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STUDIES ON HOST RESISTANCE OF MUNGBEAN AGAINST MUNGBEAN YELLOW MOSAIC VIRUS IN THE AGRO-ECOLOGICAL CONDITION OF LATERITIC ZONE OF WEST BENGAL

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ABSTRACT

An experiments was conducted on various aspect of mungbean yellow mosaic virus (MYMV) under the agro-ecological condition of lateritic zone of West Bengal during the pre-*kharif* season of 2009 on mungbean (*Vigna radiate*). Survey on the natural incidence of the yellow mosaic disease (YMD) in different locations indicated an incidence range of 5.33% to 14.00% according to the location and variety. Out of 18 mungbean germplasm tested, one was found Resistant (R), 9 Moderately Resistant (MR), 7 Moderately Susceptible (MS) and only one accessions was found Susceptible (S). Minimum incidence 4.80% was recorded from variety ML-818 and found resistant (R) against MYMV. Whereas, variety Pusa-Baishakhi was found most susceptible (S) in this region and showed maximum incidence of 21.03%. Mungbean genotype ML-818, IPM-99-125, PANT-M-4, PDM-139, UMP-9903, Pusa-2072, SML-668, Asha, PS-16, and MH-96-1 can be considered as prominent lines against mosaic disease. The percentage reduction in yield was varied among the germplasm of mungbean. Minimum reduction in yield (4.11%) was noticed in genotype ML-818 followed by IPM-99-125 (4.27%), PANL-M-4 (5.03%), PDM-139 (5.06%), UMP-9903 (5.56%) and Asha (6.25%).

INTRODUCTION

India grows a variety of pulse crops under a wide range of agro-climatic conditions and is recognized globally as a major player in pulses contributing 25% of the global production. In spite of being the largest producer in the world, India has to import pulses to the tune of two million tones every year to meet its domestic requirement (Ali and Kumar 2005). In India mung bean is mostly grown in states like Andhra Pradesh, Maharastra, Orissa, Rajasthan, Gujrat, Madhya Pradesh, West Bengal, Punjab, and Uttar Pradesh etc. Mung bean is grown in summer and Kharif season in northern India and in southern India; it is also grown in winter season. In West Bengal, mung bean is the principal pulse crop and mainly grown in pre-*kharif* and *kharif* season. The mungbean suffers from several diseases, especially cercospora leaf spot (*C. canescens, C. cruenta*), powdery mildew (*Erysiphe polygoni*), root disease complex (*Pythium* spp., *Rhizoctonia solani*, *Fusarium* spp.) and the reniform (*Rotylenchulus reniformis*) and root knot (*Meloidogyne* spp.) nematodes. Moreover mungbean harbours different viruses namely, alfalfa mosaic virus, bean common mosaic virus, cucumber mosaic virus, leaf crinkle virus, leaf curl virus, mosaic mottle virus and mungbean yellow mosaic virus. Among all the viruses, mungbean yellow mosaic virus (MYMV) is the most destructive one. Presently in India, nearly all the varieties are susceptible to Mung bean yellow Mosaic viruses and rate of infection may vary from 10-100% (Nene 1972). It depends upon the susceptibility of the variety, time of infection, population of virus transmitter (*Bemisia tabaci*) and other favorable conditions. Varma *et al.* (1992) has shown that, an annual loss of US$ 300 million was caused by 'Mungbean yellow mosaic virus' by reducing the yield of mungbean, black gram, soyabean. *Bemisia tabaci* the major vector of yellow mosaic virus is abundantly present and the environmental conditions prevailing in West Bengal are most congenial for rapid building up of its population. Yellow mosaic is reported to be the most destructive viral disease not only in India, but also in Pakistan, Bangladesh, Srilanka and contiguous areas of South East Asia. Considering the potentiality of the spread of yellow mosaic disease of mungbean and its annual recurrent, this investigation was undertaken to study the natural incidence of Yellow mosaic disease of Mung bean and the genetic resistance of various mungbean germplasms against Mungbean Yellow Mosaic Virus.

MATERIALS AND METHODS

The survey on the incidence of mungbean yellow mosaic disease caused by MYMV was conducted in various districts of lateritic zone of West Bengal during pre *kharif* season of 2009. Farmers field of important mungbean growing areas *i.e.* Ilam bazaar, Sriniketan, Binuria, Saithiya, Suri, Bankura and Purulia were selected for the study where, mung bean are extensively grown by the farmers. An approximate area of 105-125 Sq. meters was selected in each of the places and

250 plants were taken for observation. For this, in each field 25 rows were selected at random and finally 10 plants were chosen from each row by simple random method for observation. The numbers of infected plants from randomly selected plants were recorded. The observations were taken at thirty days, forty five days and at sixty days after sowing of the seed.

Eighteen varieties of mungbean *i*.e. Asha, S-9, UMP-9903, IPM-99-125, Pusa-Vishal, Pusa-Ratna, PDM-139, PS-10, PANT-M-4, Pusa-9072, Pusa-Baishakhi, Pusa-9531, PS-16, Pusa-2072, ML-818, Pusa-105, MH-96-1, SML-668 were grown at PSB Agricultural farm in a randomized block design. Each treatment was replicated three times. To record the initial infection of MYMV in different varieties, all plants were examined regularly after showing. Incidence of the mungbean yellow mosaic disease was recorded at an interval of three days after disease symptoms appeared and it was continued up to the senescence of crop. The interval between the date of sowing and the appearance of symptoms in different varieties and the period from the initial symptoms appeared and the final incidence of the disease were also considered. Apparent infection rate of spread of the disease was calculated according to the following formula (Nagarajan and Muralidharan, 1995).

$$r = \frac{2.3}{t_2 - t_1}\left\{\text{Log}\left(\frac{X_2}{1-X_2}\right) - \text{Log}\left(\frac{X_1}{1-X_1}\right)\right\}$$

Where, r = Apparent infection rate at exponential growth stage

t_1 = First day of observation

t_2 = Last date of observation

X_1 = Production of the disease on first day of observation

X_2 = Production of the disease on last day of observation

Actual yield of different varieties were taken separately. To determine the potential yield of a variety, 10 healthy plants were identified in each replication and average yield/plant of a variety was calculated on the basis of total yield of 30 plants/ variety. Finally, potential yield was calculated by multiplying total numbers of plants of a variety and the average weight/ healthy plant of that variety. Thus yield loss due to disease was calculated by the following formula (Cooke, 2006),

Yield loss = Potential yield - Actual yield

$$\text{Percentage yield loss} = \frac{\text{Potential yield - Actual yield}}{\text{Potential yield}} \times 100$$

Disease infection was scored on 1-6 arbitrary scale (Bashir *et al*., 2006). The identity of MYMV was confirmed by inoculating the MYMV in healthy mungbean plants through the vector whitefly (*Bemisia tabaci*) under insect proof condition. The following scoring scale (1-6) was followed to determine the response of mungbean to MYMV infection in Table 1.

RESULTS AND DISCUSSION

To obtain information's on the natural incidence of yellow mosaic disease (YMD) of mungbean (*Vigna radiata*) in the agro-ecological condition of lateritic zone of West Bengal, survey was conducted during the pre *kharif* season of 2009 in different locations of Birbhum , Bankura and Purulia District to record the natural incidence of the disease in farmers fields . The data obtained on various parameters are presented in the Table 2.

It is evident from the Table that the incidence of YMD was varied from 5.33% to 14.00% according to the location and variety. Maximum incidence of YMD, 14.00% was recorded from Bankura farmer's field on variety Samrat (PDM-84-139) followed by variety Panna (B-105) 11.33%, 10.33% and variety Sonali (B1) 10.00% in Purulia, Saithiya and Suri Farmer's field respectively. Minimum incidence 5.33% was recorded in Sriniketan, PSB farm on variety Kalindi (B 76). Maximum incidence in variety Samrat (PDM-84-139) was probably due to mosaic motile and stunting symptoms developed by the severe strain of MYMV and the appropriate environmental condition suitable for building up of vector (*Bemisia tabaci*) in that region. While, early showing of the crop (2^{nd} week of February), genetic characters of the cultivar Kalindi (B 76) and less vector population could the reasons of minimum incidence of YMV in Sriniketan belt of Birbhum District.

Eighteen germplasm of mungbean of diverse origin/source were sown under natural environmental conditions for evaluating their resistance against yellow mosaic disease (YMD) caused by MYMV. To determine the response of mungbean genotype to MYMV infection, the germplsm were assessed on the basis of scoring scale (1-6) and the data obtained are presented in Table 3.

The symptom of yellow mosaic disease (YMD) was appeared in the field within 29 to 39 days of sowing in all varieties and the incidence of YMD varied greatly within the germplasm. Symptoms was developed early in variety, Pusa-2072 (29 DAS) which was minimum among all the varieties. While, it was found maximum (39 DAS) in variety Pusa- Vishal out of 18 mungbean germplasm, one was found Resistant (R), 9 Moderately Resistant (MR), 7 Moderately Susceptible (MS) and only one accession was found Susceptible (S). Minimum incidence 4.8% was recorded from variety ML-818 and found resistant (R) against MYMV. Whereas, variety IPM-99-125, PANT-M-4, PDM-139, UMP-9903, Pusa-2072, SML-668, Asha, PS-16 and MH- 96- 1 showed an incidence range of 5.56% to 9.84 % and found moderately resistance (MR) against MYMV. All the above varieties were found statistically at par with the resistant variety ML-818 in terms of disease incidence.

Table 1: Disease Scoring Scale (1-6) for MYMV

Points	Reaction Grade	Reaction Group
1	Highly Resistant (HR)(0% infection, all plants free of symptoms)	I
2	Resistant (R)(1-5% plants infected with MYMV)	II
3	Moderately Resistant (MR) (5-10% plants infected with MYMV)	III
4	Moderately Susceptible (MS) (10-20% plants infected with MYMV)	IV
5	Susceptible (S)(20-40% plant infected with MYMV)	V
6	Highly Susceptible(More than 40% plants infected with MYMV)	VI

Table 2: Natural incidence of mungbean yellow mosaic disease (YMD) in different locations of Lateritic zone of West Bengal

Sl. No.	Locality of West Bengal	Variety grown	Area under observation in sq. meter	Date of sowing	No. of plants observed	Range of % disease incidence	% disease incidence (Average)	Symptoms
1.	Iilam Bazar(Farmer's field)	Bireswar(WBM-4-34-1-1)	115	20.02.2009	250	4-12	8.66	YM, MM
2.	Sriniketan(P.S.B Farm)	Kalindi(B-76)	120	11.02.2009	250	3-8	5.33	YM
3.	Binuria(Farmer's field)	Bireswar(WBM-4-34-1-1)	110	27.02.2009	250	5-11	9.00	YM, MM
4.	Suri(Farmer's field)	Sonali(B-1)	116	25.02.2009	250	6-12	10.00	YM, ST
5.	Saithiya(Farmer's field)	Panna(B-105)	108	19.02.2009	250	8-13	10.33	YM, MM,
6.	Bankura(Farmer's field)	Samrat(PDM-84-139)	105	23.02.2009	250	8-18	14.00	YM, ST
7.	Purulia(Farmer's field)	Panna(B-105)	125	19.02.2009	250	7-15	11.33	YM, ST

YM= Yellow Mosaic, MM = Mosaic Mottle, ST = Stunting

Table 3: Screening of mungbean germplasm for resistance against yellow mosaic disease

Sl. No.	Variety	Time taken for developing 1st YMD Symptoms in field from DAS	Date of 1st appearance of disease Symptoms	Date of final incidence of the disease	Incidence range (%)	*Disease incidence (%)	*Apparent infection rate of the disease	Symptoms	Reaction grade	Reaction group
1	Asha	33 days	04.04.09	07.05.09	7.75-10.00	8.88	0.044	YM	MR	III
2	S-9	38 days	09.04.09	06.05.09	10.00-13.32	10.47	0.043	YM	MS	IV
3	UMP-9903	34 days	05.04.09	07.05.09	5.55-8.88	7.50	0.042	YM	MR	III
4	IPM-99-125	30 days	01.03.09	06.05.09	3.44-7.70	5.56	0.048	YM	MR	III
5	Pusa- Vishal	39 days	10.04.09	04.05.09	11.32-17.77	16.44	0.070	YM	MS	IV
6	Pusa- Ratna	33 days	04.04.09	02.05.09	10.00-15.54	12.21	0.050	YM	MS	IV
7	PDM-139	32 days	03.04.09	08.05.09	5.55-7.77	6.90	0.035	YM	MR	III
8	PS-10	33 days	04.04.09	01.05.09	13.32-16.65	14.18	0.061	YM	MS	IV
9	PANT-M-4	35 days	06.04.09	07.05.09	5.55-8.88	6.25	0.051	YM	MR	III
10	Pusa-9072	33 days	04.04.09	30.04.09	3.33-21.11	13.25	0.053	YM	MS	IV
11	Pusa-Baishakhi	36 days	07.04.09	01.05.09	18.88-22.22	21.03	0.097	YM	S	V
12	Pusa-9531	37 days	08.04.09	06.05.09	8.88-13.33	11.14	0.051	YM	MS	IV
13	PS-16	31 days	02.04.09	40.05.09	6.75-11.10	9.62	0.046	YM	MR	III
14	Pusa-2072	29 days	31.03.09	03.05.09	4.44-10.00	7.50	0.028	YM	MR	III
15	ML-818	31 days	02.04.09	09.05.09	3.33-7.77	4.85	0.041	YM	R	II
16	Pusa-105	34 days	05.04.09	02.05.09	7.77-16.65	11.20	0.051	YM	MS	IV
17	MH-96- 1	35 days	06.04.09	07.05.09	8.88-11.10	9.84	0.031	YM	MR	III
18	SML- 668	32 days	03.04.09	05.05.09	7.77-10.00	8.62	0.029	YM	MR	III
S.Em(±)						1.572	0.005			
C.D.at 5%						4.360	0.013			

YM= Yellow Mosaic, MR = Moderately Resistant, MS = Moderately Susceptible, R = Resistant, S = Susceptible, * Significant at 5% level

Table 4: Yield Performance and percentage yield loss due to YMD in different mungbean genotype under natural condition.

Sl. No.	Variety	*Disease incidence (%)	*Actual yield (q/ha)	*Potential yield (q/ha)	Percentage Yield loss/ha
1	Asha	8.88	6.30	6.72	6.25
2	S-9	10.47	7.53	8.32	9.50
3	UMP-9903	7.50	6.46	6.84	5.56
4	IPM-99-125	5.56	8.08	8.44	4.27
5	Pusa-Vishal	16.44	4.87	5.72	14.86
6	Pusa-Ratna	12.21	5.33	5.96	10.57
7	PDM-139	6.90	7.31	7.70	5.06
8	PS-10	14.18	5.57	6.48	14.04
9	PANL-M-4	6.25	7.18	7.56	5.03
10	Pusa-9072	13.25	5.60	6.40	12.50
11	Pusa Baishakhi	21.03	4.83	5.68	14.96
12	Pusa-9531	11.14	5.68	6.25	9.12
13	PS-16	9.62	6.31	6.76	6.66
14	Pusa-2072	7.50	5.55	5.88	5.61
15	ML-818	4.85	8.86	9.24	4.11
16	Pusa-105	11.20	7.06	7.64	7.59
17	MH-96-1	9.84	6.20	6.68	7.19
18	ML-668	8.62	8.14	8.70	6.44
S.Em (±)		1.57	0.41	0.36	
CD at 5%		4.35	1.16	1.10	

Other lines *i.e.* S-9, Pusa- Vishal, Pusa- Ratna, PS-10, Pusa-9072 and Pusa -105 were found to be moderately susceptible (MS) against MYMV and exhibited 10.47% to 14.18% disease incidence. Variety Pusa- Baishakhi was found most susceptible (S) in this region and showed maximum incidence of 21.03% which differ significantly than other varieties. However, the correlation in between the time taken for appearance of natural symptoms of YMD in field from DAS and final incidence of the disease in different varieties was found insignificant.

The infection rate (r) of YMD was found maximum in variety Pusa-Baishakhi (0.097) followed by Pusa- Vishal (0.070), PS-10 (0.061) and Pusa-9072 (0.053). Minimum infection rate was observed in variety Pusa-2072 (0.028). However, the variety ML-818 found to be resistant in field shown higher infection rate of YMD. The findings of the Medium-tall stature high yielding variety ML-818 were corroborating with the reports of Singh *et al.* (2000). Whereas, the performance of variety PDM-139, and PS-16 against MYMV was found be similar to the findings of Green *et al.* (1996) and Sahoo *et al.* (1989). Early flowering (40-50days), medium plant height, medium size of leaf and green leaf colour could be reason for lesser infection of MYMV in variety Pant-M-4. While, erect plant growth habit of variety IPM 99-125 and presence of stem pubescence in variety SML- 668 could be one of the reason of resistance towards MYMV. Whereas, determinate plant growth habit of variety Pusa Vishal and presence of yellow colour petal in variety Pusa 9072 may contributed negatively towards the resistance by attracting more vectors (*Bemisia tabaci*) in plants which resulted in higher incidence of YMD in field. Mungbean genotype ML-818, IPM-99-125, PANT-M-4, PDM-139, UMP-9903, Pusa-2072, SML-668, Asha, PS-16, and MH-96-1 can be considered as prominent lines against MYMV under the environmental conditions of lateritic zone of West Bengal.

During the screening of different genotype of mungbean against YMD in field, yield parameter was also taken into consideration for comparison and the data obtained are presented in Table 4.

The percentage reduction in yield was varied among the germplam of mungbean . Maximum reduction in yield was noticed in variety Pusa- Baishakhi (14.96%) followed by variety Pusa - Vishal, PS-10, Pusa-9072 and Pusa- Ratna showed reduction in yield 14.86%, 14.04%, 12.50% and 10.57% respectively, considered as moderately susceptible (MS) variety. Minimum reduction in yield (4.11%) was noticed in genotype ML-818 followed by IPM-99-125 (4.27%), PANL-M-4 (5.03%), PDM-139 (5.06%), UMP-9903 (5.56%) and Asha (6.25%). A positive correlation was existing among the percentage yield reduction and percentage incidence of YMD in all variety. However, the extent of reduction in yield was not found to be proportionately related to the extent of disease incidence of the variety, was probably due to interference of other factors forced the plants toward less vigor and yield.

Similar trend in yield loss and disease incidence (YMD) in mungbean was also observed by Khattak *et al.* (2003) at Faisalabad, Pakistan during summer 1997 in fourteen F3 MYMV susceptible progenies of mungbean and Jain *et al.* (1995) in variety PD-41, PDU-7 and AMP-56. However, many workers reported higher incidence of YMD and reduction in yield with other varieties and locations (Chand and Verma 1983; Singh *et al.* 1982).

REFERENCES

Ali, M. and Kumar, S. 2005. Pulses yet to see a break through. In Hindu Survey of Indian Agri., pp 54-56.

Bashir, A. R. J. and Zahoor, A. 2006. Genetic resistance in mungbean and mashbean germplasm against mungbean yellow mosiac begomovirus. *Mycopath.* **4(2):** 1-4.

Chand, P. and Varma, J. P.1983. Effect of yellow mosaic on growth components and yield of mungbean and urdbean. *Haryana Agril. University J. Res.* **13(1):** 98-102.

Cooke, B. M. 2006. Disease assessment and yield loss. In: The Epidemiology of Plant Diseases. B. M. Cooke, D. Gareth Jones and B. Kaye (Eds.) Second edition. *The Netherlands: Springer*. pp 43-75

Green, S. K., Chiang, B. T. Maxwell, D. P. and Kim, D. H. 1996.

Mungbean, yellow mosaic virus in the AVRDC mungbean improvement program. In Recent Advances in Mungbean Research (A.N. Asthana and D.H. Kim,eds.). *Indian Society of Pulses Research, IIHR, Kanpur* 208024, India, p 51-65.

Jain, A. K., Yadava, H. S. and Gupta, J. C. 1995. Grain yield and its components as affected by yellow mosaic virus in black gram (*Vigna mungo* L. Hepper). *Ann. Agril. Res.* **16(3):** 364-366.

Khattak, G. S. S. Zamir, R., Muhammaad, T. and Shah, S. A. 2003. Breeding [vigna radiate (L) Wilczek] genotype for the agro climatic conditions of NWFP. *Pakistan J. Bot.* **35(5):** 763-770.

Nagarajan, S. and Muralidharan, K. 1995. Dynamics of Plant Diseases. *Allied Publishers*, New Delhi, pp 122-135.

Nene, Y. L. 1972. A survey of viral diseases of pulse crop in Uttar Pradesh, Research Bulletin-4.G.B. *Pant University of Agriculture and Technology, Pantnagar, U.P, India*. p 191.

Sahoo, B. K, Sahu, P. N. and Mishra, M. R. 1989. Field evaluation of greengram varieties against whitefly and ellow mosaic virus disease. *Orissa J. Agril. Res.* **2(2):** 136- 137.

Singh, B. R., Chandra, S., Shiv, R., Chandra, S. and Ram, S. 2000. Evaluation of mungbean varieties against yellow mosaic virus. *Ann. Pl. Protec. Sci.* **8:** 270- 271.

Singh, B. R., Singh, M. Yadav, M. D. and Dingar, S. M. 1982. Yield loss in mungbean due to yellow mosaic. *Sci. Cul*. **48(12):** 435-436.

Varma, A., Dhar, A. K., Mandal, B., Gocen, S. K. and Kim, D. 1992. MYMV transmission and control in India. Mungbean yellow mosaic disease: *Proceeding of and International Workshop, Bangkok*. **8-27:** 92-373.