

Original Research Article

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Screening for Mungbean Yellow Mosaic Virus Resistance in Green Gram (*Vigna radiata* (L.) Wilczek)

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ABSTRACT

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Field screening of 50 green gram genotypes was done at Economic Botany (EB)-II, OUAT, Bhubaneswar, Odisha during summer 2015 to identify the Mungbean Yellow Mosaic Virus (MYMV) resistant genotypes. The disease screening for MYMV was carried out under natural field condition using infector rows of highly susceptible genotype, KPS 2, in the hot spot area during summer 2015 when vector population was high. The disease scoring was done as per the modified scale of All India Coordinated Research Project on MULLaRP proposed by Alice and Nadarajan, 2007. The results revealed that there was considerable variation among the genotypes for resistance against MYMV. Based on the average MYMV score, genotypes were classified in to five groups viz., 3 resistant, 12 moderately resistant, 13 moderately susceptible, 10 susceptible and 12 highly susceptible.

Introduction

Greengram or mungbean (*Vigna radiata* L. Wilczek) is the third most popular pulse crop in India after pigeon pea and chick pea which can be grown during all three crop seasons in different parts of the country. Being a short

duration crop, it is suitable for various multiple and inter-cropping systems. It is an excellent green fodder to the animals and cover crop for enriching soil fertility due to its high atmospheric nitrogen fixation. It contains high quality easily digestible protein and contains fiber, calcium, phosphorus and

vitamin B. The major constraint for green gram cultivation in India is yellow mosaic disease which causes significant yield reduction yield by up to 100% or even kill a plant infected at an early vegetative stage (R. Kitsanachandee *et al.*, 2013). The yellow mosaic disease is caused by the Mungbean Yellow Mosaic Virus (MYMV) belonging to begomovirus species in the family, Geminiviridae. The viruses are transmitted by the vector, whitefly (*Bemisia tabaci*) in a persistent circulative manner. The disease was first observed in India in 1955, at the experimental farm of the Indian Agricultural Research Institute, New Delhi and Nariani described it for the first time in 1960. Yellow mosaic virus disease is noticed in almost all leguminous crops like green gram, black gram, cowpea, soybean, horsegram, dolichos bean, moth bean and French bean. The disease symptoms starts as small scattered yellow spots on the veinlets and then spreads over the lamina. The tender leaves show yellow mosaic symptoms (alternating green and yellow patches), which gradually increase in size and ultimately the leaves turn completely yellow. The infected leaves also show necrotic symptoms. The diseased plants become stunted, mature late and produce very few flowers and pods. The pods of infected plants become yellow and reduced in size. Early infection often leads to death of plants.

The common method used to control yellow mosaic disease is management of the vector (whitefly) population using insecticides. The major constraint of this method is unavailability of effective insecticide for complete control of the disease. These chemicals cause health hazards and create adverse impact on surrounding environment (Nariani, 1960). Moreover it is not cost effective and recurrent spraying of insecticides causes development of insecticide resistance and the evolution of new vector biotypes. Moreover use of insecticide is not effective

under severe whitefly infestations. The most economic, effective and environmentally friendly method to control the disease is the utilization of natural genetic resource and breeding of resistant cultivars against MYMV. Thus the present study aims in identification of MYMV resistant genotypes among the popular released varieties, exotic collections and local green gram varieties of Odisha. This will help in the identification of green gram genotypes which can be recommended for cultivation in Odisha. It also helps in the improvement of these identified genotypes either through conventional or molecular techniques. The resistant donors for hybridization can be identified which helps in the development of resistant varieties.

Materials and Methods

The present study was carried out at Economic Botany (EB)-II, Department of Plant Breeding and Genetics, OUAT, Bhubaneswar, Odisha, which is a hot spot area for MYMV due to the continuous cultivation of the green gram.

The fifty genotypes of green gram were grown in Randomized Complete Block Design (RCBD) with three replications during summer, 2015 when the white fly (vector) population was high. Each genotype was grown in a row of two meter length with a spacing of 30 cm x 10 cm. The MYMV susceptible variety, KPS 2 was grown as infector row after every two rows of the test genotypes for increasing the virus inoculums in the field.

The recommended agronomical practices for green gram were followed. No insecticidal spray was done in the field during the experiment to maintain whitefly population in the field. The test genotypes were screened for MYMV resistance when 90% of the plants in the infector row exhibited the typical MYMV

disease symptoms. The visual scoring for the disease was done according to the modified scale of All India Coordinated Research Project on MULLaRP (Alice and Nadarajan, 2007) and is given in Table 1.

Five plants of each genotype were selected randomly and scored for MYMV resistance based on the visual observation of the disease symptoms as given in Table 1.

The mean value of MYMV scores for each genotype was calculated and based on these scores, the genotypes were grouped into different disease reaction categories for yellow mosaic disease resistance as resistant, moderately resistant, moderately susceptible, susceptible and highly susceptible.

Results and Discussion

The genotypes were scored for MYMV resistance according to 1 to 9 disease rating scale proposed by Alice and Nadarajan, 2007. The MYMV score of the genotypes in the present study varied from 1.00 (IPM 02-03, IPM 02-14 and PDM-139) to 9 (KPS-2 and BKG). Based on these MYMV scores, the test genotype were classified into different disease reaction categories as resistant, moderate resistant, moderate susceptible, susceptible and highly susceptible.

None of the genotype showed highly resistant reaction or immune reaction to MYMV. Among 50 genotypes screened for MYMV, 3 genotypes were MYMV resistant, 12 shown moderate resistance, 13 genotypes shown moderate susceptibility, 10 were susceptible and 12 genotypes were highly susceptible to MYMV.

The frequency of genotypes falling on each category was calculated and it was seen that among 50 genotypes used for study, 6%

genotypes were resistant, 24% moderately resistant, 26% moderate susceptible, 20% susceptible and 24% genotypes were highly susceptible to MYMV.

The genotypes viz., IPM 02-14, PDM 139 and IPM 02-03 were found resistant. The genotypes OUM 62, IPM 2-17, IPM 99-125, ML 818, ML 1299, ML 1666, NM 92, V2-22, EC 693358, EC 693367, EC 693369 and OGG 12 were found moderately resistant. While the genotypes viz., EC 693356, Sujatha, OBG 52, PAU 911, V 1-19, V 2-11, VC 6173, VC 6368, HUM 12, EC 693376, NM 94, Pusa 9072 and PDM 54 were categorized as moderately susceptible and the genotypes, Kendrapara local, Bhawanipatna local, OUM 11-5, LGG 407, VC 6372, Tarm 1, Pusa 9531, Jharsuguda local, OBG 177 and T 43-1-3 were found highly susceptible to MYMV.

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 earlier reported by many authors viz. Shukla *et al.*, (1978), Mohan *et al.*, (2014), Suman *et al.*, (2015), Bhanu *et al.*, (2017), Deepa *et al.*, (2017), Jalaluddin *et al.*, (1981), Khaliq *et al.*, (2017), Dharajiya *et al.*, (2018), Awasthi *et al.*, (2007) etc. Different disease rating scales were used by many of the workers, but in the present study, 1-9 scale and grouping as proposed by Alice and Nadarajan (2007).

Three genotypes viz. IPM 02-14, PDM 139 and IPM 02-03 identified as resistant to MYMV in the present study can be further confirmed through molecular analysis. These genotypes can be used for developing MYMV resistant genotypes through different breeding techniques (Table 1 and 2).

Table.1 The rating scale for scoring Mungbean Yellow Mosaic Virus disease (Alice and Nadarajan, 2007)

Score	Category	Reaction
1	No visible symptoms on leaves	Free
2	Small yellow specks with restricted spread covering (0.10 – 5.00%) leaf area of plant	Highly Resistant (HR)
3	Yellow mottling of leaves covering (5.10 – 10.00 %) leaf area of plant	Resistant (R)
4	Yellow mottling of leaves covering (10.10 – 15.00 %) leaf area of plant	Moderately resistant(MR)
5	Yellow mottling and discolouration of (15.10 – 30.00 %) leaf area of plant	Moderately susceptible (MS)
6	Yellow discoloration of (30.10 – 50.00 %) leaf area of plant	Susceptible(S)
7	Pronounced yellow mottling and discolouration of leaves and pods, reduction in leaf size and stunting of plants covering (50.10 – 75.00 %) foliage of plant	Susceptible(S)
8	Severe yellow discoloration of leaves covering (75.10 – 90.00 %) of foliage, stunting of plants and reduction in pod size	Highly susceptible (HS)
9	Severe yellow discoloration of leaves covering above (90.10 %) of foliage, stunting of plants and reduction in pod size	Highly susceptible (HS)

Table.2 Classification of green gram genotypes for yellow mosaic disease resistance based on MYMV score

MYMV score	Disease reaction category	Genotypes	No. of genotypes	Frequency (%)
1.0 to 2.0	Resistant (R)	IPM-02-14, PDM 139, IPM-02-03	3	6
2.1 to 4.0	Moderately resistant (MR)	OUM 62, IPM 2-17, IPM 99-125, ML 818, ML 1299, ML 1666, NM 92, V2-22, EC 693358, EC 693367, EC 693369, OGG 12,	12	24
4.1 to 5.0	Moderately susceptible (MS)	EC 693356, Sujatha, OBG 52, PAU 911, V1-19, V2 -11, VC 6173, VC 6368, HUM 12, EC 693376, NM 94, Pusa 9072, PDM 54	13	26
5.1 to 7.0	Susceptible (S)	Kendrapara local, Bhawanipatna local, OUM 11-5, LGG 407, VC 6372 Tarm 1, Pusa 9531, Jharsuguda local, OBG 177, T 43-1-3	10	20
7.1 to 9.0	Highly susceptible (HS)	Makarjholia local, Kalahandi local, Pusa Vishal, Ambagaon local, Keonjhar local-A, BKG, KPS 1, KPS 2, T 32 -2-3, Dhauri, EC 693363, LGG 460	12	24

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