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Screening of Mungbean Genotypes against Mungbean Yellow Mosaic Virus Disease

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A B S T R A C T

Hundred genotypes of mungbean were screened against Mungbean Yellow Mosaic Virus (MYMV) disease. Among hundred genotypes screened, three genotypes namely LGG-593, KMP-24, and KMP-40 were found moderately resistant, nineteen genotypes *viz.*, KMP-4, KMP-22, VBN-2-3, LGG-594, MGG-40-1, JNG-13, TK-6-1, BGG-1, VBN-2-3, LGG-410, LGG-410, KKM-3-1, ICC-12947, LGG-592, KMP-1, KMP-22, KMP-23, KMP-17 and KMP-4 found moderately susceptible, sixty-six genotypes found susceptible and twelve genotypes were found highly susceptible. Maximum whiteflies population per trifoliate leaf was recorded in highly susceptible genotypes and positive correlation between vector population and disease incidence was also observed.

Introduction

Mungbean (*Vigna radiata* L.) is also known as mung, moong, mungo. In India, the name greengram is more commonly used than mungbean (Chatterjee and Randhawa, 1952). It is third most important pulse crop of India after chickpea and pigeonpea.

Mungbean can grow in all three seasons in India, *viz*., *Kharif* (July- Oct), *Rabi* (Sept-Dec) and summer (March- June). It is grown under rainfed condition during *Kharif* and on residual moisture during *Rabi* in eastern and southern part of the country. However, *Kharif* season crop occupies maximum area of its cultivation.

Intercropping with sorghum, pearl-millet, maize, cotton, castor, pigeonpea etc., are popular. India alone contributes 54% of world production and covers 65% of the world acreage (Singh, 2011). It is grown in intercropping, catch cropping and relay cropping systems because of its short duration (less than 60 days).

In India, mungbean is grown in an area of 3.02 lakh ha with production of 1.50 lakh tons and productivity of 498 kg/ha. Important mungbean growing states are Rajasthan, Maharashtra, Karnataka, Andhra Pradesh, Odisha, Tamil Nadu and Uttar Pradesh

(Anon, 2012). The standard worldwide yield of mungbean is very low (389kg/ha) and its production has not increased over the year. The main reason for low yield is the susceptibility of the crop to insects, weeds and diseases caused by fungus, virus and bacteria. Among these, the viruses are the most important group of plant pathogens affecting the production of the crop. They cause severe diseases and economic losses in mungbean and reducing seed yield and quality (Kang *et al.,* 2005).

As many as 12 viral diseases are reported on mungbean crop *viz*., Mungbean yellow mosaic virus (MYMV) disease, Bean yellow mosaic virus (BYMV) disease, Southern bean mosaic virus (SBMV) disease, Leaf crinkle virus(LCV) disease, Mungbean mosaic virus (MMV) disease, Cowpea aphid-borne virus (CABV) disease, Cucumber yellow mosaic virus (CMV) disease, Alfalfa mosaic virus (AMV) disease, Leaf curl virus (LCV) disease, Bean common mosaic virus (BCMV) disease, Cowpea yellow mosaic virus (CYMV) disease, Blackeye cowpea mosaic virus (BLCMV) disease.

Among these, occurrence of MYMV is the major constraint in successful cultivation of mungbean. Mungbean yellow mosaic virus is a geminivirus belongs to Family Geminiviridae, Subgroup – II, Genus: Begomovirus containing ssDNA and spread by *Bemicia tabaci*, considered as the most important and destructive viral pathogen in many parts of India (Saikia and Muniyappa, 1989).

Plant resistance for MYMV is rare and has not been actively pursued in breeding programs, hence, in this present study, germplasm lines have been screened for resistance against MYMV, that may be useful to reduce the impact of the disease in Mungbean crop.

Materials and Methods

A field experiment was conducted in the experimental plots, maintained at ZARS, GKVK, Bengaluru, India. Hundred mungbean genotypes including varieties were used for screening.

Plant spacing of 30×10 cm with a row length of 2.5m in RCBD design with two replications and all the package of practices were followed for raising the crop. Plants were exposed to natural infection. Per cent disease incidence of MYMV disease in each genotype/ variety was calculated based on disease scale and ratings.

Per cent Disease Incidence (PDI) =

$$\frac{\text{Number of infected plants}}{\text{Total number of plants observed}} \times 100$$

The genotypes were later grouped into different categories based on 0 to 9 scale (Mayee and Datar, 1986) as given in table 1.

Results and Discussion

The objective was to identify source of resistance against the MYMV disease. The grouping of genotypes based on per cent incidence of the disease in each genotype/variety at pre-flowering stage was done as described in 'Materials and Methods'. The results are presented in table 2.

Mungbean genotypes including varieties were screened against MYMV under field condition with natural infection by *Bemicia tabaci*. Disease rating scale was followed as given by Mayee and Datar (1986).

Mungbean yellow mosaic virus disease incidence varied from 8.03 per cent in KMP-24 to 78.12 per cent in KMP-47 with disease

reaction of moderately resistant and highly susceptible respectively (Table 3).

Only three genotypes such as KMP-24, KMP-40 and LGG-593 with 8.03 per cent, 8.26 per cent and 11.06 per cent respectively were found moderately resistant as shown in Plate1 (a, b and c). Yellow mottling and discolouration of leaves were observed in all these lines.

Sixteen genotypes found to be moderately susceptible such as KMP-4, KMP-22, VBN-2-3, LGG-594, MGG-40-1, JNG-13, TK-6-1, BGG-1, VBN-2-3, LGG-410, LGG-410, KKM-3-1, ICC-12947, LGG-594, KMP-1, KMP-23, KMP-17 and KMP-4 having per cent disease incidence of 15.58, 16.66, 13.04, 15.64, 16.91, 14.06, 17.85, 15.48, 13.04, 13.63, 21.12, 14.33, 08.33, 18.25, 13.18, 20.18 and 15.58 respectively and infected plants shown symptoms of leaf puckering. Mohan *et al*., (2014) was also reported similar results wherein, he screened 120 germplasm lines under field condition at two locations during *Kharif* 2013 by planting infector rows along with the test entries. Results revealed that most of the genotypes were categorized as moderately susceptible to highly susceptible in both the locations. None of the test entries appeared to be immune.

Sixty-nine genotypes were showed susceptible reaction with the range of 21.07 to 50.23 per cent. TM-97-55, GREEN DIAMOND, LGG-572, KKM-3, KKM-3-5, PUSA-9537, MGG-347, LGG-1, KMP-6, ML-4, PDM-84-578, JNG-21, PUSA BAISAKI-1, GNJ-5, KKM-3-10, VGG-04-149, NM-94, JNG-5, JNG-18, NM-97, JNG-14-1, LGG-595, JNG-2, PM-115, LGG-920, 2KM-139, TURUVEKERE LOCAL, VGG-04-011, LGG-596, JNG-12, JNG-19, 2KM-165, COGG-954, 2KM-165, 2KM-137 , TM-962, 2KM-102, VGG-07-3, 2KM-101, VBN(Gg)-2, PM-110, VBN(g)-3, KMP-41, KMP-46, KMP-30, KMP-42, KMP-12, KMP-27, KMP-19, KMP-9, KMP-2, KMP-45, KMP-7, KMP-28, KMP-21, KMP-32, KMP-35, KMP-48, KMP-18,KMP-25, KMP-11,KMP-26, KMP-44, KMP-14, KMP-52, KMP-5, KMP-39, KMP-6 and KMP-34 lines were found susceptible to MYMV. Pronounced yellow mottling and discolouration of leaves, reduction in leaf size and stunting of plants were observed, these results were also correlated with Singh *et al.*, (1996).

Table.1 Disease scale referred for grouping of genotypes against MYMV disease (Mayee and Datar, 1986)

Scale	Description	Category
0	No plants showing any symptom	Immune (I)
1	1% or less plants exhibiting symptoms	Resistant (R)
3	1-10% plants exhibiting symptoms	Moderately resistant (MR)
5	11-20 %plants exhibiting symptoms	Moderately susceptible (MS)
7	21-50%plants exhibiting symptoms	Susceptible (S)
9	51% plants exhibiting symptoms	Highly susceptible (HS)

Table.2 Reaction of Mungbean genotypes against MYMV

Sl. No	Genotypes	Per cent disease incidence	Disease Reaction*	Scale	Sl. No	Genotypes	Per cent disease incidence	Disease Reaction*	Scale
1	KMP-34	31.75	S	7	26	KMP-23	13.18	MS	5
2	KMP-13	67.09	HS	9	27	KMP-2	32.06	S	7
3	KMP-6	46.51	S	7	28	KMP-36	53.75	HS	9
4	KMP-33	55.84	HS	9	29	KMP-42	41.81	S	7
5	KMP-39	42.14	S	7	30	KMP-12	40.92	S	7
6	KMP-5	26.63	S	7	31	KMP-27	48.90	S	7
7	KMP-52	49.54	S	7	32	KMP-19	24.9	S	7
8	KMP-3	56.48	HS	9	33	KMP-9	24.92	S	7
9	KMP-14	41.10	S	7	34	KMP-22	16.66	M S	5
10	KMP-4	15.58	MS	5	35	KMP-30	49.07	S	7
11	KMP-44	43.04	S	7	36	KMP-40	8.26	MR	3
12	KMP-26	50.23	S	7	37	KMP-41	50.00	S	7
13	KMP-47	78.12	HS	9	38	KMP-46	47.18	S	7
14	KMP-11	50.22	S	7	39	KMP-1	18.25	MS	5
15	KMP-25	46.63	S	7	40	KMP-24	8.03	M R	3
16	KMP-18	41.81	S	7	41	VBN(g)-3	44.52	S	7
17	KMP-48	49.67	S	7	42	LGG-593	11.06	MS	5
18	KMP-17	20.18	MS	5	43	VGG-07-3	37.50	S	7
19	KMP-32	43.37	S	7	44	2KM-101	46.82	S	7
20	KMP-35	37.39	S	7	45	VBN(Gg)-2	35.71	S	7
21	KMP-21	28.5	S	7	46	PM-110	33.42	S	7
22	KMP-20	58.69	HS	9	47	2KM-102	21.07	S	7
23	KMP-45	39.28	S	7	48	ICC-12947	14.33	MS	5
24	KMP-7	31.88	S	7	49	2KM-165	40.00	S	7
25	KMP-28	35.71	S	7	50	2KM-137	42.25	S	7

Sl. No	Genotypes	Per cent disease incidence	Disease Reaction*	Scale	Sl. No	Genotypes	Per cent disease incidence	Disease Reaction*	Scale
51	TM-962	30.73	S	7	75	KKM-3-10	21.12	S	7
52	LGG-563	60.43	HS	9	76	VGG-04-149	29.42	S	7
53	JNG-19	40.52	S	7	77	NM-94	29.72	S	7
54	2KM-165	38.00	S	7	78	JNG-5	38.36	S	7
55	COGG-954	33.75	S	7	80	TK-6-1	17.85	MS	5
56	VGG-04-025	64.00	HS	9	81	GNJ-5	35.11	S	7
57	JNG-12	49.99	S	7	82	JNJ-13	14.06	MS	5
58	KKM-3-1	15.00	MS	5	83	PUSA BAISAKI-1	46.73	S	7
59	TURUVEKERE LOCAL	44.92	S	7	84	MGG-40-1	16.91	MS	5
60	VGG-04-011	29.48	S	7	85	MGG-347	23.36	S	7
61	LGG-596	48.00	S	7	86	JNG-16	58.46	HS	9
62	LGG-410	13.63	MS	5	87	LGG-1	24.09	S	7
63	VGG-112	51.28	HS	9	88	KMP-6	43.33	S	7
64	2KM-139	50.19	S	7	91	JNG-21	31.19	S	7
65	VBN-2-3	13.04	MS	5	92	VBN-2-3	12.96	MS	5
66	LGG-920	33.33	S	7	93	LGG-594	15.64	MS	5
67	BGG-1	15.48	MS	5	94	LGG-593	08.33	MR	3
68	NG-14-1	50.00	S	7	95	KKM-3-5	24.93	S	7
69	LGG-595	44.86	S	7	96	PUSA-9537	37.43	S	7
70	JNG-2	27.77	S	7	97	TM—97-55	27.30	S	7
71	PM-115	31.15	S	7	98	KKM-3	43.51	S	7
72	NM-97	43.34	S	7	99	LGG-572	33.46	S	7
73	2KM-164	79.78	HS	9	100	GREEN DIAMOND	47.39	S	7
74	JNG-15	76.66	HS	9					

*Note: MR- moderately resistant, MS- moderately susceptible, S-susceptible, HS- highly susceptible

Table.3 Grouping of Mungbean genotypes based on their reaction to MYMV

Sl. No	Reaction	Scale	No. of genotypes	Genotypes
1	Immune	0	0	-
2	Resistant	1	0	-
3	Moderately resistant	3	3	LGG-593, KMP-24 and KMP-40
4	Moderately susceptible	5	16	KMP-04, KMP-22, LGG-594, MGG-40-1, JNG-13, TK-6-1, BGG-1, LGG-410, VBN-2-3, KKM-3-1, ICC-12947, LGG-592, KMP-1, KMP-22, KMP-23 and KMP-17
5	Susceptible	7	69	TM-97-55, GREEN DIAMOND, LGG-572, KKM-3, KKM-3-5, PUSA-9537, MGG-347, LGG-1, KMP-6, ML-4, PDM-84-578, JNG-21, PUSA BAISAKI-1, GNJ-5, KKM-3-10, VGG-04-149, NM-94, JNG-5, JNG-18, NM-97, JNG-14-1, LGG-595, JNG-2, PM-115, LGG-920, 2KM-139, TURUVEKERE LOCAL, VGG-04-011, LGG-596, JNG-12, JNG-19, 2KM-165, COGG-954, 2KM-165, 2KM-137 , TM-962, 2KM-102, VGG-07-3, 2KM-101, VBN(Gg)-2, PM-110, VBN(g)-3, KMP-41, KMP-46, KMP-30, KMP-42, KMP-12, KMP-27 , KMP-19, KMP-9, KMP-2, KMP-45, KMP-7, KMP-28, KMP-21, KMP-32, KMP-35, KMP-48, KMP-18,KMP-25, KMP-11,KMP-26, KMP-44, KMP-14, KMP-52, KMP-5, KMP-39, KMP-6 and KMP-34
6	Highly susceptible	9	12	KMP-13, KMP-33, KMP-3, KMP-47, KMP-20, KMP-36, LGG-563, VGG-04-025, VGG-112, 2KM-164, JNG-15 and JNG-16.

Plate.1 Reaction of Mungbean genotypes to MYMV in field condition

a) KMP-24 **b) KMP-40** **c) LGG-593**

In this study screened 126 mungbean germplasm lines against MYMV, among them 9 were highly susceptible. Present investigation showed that KKM-3 is susceptible to MYMV. However, Manjunath *et al*., (2013) reported KKM-3 as resistant cultivar against MYMV disease. It may be due to variability existing in vector and/or virus coupled with climate change. Among 64 mungbean lines evaluated under field conditions, 16 accessions were graded as susceptible whereas 7 were found highly susceptible (Munnawar *et al.,* 2014). Mungbean genotypes such as KMP-13, KMP-33, KMP-3, KMP-47, KMP-20, KMP-36, LGG-563, VGG-04-025, VGG-112, 2KM-164, JNG-15and JNG-16 were found highly susceptible, showing disease reaction more than 50 per cent to MYMV. Sever yellow discolouration of leaves, stunting of plants, reduction in leaves and pod size were noticed. Salam (2011) and Singh *et al.,* (2000) also found Chinamung was highly susceptible to MYMV.

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