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Screening for identification of resistance source in Mung bean against Yellow Mosaic Virus (YMV)

Screening of Mung bean Genotypesagainst Yellow Mosaic Virus (YMV)Resistance

Abstract

Mungbean [*Vignaradiata (*L.)] is an important pulse crop in South East Asia but also grown in some part of America and Africa. It belongs to Leguminaceae family and native to India-Burma region of South-East Asia. It is being affected by a number of insect pests from seedling stage to maturity. Among them, whitefly is an important pest that transmit yellow mosaic virus (YMV), which is a major disease that can cause a severe yield losses accounting 70% or more and may result in complete failure of the crop economically atits early stages.(Not needed to write this paragraph in this part, delete it).

Experiment was conducted to identify the resistant Mung bean varieties against MYMV in *Kharif*during 2017.Ten Indian mung bean genotypes obtained from AICRP on Arid legumes, RARI, Durgapura, Jaipur, were used in the screening experimentand the obtained results revealed that there was significant variation among the genotypes for resistance against MYMV. Based on the average MYMV score, only two genotypes(IPM 02-3 and IPM 0205-7) were found completely free from the disease and the plants had maximum chlorophyll content whereas IPM-409-4 and RMG 991 were found resistant and chlorophyll content was low as compared to the highly resistantgenotypes. The rest of six genotypes observed moderately resistant, moderately susceptible, susceptible and highly susceptible to the disease.

Key words: Mungbean,Vector,*Bemisiatabaci,*Yellow Mosaic Virus and Resistance Source

Introduction:

The mungbean [*Vignaradiata (*L.)]is native to India-Burma region of South-East Asiaand also grown in some part of America and Africa. Mungbean belongs to the leguminaceaefamily and sub family Papilinoaceae.It is very primeval annual crop in Indian farming cultivation. The crop is being sown usually asa dry land crop in almost all the states of India. It is also known as greengram, greenbean, mashbean, goldengram,chickasawpe and greensoy (Markam*et al*., 2018).Being a short duration pulse crop, it fits well in mixtures and crop rotation and it can be used as green manure crop or as a combined cash and soil improvement crop with residues incorporated in to soil after pods have been harvested and it helps to enrich the soil by symbiotic

relationship with specific soil rhizobia of the genus Bradyrhizobium.It is an excellent source of high quality protein with easy digestibility hence preferred to patient too. It fixes biological nitrogen ranging 30-74 kg/ha in the soil and also provides plant residues 15-20 q/ha(Source?).The mungbean rank third to Bengalgram and Redgram. It contains protein 24 per cent, Fat 1.3 per cent, Carbohydrates 56 per cent,Fibre 4.1 per cent, Moisture 10 per cent, Minerals 4 per cent, Iron 7.3 mg per 100 g, Calcium 124 mg per 100 gm, Phosphorus 326 mg per 100 g(Source?). As vegetable protein, it is rich in vitamin B which is protective against the beriberi disease.

Mungbean being an extremely drought resistant crop is extensively cultivated in arid and semi-arid areas of Rajasthan, Gujarat, Maharashtra, Haryana, U.P., Andhra Pradesh and Orissa. In Rajasthan Mungbean mostly grown under rain fed conditionin Jaipur, Ajmer, Nagour, Sikar and Tonk.This crop is alsosown in *kharif* season during July-August and harvested from October to November. The reasons for low productivity may be traditional methods ofcultivation practiced by the farmerswith the development of high yielding genotypes and better management practices.Hence, there is a much opportunity for further increase in yield. In the arid areas of Rajasthan, this is the only crop taken during *Kharif* and cannot be replaced by other legumes like moth bean, cowpea, guar etc. because of its drought resistance.

There are various factors which limit the production of the crop including several diseases viz, cercospora leaf spot (*C. canescens*,), powdery mildew (*Erysiphepolygoni*), root disease complex (*Pythium spp*. or*Fusarium spp.*) and the reniform (*Rotylenchulusreniformis*) and root knot (*Meloidogyne spp*.) nematodes, viruses namely, bean common mosaic virus, cucumber mosaic virus, leaf crinkle virus, leaf curl virus, mosaic mottle virus and mungbean yellow mosaic virus. Among all theconstraints, mungbean yellow mosaic virus (MYMV) caused by the Mungbean Yellow Mosaic Virus (MYMV) belonging to Begomovirus species in the family, Geminiviridaeis the most destructive and cause significant yield losses by up to 100% or even kill a plant infected at an early vegetative stage (Kitsanachandee*et al.*, 2013). The viruses are transmitted by the vector, whitefly (*Bemisiatabaci*) in a persistent circulative manner. In India, Mungbean yellow mosaic virusis the most viral destructive disease of legumes popularly known as yellow plague of *Kharif* pulses.Mungbean yellow mosaic virus disease on mungbean was first ever reported from fields of IARI, New Delhi in 1960 and is transmitted principally by whitefly, *Bemisiatabaci* (Genn.) and grafting but not by sap, seed or soil (Nariani, 1960). Whitefly is the

only vector reported by several scientists for the natural transmission of virus in different plants.The virus has geminate particle morphology (20 x 30 nm) and the coat protein encapsulates spherical, single stranded DNA genome of approximately 2.8 Kb.

Mungbean yellow mosaic virus causes irregular green and yellow patches in older leaves and yellowing of younger leaves. Affected plants produce fewer flowers and pods, pods often develop mottling, remain small and contain fewer and smaller seeds thus affecting yields qualitatively and quantitatively. Yellow mosaic virus infection bring about drastic change in the biochemical components such as chlorophyll "a", "b" and total chlorophyll, nitrogen, protein etc. There might be adeviation from normal development and functioning of plant due to virus infection, the extent of metabolize disturbance brought by viral infection with in the host plant.

Screening of genotypes for yellow mosaic resistance is the most important step in developing MYMV resistant genotypes. Screening of green gram for yellow mosaic disease resistance in natural field condition was also earlier studied by many authors viz. Mohan *et al.*, (2014), Suman*et al.*, (2015), Bhanu*et al.*, (2017), Deepa*et al.*, (2017), Khaliq*et al.*, (2017) and Awasthi*et al.*, (2007) (N.B:Taken from result and discussion part).In order to gain an insight in the deranged physiology of yellow mosaic effect on mung bean comparative studies is healthy and diseased tissue of some of the biochemical resistance were carried out(Rewrite again or omit it).

The most economic, operative and ecological method to minimize the losses due to MYMV is the utilization of natural genetic resource and resistant genotypes against MYMV. Thus, the objective of the present experiment is identification of MYMV resistant mung bean genotypes among the popularly released genotypes and local green gram varieties of Rajasthan arid zone. This will alsohelp in the identification of green gram genotypes which can be recommended for cultivation inmungbean growing areas.

Material and Methods:

The present study was carried out at Agronomy Research Farm, SKN College of Agriculture, Jobner during *Kharif*, 2017. The field experiment was conducted in randomized block design in 3 m × 2 mplot at a spacing of 40 cm × 15 cm with four replications. Mung bean genotypes were obtained from AICRP on Arid legumes, the Department of Plant Breeding and Genetics, RARI, Durgapura, Jaipur. Tengermplasm entries and varieties were screened out against Mungbean yellow mosaic disease under field conditions and total chlorophyll content

(mg/g f. wt) were also observed of the all ten screened varieties.

Estimation of chlorophyll (Chlorophyll a, b and total Chlorophyll)

Chlorophyll was estimated in healthy and diseased leaves showing four categories of disease severity (25%, 50%, 75% and 100%). One gram fresh plant material of each healthy and diseased leaves were rapidly used and homogenized with 25 ml of 80 per cent acetone in Mortar with Pestle. The homogenate was centrifuged at 2000 rpm for 20 minutes and the volume made to 100 ml. The optical density was read at 645 nm, 652nm & 663 nmusing 80 per cent acetone as blank. Three replicates of each sample were prepared and mean value of optical density was recorded.

For calculation of total chlorophyll, chlorophyll a and b following equation were used:

$$\text{Total chlorophyll} = \frac{20.2A_{645} + 8.02A_{663}}{a \times 1000 \times W} \times V \text{ (mg/g f. wt.)}$$

$$\text{Chlorophyll a} = \frac{12.7A_{663} - 2.69A_{645}}{a \times 1000 \times W} \times V \text{ (mg/g f. wt.)}$$

$$\text{Chlorophyll b (mg/gm)} = \frac{22.9A_{645} - 4.68A_{663}}{a \times 1000 \times W} \times V \text{ (mg/g f. wt.)}$$

Where,

a = Length of light path in the cell (usually 1 cm)

V = Volume of the extract in ml.

W = Fresh weight of the sample in gram

*A_{645} and A_{663} are the optical densities of the sample at 645 nm and 663 nm, respectively.

The seeds of each variety was sown in two rows and flanked with one line of local susceptible variety to Mungbean yellow mosaic virus disease on both sides. Observations for disease intensity were being recordedduring near to crop maturity. Total chlorophyll content of all the varieties were also recorded usingtheabove procedure. Per cent disease index were alsocalculated by scoring disease as per disease rating scale of 0 – 5 and using thefollowing formula suggested by Mc Kinney (1923).

$$\text{PDI} = \frac{\text{Sum of all numerical ratings} \times 100}{\text{Number of plants assessed} \times \text{Maximum disease rating}}$$

Mung bean yellow vein mosaic virus disease was scored on 0-5 arbitrary scale as suggested by Bashir (2006) and the genotypes were scored as Highly Resistant (HR), Resistant

(R), Moderately Resistant (MR), Susceptible (S) and Highly Susceptible (HS) based on disease severity.

0 = No virus symptoms seen (Highly Resistant)

1= Occasional mild symptoms (1-10% infection) (Resistant)

2= moderate infections (11-20% infection) (Moderately Resistant)

3= 21-30% infection (Moderately Susceptible)

4 = severe and wide spread symptoms (30-50% infection) (Susceptible)

5 = Severe with likely loss in yield (More than 50% infection) (Highly Susceptible)

Result and Discussion:

Resistant genotypes are considered to be the most practical and economical means of controlling a plant-disease.Tenmung bean genotypes were screened under natural field condition against yellow mosaic virus disease.The observations on disease intensity of various genotypes were recorded and total chlorophyll content (mg/g f. wt.) was calculated. The results of pooled data presented in table-1,revealed that only two genotypes (IPM 02-3 and IPM 0205-7) were found completely free from the disease whereas IPM-409-4 and RMG 991 were found resistant. IPM 02-17 was found moderately resistant. Further, two genotypes namely RMG 1145, RMG 1136 were found moderately susceptible whereas RMG 62 and RMG 1099 were found susceptible to the disease. Remaining genotype, RMG 344 was found highly susceptible to the Mung bean yellow mosaic disease.

Table: 1 Screening ofbiochemical nature of resistance in different varieties against Mungbean yellow mosaic virus

S.No.	Variety/ Entries	Percent Disease Intensity (PDI)	Total chlorophyll content (mg/g f.wt.)*	Host Reaction
1	RMG-1099	34.45	0.70	S
2	RMG-62	45.32	0.65	S
3	RMG-1145	22.62	0.80	MS
4	RMG-1136	26.48	0.78	MS
5	RMG-344	16.41	0.46	HS
6	IPM-02-17	58.61	0.86	MR
7	IPM-409-4	6.62	0.91	R
8	RMG-991	7.52	0.94	R

9	IMP-0205-7	0.00	0.98	HR
10	IPM-02-3	0.00	1.07	HR

*Average of four Replications

Chlorophyll content of highly resistant varieties IPM 02-3 and IPM 0205-7 were recorded 1.07 and 0.98 (mg/g f. wt.), respectively. Whereas chlorophyll content 0.46 (mg/g f. wt.) was recorded in highly susceptible variety RMG 344. It was noted that total chlorophyll content recorded more in highly resistant varieties followed by resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible.

Out of ten screened genotypesof mungbean under natural field conditions against yellow mosaic virus disease, only two genotypes (IPM 02-3 and IPM 0205-7) were found completely free from the disease and plant had maximum chlorophyll content whereas, IPM-409-4 and RMG 991 were found resistant and chlorophyll content was low as compared to highly resistant varieties. Similar result was obtained by Darshan*et al.* (2018). They screened 35 mungbean genotypes against MYMV. Among these five were found highly resistant.

IPM 02-3 and IPM 0205-7either be released as a variety or can be utilized as a source of resistance in future breeding programs for improvement of the crop. Earlier also, resistance to yellow mosaic in mung bean has been reported by Singh *et al.*(1988) and Singh *et al.* (1989). Present investigation was found that total chlorophyll content was also found lower in virus infected mung bean varieties supported with the study of Sinha and Shrivastava (2010). They reported that the effect of mungbean yellow mosaic virus on the chlorophyll content in three varieties of mungbean plants – HUM-2, ML-192 and Pusabaishakhi had lowest total chlorophyll content.John *et al.* (2015) screened one hundred genotypes of mungbean (*Vignaradiata* L. Wilczek) against Mungbean yellow mosaic virus under natural field condition in Agricultural Research Station, TNAU, Virinjipuram, Tamil Nadu. They observed mungbean genotypes to yellow mosaic virus showed that 11 genotypes were found to be resistant, 23 genotypes were found to be moderately resistant reaction and 21 genotypes were moderately susceptible to mungbean yellow mosaic virus.

Screening of genotypes for yellow mosaic resistance is the most important step in developing MYMV resistant genotypes. Screening of green gram for yellow mosaic disease resistance in natural field condition was also earlier studied by many authors viz. Mohan *et al.*, (2014), Sumanet *al.*, (2015), Bhanu*et al.*, (2017), Deepa*et al.*, (2017), Khaliq*et al.*, (2017) and

Awasthi*et al.*, (2007). *(To be deleted, because this part should be and already taken to the introduction part).*

Summary and Conclusion:

The present investigation concluded and reveals that two varieties/genotypes viz. IPM 02-3 and IPM 0205-7were identified as Resistant against to the MYMV that can be used to further developing of resistant varieties against MYMV through different breeding techniques.

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