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Screening of greengram genotypes against pod borer complex

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Abstract

Field evaluation of 13 genotypes and 2 checks of greengram *Vigna radiata* (L.) Wilczek was carried out during *rabi* 2023-24 for screening against resistance to pod borer complex. The population of spotted pod borer, *Maruca vitrata* (Geyer) was recorded from bud initiation stage and the damage in the pods was estimated from the harvested pods for gram pod borer, *Helicoverpa armigera* (Hubner) and podfly, *Melanagromyza obtusa* (Malloch). The results revealed that the mean larval population of *M. vitrata* was in the range of 0.69 to 2.53 larvae per plant and based on per cent pod damage genotype LGG 667 was categorized as moderately resistant to *M. vitrata.* Based on pest susceptibility %, seven genotypes (LGG 610, LGG 673, PUSA 9072, LGG 667, LGG 678, VBN 2 and LGG 683) were categorized as resistant to *H. armigera*. Based on pest susceptibility %, eight genotypes (LGG 610, LGG 673, PUSA 9072, LGG 667, VBN 4, LGG 678, VBN 2 and LGG 683) were categorized as resistant to *M. obtusa.*

Keywords: Greengram genotypes, pod borer complex, maruca vitrata, helicoverpa armigera, melanagromyza obtusa

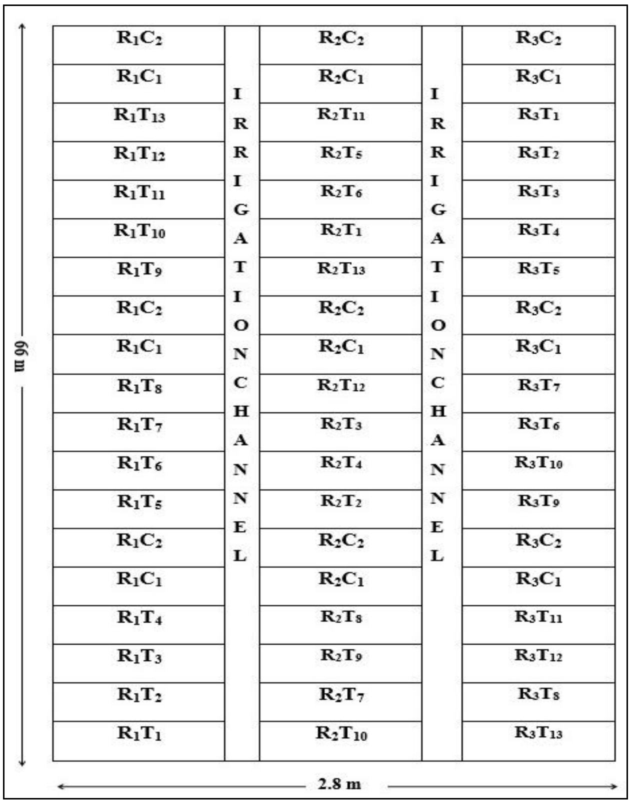
Introduction

Pulse crops are major crops in Indian agriculture and India is a major pulse growing country in the world. After chickpea and pigeon pea, greengram is the third important pulse crop of India. Greengram [*Vigna radiata* (L.) Wilczek] also known as mungbean, is a short duration pulse crop and occupies nearly 16 per cent of total pulse area in India. Greengram contains protein rich seeds with 20-25 per cent protein. Lal (1985) [4] reported 64 species of insects attacking greengram in the field. Among all the insects the pod borers cause major damage. They damage the flowers, immature pods, partly and fully developed pods and seeds by feeding on them. Major pod borers attacking greengram includes spotted pod borer, gram pod borer and pod fly. Host plant resistance play a crucial role in insect pest management and resistance to insect pest has been a major criteria in the development and release of new varieties (Soundararajan *et al.*, 2013) [11]. In this study 13 genotypes along with 2 checks were screened against pod borer complex under field condition and evaluated their level of resistance.

Materials and Methods

Field experiment was conducted during *Rabi*, 2023-24 at Agricultural Research Station, Darsi, Prakasam, and Andhra Pradesh, India. The germplasm was sown in 4 rows of 3 m length plots in randomized block design with three replications. Standard agronomic practices were followed in the experimental field without any chemical spraying.

Layout of greengram genotypes in screening trial



For spotted pod borer from the bud initiation stage to pod maturation stage, observations on the number of larvae per plant was collected from five randomly tagged plants per plot at weekly interval. At the time of the harvest per cent

pod damage was recorded from randomly selected hundred pods from each plot. The genotypes were categorized on a 1-9 scale based on per cent pod damage. (Sandhyarani *et al.*, 2009) [7].

Per cent infestation	Reaction	Scale (1-9)
No damage	No infestation	1
<10% of affected pods	Moderately resistant	3
11-20% of affected pods	Susceptible	5
21-40% of affected pods	Moderately susceptible	7
>40% of affected pods	Highly susceptible	9

$$\text{Per cent pod damage} = \frac{\text{Number of damaged pods}}{\text{Total number of pods}} \times 100$$

For gram pod borer and podfly at the time of harvest 100 pods were picked out from each replication and per cent pod damage was calculated. In order to group the genotypes, the pest susceptibility was calculated and then converted to 1 to 9 rating scale as given by Abbott (1925) [1].

$$\text{Pest susceptibility (\%)} = \frac{\text{P.D. of check} - \text{P.D. of entry}}{\text{P.D. of check}} \times 100$$

Where, P.D. is Per cent pod damage.

Pest Susceptibility rating	Pest Susceptibility (%)	Remarks
1	100	A rating of scale 1-5 was considered as resistant, 6 was equal to check and from 7-9 as susceptible.
2	75 to 99.5	
3	50 to 74.9	
4	25 to 49.9	
5	10 to 24.9	
6	-10 to 9.9	
7	-25 to -9.9	
8	-50 to -24.9	
9	-50 or less	

Results and Discussion

The results pertaining to larval population of *M. vitrata* were presented in Table 4.1. and graphically depicted in Fig. 4.1. There were significant differences with respect to spotted pod borer larval population between the genotypes under study. The mean larval population was in the range of 0.69 to 2.53 larvae per plant. The highest mean larval population of 2.53 larvae per plant was recorded in genotype LGG 607, which is followed by genotype LGG 628 in which 2.37 larvae per plant was recorded. The lowest mean larval population (0.69 larvae per plant) was observed in genotype LGG 667, followed by genotype LGG 673 in which 0.91 larvae per plant was observed. The results are in accordance with the research findings of Bhuva and Patel (2024) [2] who reported that larval population of *M. vitrata* among the different genotypes was significantly different and ranged from 0.40 larvae per plant in genotype VSGG 9 to 2.81 larvae per plant in genotype VSGG 4, Singh and Singh (2019) [9] whose results showed that mean larval population of *M. vitrata* ranged from 0.53 to 3.01 larvae per plant with maximum being in IPM 306-6 (3.01 larvae per plant) and minimum population in PM-5 (0.53 larvae per plant).

Table 1: Screening of greengram genotypes against *M. vitrata* during *Rabi*, 202324

S. No	Genotypes	No. of *M. vitrata* larvae /plant					Mean larval population
		35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	
1	LGG 610	0.33 (0.90)	0.67 (1.07)	1.87 (1.52)	2.33 (1.52)	2.40 (1.54)	1.52 (1.31)^{def}
2	LGG 673	0.00 (0.71)	0.40 (0.94)	1.07 (1.25)	1.53 (1.22)	1.57 (1.24)	0.91 (1.07)^{fg}
3	PUSA 9072	0.20 (0.82)	0.37 (0.93)	1.47 (1.40)	2.00 (1.41)	2.03 (1.42)	1.21 (1.20)^{efg}
4	LGG 667	0.00 (0.71)	0.27 (0.87)	0.87 (1.16)	1.13 (1.06)	1.20 (1.09)	0.69 (0.98)^{g}
5	VBN 4	0.27 (0.87)	1.10 (1.25)	2.80 (1.82)	3.03 (1.74)	3.10 (1.76)	2.06 (1.49)^{abcd}
6	LGG 678	0.13 (0.79)	0.67 (1.08)	2.37 (1.69)	2.57 (1.60)	2.60 (1.61)	1.67 (1.35)^{cde}
7	VBN 2	0.30 (0.88)	0.57 (1.03)	1.80 (1.52)	2.30 (1.51)	2.33 (1.53)	1.46 (1.29)^{def}
8	LGG 600	0.10 (0.77)	0.70 (1.09)	2.47 (1.72)	2.60 (1.61)	2.63 (1.62)	1.70 (1.36)^{bcde}
9	LGG 713	0.00 (0.71)	0.87 (1.16)	2.63 (1.77)	2.87 (1.68)	2.93 (1.71)	1.86 (1.41)^{bcde}
10	LGG 607	0.47 (0.98)	2.13 (1.62)	3.20 (1.92)	3.40 (1.84)	3.47 (1.86)	2.53 (1.65)^{a}
11	LGG 628	0.53 (1.02)	1.53 (1.42)	3.03 (1.88)	3.37 (1.83)	3.40 (1.84)	2.37 (1.60)^{ab}
12	LGG 630	0.60 (1.05)	1.27 (1.33)	2.97 (1.86)	3.13 (1.76)	3.17 (1.78)	2.23 (1.56)^{abc}
13	LGG 683	0.13 (0.79)	0.47 (0.98)	1.30 (1.33)	1.87 (1.36)	1.90 (1.38)	1.13 (1.17)^{efg}
14	IPM 2-14 (C)	0.20 (0.82)	0.53 (1.02)	1.60 (1.45)	2.17 (1.47)	2.20 (1.48)	1.34 (1.25)^{def}
15	LGG 460 (C)	0.47 (0.98)	1.40 (1.37)	3.00 (1.87)	3.13 (1.77)	3.23 (1.80)	2.25 (1.56)^{abc}
	F-test	Sig.	Sig.	Sig.	Sig.	Sig.	Sig.
	SEm±	0.07	0.06	0.07	0.06	0.05	0.08
	CD (p=0.05)	0.20	0.18	0.20	0.17	0.16	0.24
	CV (%)	14.22	9.42	7.44	6.61	6.00	10.69

Values in the parenthesis are square root transformed values; Means with the same letter are not significantly different. DAS-Days after Sowing, C-Check, Sig. – Significant

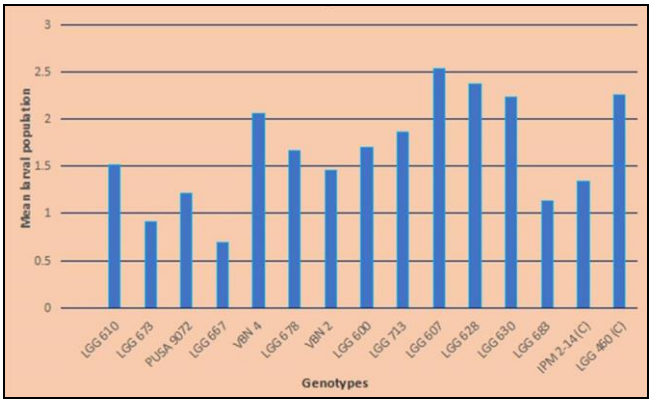


Fig 1: Mean larval population of spotted pod borer, *M. vitrata* on different greengram genotypes during *rabi*, 2023-24.

Pod damage among the genotypes ranged from 26.33 to 10.67 per cent. Highest pod damage (26.33%) was observed in genotype LGG 607 followed by LGG 628 (22.33%) and LGG 460 (21.33%). Lowest pod damage was observed in genotype LGG 667 (10.67%) followed by LGG 673 (11.00%) and LGG 683 (13.33%). (Table 2). Based on the results genotype LGG 667 was categorized as moderately resistant with the pod damage of 10.67 per cent, eleven genotypes showed susceptible reaction with the per cent pod damage in the range of 19.00 per cent in genotype LGG 713 to 11.00 per cent in LGG 673 and three genotypes LGG 607, LGG 628 and LGG 460 with pod damage of 26.33 per cent, 22.33 per cent and 21.33 per cent respectively. The results are in proximity with Raj and Singh (2017) [5, 8] who reported that damage caused by spotted pod borer was recorded maximum in genotype LGG 460 which is 15.93 per cent and minimum pod damage was observed in genotype PM 10-18 which is 9.50 percent.

Table 2: Response of greengram genotypes against *M. vitrata* during *rabi*, 202324

S.No	Genotype	Pod damage (%)*	Scale (1-9)	Reaction
1	LGG 610	15.33 (22.99)	5	S
2	LGG 673	11.00 (19.36)	5	S
3	PUSA 9072	14.00 (21.91)	5	S
4	LGG 667	10.67 (19.06)	3	MR
5	VBN 4	16.67 (24.05)	5	S
6	LGG 678	16.00 (23.49)	5	S
7	VBN 2	15.00 (22.72)	5	S
8	LGG 600	16.67 (24.07)	5	S
9	LGG 713	19.00 (25.84)	5	S
10	LGG 607	26.33 (30.85)	7	MS
11	LGG 628	22.33 (28.20)	7	MS
12	LGG 630	17.33 (24.57)	5	S
13	LGG 683	13.33 (21.37)	5	S
14	IPM 2-14 (C)	13.67 (21.64)	5	S
15	LGG 460 (C)	21.33(27.48)	7	MS
	F-test	Sig.	-	-
	SEm±	1.03	-	-
	CD (p=0.05)	3.00	-	-
	CV (%)	7.54	-	-

*****Values in the parenthesis are arc sine transformed values; Scale (1-9): 1- No infestation; 3- Moderately resistant; 5- Susceptible; 7- Moderately susceptible; 9- Highly susceptible.
DAS- Days after Sowing,
C-Check,
Sig. – Significant

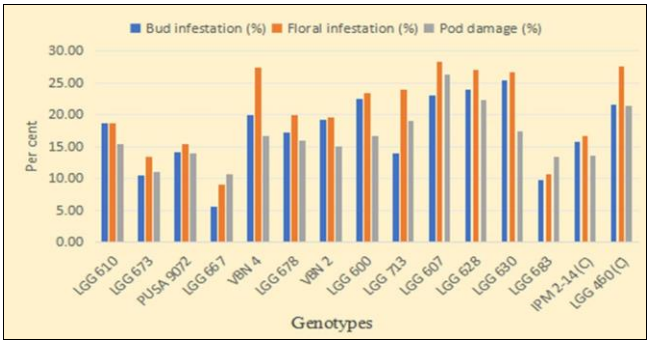


Fig 2: Response of greengram genotypes against the infestation of spotted pod borer during *rabi*, 202324

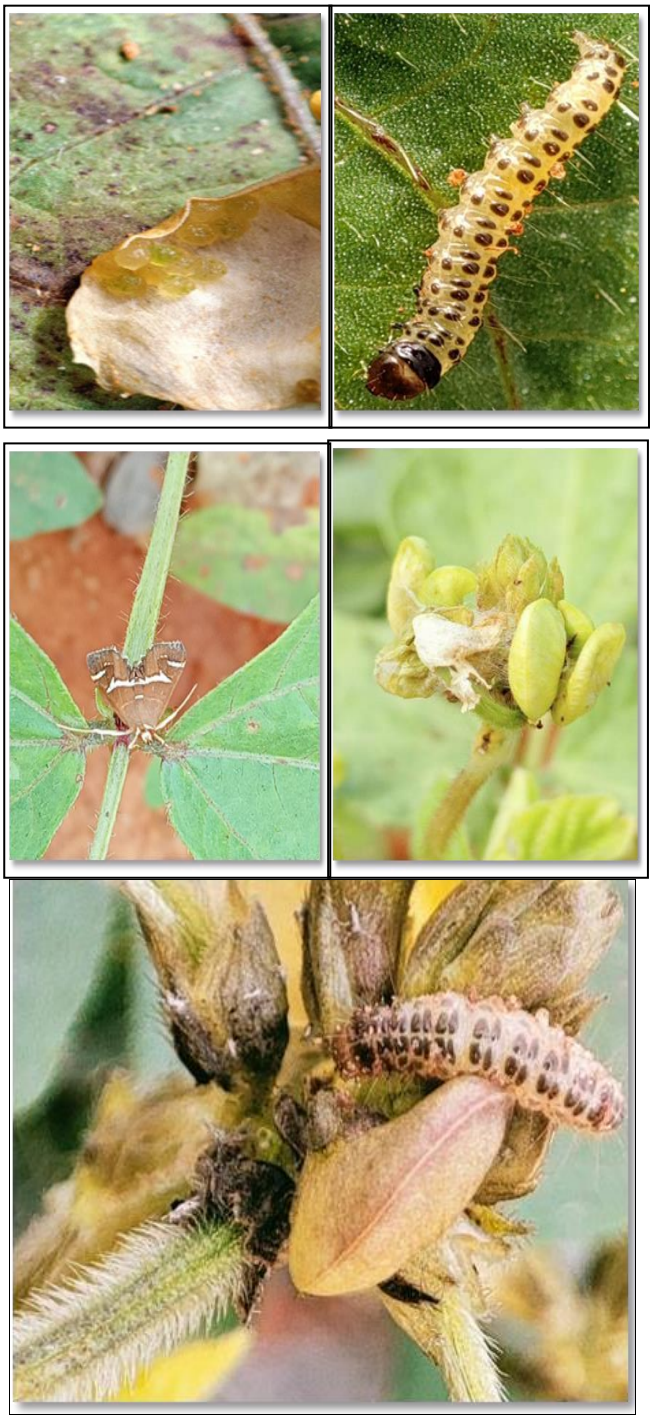


Fig 3: Eggs, larvae, adult and damage caused by spotted pod borer, *M. vitrata* in greengram

Pod damage caused by *H.armigera* among different genotypes ranged between 2.67 to 13.00 per cent. Highest pod damage (13.00%) was observed in the genotype LGG 607, followed by LGG 630 (12.00%) and VBN 4 (11.67%) and lowest pod damage (2.67%) was observed in genotype LGG 673 followed by the genotype LGG 667 (4.00%) and LGG 683 (4.33%). (Table 3). Out of 15 genotypes screened for resistance against *H.armigera*, based on pest susceptibility %, seven genotypes (LGG 610, LGG 673, PUSA 9072, LGG 667, LGG 678, VBN 2 and LGG 683) were categorized as resistant with pest susceptibility rating ranging between 1-5. Two genotypes (LGG 600 and LGG 713) response was regarded equal to check and the pest susceptibility rating of these genotypes was 6. Four genotypes (VBN 4, LGG 607, LGG 628, and LGG 630) were categorized as susceptible and their pest susceptibility rating ranged between 7-9. The findings are in accordance with Kol *et al.* (2022) [3] who reported that minimum pod damage by *H. armigera* was observed in germplasm OBGG 109 with 0.5 per cent, which was found at par with LGG 460 and PM 1711 with 1.00 per cent and IPM 1603-3, IPM 20-1, MH 1830, ML 2506, ML 818, SML 2015 with 1.5 per cent pod damage respectively, whereas the maximum pod damage was observed in germplasm BCM 20-9 with 10.5 per cent pod damage. Sreekanth *et al.* (2017) [10] recorded lowest and highest mean pod damage due to *H. armigera* in CO 6 (2.8%) and AKTM 10-07 (11.5%), respectively.

Table 3: Response of greengram genotypes against *H. armigera* during *rabi*, 2023-24

S.No	Genotypes	Pod damage (%)	Pest susceptibility (%)	Susceptibility rating	Remarks
1.	LGG 610	6.00 (14.15)	37.95	4	R
2.	LGG 673	2.67 (9.08)	72.38	3	R
3.	PUSA 9072	5.33 (13.27)	44.88	4	R
4.	LGG 667	4.00 (11.15)	58.63	3	R
5.	VBN 4	11.67 (19.95)	-20.68	7	S
6.	LGG 678	7.33 (15.70)	24.19	5	R
7.	VBN 2	8.33 (16.77)	13.85	5	R
8.	LGG 600	9.00 (17.39)	6.92	6	Equal to check
9.	LGG 713	9.67 (18.08)	0.00	6	Equal to check
10.	LGG 607	13.00 (20.83)	-34.43	8	S
11.	LGG 628	11.00 (19.17)	-13.75	7	S
12.	LGG 630	12.00 (20.02)	-24.09	7	S
13.	LGG 683	4.33 (11.90)	55.22	3	R
14.	IPM 2-14 (C)	5.33 (13.27)	-	-	-
15.	LGG 460 (C)	9.67 (18.11)	-	-	-
	F-test	Sig.	-	-	-
	SEm±	1.35	-	-	-
	CD (p=0.05)	3.93	-	-	-
	CV (%)	14.76	-	-	-

Values in the parenthesis are arc sine transformed values; C-Check;
Pest Susceptibility rating: 1 to 5 –Resistant, 6- Equal to check, 7 to 9 – Susceptible, R --Resistant, S---Susceptible;
Sig. – Significant

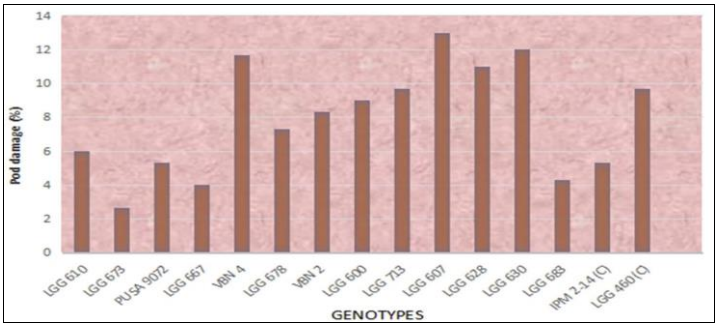


Fig 4: Response of greengram genotypes against the infestation of gram pod borer during *rabi*, 2023-24

Fig 5: Damage caused by gram pod borer, *H. armigera* in greengram

Observations on pod damage done by *M. obtusa* was recorded from the damaged pods at the time of harvesting and and were presented in Table 4. Pod damage among different genotypes ranged between 5.00 to 15.33 per cent. Highest pod damage (15.33%) was observed in the genotype LGG 628, followed by LGG 630 and LGG 600 with 14.67 per cent pod damage in each genotype and 13.67 per cent pod damage in LGG 607. Lowest pod damage (5.00%) was observed in genotype LGG 673 followed by the genotype LGG 667 (5.67%) and LGG 683 (6.67%). Based on the per cent pod damage in the entry and the check, pest susceptibility % was calculated and the genotypes were

categorized as resistant or susceptible following the pest susceptibility rating. Out of 15 genotypes screened for resistance against *M. obtusa*, based on pest susceptibility %, eight genotypes (LGG 610, LGG 673, PUSA 9072, LGG 667, VBN 4, LGG 678, VBN 2 and LGG 683) were categorized as resistant with pest susceptibility rating ranging between 1-5. Genotype LGG 713 response was regarded equal to check and the pest susceptibility rating of this genotype was 6. Four genotypes (LGG 600, LGG 607, LGG 628, LGG 630) were categorized as susceptible and their pest susceptibility rating ranged between 7-9. The findings are in agreement with Reddy *et al.* (2017) [] who reported that out of 14 genotypes screene6d for resistance/tolerance against pod fly, based on per cent pod damage, eight genotypes *viz.*, WRP 1 (9.33%), ICPHaRL 4985-11 (12.17%), ICPHaRL 4985-10 (13.50%), ICPHaRL 4989-7 (14.17%), LRG 52 (17.67%), CO 6 (18.33%), ICP 11957 (18.75%) and BRG 10-2 (23.67%) were grouped under resistant category as they recorded the pest susceptibility rating ranging from 1 to 5 and five genotypes *viz.*, ICPL 87119 (32.67%), ICPL 332- WR (33.83%), Guliyal Local (Red) (34.33%), ICP 8863 (41.44%) and GRG 2013 (52.67%) were grouped under susceptible category as they showed the pest susceptibility rating ranging from 7 to 9. Whereas, local check variety LRG 41 recorded 26.50 per cent pod damage. Singh *et al.* (2017) [8] reported that the per cent pod damage caused by pod fly on different genotypes ranged from 22.33 per cent in genotype IVT-520 to 46.67 per cent in genotype IVT- 510. Maximum pod damage due to pod fly were seen in IVT-510 (46.67%) followed by IVT-502 (45.67%) and IVT-501 (45.00%) and lowest pod damage was observed in IVT-520 (22.33%) followed by IVT-509 (29.80%) and AVT-603 (34.33 %).

Table 4: Response of greengram genotypes against *M. obtusa* during *rabi*, 202324

S.No	Genotypes	Pod damage (%)	Pest susceptibility (%)	Susceptibility rating	Remarks
1	LGG 610	10.00 (18.43)	18.89	5	R
2	LGG 673	5.00 (12.49)	59.44	3	R
3	PUSA 9072	7.33 (15.60)	43.22	4	R
4	LGG 667	5.67 (13.63)	54.01	3	R
5	VBN 4	11.00 (19.36)	10.78	5	R
6	LGG 678	9.33 (17.72)	24.33	5	R
7	VBN 2	10.33 (18.72)	16.22	5	R
8	LGG 600	14.67 (22.51)	-18.97	7	S
9	LGG 713	12.67 (20.81)	-2.75	6	Equal to check
10	LGG 607	13.67 (21.68)	-10.86	7	S
11	LGG 628	15.33 (23.01)	-24.33	7	S
12	LGG 630	14.67 (22.47)	-18.97	7	S
13	LGG 683	6.67 (14.93)	45.90	3	R
14	IPM 2-14 (C)	7.00 (15.32)	-	-	-
15	LGG 460 (C)	12.33 (20.50)	-	-	-
	F-test	Sig.	-	-	-
	SEm±	1.14	-	-	-
	CD (p=0.05)	3.30	-	-	-
	CV (%)	10.69	-	-	-

Values in the parenthesis are arc sine transformed values; C-Check;
Pest Susceptibility rating: 1 to 5 –Resistant, 6- Equal to check, 7 to 9 – Susceptible, R --Resistant, S---Susceptible;
Sig. – Significant

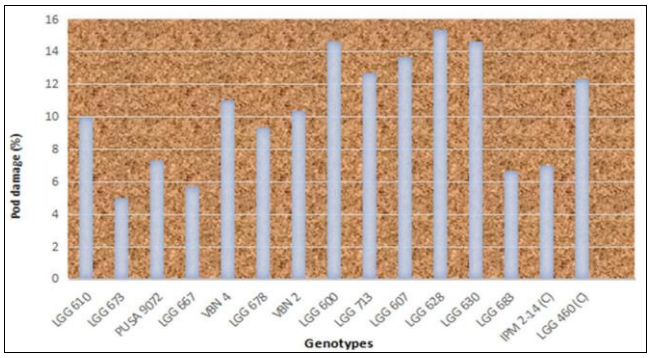


Fig 6: Response of greengram genotypes against the nfestation of pod fly during *rabi*, 2023-24

Fig 7: Pod fly, *M. obtusa* adults, maggot and pupae in greengram

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