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Impact of Mungbean Yellow Mosaic Virus Disease on Seed Planting Value of Soybean

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ABSTRACT: An epidemic of Mungbean Yellow Mosaic Virus (MYMV) disease was recorded in soybean at V3-R2 stage under agro-conditions of Jabalpur (MP), that favored by temperature (26.5 to 27^0 C) and relative humidity (75-80%), with presence of population of whiteflies up to 25 flies/leaf (trifoliate), higher rainfall (116.80 mm) with more number of rainy days (four). Within a period of 10-12 days the entire soybean plant population was infected by vector borne pathogen (*Bemisia tabaci*) in the region. Loss in seed germination (35.58%), seed emergence (44.41%), seed weight (37.2%) and seed vigor (55.27%) was noticed in JS 335 obtained from no-disease and more than 60% infected plant population. A slight change in seed morphology was observed in seeds from diseased plants. The seed from infected plants has elliptical shape as compared to normal oval shape. No seed coat cracking was observed. The viability test of soybean seeds obtained from healthy and infected plants indicated no difference. The infection of MYMV did not attack the embryo, as evident in standard tetrazolium test.

Keywords: Soybean, Mungbean Yellow Mosaic Virus, Whitefly, Seed germination, Vigour, Seed Viability

Soybean (*Glycine max* L. Merr.), a miracle crop is valued due to high quality protein (40-42%) and oil content (18-20%) and on account of its ability to fix biological nitrogen 270 kg/ha as compared to 150 kg/ha by other pulses [1]. In Madhya Pradesh, the crop is grown on 55.5 lakh ha with a production of 51.6 lakh MT and productivity of 930 kg/ha. Soybean oil is the largest component of world's edible oil and its protein is composed of ten properly balanced amino acids. Soybean seeds suffer from a number of problems including viability, longevity and seed associated micro-organisms [2]. Soybean suffers from many diseases caused by fungus, bacteria, nematode and viruses, many of which are transmitted through seeds [3, 4]. More than fifty virus pathogens have been observed causing various diseases in soybean [5, 6].

Recently at Jabalpur for the first time, an epidemic of Mungbean Yellow Mosaic Virus (MYMV) disease was recorded at V3-R2 stage during Kharif 2015 [7] (Plate 1). Within a short period of 10-12 days the entire soybean plant population was infected by virus pathogen. Mungbean Yellow Mosaic Virus has been reported by several workers [8-10]. The virus pathogen is transmitted through whitefly (*Bemisia tabaci*) and it is not seedborne in nature. V3 considering the widespread occurrence at early stage of soybean, the present investigation was undertaken to determine the possible impact of disease on sowing seed quality of soybean.

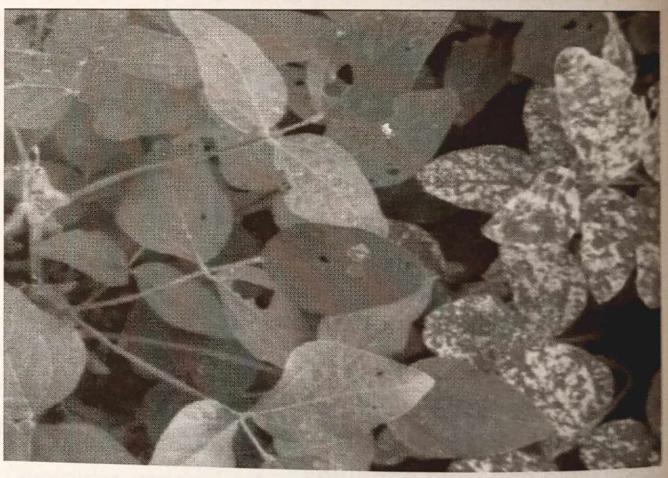

Plate 1. Field symptoms of MYMV on soybean

MATERIALS AND METHODS

Distribution of MYMV

Incidence of MYMV was determined [8] at V3-R2 stage (one flower at any node and onward stage) during second fortnight of August to first fortnight of September, 2015 with sample size of hundred randomly selected plants (Table 1).

Table 1. Disease measurement scale

Scale	Description	Category
0	No plant 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	51% plants exhibiting symptoms	Highly susceptible

The prevalence of disease was recorded at farmer's field using fix plot survey technique at eight villages covering 24 locations in the vicinity of Jabalpur.

Impact on Sowing Seed Quality

Soybean seeds from no-disease plants (healthy) and infected (more than 60%) plant canopy infection were hand harvested, collected and employed for investigations for determination of seed germination, seed emergence [11]; seed vigour [12,13]; seed viability (Tz Test) , seed coat cracking and morphology [14]. Seed samples from the farmers field (two varieties), Breeders Seed Productions field (three varieties) were selected for investigation.

RESULTS AND DISCUSSION

Status of MYMV Incidence at Farmer's Field

Observations made at V3-R2 stage at the farmers field in eight villages during II fortnight of August to I fortnight of September, 2015 indicates that incidence of MYMV ranged from 45.0% (Katangi village) to 69- 70% (Jabalpur, Barela, Patan). During the period, temperature was in the range of 26.5 to 27^{0}C and relative humidity 75-80%. The population of whiteflies was up to 25 flies/ leaf (trifoliate) during the period. Higher rainfall (116.80 mm) with higher number of rainy days (four) helped in increasing the relative humidity resulting in greater population of vector and increase in incidence of the disease (Table 2). The disease has not been a major problem under the agro-climatic conditions of Jabalpur; however, it has also been recorded in the Tikamgarh region, adjoining the Uttar Pradesh [15].

Table 2. Incidence of MYMV at farmer's field around Jabalpur

Village	% disease incidence*	Village	% disease incidence*
Patan	60.0-70.0	Jabalpur	58.0-69.0
Katangi	45.0-70.0	Bhedaghat	59.0-66.0
Panagar	55.0-65.0	Tilwara	47.0-60.0
Maharajpur	52.0-59.0	Barela	43.0-69.0

*Observations made at V3-R2 stage, sample size 100 plants, randomly selected in each field during II fortnight of August to I fortnight of September, 2015, Average range Temperature 26.5-27^{0}C, Relative Humidity 75-80%.

Impact of MYMV Incidence on Seed Germination and Emergence

The results obtained by the test conducted by employing Standard Ragdoll method (ISTA, 2014), paper towel method, placed in seed germinator; temperature 25^{0}C & RH 85% on seed lot obtained from healthy and infected plants revealed the loss in seed germination and field emergence (Table 3). The lowest loss (25.1%) was noticed in seeds of variety JS 20-69 whereas, maximum loss (35.83%) was noticed in JS 335 from farmers field. No systematic information is available on the adverse effect of MYMV on seed germination, seed emergence, seed vigour and other characteristics related to sowing seed quality of soybean. However, under conditions of Maharashtra effect of SMV on these characters has been studied [6].

Table 3. Impact of MYMV incidence on seed germination and emergence

	Seeds obtained from healthy plants		Seeds obtained from plants having more than 60% infection		Percentage Loss	
	Germination (%)	Emergence (%)	Germination (%)	Emergence (%)	Germination (%)	Emergence (%)
Farmer's Field						
JS 335	82.66	79.33	53.00	44.33	35.83	44.41
JS 20-34	81.66	77.66	55.66	50.00	31.91	35.61
Breeders Seed Production Field (BSP)						
JS 335	80.00	77.66	52.00	49.61	35.00	35.28
JS 20-34	83.33	79.33	54.66	53.00	34.40	33.19
JS 20-69	85.00	81.66	63.66	61.33	25.10	24.89

Table 4. Impact of MYMV incidence on seed vigour index

Observation taken	Range of vigour in soybean varieties		
	JS 335	JS 20-34	JS 20-69
Seeds obtained from no disease plants	1772.2-1840.0	1757.7-2074.0	2108.2-2331.6
Seeds obtained from plants having more than 60% infection	784.4-873.6	800.3-902.0	1158.4-1261.0
Loss percent	54.08	55.27	45.38

Seeds obtained from healthy and infected plants also revealed the loss in seed emergence, when tested as GOT, seeds placed in sterile sand in plastic tray under lab conditions; temperature 25°C & RH 45%. Least loss (24.89%) was recorded in seeds of variety JS 20-69 whereas, maximum loss (44.41%) was noticed in JS 335 seeds collected from farmer's fields.

Impact of MYMV Incidence on Seed Vigour

Based on the mean root & shoot length and seed germination vigour was calculated from the seeds planted in sterile sand which were kept in plastic trays under lab conditions where the temperature was 25°C with relative humidity 45%. Loss in vigour was recorded in the range of 45.38 to 55.27, based on the seeds obtained from no-disease plants and seeds obtained from plants having more than 60% infection of MYMV (Table 4 and Figure 1).

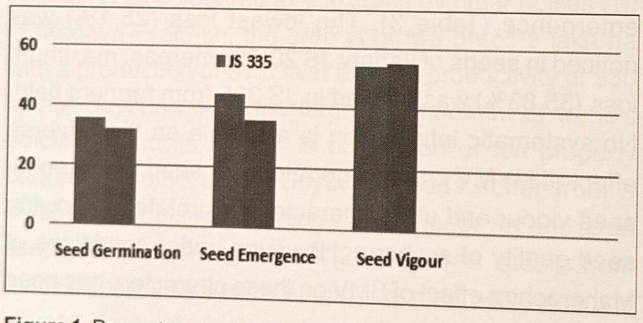

Figure 1. Percentage loss in germination and emergence of soybean Farmer's seeds obtained from healthy and diseased plants

Impact of MYMV Incidence on Seed weight, Color, Morphology and Viability

The impact of MYMV incidence recorded on seed weight, morphology, seed coat cracking, viability and color has been given in table 5. Around 37.2% loss in 100 seed weight was observed due to infection in JS 335, the most popular cultivated soybean variety, whereas only 9.8% loss was recorded in JS 20-69. In JS 335, the hundred seed weight was 11.0 g from the plants with no-disease whereas, it was 6.9 g from the plants having more than 60% infection. In a study of seed quality assessment variables, seed germination, 100 seed weight, total protein content were not significantly different between normal and damaged seed lots while studying seed transmission of soybean vein necrosis virus.[17]

A slight change in seed morphology was observed in seeds obtained from the infected plants the shape of the soybean seeds was slightly elliptical as compared to oval, the normal seed from no-disease plants. Seed coat cracking was determined by ferric chloride test in both the category of seeds. No seed coat cracking was observed in both the categories. The test was performed as per the technique advocated [12]. The infected seeds had dull yellow color as compared to golden yellow color, the seeds obtained from no-disease plants. The viability test of soybean seeds obtained from healthy and infected plants indicate no difference.

Table 5. Impact of MYMV incidence on seed weight, color, morphology and viability

Characteristics	Varieties			
	JS 335		JS 20-69	
	Infected	Non-infected	Infected	Non-infected
100 seed weight (g)	6.9 (37.2%)	11.0	11.0 (9.8%)	12.2
Seed Color	Dull Yellow	Golden Yellow	Dull Yellow	Golden Yellow
Morphology	Slightly elliptical	Oval	Slightly elliptical	Oval
Viability	Yes	Yes	Yes	Yes
Seed coat cracking	No	No	No	No

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