The Andhra Agric. J 70 (1): 93-102, 2023
10.61657/aaj.2023.14

Screening of Greengram Genotypes for Resistance to Sucking Pests Under Natural Conditions

D Mounika, C Sandhya Rani, N Kamakshi, Rani Chapara and P Kishore Varma
Department of Entomology, Agricultural College, Bapatla

ABSTRACT

A field experiment on screening of Greengram genotypes was conducted at Regional Agricultural Research Station, Lam, Guntur during *Rabi*, 2022-23 to find out the resistant genotypes against sucking pests and associated viral diseases. Twenty nine genotypes were screened including susceptible check LGG 450 and resistant check LGG 460. Among twenty nine genotypes screened, the mean whitefly population ranged from 0.96 to 10.70/ trifoliate leaf with highest population in MH 18-181 and lowest in COGG-912. The mean aphid population ranged from 0.53 (VGG 104) to 62.67 (IPM 1603-1) per 10 cm terminal shoot, while the mean population of thrips ranged from 2.54 (VGG 17-106) to 26.00 (MH 18-181)/three leaves per plant. The yield also varied significantly among the genotypes and ranged from 1992 kg ha^{-1} in the genotype COGG-912 to 264 kg ha^{-1} in genotype PMS-12.

Keywords**:** *Aphids, Greengram, Leaf Curl, Screening, Thrips, Whitefly and Yield.*

Greengram is one of the important legume crop and third largely grown pulse crop of India after chickpea and pigeonpea. Greengram [*Vigna radiata* (L.) Wilczek] is popularly known as Mung bean, is an important short duration pulse crop in India. Mung bean is a self pollinating, diploid (2n=22) and belongs to the family, Leguminaceae. According to Vavilov (1926), Greengram has originated from India and Central Asia.

Greengram is protein rich food, containing about 24-25 per cent protein, which is almost three times to that of cereals with 56 per cent carbohydrates, 1.3 per cent fat, 3.5 per cent minerals and 4.1 per cent fiber content (Tiwari and Shivhare, 2016). Greengram supplies a major share of protein requirement to vegetarian population of the country. It not only plays an important role in human diet but also in improving the soil fertility by fixing the atmospheric nitrogen (58-109 kg/ha) in symbiotic association with Rhizobium bacteria, which not only enables it to meet its own nitrogen requirement but also benefits the succeeding crops, thereby enhances the soil fertility and improves the soil structure (Hafeez *et al.* 1988).

Greengram [*Vigna radiata* (L.)] is an important pulse crop of India sharing 10 per cent of total pulse production *i.e.*, 24.48 lakh tonnes, occupying an area of 46.07 lakh hectares and an average yield of 531 kg/ha (Directorate of Pulses Development, Annual Report: 2021-2022). In Andhra Pradesh, Greengram, is grown in an area of 1.3 lakh ha with a production of 0.77 lakh tonnes and a productivity of 735 kg/ha (Agricultural Market Intelligence Centre, ANGRAU, Lam, 2021).

Mung bean crop is vulnerable to different species of insect pests. Insect pests damage is a serious limiting factor in cultivation of pulses leading to reduced production and productivity. Greengram is ravaged by an array of insect pests from sowing to harvest in the field as well as in storage (Lal and Sachan, 1987). There are 64 species of insects attacking on mungbean crop and among them sucking pests such as whiteflies, thrips and aphids are the most notorious one during early stages of crop growth which not only reduces the plant vigour but also acts as vectors for deadly viral diseases (Khattak *et al.*, 2004).

Whitefly (*Bemisia tabaci*), is the most serious pest causing damage by sucking cell sap from leaves and tender parts, and secretes honeydew on which sooty mould develops that hinders photosynthesis. Besides, it also acts as vector for mung bean yellow mosaic virus, which is a serious threat to pulse production in India.

Thrips (*Megalurothrips typicus* & *Thrips palmi*) are another major sucking pest in both Greengram and Blackgram crops (Chhabra and Kooner, 1998). Thrips cause substantial damage to tender shoots, leaves, buds and flowers resulting in curling of leaves dropping of flower buds and flowers by sucking cell sap from different tender parts of plant (Satyapriya *et al*., 2017). Severe infestation may reduce the pod set and distort the pods.

Aphids, (*A. craccivora*) are widely distributed species of sucking insect pest prevalent throughout the country. Both nymphs and adults suck plant sap and cause severe damage from the seedling to harvesting stage, which may induce plant deformation, reduction in plant height, bear few flowers and pods, the pods and seeds become shrivelled. They also cause indirect damage caused by honeydew secretion which leads to development of sooty mould, it inhibits photosynthesis of the plant.

Cultivation of insect pest resistant cultivars is one of the main technique for pest management as an integrated pest management strategy under low input farming system. By keeping all these aspects in view, the present study is aimed at screening of greengram genotypes for identification of resistant genotypes against to sucking pests and associated viral diseases.

MATERIAL AND METHODS

A field experiment on screening of Greengram genotypes was conducted at Regional Agricultural Research Station, Lam, Guntur during *Rabi*, 2022-23 to find out the resistant genotypes against sucking pests. Twenty nine Greengram genotypes including resistant (LGG 460) and susceptible check (LGG 450) were procured and evaluated.

The experiment was laid out in a simple Randomized Block Design (RBD) with twenty nine genotypes and two replications. Each entry was sown directly in two rows of four meter length with a spacing 30 cm × 10 cm. No plant protection measures were provided to create optimum conditions for pest multiplication.

Observations were recorded from 10 to 50 days after sowing at weekly intervals from randomly selected five plants from each genotype in two replications. Population of whitefly was counted by using the magnifying lens (Salam *et al*., 2009) during the early hour of the day from fully formed trifoliate leaf of the plant and expressed as mean population per plant in individual genotypes (Men and Sarode 1999). The population of thrips was recorded early in the morning (6-8 A.M) by tapping the top, middle and bottom leaves on a white paper and expressed as number of thrips/three leaves per plant as suggested by Rathore and Tiwari (1999). Aphid population was counted from the 10 cm terminal shoot portion of the plant. Based on the aphid population, the genotypes were grouped into six categories based on a 5-point score given by Souleymane *et al.* (2013) (Table 1) and expressed as number of aphids per plant.

Table 1. Rating scale (0-5) for aphid population in Greengram

Score	No. of Aphids	Reaction
0	0-1	Very highly resistant
1	1-5	Highly resistant
2	5-20	Moderately resistant
3	20-100	Moderately susceptible
4	100-500	Susceptible
5	> 500	Highly susceptible

The yield data of different genotypes was collected separately and subjected to statistical analysis (Gomez and Gomez, 1984) to test the significance. All the data recorded were subjected to statistical analysis using Analysis of Variance (ANOVA) as per the Randomized Block Design procedure and insect population data were transformed with square root transformed “x+0.5 method. Standard error of mean and the critical difference were computed at 5% level of probability. The significance difference has been judged by using Duncan Multiple Range Test (SPSS).

RESULTS AND DISCUSSION

Whitefly Infestation

Whitefly incidence started from 10 days after sowing and attained its peak at 31 days and then slowly declined upto 45 days. After 45 days whitefly population disappeared. At 10th day after sowing whitefly population was in the range of 0.50 (COGG -912) to 4.00 (PUSA M 2241) whiteflies/trifoliate leaf. At 17 days after sowing the population was in the range of 0.50 (IGKM 05-18-2) to 9.20 (MH 18-181) per trifoliate leaf. The observation at 24th day after sowing recorded a whitefly population of 0.50 (VGG 16-045) to 6.60 (PMS-12)/trifoliate leaf.

During 38 days after sowing the population of whitefly was observed in the range of 0.40 (LGG 711) to 28.00 (MH 18-181) whiteflies/trifoliate leaf. The mean population of whitefly was ranged between 0.96 to 10.70 whiteflies per trifoliate leaf. The highest mean whitefly population of 10.70/trifoliate leaf was recorded with genotype MH 18-181 while least population of whitefly was recorded with genotype COGG-912 (0.96/trifoliate leaf) (Table 2 and fig 1).

The results were in accordance with the research findings of Ramarao *et al*. (2021) who studied the varietal preference of insect pests on greengram genotypes under field conditions and reported that LGG 450 (susceptible check) was susceptible to whitefly infestation and Satveer *et al*., (2018) who reported that maximum population of whiteflies was recorded on the genotype ML 2410 (3.20 whitefly/split cage) followed by genotype PM 11-25 (3.07 whitefly/split cage) and low in genotype RMG 1087 (1.38 whitefly/split cage) followed by genotype AKM 12-24 (1.67 whitefly/split cage).

Table 2. Screening of Greengram genotypes to whitefly incidence during *Rabi*, 2022-23

S.No.	Genotypes	*Whitefly (Mean no./trifoliate leaf)					Mean
		10 DAS	17 DAS	24 DAS	31 DAS	38 DAS	
1	COGG-912	0.50 (1.22)	0.70 (1.30)	1.10 (1.45)	1.40 (1.55)	1.10 (1.45)	0.96 (1.40)[j]
2	IGKM 05-18-2	0.50 (1.22)	0.50 (1.22)	1.50 (1.58)	1.90 (1.70)	0.90 (1.38)	1.06 (1.44)[ij]
3	LGG 706	0.90 (1.38)	1.10 (1.45)	1.10 (1.45)	0.90 (1.38)	1.50 (1.58)	1.10 (1.45)[ij]
4	LGG 686	1.20 (1.48)	1.80 (1.67)	0.70 (1.30)	1.40 (1.55)	1.20 (1.48)	1.26 (1.50)[hij]
5	COGG-8	0.90 (1.38)	1.40 (1.55)	1.60 (1.61)	1.70 (1.64)	0.90 (1.38)	1.30 (1.52)[hij]
6	LGG 574	0.80 (1.34)	6.60 (2.76)	1.30 (1.52)	1.40 (1.55)	1.50 (1.58)	2.32 (1.82)[efg]
7	MH 18-189	0.60 (1.26)	0.80 (1.34)	3.20 (2.05)	2.00 (1.73)	0.80 (1.34)	1.48 (1.57)[ghij]
8	Pusa 9072	0.60 (1.26)	0.70 (1.30)	1.10 (1.45)	2.00 (1.73)	0.60 (1.26)	1.00 (1.41)[j]
9	LGG 609	0.90 (1.38)	1.00 (1.41)	1.50 (1.58)	1.80 (1.67)	1.30 (1.52)	1.30 (1.52)[hij]
10	MH 1762	0.80 (1.34)	2.80 (1.95)	1.90 (1.70)	3.80 (2.19)	0.90 (1.38)	2.04 (1.74)[efghi]
11	LGG 711	0.50 (1.22)	1.80 (1.67)	1.10 (1.45)	1.80 (1.67)	0.40 (1.18)	1.12 (1.46)[ij]
12	JLPM 707-27	2.10 (1.76)	6.40 (2.72)	1.60 (1.61)	3.20 (2.05)	1.80 (1.67)	3.02 (2.00)[e]
13	LGG 450 (SC)	1.70 (1.64)	5.80 (2.61)	5.80 (2.61)	9.10 (3.18)	1.60 (1.61)	4.80 (2.41)[cd]
14	LGG 460 (RC)	1.10 (1.45)	2.30 (1.82)	1.30 (1.52)	2.60 (1.90)	1.10 (1.45)	1.68 (1.64)[fghij]
15	VGG 16-045	1.70 (1.64)	5.20 (2.49)	0.50 (1.22)	1.80 (1.67)	2.70 (1.92)	2.38 (1.84)[efg]
16	VGG 17-009	0.70 (1.30)	1.30 (1.52)	1.20 (1.48)	1.80 (1.67)	2.80 (1.95)	1.56 (1.60)[ghij]
17	PMS-12	2.40 (1.84)	4.30 (2.30)	6.60 (2.76)	10.60 (3.41)	4.50 (2.35)	5.68 (2.58)[bc]
18	OBGG 59	1.00 (1.41)	2.20 (1.79)	2.30 (1.82)	4.50 (2.35)	1.60 (1.61)	2.32 (1.82)[efg]
19	PM 2	2.20 (1.79)	2.90 (1.97)	1.00 (1.41)	2.70 (1.92)	4.40 (2.32)	2.64 (1.91)[ef]
20	VGG 17-106	2.00 (1.73)	3.00 (2.00)	1.40 (1.55)	3.40 (2.10)	2.10 (1.76)	2.38 (1.84)[efg]
21	VGG 104	0.50 (1.22)	0.80 (1.34)	0.70 (1.30)	2.60 (1.90)	0.80 (1.34)	1.08 (1.44)[ij]
22	TMB 146	1.20 (1.48)	1.00 (1.41)	1.40 (1.55)	2.90 (1.97)	0.80 (1.34)	1.46 (1.57)[ghij]
23	PUSA M 2141	1.00 (1.41)	5.00 (2.45)	0.70 (1.30)	2.90 (1.97)	1.20 (1.48)	2.16 (1.78)[efgh]
24	IPM 1103-1	1.80 (1.67)	1.80 (1.67)	1.60 (1.61)	5.90 (2.63)	1.20 (1.48)	2.46 (1.86)[efg]
25	MHBC 20-8	2.70 (1.92)	2.60 (1.90)	5.10 (2.47)	7.20 (2.86)	6.30 (2.70)	4.78 (2.40)[cd]
26	SML 2016	2.20 (1.79)	2.80 (1.95)	4.80 (2.41)	6.40 (2.72)	4.60 (2.37)	4.16 (2.27)[d]
27	PUSA M 2241	4.00 (2.24)	4.20 (2.28)	3.30 (2.07)	3.60 (2.14)	10.10 (3.33)	5.04 (2.46)[cd]
28	IPM 1603-1	3.30 (2.07)	8.10 (3.02)	3.80 (2.19)	4.60 (2.37)	12.30 (3.65)	6.42 (2.72)[b]
29	MH 18-181	1.00 (1.14)	9.20 (3.19)	6.20 (2.68)	9.10 (3.18)	28.00 (5.39)	10.70 (3.42)[a]
	F' test	S	S	S	S	S	S
	Sem	0.13	0.26	0.08	0.03	0.15	0.09
	CD (P = 0.05%)	0.38	0.74	0.22	0.1	0.45	0.25
	CV	12.15	18.91	6.25	2.32	11.46	6.42

*Values in the parenthesis are square root transformed values
DAS – Days After Sowing, S-Significant
SC- Susceptible Check, RC- Resistant Check

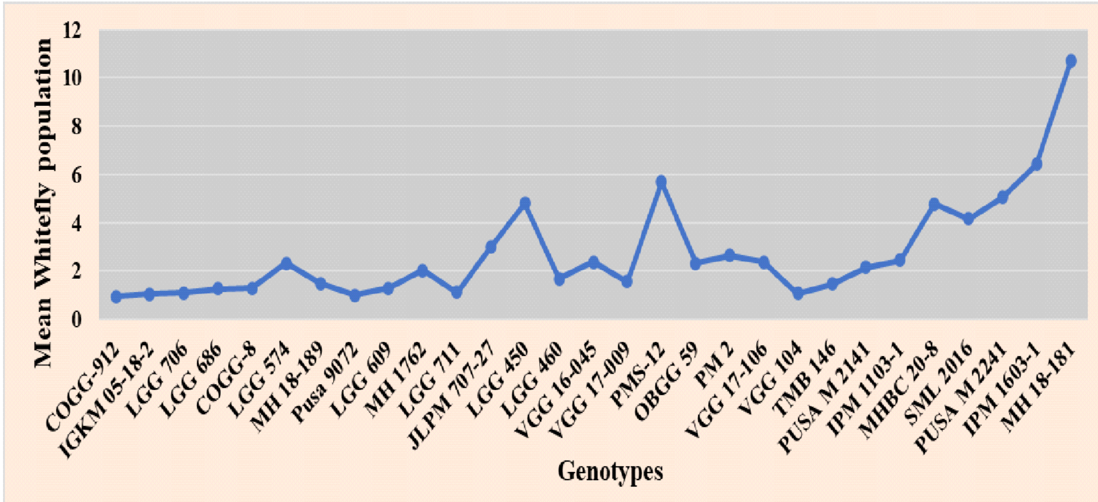

Fig 1. Population of whiteflies on different Greengram genotypes during *Rabi*, 2022-23

Aphid Infestation

Aphid infestation started from 10 days after sowing and from 24 days after sowing aphid infestation was not observed. Aphid population reappears during 52 days after sowing. At 10 days after sowing the population of aphids were observed in the range of 0.80 (VGG 104) to 19.20 (PMS-12) no./10 cm terminal shoot. At 17 days after sowing, aphids were in the range of 0.80 (VGG 104) to 24.00 (IGKM 05-18-2) no./10 cm terminal shoot. At 52 days after sowing maximum aphid population of 146.40/10 cm terminal shoot was recorded in IPM 1603-1 while least population of 3.20/10 cm terminal shoot was recorded in LGG 450. The mean population of aphids was in the range of 0.53 (VGG 104) to 62.67 (IPM 1603-1) no./10 cm terminal shoot (Table 3 and fig 2). Based on 0-5 scale aphid population was categorized into four categories (Table 4).

The results obtained in the present investigation are in accordance with Mahore *et al*., (2022) who reported least aphid incidence on greengram genotypes of Virat (2.73), Shikha (2.77), TM-37 (2.89) and PDM-139 (2.91). Abdullah-Al-Rahad *et al*. (2018) reported that BARI Mung-6 showed the least aphid population and highest resistance against aphid infestations at different stages. Similarly, Bhople *et al*. (2017) recorded the least aphid population on genotype Phule M-702-1 (2.78 aphids per inch of shoot per plant), while the highest (3.64 aphids per inch of shoot per plant) on genotype PKV AKM.

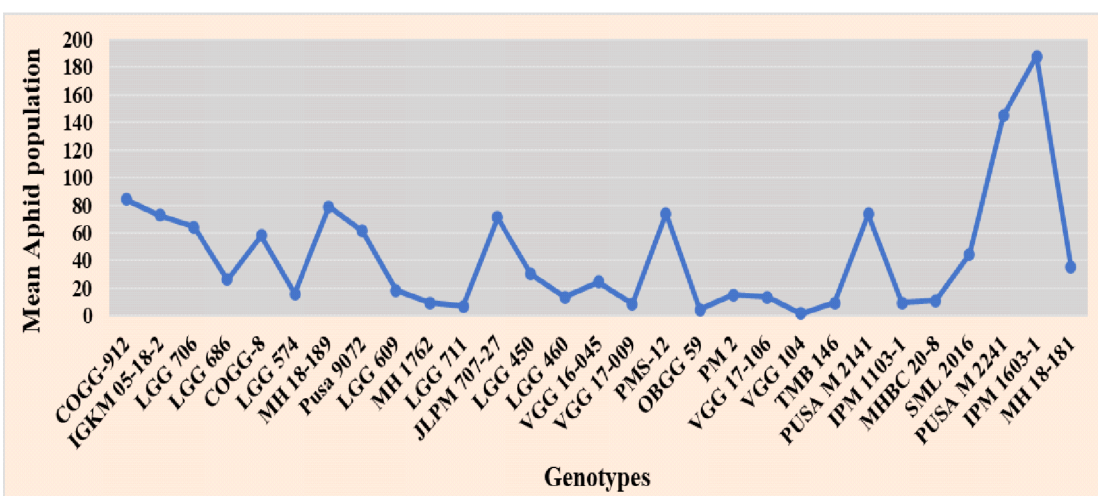

Fig 2. Population of aphids on different Greengram genotypes during *Rabi*, 2022-23

Table 3. Screening of Greengram genotypes to aphid incidence during *Rabi*, 2022-23

S.No.	Genotype	*Aphid Population (No./10 cm terminal shoot)				Reaction
		10 DAS	17 DAS	52 DAS	Mean	
1	COGG-912	16.80 (4.22)	23.20 (4.92)	44.40 (6.74)	28.13 (5.40)[c]	MS
2	IGKM 05-18-2	18.40 (4.40)	24.00 (5.00)	30.40 (5.60)	24.27 (5.03)[de]	MS
3	LGG 706	12.40 (3.66)	18.40 (4.40)	33.60 (5.88)	21.47 (4.74)[ef]	MS
4	LGG 686	8.80 (3.13)	7.20 (2.86)	10.40 (3.38)	8.80 (3.13)[hij]	MR
5	COGG-8	16.80 (4.22)	11.80 (4.67)	20.80 (4.67)	19.47 (4.52)[f]	MR
6	LGG 574	4.80 (2.41)	11.20 (3.49)	0.00 (1.00)	5.33 (2.52)[klm]	MR
7	MH 18-189	12.80 (3.71)	8.00 (3.00)	58.40 (7.71)	26.40 (5.23)[cd]	MS
8	Pusa 9072	9.60 (3.26)	18.40 (4.40)	33.60 (5.88)	20.53 (4.64)[f]	MS
9	LGG 609	6.40 (2.72)	12.00 (3.61)	0.00 (1.00)	6.13 (2.67)[jkl]	MR
10	MH 1762	5.60 (2.57)	4.00 (2.24)	0.00 (1.00)	3.20 (2.05)[lmno]	HR
11	LGG 711	1.60 (1.61)	5.60 (2.57)	0.00 (1.00)	2.40 (1.84)[mno]	HR
12	JLPM 707-27	17.60 (4.31)	20.00 (4.58)	33.60 (5.88)	23.73 (4.97)[de]	MS
13	LGG 450 (SC)	9.60 (3.26)	17.60 (4.31)	3.20 (2.05)	10.13 (3.34)[hi]	MR
14	LGG 460 (RC)	6.40 (2.72)	7.20 (2.86)	0.00 (1.00)	4.53 (2.35)[lmn]	HR
15	VGG 16-045	10.40 (3.38)	14.40 (3.92)	0.00 (1.00)	8.27 (3.04)[ijk]	MR
16	VGG 17-009	4.00 (2.24)	4.80 (2.41)	0.00 (1.00)	2.93 (1.98)[mno]	HR
17	PMS-12	19.20 (4.49)	20.80 (4.67)	34.00 (5.92)	24.67 (5.07)[d]	MS
18	OBGG 59	2.40 (1.84)	2.40 (1.84)	0.00 (1.00)	1.60 (1.61)[no]	HR
19	PM 2	8.80 (3.13)	6.40 (2.72)	0.00 (1.00)	5.07 (2.46)[lm]	MR
20	VGG 17-106	7.20 (2.86)	6.40 (2.72)	0.00 (1.00)	4.53 (2.35)[lmn]	HR
21	VGG 104	0.80 (1.34)	0.80 (1.34)	0.00 (1.00)	0.53 (1.24)[o]	VHR
22	TMB 146	4.00 (2.24)	5.60 (2.57)	0.00 (1.00)	3.20 (2.05)[lmno]	HR
23	PUSA M 2141	6.40 (2.72)	6.40 (2.72)	60.80 (7.86)	24.53 (5.05)[de]	MS
24	IPM 1103-1	4.80 (2.41)	4.80 (2.41)	0.00 (1.00)	3.20 (2.05)[lmno]	HR
25	MHBC 20-8	5.60 (2.57)	5.60 (2.57)	0.00 (1.00)	3.73 (2.18)[lmn]	HR
26	SML 2016	8.00 (3.00)	8.80 (3.13)	28.00 (5.39)	14.93 (3.99)[g]	MR
27	PUSA M 2241	7.20 (2.86)	10.40 (3.38)	127.20 (11.32)	48.27 (7.02)[b]	MS
28	IPM 1603-1	18.40 (4.40)	23.20 (4.92)	146.40 (12.14)	62.67 (7.98)[a]	MS
29	MH 18-181	9.60 (3.26)	16.00 (4.12)	9.60 (3.26)	11.73 (3.57)[h]	MR
F' test		S	S	S	S	-
Sem		0.22	0.41	0.15	0.17	
CD (P = 0.05%)		0.64	1.19	0.44	0.49	
CV		10.20	17.39	5.73	6.71	

***Values in the parenthesis are square root transformed values**
DAS – Days After Sowing
S-Significant
SC- Susceptible Check
RC- Resistant Check
VHR=Very Highly Resistant, HR= Highly Resistant, MR=Moderately Resistant and MS=Moderately Susceptible

Table 4. Categorization of Greengram genotypes based on resistant reaction to Aphid population (0-5 scale)

Score	No. of Aphids	Reaction	Genotypes
0	0-1	Very Highly Resistant (VHR)	VGG 104
1	5-Jan	Highly Resistant (HR)	MH 1762, LGG 711, LGG 460, VGG 17-009, OBGG 59, VGG 17-106, TMB 146, IPM 1103-1, MHBC 20-8.
2	20-May	Moderately Resistant (MR)	LGG 686, COGG-8, LGG 574, LGG 609, LGG 450, VGG 16-045, PM 2, SML 2016, MH 18-181.
3	20-100	Moderately Susceptible (MS)	COGG-912, IGKM 05-18-2, LGG 706, MH 18-189, Pusa 9072, JLPM 707-27, PMS-12, PUSA M 2141, PUSA M 2241, IPM 1603-1.

Thrips Infestation

Thrips incidence was observed from 24 days after sowing and attained its peak during 38 days after sowing and then slowly declined upto the crop maturity. At 24 days after sowing the thrips population ranged from 0.90 (VGG 17-106) to 14.30 (IPM 1603-1)/three leaves/plant. At 31 days after sowing thrips population was in the range of 1.50 (VGG 17-106) to 35.90 (MH 18-181)/three leaves/plant. At 38 days after sowing the population of thrips were in the range of 1.85 (COGG-912) to 47.10 (MH 18-181)/three leaves/plant. Similar trend was observed at 45 and 52 days after sowing. The mean population of thrips was in the range of 2.54 to 26.00/three leaves/plant. The highest mean population of thrips (26.00/three leaves/plant) was recorded in the genotype MH 18-181, lowest mean population of thrips were recorded in genotype VGG 17-106 (2.54/three leaves/plant) (Table 5 and fig 3).

The results are in accordance with Kumar *et al.* (2019) who reported that LGG 460 (2.93 thrips/10 flowers) recorded maximum infestation of flower thrips among the varieties screened and Singh *et al.*, (2018) reported minimum infestation of thrips in the genotype COGG 912 (0.45 thrips/5 flowers) among the twenty varieties screened. The results of lower thrips population in genotype COGG 912 is in accordance with Satveer *et al.* (2018) who reported that minimum infestation of thrips observed in genotype VGG 15-030 (0.21 thrips/5 flowers) followed by genotype COGG 912 (0.45 thrips/5 flowers).

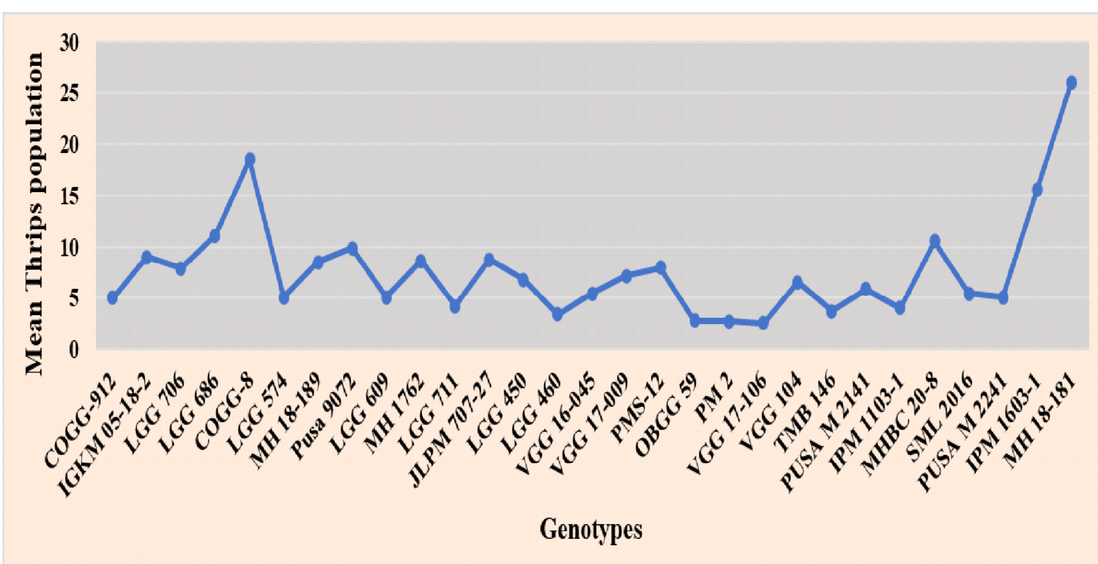

Fig 3. Population of thrips on different Greengram genotypes during *Rabi*, 2022-23

Table 5. Screening of Greengram genotypes to thrips infestation during *Rabi*, 2022-23

S.No.	Genotype	*Thrips Population (No./three leaves/plant)					Mean
		24 DAS	31 DAS	38 DAS	45 DAS	52 DAS	
1	COGG-912	7.90 (2.98)	1.60 (1.61)	1.85 (1.69)	8.40 (3.07)	5.25 (2.50)	5.00 (2.45)[lm]
2	IGKM 05-18-2	9.25 (3.20)	13.50 (3.81)	11.60 (3.55)	7.70 (2.95)	2.90 (1.97)	8.99 (3.16)[fg]
3	LGG 706	6.30 (2.70)	9.20 (3.19)	10.30 (3.36)	8.75 (3.12)	4.90 (2.43)	7.89 (2.98)[ghi]
4	LGG 686	12.60 (3.69)	15.40 (4.05)	17.50 (4.30)	5.60 (2.57)	4.40 (2.32)	11.10 (3.48)[d]
5	COGG-8	9.80 (3.29)	30.70 (5.63)	40.80 (6.47)	2.20 (1.79)	9.00 (3.16)	18.50 (4.42)[b]
6	LGG 574	5.30 (2.51)	6.80 (2.79)	7.00 (2.83)	3.00 (2.00)	3.20 (2.05)	5.06 (2.46)[lm]
7	MH 18-189	9.50 (3.24)	10.50 (3.39)	13.10 (3.75)	4.00 (2.24)	5.50 (2.55)	8.52 (3.09)[g]
8	Pusa 9072	11.10 (3.48)	15.00 (4.00)	10.80 (3.44)	8.35 (3.06)	4.20 (2.28)	9.89 (3.30)[ef]
9	LGG 609	6.30 (2.70)	5.40 (2.53)	5.60 (2.57)	4.40 (2.32)	3.60 (2.14)	5.06 (2.46)[lm]
10	MH 1762	5.20 (2.49)	13.00 (3.74)	15.00 (4.00)	4.60 (2.37)	5.40 (2.53)	8.64 (3.10)[g]
11	LGG 711	3.60 (2.14)	4.20 (2.28)	5.80 (2.61)	4.20 (2.28)	3.30 (2.07)	4.22 (2.28)[mn]
12	JLPM 707-27	12.60 (3.69)	9.10 (3.18)	10.50 (3.39)	6.00 (2.65)	5.60 (2.57)	8.76 (3.12)[g]
13	LGG 450 (SC)	6.70 (2.77)	9.10 (3.18)	8.50 (3.08)	5.00 (2.45)	4.80 (2.41)	6.82 (2.80)[ijk]
14	LGG 460 (SC)	1.10 (1.45)	4.90 (2.43)	5.20 (2.49)	4.70 (2.39)	1.20 (1.48)	3.42 (2.10)[nop]
15	VGG 16-045	4.90 (2.43)	5.60 (2.57)	7.20 (2.86)	5.10 (2.47)	4.30 (2.30)	5.42 (2.53)[l]
16	VGG 17-009	6.10 (2.66)	10.20 (3.35)	10.30 (3.36)	4.80 (2.41)	4.40 (2.32)	7.16 (2.86)[hij]
17	PMS-12	3.60 (2.14)	15.00 (4.00)	9.10 (3.18)	8.05 (3.01)	4.10 (2.26)	7.97 (2.99)[gh]
18	OBGG 59	1.40 (1.55)	3.50 (2.12)	3.20 (2.05)	4.30 (2.30)	1.50 (1.58)	2.78 (1.94)[op]
19	PM 2	1.30 (1.52)	2.50 (1.87)	4.00 (2.24)	4.30 (2.30)	1.50 (1.58)	2.72 (1.93)[op]
20	VGG 17-106	0.90 (1.38)	1.50 (1.58)	6.80 (2.79)	2.50 (1.87)	1.00 (1.41)	2.54 (1.88)[p]
21	VGG 104	4.60 (2.37)	6.60 (2.76)	10.00 (3.32)	7.60 (2.93)	4.10 (2.26)	6.58 (2.75)[jk]
22	TMB 146	2.10 (1.76)	3.80 (2.19)	6.30 (2.70)	4.20 (2.28)	2.30 (1.82)	3.74 (2.18)[mn]
23	PUSA M 2141	3.70 (2.17)	6.10 (2.66)	7.40 (2.90)	8.10 (3.02)	4.20 (2.28)	5.90 (2.63)[kl]
24	IPM 1103-1	1.80 (1.67)	3.70 (2.17)	5.30 (2.51)	7.20 (2.86)	2.20 (1.79)	4.04 (2.24)[mn]
25	MHBC 20-8	7.90 (2.98)	13.00 (3.74)	17.10 (4.25)	8.40 (3.07)	6.40 (2.72)	10.56 (3.40)[de]
26	SML 2016	3.40 (2.10)	6.20 (2.68)	7.50 (2.92)	6.70 (2.77)	3.50 (2.12)	5.46 (2.54)[l]
27	PUSA M 2241	4.20 (2.28)	5.80 (2.61)	6.10 (2.66)	5.90 (2.63)	3.30 (2.07)	5.06 (2.46)[lm]
28	IPM 1603-1	14.30 (3.91)	16.60 (4.20)	15.70 (4.09)	16.70 (4.21)	14.70 (3.96)	15.60 (4.07)[c]
29	MH 18-181	3.10 (2.02)	35.90 (6.07)	47.10 (6.94)	40.62 (6.45)	3.30 (2.07)	26.00 (5.20)[a]
F' test		S	S	S	S	S	S
Sem		0.12	0.11	0.05	0.11	0.23	0.06
CD (P = 0.05%)		0.34	0.31	0.14	0.31	0.65	0.18
CV		6.66	4.85	2	5.48	14.27	3.12

*Values in the parenthesis are square root transformed values
DAS – Days After Sowing
S-Significant
SC- Susceptible Check
RC- Resistant Check

Table 6. Yield parameters of greengram genotypes during *rabi*, 2022-23

S.No.	Genotype	100 Seed Weight (g)	Seed Yield (Kg ha^{-1})
1	COGG-912	3.17	1992
2	IGKM 05-18-2	3.11	1158
3	LGG 706	3.10	1204
4	LGG 686	3.79	781
5	COGG-8	2.79	1916
6	LGG 574	3.35	793
7	MH 18-189	3.00	805
8	Pusa 9072	3.61	852
9	LGG 609	3.51	856
10	MH 1762	4.28	940
11	LGG 711	3.81	1021
12	JLPM 707-27	2.87	576
13	LGG 450 (SC)	3.19	753
14	LGG 460 (RC)	3.26	1913
15	VGG 16-045	2.97	1248
16	VGG 17-009	4.14	1262
17	PMS-12	3.60	264
18	OBGG 59	2.81	1329
19	PM 2	3.39	1338
20	VGG 17-106	3.43	1365
21	VGG 104	3.48	1490
22	TMB 146	3.91	1700
23	PUSA M 2141	3.94	1708
24	IPM 1103-1	3.60	1950
25	MHBC 20-8	3.91	1829
26	SML 2016	3.20	1781
27	PUSA M 2241	3.28	1316
28	IPM 1603-1	3.25	1221
29	MH 18-181	3.37	766
F' test		NS	S
Sem			1.21
CD (P = 0.05%)			3.51
CV (%)			4.95

SC- Susceptible Check
RC- Resistant Check
S-Significant
NS- Non-significant

Yield (kg ha^{-1})

Data collected on yield was presented in the table 6. Among the Twenty nine genotypes highest yield (1992 kg ha^{-1}) was recorded with COGG-912 followed by IPM 1103-1 (1950 kg ha^{-1}), COGG-8 (1916 kg ha^{-1}) and LGG 460 (1913 kg ha^{-1}). The lowest yield was recorded in PMS-12 (264 kg ha^{-1}) followed by JLPM 707-27 (576 kg ha^{-1}), LGG 450 (753 kg ha^{-1}) and MH 18-181 (766 kg ha^{-1}) (Fig 4).

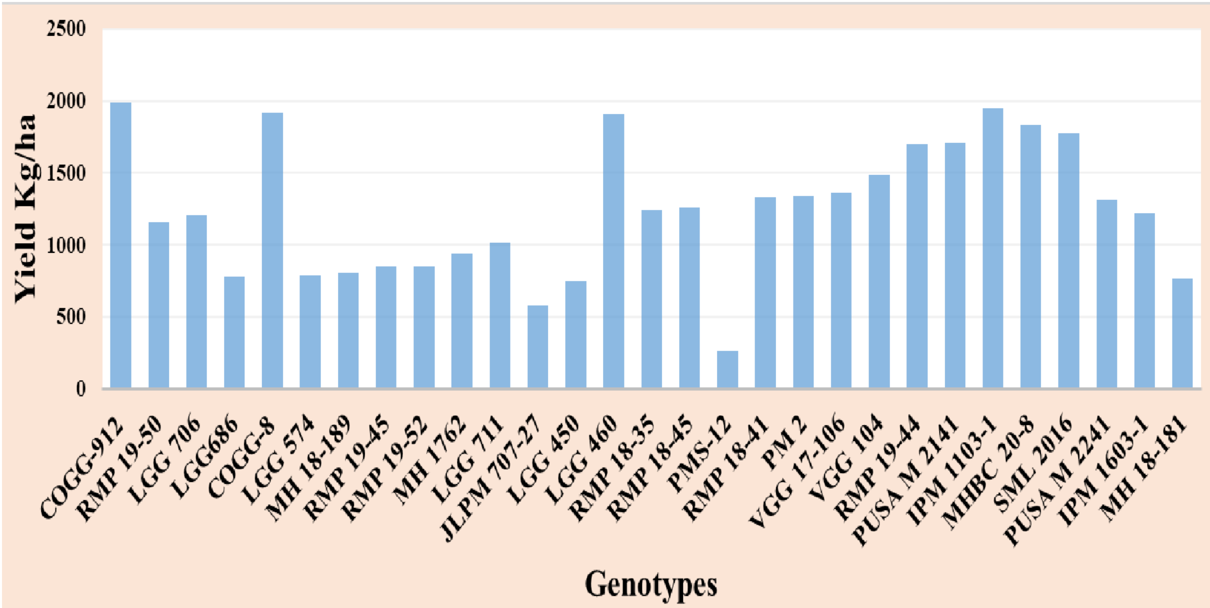

Fig 4. Yield of different genotypes under field conditions during *Rabi*, 2022-23

The infestation of whiteflies was first observed at 10 days after sowing (0.50/trifoliate leaf) and attained its peak at 31 days after sowing (0.90 to 10.60/trifoliate leaf). Aphid population was low in initial period (10 DAS - 0.80 to 19.20/10 cm terminal shoot), disappeared in reproductive period and reappeared at crop maturity (3.20 to 146.40/10 cm terminal shoot). However, the infestation of thrips was first observed at 24 days after sowing (0.90 to 14.30/ three leaves/plant) and attained its peak at 38 days after sowing (1.85 to 47.10/three leaves/plant). Based on 0-5 scale twenty nine genotypes were categorized into four categories, one genotype VGG 104 was grouped into very highly resistant category, nine were highly resistant, nine were moderately resistant and ten genotypes were moderately susceptible. Among the twenty nine genotypes screened against sucking pests COGG-912, COGG-8 and IPM 1103-1 were found resistant genotypes to whitefly, aphids and thrips infestation. PMS-12, JLPM 707-27, MH 18-181 were found to be susceptible to aphids, thrips.

LITERATURE CITED

Abdullah-Al-Rahad M, Rahman M S, Akter T, Akter J, Rahman M A and Aziz S M S 2018. Varietal screening of mungbean against whitefly and aphid. *Journal of Bioscience and Agriculture Research*. 18(1): 1478-1487.

Agricultural Market Intelligence Centre, ANGRAU , Lam. Greengram Outlook Report. 2021.

Bhople S K, Dhandge S R, Aravindarajan G and Patange N R 2017. Varietal screening of mungbean genotype for their resistence against pest complex of mungbean. *AGRES – An International e-Journal*. 6(1): 123-128.

Chhabra K S and Kooner B S 1998. Insect pest management in mungbean and blackgram-status and strategies. *Pulses- IPM system in agriculture*. 4: 233-310.

Directorate of Pulses Development, Government of India, Bhopal, Madhya Pradesh. *Annual Report*. 2021-22.

Gomez K A and Gomez A A 1984. *Statistical procedures for Agricultural Research*, 2nd Edition. IRRI, Phillippines. 12: 680.

Hafeez F Y, Aslam Z and Malik K A 1988. Effect of salinity and inoculation on growth, nitrogen fixation and nutrient uptake of *Vigna radiata* (L.) Wilczek. *Plant and Soil*. 106: 3-8.

Khattak M K, Ali S and Chishti J I 2004. Varietal resistance of mungbean (*Vigna radiata* L.) against whitefly (*Bemisia tabaci* Genn.), jassid (*Amrasca devastans* Dist.) and thrips (*Thrips tabaci* Lind.) *Pakistan Entomology*. 26 (1): 9-12.

Kumar R, Singh P S and Singh S K 2019. Evaluation of certain mungbean [*Vigna radiata* (L.) Wilczek] genotypes for resistance against major sucking insect pests. *International Journal of Agriculture, Environment and Biotechnology*. 12(2): 135-139.

Lal S S and Sachan J N 1987. Recent advances in pest management in pulses. *Indian Farming*. 37(7): 29-32.

Mahore P, Bhowmick A K, Makwana M and Sharma K 2022. Evaluation of mungbean genotypes against major insect pests. *Indian Journal of Entomology*. 84(2): 380-383.

Men U B and Sarode S B 1999. Vertical distribution of whiteflies, *Bemisia tabaci* G. on sunflower. *Insect Environment*. 5(3): 111.

Ramarao G, Satishbabu J, Harisatyanarayana N and Adinarayana M 2021. Morpho-physiological and biochemical variability in greengram [*Vigna radiata* (L.) Wilczek] varieties for Mungbean Yellow Mosaic Virus (MYMV) resistance under natural field conditions. *Legume Research*. 1: 6.

Rathore Y S and Tiwari S N 1999. Spatial distribution of *Megalurothrips distalis* as affected by phenology, crops and cropping seasons. *Indian Journal of Entomology*. 61(2): 144-158.

Salam S A, Patil M S and Byadgi A S 2009. Integrated disease management of Mungbean Yellow Mosaic Virus. *Annals of Plant Protection Sciences*. 17(1): 157-160.

Satveer S, Singh P S, Singh S K and Saxena R P N 2018. Screening of certain green gram, *Vigna radiata* genotypes against sucking insect pests. *Flora and Fauna*. 24(1): 91-96.

Satyapriya S, Srivastava C P, Varun S and Ramesh K B 2017. Screening of greengram [*Vigna radiata* (L.) Wilczek] genotypes for resistance to flower thrips, *Caliothrips indicus* (Begnall) under natural conditions. *Journal of Experimental Zoology*. 20(1): 491-495.

Souleymane A, Aken'Ova M E, Fatokun C A and Alabi O Y 2013. Screening for resistance to cowpea aphid (*Aphis craccivora* Koch) in wild and cultivated cowpea (*Vigna unguiculata* L. Walp.) accessions. *International Journal of Environmental Science and Technology*. 2(4): 611-621.

Tiwari A K and Shivhare A K 2016. Pulses in India: retrospect and prospects. *Published by Director, Government of India, Ministry of Agriculture and Farmers Welfare (DAC&FW), Directorate of Pulses Development, VindhyachalBhavan, Bhopal, MP*. 2: 62-68.

Vavilov N I 1926. Studies on the origins of cultivated plants. *Bulletin of Applied Botany and Plant Breeding*. 16: 1-245.

Received on 10.11.2022 and Accepted on 30.03.2023