Screening of Soybean Genotypes against Mungbean Yellow Mosaic Virus Disease under Field Conditions

Short Research Article

ABSTRACT

Soybean (*Glycine max* L.) is a nutrionally enrich leguminous crop, playing a pivotal part in food, feed and industrial sectors. In India it has been escalated owing to high adaptability, nitrogen fixing capability economic returns. However, production is significantly constrained by many biotic and abiotic stresses. Among biotic stresses Mungbean Yellow Mosaic Virus (MYMV) disease is a major viral disease transmitted by whitefly (*Bemisia tabaci)*, leading to chlorosis, stunted growth and severe yield losses. The present investigation aimed to evaluate twelve soybean genotypes for speckled resistance to MYMV under natural epiphytotic conditions during the *kharif* 2024. The experiment was laid out by using RBD, with 2 replications; Disease severity was scored based on a standardized 0-5 scale, wherein lower scores indicated higher resistance. Sustained variability was evident in disease response, with genotypes categorized as highly resistant, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible. Genotypes such as KDS 726, KDS 992 and MAUS 162 exhibited moderately susceptible whereas, MAUS 61, MAUS 81 and MAUS 612 showed susceptible against the Mungbean Yellow Mosaic Virus (MYMV). These findings provide a valuable foundation for the development of Mungbean Yellow Mosaic Disease (MYMD) resistant soybean cultivators in future. Future efforts for integrating molecular markers and genomic tools with phenotypic selection may be instrumental in accelerating the development of resilient soybean varieties for sustainable production in MYMV-endemic areas.

Keywords: Disease resistance; epiphytic screening; soybean genotypes; soybean (Glycine max); mungbean yellow mosaic virus (MYMV); whitefly (Bemisia tabaci).

1. INTRODUCTION

Soybean (*Glycine max* L.) is a self- pollinated crop belonging to the Leguminosae family and subfamily Papilionaceae genus Glycine. Soybean is an important oil seed crop with a high protein content (40-42 %), high lysine content and oil (20-22 %) rich in vital fatty acids. It is a major oil seed crop of world growing in an area of 134.55 mha and production of 370.42 million metric tons with average yield of 2750 kg/ ha in the world. Soybean is more susceptible to several biotic and abiotic stresses. Among all the biotic stresses diseases are the major ones. In India soybean crop is grown in the *kharif* season under rainfed conditions wherein severe attacks of many diseases have been reported (Amrate *et al.,* 2023a, Amrate *et al.,* 2023b and Amrate *et al*., 2024). Among all the diseases Mungbean Yellow Mosaic Disease is the major one. Mungbean Yellow Mosaic Disease in soybean is caused by Mungbean Yellow Mosaic Virus (MYMV) and exclusively transmitted by whitefly (*Bemisia tabaci* Genn.) in a persistent manner. This Mungbean Yellow Mosaic Virus (MYMV) is majorly distributed in India, Srilanka, Bangladesh, Pakistan and Thailand (Kumar *et al*., 2023). Mungbean Yellow Mosaic Virus (MYMV) gradually started appearing in central India and has become a common disease of soybean, mungbean and urdbean (Amrate *et al*., 2023a). In north India, Mungbean Yellow Mosaic Virus (MYMV) of soybean was first detected in the year 1970s (Nariani, 1960 and Suteri, 1974) and has since been transmitted at unprecedented proportions. Considering the importance of the disease and virus this research i.e., Screening of soybean genotypes against Mungbean Yellow Mosaic Virus (MYMV) disease under field conditions has been conducted.

2. MATERIAL AND METHODS / EXPERIMENTAL DETAILS / METHODOLOGY

A total of 12 genotypes of soybean were screened for the reaction against Mungbean Yellow Mosaic Virus on soybean. The field study was carried out in year 2024 at Department of Plant Pathology, College of Agriculture, Latur. The experiment was undertaken under natural epiphytic conditions. Available soybean genotypes were grown, at spacing of 45x 5 cm^2 by maintaining 2 replications and the entire set of recommended techniques were followed. No insecticidal spray was done in the experimental plot or in the vicinity during the crop season. Plants were exposed to natural infection. Based on ratings of the disease, the percentage of Mungbean Yellow Mosaic Virus disease incidence was estimated in each genotype. Later these were also categorized as highly resistant, resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible, respectively.

Table 1: List of genotypes of soybean used in screening against MYMV

Sr. No	Genotypes	Sr. No.	Genotypes
1	MAUS 47	7	MAUS 81
2	KDS 726	8	MAUS 158
3	KDS 753	9	MAUS 725
4	MAUS 731	10	MAUS 71

5	KDS 992	11	MAUS 61
6	MAUS 612	12	MAUS 162

Table 2: Disease rating scale of soybean genotypes against Mungbean yellow mosaic virus (MYMV) (Mayee and Datar, 1986)

Disease scale	Description	Category
0	No Plants showing in any symptom	Immune (I)
1	Less than 1 % plants showing symptoms	Resistant (R)
3	1-10 % plants showing mottling symptom	Moderately Resistant (MR)
5	11-20 % plants showing mottling and yellow discoloration of leaves	Moderately Susceptible (MS)
7	21-50 % plants showing mottling and yellow discoloration of leaves; stunting of plants	Susceptible (S)
9	51 % of more plants are affected, stunting of plants pronounced flower and fruit set reduced. Yellow mosaic severe.	Highly Susceptible (HS)

Observations

The soybean Mungbean Yellow Mosaic Virus disease affected plants were monitored for every 7 days and the Per cent disease incidence was estimated by using the following formula, given by Wheeler in (1969).

$$\text{Percent disease incidence} = \frac{\text{Number of infected plants in the plot}}{\text{Total number of plants in plot}} \times 100$$

The observations on plant growth and yield contributing characters, such as plant height, number of pods/ plant and Pods lengths were recorded for all the genotypes at 45 days after sowing. Mature and dried Soybean pods were harvested. Grain yield data was calculated on a hectare basis after the pods were harvested separately according to their genotypes.

3. RESULTS AND DISCUSSION

Table 3: Screening of soybean genotypes against Mungbean Yellow Mosaic Virus

Sr. No.	Name of Genotypes	No. of Whiteflies/ leaf*	Disease Incidence (%)	First appearance of disease on plants (Days after sowing)	Reaction
1	MAUS 47	0.60	8.5 %	36	MR
2	KDS 726	1.67	16.17 %	26	MS

3	KDS 753	1.73	39.86 %	24	S
4	MAUS 731	1.30	9.86 %	29	MR
5	KDS 992	1.54	15.45 %	28	MS
6	MAUS 612	1.78	36.60 %	21	S
7	MAUS 81	1.85	41.4 %	19	S
8	MAUS 158	0.80	9.5 %	32	MR
9	MAUS 725	0.66	9.32 %	34	MR
10	MAUS 71	1.20	9.8 %	30	MR
11	MAUS 61	1.80	39.7 %	20	S
12	MAUS 162	1.46	13.3 %	27	MS

*= Average of five plants

Results (Table 3, Fig. 1) revealed that, minimum whitefly population (0.60 whitefly/ leaf) was recorded in MAUS 47 and maximum whitefly population in (1.85 whitefly/ leaf) was recorded in MAUS 81. MAUS 47 showed less disease incidence (8.5 %) and MAUS 81 showed high disease incidence (41.4 %). The maximum yield was recorded in MAUS 47 (7.06 q/ ha) and least grain yield was found in MAUS 81 (3.68 q/ha), respectively.

In screening among twelve soybean genotype varieties, the average number of whitefly/ leaf and per cent disease incidence was recorded. Amongst the genotype varieties, least mean whitefly/ leaf i.e. 0.60 whitefly/ leaf was recorded in MAUS 47, followed by MAUS 725, MAUS 158, MAUS 71, MAUS 162, KDS 992, KDS 726, KDS 753, MAUS 612, MAUS 61 and MAUS 81 with 0.66, 0.80, 1.20, 1.30, 1.46, 1.54, 1.67, 1.73, 1.78, 1.80 and 1.85 whitefly/ leaf and highest no. of whitefly/ leaf was recorded in MAUS 81 i.e. 1.85 whitefly/ leaf.

Amongst the genotypes, least mean disease incidence of 8.5 % was recorded in MAUS 47 followed by MAUS 725, MAUS 158, MAUS 71, MAUS 162, KDS 992, KDS 726, KDS 753, MAUS 612, MAUS 61 and MAUS 81 with 8.5 %, 9.32 %, 9.5 %, 13.3 %, 15.45 %, 16.17 %, 39.86 %, 36.60 %, 39.98 % and 41.4 %. The maximum per cent disease incidence was recorded in MAUS 81 with 41.4 %, respectively.

Typically, the infected genotypes exhibited the symptoms as yellow spots along the veins, areas of yellowish green on the leaves, a bright yellow leaf surface, deformed leaves and stunted plants.

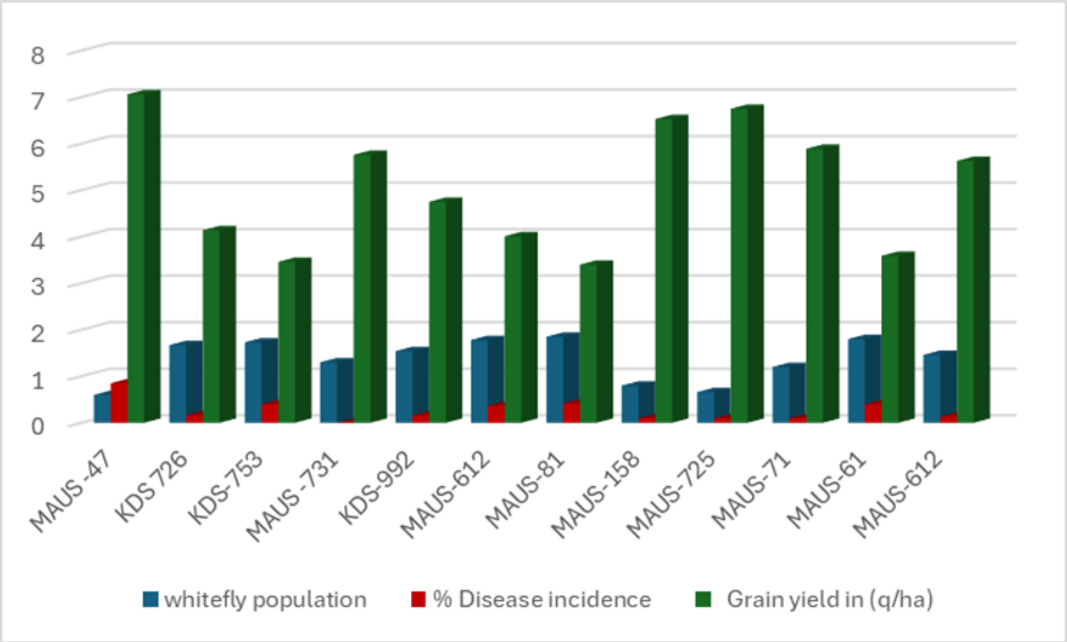

Fig. 1: Evaluation of whitefly, % disease incidence and grain yield

Table 4: Categorization of soybean genotype varieties on the basis of their reaction to Mungbean Yellow Mosaic Virus (MYMV) disease

Sr. No.	Scale	Reaction	Genotypes
1	**0**	Highly Resistant (HR)	**----**
2	**1**	Resistant (R)	**----**
3	**2**	Moderately Resistant (MR)	MAUS47, MAUS 731, MAUS 158. MAUS 725, MAUS 71
4	**3**	Moderately Susceptible (MS)	KDS 726, KDS 992, MAUS 162
5	**4**	Susceptible (S)	KDS 753, MAUS 61, MAUS 612, MAUS 81
6	**5**	Highly Susceptible (HS)	**----**

Based on the per cent disease incidence on soybean genotypes, they were classified as Highly resistant (HR), Resistant (R), Moderately Resistant (MR), Moderately Susceptible (MS), Susceptible (S) and Highly Susceptible (HS) and they were presented in Table 4.

Among the twelve genotypes, that were screened, results (Table 4) revealed that, none of them were found to be highly resistant or immune and five genotypes *viz.*, MAUS 47, MAUS 731, MAUS 158, MAUS 725 and MAUS 71 were categorized as Moderately Resistant (MR), four genotypes *viz*., KDS 726, KDS 992 and MAUS 162 were categorized as Moderately Susceptible (MS) and KDS 753, MAUS 81, MAUS 612 and MAUS 61 were categorized as Susceptible (S) genotypes to mungbean yellow mosaic virus.

Several researchers had recorded earlier mungbean yellow mosaic disease reactions in soybean such as Das *et al.* (2017); Yadav and Dahiya (2000) in mungbean, Mandhare and Suryawanshi (2008); Salam *et al*. (2009); Suman *et al.* (2015); Bhanu *et al*. (2017); Deepa *et al*. (2017); Khaliq *et al*. (2017); Dharajiya *et al*. (2018); Mahalingam *et al*. (2018), Ramesh *et al.* (2019) and Yadav *et al.* (2021), respectively.

Table 5: Yield and yield parameters of different genotypes of soybean

Sr. No.	Name of the Genotypes	Plant height (30 days)*	Plant height (90 days)*	Germination (%)*	No. of pods/ plant*	Pod length (cm)*	Yield (q/ ha)
1	**MAUS 47**	33.53	47.78	55.98	28.99	4.1	7.06
2	**KDS 726**	35.6	42.8	36.21	16.59	3.0	4.14
3	**KDS 753**	26.4	30.01	20.56	14.87	2.4	3.46
4	**MAUS 731**	31.23	39.45	44.51	19.67	3.4	5.76
5	**KDS 992**	31.5	37.85	38.98	19.10	3.0	4.75
6	**MAUS 612**	28.06	35.26	33.69	15.11	2.9	4.01
7	**MAUS 81**	21.26	29.88	19.89	11.10	2.0	3.40
8	**MAUS 158**	35.39	42.36	51.21	21.98	3.8	6.53
9	**MAUS 725**	31.54	44.56	52.98	24.24	3.9	6.75
10	**MAUS 71**	32.76	40.22	46.69	20.29	3.7	5.89
11	**MAUS 61**	29.46	32.26	24.21	13.23	2.7	3.59
12	**MAUS 162**	29.65	38.98	40.45	19.79	3.2	5.63

*Average no. of plants =5

The results in (Table 5) on the effect of Mungbean Yellow Mosaic Virus (MYMV) on plant growth and yield contributing parameters revealed that, Mungbean Yellow Mosaic Disease (MYMD) incidence had profound influence on number of pods/ plant, number of seeds/ pod and seed yield in twelve soybean genotypes. Soybean plant height was found to be influenced by Mungbean Yellow Mosaic

Disease (MYMD). The plant height of soybean was ranged from 47.78 cm (MAUS 47) to 29.88 cm (MAUS 81). The number of pods/ plant ranged from 29 (MAUS 47) to 11 (MAUS 81). The pod length of soybean genotypes that were screened ranged from 4.1 cm (MAUS 47) to 2.0 cm (MAUS 81). The grain yield (q/ ha) was distinctly influenced due to per cent Mungbean Yellow Mosaic Disease (MYMD) incidence. The grain yield was highly influenced due to Mungbean Yellow Mosaic Disease (MYMD) incidence and was ranged from 7.06 q/ ha (MAUS 47) to 3.40 q/ ha (MAUS 81), respectively.

The highest plant height i.e. 47.78 cm, more no. of pods/ plant i.e. 29 pods/ plant, length of 4.1cm, more and highest yield i.e. 7.06 q/ ha was recorded in MAUS 47, followed by plant height of 44.56 cm, no. of pods/ plant was 24.24, pods/ plant length of 3.9 cm and yield of 6.75 q/ ha was recorded in MAUS 725. The less plant height i.e., 29.88 cm, less no. of pods/ plant was 11.10, pods/ plant length of 2.0 cm and lowest yield of 3.40 q/ ha was recorded in MAUS 81. The susceptible genotypes i.e. were recorded less in plant height, less number of pods/ plant and less number of seeds/ pod, when compared to moderately resistant genotypes *viz*., MAUS 47, MAUS 731, MAUS 158, MAUS 725 and MAUS 71, respectively.

Several researchers had reported earlier the effect of Mungbean Yellow Mosaic Virus (MYMV) disease on plant growth and yield contributing parameters of soybean, such as Khattak *et al*. (2000) and Alam *et al.* (2014), respectively.

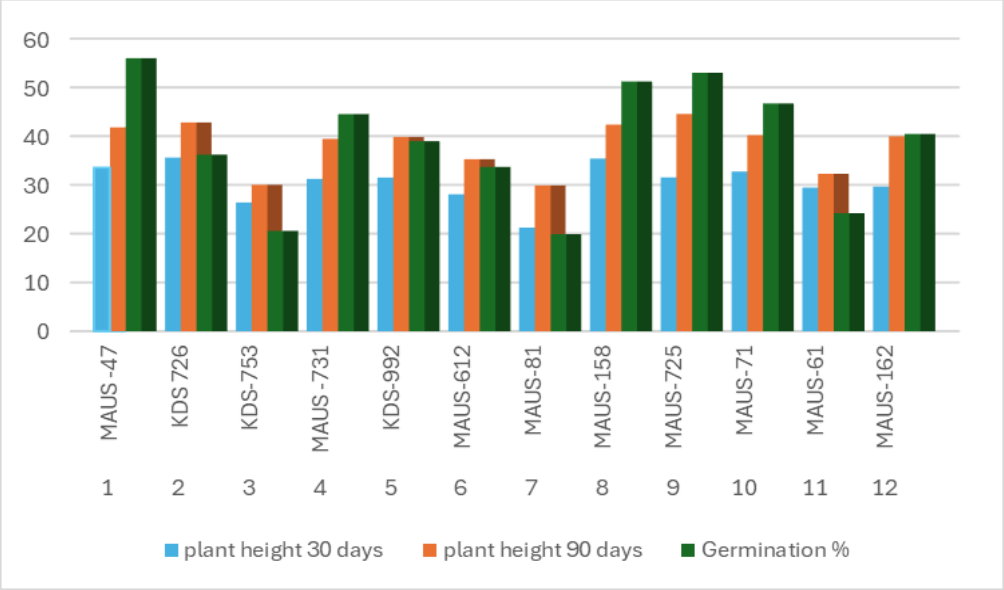

Fig. 2: Plant height and Germination % are shown in this graph

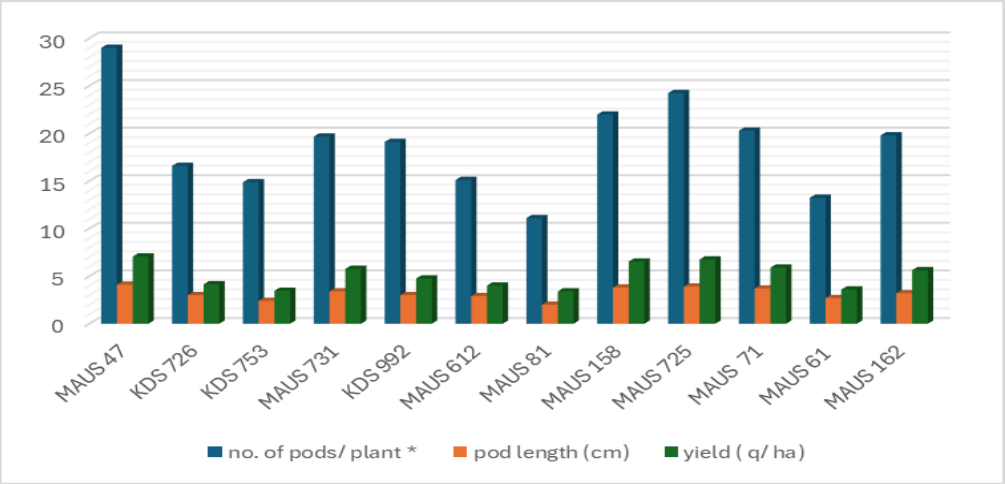

Fig. 3: No. of pods, pod length and yield per plants are shown in this graph

4. CONCLUSION

A total of twelve genotype varieties of soybean were screened against Mungbean Yellow Mosaic Virus (MYMV), among which, some of the genotypes were found to be moderately resistant *viz*., MAUS 47, MAUS 725, MAUS 158, MAUS 731 and MAUS 71 with a mean whitefly population of 0.60, 0.66, 0.80, 1.30 and 1.20 and mean disease incidence of 8.5 %, 9.32 %, 9.5 %, 9.86 % and 9.8 % respectively.

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DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative Al technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that they have no known competing financial interests or non-financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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