPM 2-3, Shikha and IPM 99-125 were more preferred for egg-laying than Pusa 1431 and MH 421. Similar results were found by Chavan *et al.*, (1997) [5] for ovipositional preference of *C. chinensis* in cowpea lines. The beetle showed a definite varietal response for oviposition. The cowpea line with a rough seed surface was less preferred for oviposition. Parmar and Patel (2016) [8] Investigations were carried out in 2013 on mung beans for their susceptibility against *Callosobruchus chinensis* L. under storage. Among the mung bean varieties; Vishal, Samrat, GM-3, GM-4 and K-851 were found to be resistant based on oviposition preference (7.97/20 seeds, 8.74, 8.99, 9.17 and 9.49, respectively).

3.7.2. Adult emergence (%)

The result indicated that the average maximum adult emergence was 75.33, 89.33 and 91.33 percent on the Pusa Vishal variety of green gram after 30, 60 and 90 days, while minimum adult emergence was 39.33, 56.67 and 61.33 (after 30, 60 and 90 days) percent on MH 421. Shaheen *et al.* (2006) [9] reported the minimum adult emergence (2.96) of pulse beetle were attracted towards Parbat grains and the maximum of 5.07 adults. Ahmad *et al.* (2017) [1] reported the lowest percent adult emergence was observed on PBG 1 (17.28%) while the maximum percent adult emergence was observed on PKG 1 (19.90%).

3.7.3. Grain damage, Weight loss and Germination (%)

The results of grain damage showed that the mean maximum damage to seed was recorded on Pusa Vishal (68.33%) and minimum on MH 421 (33.33%) variety of green gram. Similar results were found by Ahmad *et al.* (2018) reported the Maximum (24.4%) of seed damage was observed on chickpea and the minimum (6-9%) was recorded in black gram. Iqbal *et al.* (2018) [7] reported the NARC-Mash-1, NCH-3-4 and Mash-Urooj showed good results with minimum grain damage $17.82 \pm 0.56\%$, $18.27 \pm 0.66\%$ and $18.43 \pm 0.55\%$, respectively. Ahmad *et al.* (2018) [2] were observed the Maximum (24.4%) of seed damage on chickpea and the minimum (6-9%) was recorded in black gram. Shaheen *et al.*, (2006) [9] reported that the minimum grain damage (24.35%) was recorded in Bittle- 98, while the maximum of 54.46% damage was seen in Flip 97-192C. The weight loss results showed that the average maximum weight loss was in Pusa Vishal and minimum in MH 421. Shaheen *et al.*, (2006) [9] reported that the adults of pulse beetle fed on Paidar-91 gained the maximum weight (10.27 mg) while the minimum weight of 7.02 mg was recorded for adults fed on grains of Bittle-98. Parmar and Patel (2016) [8] Investigations were carried out on mung beans for their susceptibility against *Callosobruchus chinensis* L. under storage. Among the mung bean varieties; Vishal, Samrat, GM-3, GM-4 and K-851 were found in weight loss percent (6.11%, 7.43%, 8.08%, 9.28% and 11.04%, respectively). The results of Infected seed germination percent showed that the maximum germination was in MH 421 and minimum in variety pusa vishal, while Healthy seed germination percent showed that the maximum seed germination was in virat variety and minimum seed

germination variety IPM 2-3. Parmar and Patel (2016) [8] Investigations were carried out on mung bean for their susceptibility against *Callosobruchus chinensis* L. under storage. Among the mung bean varieties; Vishal, Samrat,

GM-3, GM-4 and K-851 were found in germination per cent loss (29.27%, 36.03%, 34.91%, 40.36% and 40.42%, respectively).

Table 1: Comparative preference for egg laying on green gram variety under force condition

Variety	Number of eggs laid/100 grains		
	3 DAR	7 DAR	10 DAR
Virat	34.00(5.87)	37.33(6.14)	38.33(6.21)
Shikha	28.67(5.40)	34.33(5.88)	34.67(5.90)
Pusa Ratna	29.33(5.46)	35.67(6.00)	36.67(6.08)
Pusa Vishal	49.33(7.06)	53.33(7.33)	55.33(7.46)
Pusa 1431	26.33(5.18)	30.67(5.57)	29.33(5.44)
TJM 3	44.67(6.72)	46.67(6.86)	48.33(6.97)
PDM 139	38.67(6.26)	40.67(6.41)	41.67(6.48)
IPM 99-125	27.67(5.30)	31.67(5.66)	32.00(5.67)
IPM 2-14	30.67(5.58)	36.67(6.09)	34.33(5.89)
MH 421	21.33(4.67)	25.33(5.07)	25.67(5.11)
IPM 2-3	31.67(5.67)	34.33(5.90)	35.33(5.97)
S.Em±	0.10	0.24	0.33
C.D. at 5%	0.31	0.70	0.96

= Figures in parentheses are square root transformed values.

Table 2: Comparative adult emergence of *Callosobruchus chinensis* (L.) on different green gram varieties

Variety	Adult emergence (%) days after release		
	30 DAR	60 DAR	90 DAR
Virat	46.67(43.08)	60.67(51.19)	68.00(55.58)
Shikha	56.67(48.88)	70.67(57.26)	75.33(60.37)
Pusa Ratna	49.33(44.62)	63.33(52.81)	72.67(58.57)
Pusa Vishal	75.33(60.42)	89.33(72.11)	91.33(73.04)
Pusa 1431	45.33(42.32)	61.33(51.65)	72.00(58.09)
TJM 3	62.67(52.49)	80.00(63.90)	84.00(66.45)
PDM 139	55.33(48.09)	68.67(56.12)	71.33(57.65)
IPM 99-125	43.33(41.14)	61.33(51.59)	70.67(57.23)
IPM 2-14	41.33(39.97)	55.33(48.09)	69.33(56.39)
MH 421	39.33(38.77)	56.67(48.86)	61.33(51.56)
IPM 2-3	42.00(40.39)	57.33(49.28)	82.00(64.98)
S.Em±	2.66	3.10	1.60
C.D. at 5%	7.80	9.10	4.71

= Figures in parentheses are angular transformed values.

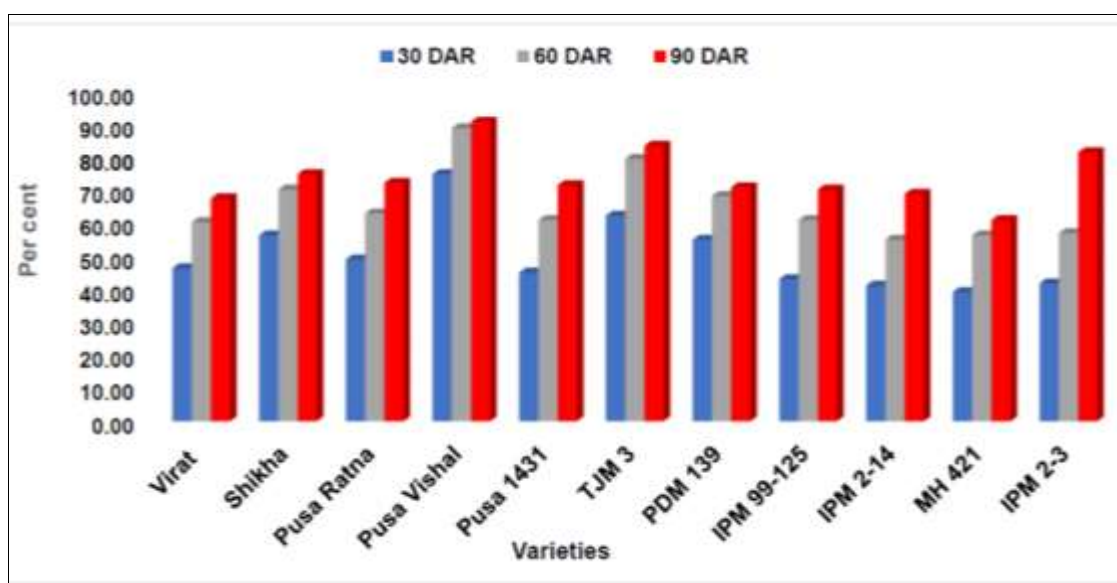
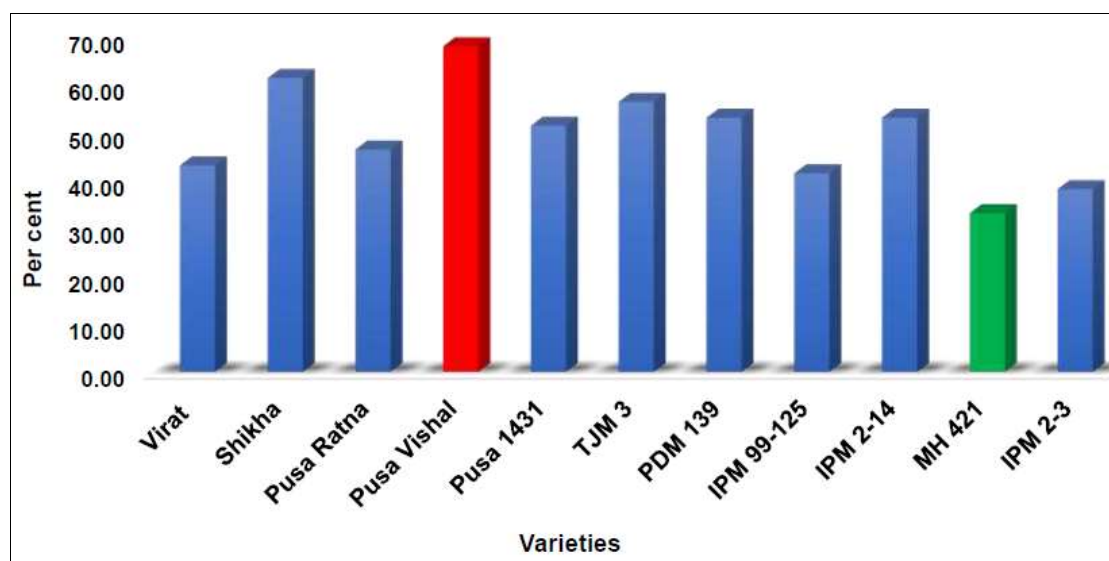
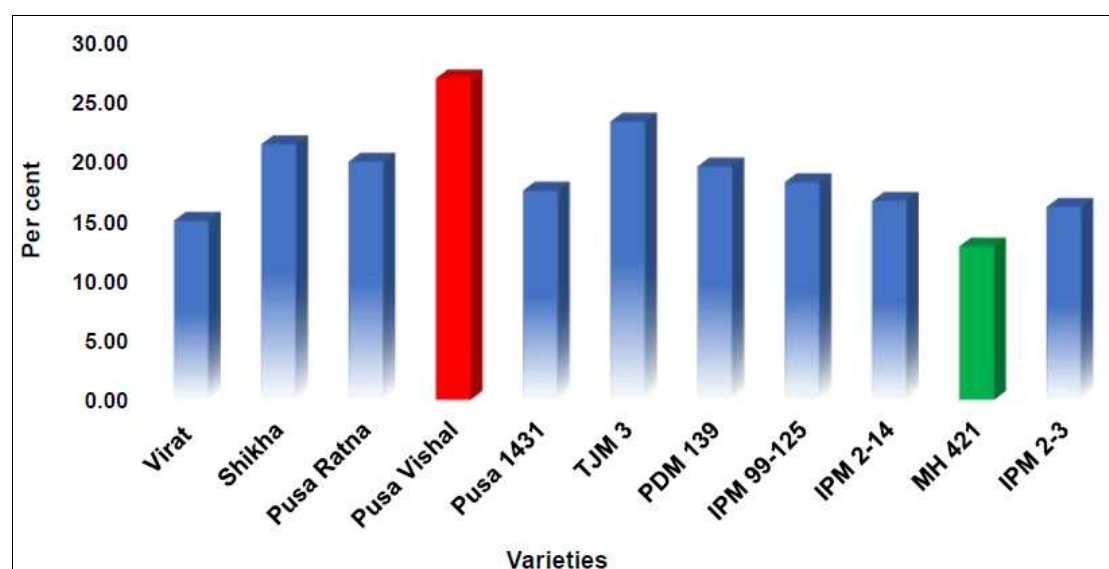


Fig 1: Comparative adult emergence per cent to different green gram varieties at 30, 60 and 90 days after storage due to pulse beetle

Table 3: Comparative damage to different green gram varieties 90 days after storage due to pulse beetle

Variety	Grain Damage (%)	Weight Loss (%)	Germination (%)	
			Infected seed	Healthy seed
Virat	43.33(41.13)	15.07(22.84)	13.33(21.40)	93.33(75.28)
Shikha	61.67(51.76)	21.50(27.62)	10.00(18.38)	89.33(71.01)
Pusa Ratna	46.67(43.08)	20.03(26.59)	8.67(17.02)	87.33(69.16)
Pusa Vishal	68.33(55.77)	27.03(31.32)	5.33(13.30)	86.67(68.73)
Pusa 1431	51.67(45.96)	17.60(24.79)	10.67(19.05)	91.33(73.04)
TJM 3	56.67(48.84)	23.43(28.94)	10.00(18.38)	85.33(67.55)
PDM 139	53.33(46.92)	19.63(26.30)	12.67(20.84)	88.67(70.52)
IPM 99-125	41.67(40.17)	18.30(25.32)	11.33(19.66)	84.67(67.06)
IPM 2-14	53.33(46.92)	16.73(24.14)	9.33(17.77)	90.67(72.37)
MH 421	33.33(35.25)	12.90(20.99)	17.33(24.60)	92.67(74.53)
IPM 2-3	38.33(38.19)	16.23(23.75)	9.33(17.77)	78.67(62.50)
S.Em±	3.45	0.37	0.84	1.67
C.D. at 5%	10.11	1.09	2.47	4.91

= Figures in parentheses are angular transformed values.

**Fig 2:** Comparative seed damage per cent to different green gram varieties 90 days after storage due to pulse beetle.**Fig 3:** Comparative weight loss per cent to different green gram varieties 90 days after storage due to pulse beetle

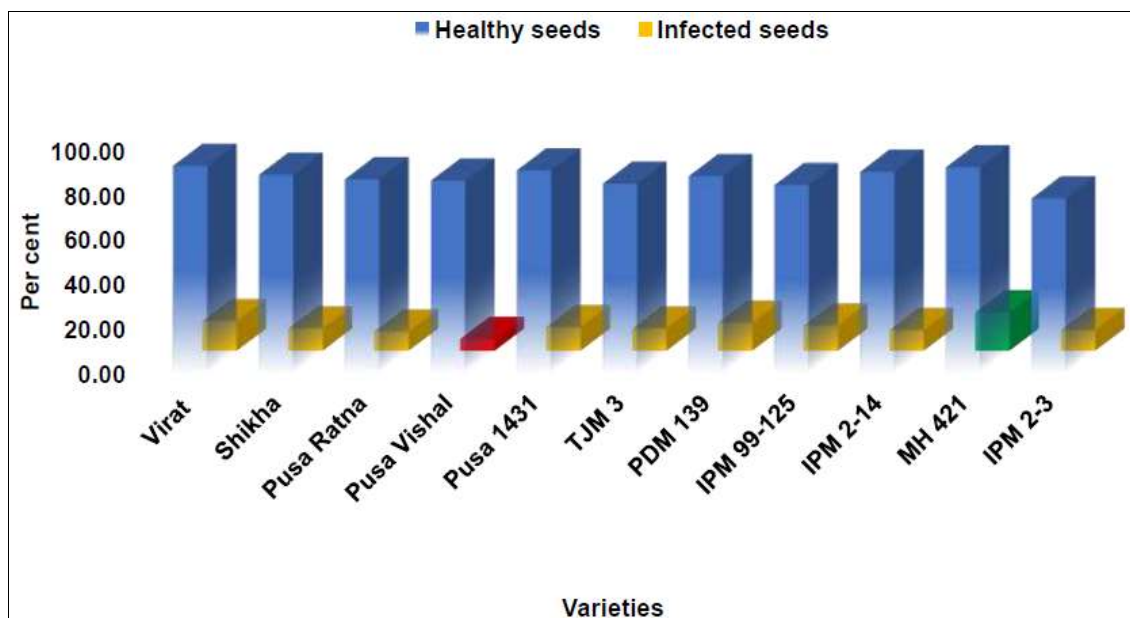


Fig 4: Comparative seed germination per cent to different green gram varieties 90 days after storage due to pulse beetle.



Plate 1A: Germination of seeds infected by *Callosobruchus chinensis* (Linn.).



Plate 1B: Germination of healthy seeds.

4. Conclusion

Green gram variety MH 421, JAKI-9218 and Subhra was found least preferred against *C. chinensis* in which lowest numbers of eggs were laid, seed damage per cent, weight loss per cent and has least emergence of adults. The maximum germination per cent showed in MH 421 while minimum germination per cent showed in pusa vishal. Variety Pusa vishal was most susceptible on the basis of above parameter.

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