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Screening of mungbean genotypes against mungbean yellow mosaic virus disease under natural condition and its management

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Abstract

To identify resistance sources against Mungbean Yellow Mosaic Virus (MYMV) screening was done under natural condition at Pulses Research Unit, Dr. PDKV Akola, during summer 2017. Among seventy four genotypes tested, all genotypes were procured from Pulses Research Unit, Dr. PDKV Akola. The data on incidence of yellow mosaic virus was recorded at different interval. The average incidence of YMD was recorded from 0 to 68.42 per cent in various genotypes. Further, tested genotypes were grouped into different categories based on 0-9 disease scale. Among the 74 genotypes of mungbean eight were found resistant, nineteen genotypes were moderately resistant, thirty seven were susceptible, five genotypes were moderately susceptible and five were highly susceptible to yellow mosaic virus of mungbean. The spraying of Dimethoate 30% EC @ 2 ml/lit was found best over treatments for managing the YMD whereas least population of vector was observed in sprays with *Allium sativum* (10%) @ 10 ml/lit.

Keywords: MYMV, screening, genotypes, begomovirus

Introduction

Green gram (*Vigna radiata* (L.) Wilczek) commonly known as mungbean or mung is very ancient annual crop in Indian farming. It is an excellent source of high quality protein with easy digestibility hence advised to patients also. In India the total mungbean production is 2.17 million tons under the area of 4.32 m ha and productivity of 502 kg/ha. In Maharashtra mungbean is grown on area of 5.11 lakh ha. with production of 3.0 lakh tons and productivity of 587 kg/ha (Anonymous 2018) [4]. Although having a high potential, its productivity is less in mungbean and India also because of several constraints. One amongst them is biotic stress including several fungal and viral diseases which caused severe reduction in its yield (Paul *et al.*, 2013) [21]. Mungbean Yellow Mosaic Virus (MYMV) is of much prevalence and in recent years, it has become a problem for successful cultivation of mungbean in Maharashtra.

Mungbean yellow mosaic virus is a destructive virus that causes severe yield losses of mungbean crops. MYMV incidence is as high as 100 per cent in farmer's field in the Indian subcontinent, often resulting in considerable yield losses (Green *et al.*, 2002) [10]. MYMD is responsible for causing more than US\$300 million loss every year in different leguminous crops. The virus particles are isometric, paired, 18-30 nm in size and have single stranded DNA. The virus particles are confined to phloem associated elements in infected plants (Bos, 1999) [7]. Whitefly is the only vector reported by several scientists for the natural transmission of virus in different plants. Therefore, use of disease resistant crop varieties is regarded as an economical and durable method of controlling viral disease. A good deal of research have been directed towards screening of mungbean germplasm against mungbean yellow mosaic disease for identification of resistant sources under diverse environmental conditions.

Material and Methods

Studies were undertaken to test the resistance of local mungbean germplasms against mungbean yellow mosaic virus disease. Field experiments were conducted during summer 2017 under natural conditions at Pulses Research Unit, Dr. P. D. K. V. Akola. For this purpose total 74 genotypes were procured from Pulses Research Unit, Dr. P. D. K. V. Akola and sown during summer 2017. Each genotype was grown in 2 line of 4 m length and replicated twice.

After every 4 row i.e. 2 entries, susceptible check for YMV i.e. Kopergaon was planted. Observations of YMV were recorded at 15, 30, 45, and 60 days after sowing on each replication of each genotypes and the average of 2 replications were worked out. The per cent disease incidence was calculated by following formula

$$\text{Per cent disease Incidence} = \frac{\text{Number of plants infected in a row}}{\text{Total number of plants in a row}} \times 100$$

The genotypes were later grouped into different categories based on 0 to 9 scale from immune to highly susceptible according to scale given by Mayee and Datar (1986) [17].

Scale	Description	Disease Reaction
0	No plants showing any symptoms	Immune
1	1% or less plants exhibiting symptoms	Resistant
3	1-10% plants exhibiting symptoms	Moderately resistant
5	11-20% plants exhibiting symptoms	Moderately susceptible
7	21-50% plants exhibiting symptoms	Susceptible
9	More than 51% plants exhibiting symptoms	Highly susceptible

Result and Discussion

Evaluation of seventy four mungbean germplasms under environmental conditions at Pulses Research Unit, Akola against mungbean yellow mosaic virus (MYMV) was carried out on the basis of 0 to 9 scale. The results revealed that there was a great variation among genotypes they showed differential disease reaction. All the genotypes were categorized into six classes based upon disease incidence. The per cent disease incidence was recorded at every 15, 30, 45 and 60 days after sowing. The results are presented in Table 1. The disease incidence varied from 0 to 68.42 per cent on tested genotypes. The categorization of these genotypes into various reaction revealed that out of 74 genotypes none was

immune to disease, eight genotypes viz., IPM 312-9, HUM-12, HUM-6, TBM-3, COGG 13-19, Phule-M-605-21, AKM-12-23 and HUM-2 showed resistant reaction towards the disease, whereas, 19 genotypes viz., Pusa Vaishakhi, PM 11-25, TRCM 351-2-1, Pusa 1672, VGG 15-030, IPM 312-20, COGG 912, Pant M 6, TRCM 87-6-2-1, GAM 5, MH 1142, AKM-12-06, GM 11-02, TBM-6, Pusa 1671, SML 1811, Samrat, HUM-1 and HUM-16 were found to be moderately resistant to Mungbean Yellow Mosaic Virus (MYMV). Thirty seven genotypes viz., AKM-10-10, AKM-12-10, ML 2410, GGG-1, AKM-10-21, BM 4, NBPGR 150, OUM 11-5, IPM 14-7, TBM-5, AKM-12-04, AKM-12-24, AKM-12-12, NMK 15-12, Phule-707-27, AKM-4, DGG-8, AKM-10-11, AKM-12-14, KM 2241, IPM 312-19, IPM 312-20, Pusa 0672, AKM 8802, AKM-12-28, IPM-2-3, Phule-M-404-2-1, Phule-M-707-5, Phule-M-601-27, IGKM 06-26-5, AKM-10-05, Phule-504-20-27, NDMK 15-513, IGKM 05-18-2, AKM-12-22, PKV Green gold and MDGGV-16, were found susceptible, 5 genotypes viz., SKNM 12-06, KM 2241, ML 2410, BM-2012-2 and RMG 1092 were moderately susceptible and remaining 5 genotypes viz., Kopergaon, BM-2011-3, Summer Vaibhav, Phule-M-302-40 and Phule-M-702-1, exhibited highly susceptible reaction to yellow mosaic disease. Several worker screened various number of mungbean genotypes against YMV using mentioned scale.

Insecticidal sprays proved effective in controlling disease incidence and vector population over control. Two sprays of Dimethoate 30% EC @ 2 ml/lit. at 20 and 35 DAS recorded significantly lowest incidence of YMD (12.13%) followed by *Allium sativum* 10% @ 10 ml/lit of water (T5) i.e. 13.12% and Thiamethoxam 25% WG @ 0.25 ml/lit of water (T4) where the incidence was 14.28%.

Sprays of *Allium sativum* (10%) @ 10 ml/lit of water (T5) has given the best control of vector recording only 3.32 whiteflies per leaf per plant which was on par with Seed treatment of Imidachloprid (48% w/w) @ 4-6 ml/kg of seed (3.41) and Benzoic acid @ 1g/lit. of water (3.44) with 48.84 percent reduction over control.

Table 1: Percent incidence of Yellow Mosaic Disease in mungbean.

Sr. No.	Genotypes	Percent incidence of MYMV				Average PDI
		15 DAS	30 DAS	45 DAS	60 DAS	
1.	RMG 1092	0	4.5	13.6	20.03	9.5
2.	Pusa Vaishakhi	0	0	0	18.75	4.6
3.	PM 11-25	0	0	0	31.31	7.8
4.	AKM 12-24	10.52	36.84	42.10	63.90	38.33
5.	SKNM 12-06	0	15.38	26.53	35.38	19.33
6.	AKM-10-10	11.11	11.11	13.88	23.33	19.85
7.	AKM-12-10	7.69	15.38	35.57	39.42	24.15
8.	ML 2410	11.02	11.02	32.04	39.74	23.45
9.	GGG-1	0	0	41.66	50	22.91
10.	TRCM 351-2-1	0	0	5.26	19	6.06
11.	IPM 312-9	0	0	0	3.5	0.87
12.	Pusa 1672	0	0	9.52	15.4	6.23
13.	AKM-10-11	24.11	25.59	46.40	56.21	38.07
14.	AKM-10-21	10	12.94	35.58	41.02	24.88
15.	AKM-12-14	11.01	16.28	49.83	58.22	33.83
16.	BM 4	14	16	38	42	27.5
17.	NBPGR 150	13.33	13.33	35.83	49.16	27.91
18.	VGG 15-030	0	0	0	15.34	3.83
19.	IPM 312-20	5.55	5.55	5.55	16.02	8.13
20.	COGG 912	0	0	4.54	18.18	5.68
21.	KM 2241	14.64	17.14	75.35	87.5	48.65
22.	HUM-2	0	0	0	2.3	0.57
23.	ML 2410	6.25	6.25	37.25	48.07	24.45
24.	Pant M 6	0	0	10.52	20.84	7.84

25.	HUM-12	0	0	0	1	0.25
26.	OUM 11-5	5.88	5.88	20.97	27.25	14.99
27.	TRCM 87-6-2-1	6.25	6.25	7.88	15.07	8.86
28.	SML 1811	0	0	0	15	3.75
29.	GAM 5	0	0	4.34	21.73	6.51
30.	HUM-16	5.55	8.62	9.19	9.19	8.13
31.	MH 1142	0	0	0	13.86	3.46
32.	AKM-12-06	5.55	5.55	12.49	18.05	10.41
33.	GM 11-02	0	0	15	21.87	9.21
34.	HUM-1	3	5.55	7.65	8.68	6.22
35.	TBM-6	5.88	5.8	9.21	15.88	9.21
36.	Samrat	0	5.55	6.51	12.39	6.11
37.	IPM 312-19	13.33	13.33	52.22	60	34.72
38.	HUM-6	0	0	0	3.3	0.82
39.	Pusa 1671	0	0	14.28	26.98	10.31
40.	IPM 14-7	25	25	37.5	50	34.37
41.	IPM 312-20	14.44	19.99	48.88	52.21	33.88
42.	Pusa 0672	13.02	13.02	72.68	72.68	42.85
43.	AKM 8802	6.66	13.33	38.33	53.33	27.91
44.	AKM-12-28	5.55	5.55	72.22	75	39.85
45.	TBM-5	22.94	22.94	44.70	47.64	34.55
46.	IPM-2-3	0	0	85.71	85.71	42.85
47.	AKM-12-04	7.80	13.33	39.13	43.68	25.98
48.	Phule-M-402-2-1	35	35	60.27	70.83	50.27
49.	Phule-M-707-5	0	0	74.99	90.47	41.36
50.	Phule-M-601-27	20.26	46.4	58.77	69.27	48.67
51.	IGKM 06-26-5	7.69	7.69	57.08	62.34	33.7
52.	AKM-10-05	6.7	6.78	35.06	53.61	25.53
53.	AKM-12-12	6.25	6.25	40.62	43.75	24.21
54.	Phule-504-20-27	13.63	18.18	63.63	77.27	43.17
55.	COGG 13-19	0	0	0	2.9	0.72
56.	BM-2011-3	41.17	52.94	83.23	89.23	66.64
57.	KM 2241	5.26	5.26	15.78	24.26	12.64
58.	NDMK 15-513	0	0	55	63.33	29.58
59.	IGKM 05-18-2	0	0	26.07	63.63	22.42
60.	NMK 15-12	14.28	14.28	28.57	42.85	24.99
61.	Phule-M-302-40	50	60	65	78.33	63.33
62.	Phule-707-27	6.25	6.25	35	51.25	24.68
63.	Phule-M-702-1	35	50	80.83	83.33	62.29
64.	TBM-3	0	0	0	2.2	0.55
65.	AKM-12-22	0	0	64.28	64.28	32.14
66.	PKV Green gold	17.22	33.16	67.51	83.64	50.38
67.	AKM-12-23	0	0	0	3.6	0.9
68.	Summer Vaibhav	52.63	52.63	84.21	84.21	68.42
69.	Phule-M-605-21	0	0	0	3.8	0.95
70.	MDGGV - 16	20	40	53.33	53.33	41.66
71.	AKM-4	10.52	10.52	21.05	26.31	17.1
72.	BM-2012-2	4.16	8.33	12.5	20.83	11.45
73.	DGG-8	0	0	6.66	46.66	13.33
74.	Kopergaon	36.84	47.36	64.49	89.47	59.54

Table 2: Grouping of genotypes screened against MYMV during summer under natural field conditions.

Scale	Description	Reaction	Genotypes
0	No plants showing any symptoms	Immune (0)	-Nil-
1	1% or less plants exhibiting symptoms	Resistant (8)	IPM 312-9, HUM-12, HUM-6, TBM-3, COGG 13-19, Phule-M-605-21, AKM-12-23, HUM-2
3	1-10% plants exhibiting symptoms	Moderately Resistant (19)	Pusa Vaishakhi, PM 11-25, TRCM 351-2-1, Pusa 1672, VGG 15-030, IPM 312-20, COGG 912, Pant M 6, TRCM 87-6-2-1, GAM 5, MH 1142, AKM-12-06, GM 11-02, TBM-6, Pusa 1671, SML 1811, Samrat, HUM-1, HUM-16
5	11-20% plants exhibiting symptoms	Susceptible (37)	AKM-10-10, AKM-12-10, ML 2410, GGG-1, AKM-10-21, BM 4, NBPGR 150, OUM 11-5, IPM 14-7, TBM-5, AKM-12-04, AKM-12-24, AKM-12-12, NMK 15-12, Phule-707-27, AKM-4, DGG-8, AKM-10-11, AKM-12-14, KM 2241, IPM 312-19, IPM 312-20, Pusa 0672, AKM 8802, AKM-12-28, IPM-2-3, Phule-M-404-2-1, Phule-M-707-5, Phule-M-601-27, IGKM 06-26-5, AKM-10-05, Phule-504-20-27, NDMK 15-513, IGKM 05-18-2, AKM-12-22, PKV Green gold, MDGGV - 16,
7	21-50% plants	Moderately	SKNM 12-06, KM 2241, ML 2410, BM-2012-2, RMG 1092,

	exhibiting symptoms	Susceptible (5)	
9	More than 51% plants exhibiting symptoms	Highly Susceptible (5)	Kopergaon, BM-2011-3, Summer Vaibhav, Phule-M-302-40, Phule-M-702-1,

Table 3: Effect of treatments on per cent incidence of YMD

Tr. No.	Treatments	% Disease Incidence of YMD		Mean	%disease reduction over control
		30 DAS	45 DAS		
T 1	ST of Imidachloprid (48% w/w) @ 4-6 ml/kg of seed.	6.85 (2.62)*	23.18 (4.81)	15.01	48.22
T 2	Dimethoate 30% EC @ 2 ml/lit.	3.81 (1.95)	12.13 (3.48)	7.97	72.50
T 3	Benzoic acid 0.1% @ 1 g/lit.	6.02 (2.45)	17.51 (4.18)	11.76	59.43
T 4	Thiamethoxam 25% WG @ 0.25 ml/lit.	5.70 (2.39)	14.28 (3.78)	9.99	65.53
T 5	<i>Allium sativum</i> 10% @ 10 ml/lit	9.63 (3.10)	13.12 (3.62)	11.37	60.77
T 6	Imidachloprid (48% w/w) @ 0.25 ml/lit	9.16 (3.03)	19.71 (4.44)	14.43	50.22
T 7	<i>Azadiractin</i> 0.15% @ 1.5 ml/lit	6.94 (2.63)	14.87 (3.86)	10.90	62.40
T 8	Control	13.93 (3.73)	44.05 (6.64)	28.99	-
	SE (M±)	1.19	0.73	-	-
	CD, P = 0.05	3.60	2.19	-	-

* Figures in parentheses are square transformed values.

Table 4: Effect of treatments on vector population of YMV

Tr. No.	Treatment	Average number of white flies on 3 top leaves/ plant				Mean
		First spray at 20 DAS		Second spray at 35 DAS		
		27 DAS	Reduction over control	42 DAS	Reduction over control	
T 1	ST of Imidachloprid (48% w/w) @ 4-6 ml/kg of seed.	3.40 (1.84)*	16.25	3.41 (1.85)	47.45	3.40
T 2	Dimethoate 30% EC @ 2 ml/lit.	3.62 (1.90)	10.83	3.83 (1.96)	40.99	3.72
T 3	Benzoic acid 0.1% @ 1 g/lit.	3.41 (1.85)	16.01	3.44 (1.85)	47.0	3.42
T 4	Thiamethoxam 25% WG @ 0.25 ml/lit.	3.41 (1.85)	16.01	3.49 (1.87)	46.22	3.45
T 5	<i>Allium sativum</i> 10% @ 10 ml/lit	3.25 (1.80)	19.95	3.32 (1.82)	48.84	3.28
T 6	Imidachloprid (48% w/w) @ 0.25 ml/lit	3.27 (1.81)	19.45	3.55 (1.88)	45.30	3.41
T 7	<i>Azadiractin</i> 0.15% @ 1.5 ml/lit	3.50 (1.87)	13.79	3.54 (1.88)	45.45	3.52
T 8	Control	4.06 (2.01)	-	6.49 (2.55)	-	5.27
	SE (M±)	0.07	-	0.07	-	-
	CD, P = 0.05	0.22	-	0.21	-	-

*Figures in parentheses are square transformed values.

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