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Screening of Different Genotypes/Varieties of Greengram against Spotted Pod Borer, *Maruca vitrata* (Fabricius)

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ABSTRACT

An experiment was carried out to evaluate the different genotypes/varieties of greengram against spotted pod borer, *Maruca vitrata* during *kharif* 2021 at Agronomy Farm, Anand Agricultural University, Anand. Total 20 genotypes/varieties were used and experiment was conducted in Randomized Block Design with two replications. Among the twenty genotypes/varieties screened for their resistance to spotted pod borer, none of the genotypes/varieties was found to be highly resistant. Based on larval population, four genotypes/variety viz., VSGG 9, VMK 19-03, VMK 18-01 and Meha were categorized as resistant to spotted pod borer. While VSGG 2, GM 6, VSGG 8 and VSGG 4 were found susceptible. None of the genotypes/varieties was categorized as highly susceptible. The grain yield of different genotypes differed significantly and ranged from 757 kg/ha in the genotype VSGG 9 to 438 kg/ha in VSGG 4.

Keywords Greengram, Spotted pod borer, larval population, Pod damage, Grain yield.

INTRODUCTION

Greengram *Vigna radiata* (L.) Wilczek (family: Leguminosae) is one of the most important *kharif* pulse crop grown in India. It is one of the most widely cultivated pulse crop after chickpea and pigeonpea (Ved-Ram *et al.* 2008, Swaminathan *et al.*, *Nepalia* 2012). In India, pulses have been described as a "poor man's meat and rich man's vegetable. In India, during 2019-20, it occupied an area of 45.81 lakh hectares having total production of 25.09 lakh tonnes of grain with a productivity of 548 kg/ha. The major greengram producing states in India are Rajasthan, Madhya Pradesh, Maharashtra, Karnataka and Bihar (Anonymous 2020). It has the unique ability to fix atmospheric nitrogen in symbiotic association with Rhizobium bacteria, which not only enables it to meet its own nitrogen requirement but also benefits the succeeding crops (Ladha *et al.* 2022).

The area under greengram has increased in the last two decades mainly because of the availability of short duration cultivars but multitude of pest still creating bottleneck in higher productivity due to infestation from germination to maturity of the crop (Meena *et al.* 2021). The major constraint responsible for poor yields is the wide array of insect pests, which attack the plants from seedling to maturity. A total of 64 species of insects have been reported to

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be attacking greengram in the field condition (Anonymous 2014). Among all, spotted pod borer is one of the major insect pests that occurs from flowering stage onwards in pulses. Spotted pod borer, *M. vitrata* is the most formidable and potential pest cause extensive damage to greengram under field conditions. It is reported that 20-30% pod damage in greengram is caused due to spotted pod borer (Zahid *et al.* 2008). Estimated losses in grain yield of 20 to 60% due to *M. vitrata* damage (Krishna and Kumar 2022). It has also been estimated that 30% of pod damage caused by spotted pod borer in greengram (Umbarkar and Parsana 2014).

MATERIALS AND METHODS

The present investigation was carried out under unprotected field condition at the Agronomy Farm, Anand Agricultural University, Anand. Experiment was conducted in Randomized Block Design with two replications. The row to row and plant to plant distance was maintained as 45 and 10 cm, respectively, in plot size of 1.8 × 4.0 m.

Observations on the larval population of *M. vitrata*, 10 plants were selected randomly from each plot and number of larvae on each plant was counted. Observations were recorded at weekly interval starting from formation of flower buds till harvest of crop. Before harvest of crop, five plants were randomly selected from each plot and number of healthy and *M. vitrata* damaged pods were counted. Grain yield was recorded from each plot area. The data on larval population of *M. vitrata,* pod damage (%) and grain yield of greengram were subjected to analysis of variance (ANOVA). Before analysis, the data on larval population of *M. vitrata* were subjected to square root transformation ($\sqrt{X+0.5}$) and data on pod damage were subjected to arcsine transformation. The treatment means were compared using Duncan's New Multiple Range Test (Steel and Torrie 1980). The periodical data on population were pooled over periods. Based on larval population and per cent pod damage genotypes/varieties were categorized into different categories of resistance. The different greengram genotypes/varieties were categorized into Highly Resistant (HR), Resistant (R), Moderately Resistant (MR), Moderately Susceptible (MS), Susceptible (S) and Highly Susceptible (HS) categories.

A scale developed by Patel *et al.* (2002) was used to categorize genotypes/varieties. The details of the scale are as under.

Category of resistance	Scale for resistance
Highly Resistance (HR)	$\bar{X}_i < \bar{X}$ - 2SD
Resistant (R)	$\bar{X}$ - 2SD $< \bar{X}_i < \bar{X}$ - SD
Moderately Resistant (MR)	$\bar{X}$ - SD $< \bar{X}_i < \bar{X}$
Moderately Susceptible (MS)	$\bar{X} < \bar{X}_i < \bar{X}$ + SD
Susceptible (S)	$\bar{X}$+SD $< \bar{X}_i < \bar{X}$+2SD
Highly Susceptible (HS)	$\bar{X}_i > \bar{X}$+ 2SD

Notes: $\bar{X}$ = Mean value of all genotypes/varieties
$\bar{X}_j$ = Mean value of individual genotypes/varieties
SD = Standard deviation

RESULTS AND DISCUSSION

The data on weekly larval population, per cent pod damage and yield are presented in Table 1 and depicted in Fig.1.

Larval population of *M. vitrata*

Differences among genotypes/varieties for larval population of *M. vitrata* were significant. On the basis of observation recorded from each genotypes/varieties significantly the lowest (0.40 larva/plant) larval

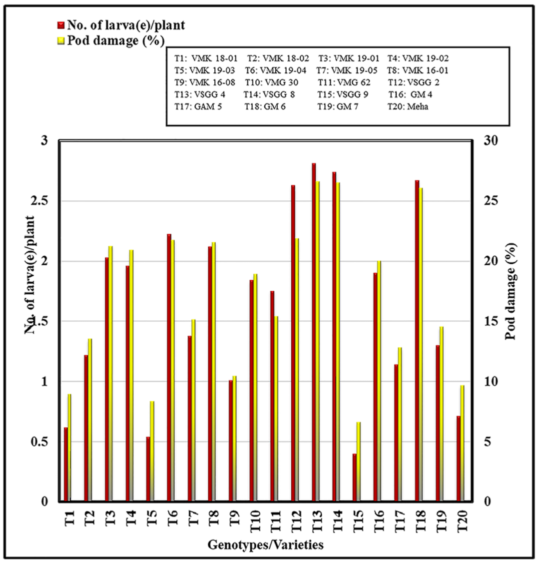

Fig. 1. Larval population and pod damage due to *M. vitrata* in different genotypes/varieties of greengram.

Table 1. Larval population of spotted pod borer and pod damage in different genotypes/varieties of greengram.

Sl. No.	Genotypes/ varieties	No. of larva(e)/ plant	Pod damage (%) before harvest
T_1	VMK 18-01	1.06^{bc*}	17.40^{abc**}
		(0.62)	(8.94)
T_2	VMK 18-02	1.31^{ef}	21.59^{bcdefg}
		(1.22)	(13.54)
T_3	VMK 19-01	1.59^{hij}	27.46^{hij}
		(2.03)	(21.26)
T_4	VMK 19-02	1.57^{hij}	27.24^{ghij}
		(1.96)	(20.95)
T_5	VMK 19-03	1.02^{b}	16.80^{ab}
		(0.54)	(8.35)
T_6	VMK 19-04	1.65^{j}	27.82^{ij}
		(2.22)	(21.78)
T_7	VMK 19-05	1.37^{f}	22.88^{defghi}
		(1.38)	(15.12)
T_8	VMK 16-01	1.62^{ij}	27.68^{ij}
		(2.12)	(21.58)
T_9	VMK 16-08	1.21^{d}	18.31^{abcd}
		(1.01)	(10.44)
T_{10}	VMG 30	1.53^{gh}	25.80^{efghij}
		(1.84)	(18.94)
T_{11}	VMG 62	1.50^{g}	23.09^{defghi}
		(1.75)	(15.39)
T_{12}	VSGG 2	1.77^{k}	27.88^{ij}
		(2.63)	(21.89)
T_{13}	VSGG 4	1.82^{k}	31.07^{j}
		(2.81)	(26.63)
T_{14}	VSGG 8	1.80^{k}	31.01^{j}
		(2.74)	(26.54)
T_{15}	VSGG 9	0.95^{a}	14.95^{a}
		(0.40)	(6.66)
T_{16}	GM 4	1.55^{ghi}	26.58^{fghij}
		(1.90)	(20.02)
T_{17}	GAM 5	1.28^{de}	20.97^{bcde}
		(1.14)	(12.81)
T_{18}	GM 6	1.78^{k}	30.71^{j}
		(2.67)	(26.08)
T_{19}	GM 7	1.34^{ef}	22.41^{cdefgh}
		(1.30)	(14.53)
T_{20}	Meha	1.10^{c}	18.12^{abcd}
		(0.71)	(9.67)
SEm ±	Treatments) T	0.02	1.52
	(Periods) P	0.02	-
	T × P	0.09	-
F test (T)		Sig.	Sig
CV (%)		8.70	8.97

Note: (1) * Figures outside the parentheses are transformed values and those inside the parentheses are retransformed values. (2) ** Figures outside the parentheses are arcsine transformed values and those inside the parentheses are retransformed values. (3) Treatment means followed by the same letter within a column are not significantly different by Duncans New Multiple Range Test (DNMRT) at 5% level of significance.

population of *M. vitrata* was observed in genotype VSGG 9 which differed significantly from the rest of the genotypes. The next best genotypes was VMK 19-03 (0.54 larva/plant) which was at par with VMK 18-01 (0.62 larva/plant). VMK 18-01 was also at par with Meha (0.71 larva/plant). Significantly higher population of *M. vitrata* was found on genotype/varieties VSGG 4 (2.81 larvae/plant) which was at par with VSGG 8 (2.74 larvae/plant), GM 6 (2.67 larvae/plant) and VSGG 2 (2.63 larvae/plant).

Per cent pod damage due to *M. vitrata*

Data indicated that significantly lower pod damage at harvest (6.66%) was observed in VSGG 9 which was at par with VMK 19-03 (8.35%), VMK 18-01 (8.94%), Meha (9.67%) and VMK 16-08 (10.44%). Significantly higher pod damaged was registered in VSGG 4 (26.63%) which was at par with VSGG 8 (26.54%), GM 6 (26.08%), VSGG 2 (21.89%), VMK 19-04 (21.78%), VMK 19-01 (21.26%), VMK 19-02 (20.95%), GM 4 (20.02%) and VMG 30 (18.94).

Categorization of genotypes/varieties for their resistance

For this purpose, larval population and pod damage

Table 2. Categorization of different genotypes/varieties of greengram based on no. of larva (e) of spotted pod borer/plant.

Category of resistance	Scale	Genotypes/varieties
	$=\bar{X}$ 1.58	SD = 0.71
Highly Resistant (HR)	$\bar{X}_i \leq 0.14$	-
Resistant (R)	$0.14 < \bar{X}_i < 0.86$	VSGG 9, VMK 19-03, VMK 18-01, Meha VMK 16-08, GAM 5
Moderately Resistant (MR)	$0.86 < \bar{X}_i < 1.58$	VMK 18-02, GM 7, VMK 19- 05 VMG 62
Moderately Susceptible (MS)	$1.58 < \bar{X}_i < 2.30$	VMG 30, GM 4 VMK 19-02, VMK 19-01 VMK 16-01, VMK 19-04
Susceptible (S)	$2.30 < \bar{X}i < 3.02$	VSGG 2, GM 6, VSGG 8, VSGG 4
Highly Susceptible (HS)	$\bar{X}i > 3.02$	-

Note: $\bar{X}$ = Mean value of all genotypes/varieties.
$\bar{X}i$ = Mean value of individual genotypes/varieties.
SD = Standard deviation.

Table 3. Categorization of different genotypes/varieties of greengram based on pod damage at harvest due to spotted pod borer.

Category of resistance	Scale $\bar{X}$= 17.07	Genotypes/varieties SD = 6.35
Highly Resistant (HR)	$\bar{X}i$ < 4.36	
Resistant (R)	4.36 <$\bar{X}i$ < 10.72	VSGG 9, VMK 19-03 VMK 18-01, Meha, VMK 16-08
Moderately Resistant (MR)	10.72 <$\bar{X}i$ < 17.07	GAM 5 VMK 18- 02, GM 7, VMK 19-05, VMG 62
Moderately Susceptible (MS)	17.07 <$\bar{X}i$ < 23.42	VMG 30, GM 4 VMK 19-02, VMK 19-01 VMK 16-01 VMK 19-04, VSGG 2
Susceptible (S)	23.42<$\bar{X}i$ <29.78	GM 6, VSGG 8,VSGG 4
Highly Susceptible(HS)	$\bar{X}i$ > 29.78	

Note: $\bar{X}$ = Mean value of all genotypes/varieties.
$\bar{X}i$ = Mean value of individual genotypes/varieties.
SD = Standard deviation.

in individual genotypes/varieties ($\bar{X}_i$) was compared with mean value of larval population/pod damage in all genotypes/varieties ($\bar{X}$) and standard deviation (SD). The categorization of different greengram genotypes/varieties is summarized in Tables 2 - 3.

Categorization on the basis of larval population

Considering the larval population of *M. vitrata*, none of the genotype/varieties was found to be highly resistant and highly susceptible (Table 2). However, VSGG 9, VMK 19-03, VMK 18-01 and Meha were categorized as resistant genotypes/varieties, while VMK 16-08, GAM 5, VMK 18-02, GM 7 and VMK 19-05 were categorized as moderately resistant. Genotype/varieties VMG 62, VMG 30, GM 4, VMK 19-02, VMK 19-01, VMK 16-01 and VMK 19-04 were rated as moderately susceptible, whereas VSGG 2, GM 6, VSGG 8 and VSGG 4 were categorized as susceptible genotypes/varieties.

Categorization on the basis of pod damage (%)

The categorization on the basis of per cent pod damage due to *M. vitrata* is given in Table 3.

It showed that none of the genotype/varieties fell under highly resistant or highly susceptible category. Considering the pod damage, VSGG 9, VMK 19-03, VMK 18-01, Meha and VMK 16-08 were categorized as resistant genotypes/varieties, while GAM 5, VMK 18-02, GM 7, VMK 19-05 and VMG 62 were categorized as moderately resistant. Genotypes/varieties VMG 30, GM 4, VMK 19-02, VMK 19-01, VMK 16-01, VMK 19-04 and VSGG 2 were rated as moderately susceptible. Remaining genotypes/varieties viz., GM 6, VSGG 8 and VSGG 4 were categorized as susceptible genotypes/varieties.

Yield

The data on grain yield of different genotypes/varieties screened for their resistance against *M. vitrata* during *kharif* season of 2021 are presented in Table 4.

Significantly higher grain yield was obtained from the genotypes/varieties VSGG 9 (757 kg/ha) which was at par with VMK 19-03 (753 kg/ha), VMK 18-01 (736 kg/ha), Meha (717 kg/ha), VMK 16-08 (712 kg/ha), VMK 18-02 (679 kg/ha), GM 7 (669 kg/

Table 4. Grain yield of different genotypes/varieties screened for resistance.

Sl. No.	Genotypes/varieties	Grain yield (kg/ha)
T_1	VMK 18-01	736[a]
T_2	VMK 18-02	679[abc]
T_3	VMK 19-01	536[cde]
T_4	VMK 19-02	545[cde]
T_5	VMK 19-03	753[a]
T_6	VMK 19-04	507[de]
T_7	VMK 19-05	641[abcd]
T_8	VMK 16-01	512[de]
T_9	VMK 16-08	712[ab]
T_{10}	VMG 30	582[bcde]
T_{11}	VMG 62	634[abcd]
T_{12}	VSGG 2	498[de]
T_{13}	VSGG 4	438[e]
T_{14}	VSGG 8	445[e]
T_{15}	VSGG 9	757[a]
T_{16}	GM 4	554[cde]
T_{17}	GAM 5	663[abc]
T_{18}	GM 6	482[e]
T_{19}	GM 7	669[abc]
T_{20}	Meha	717[ab]
	SEm ±	42.78
	F test	Sig
	CV(%)	10.04

Note: Treatment means followed by same letter(s) within a column are not significantly different by DNMRT at 5% level of significance.

ha), GAM 5 (663 kg/ha), VMK 19-05 (641 kg/ha) and VMG 62 (634 kg/ha). On the other hand, significantly lower grain yield was registered in genotypes/varieties VSGG 4 (438 kg/ha) which was at par with VSGG 8 (445 kg/ha), GM 6 (482 kg/ha), VSGG 2 (498 kg/ha), VMK 19-04 (507 kg/ha), VMK 16-01 (512 kg/ha), VMK 19-01 (536 kg/ha), VMK 19-02 (545 kg/ha), GM 4 (554 kg/ha) and VMG 30 (582 kg/ha).

Chaudhari and Patel (2020) reported that larval population of *M. vitrata* was significantly lower in Meha (0.23 larva/plant) and SKNM 14-01 (0.31 larva/plant). Rest of the genotypes/varieties screened in this study had not been screened by previous researchers. Hence, further studies are required to confirm the present findings.

CONCLUSION

On the basis of the above experiment, it can be concluded that screening is a suitable way to find resistant genotypes/varieties and that host plant resistance has a significant role in regulating the level of pest infestation in green gram. According to the results of the present screening investigation, the greengram genotypes/varieties VSGG 9, VMK 19-03, VMK 18-01 and Meha are resistant to *M. vitrata* on the basis of larval population as well as per cent pod damage at harvest.

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