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Original Research Article

# Identification of Resistance Sources to Mungbean Yellow Mosaic Virus among Mungbean Germplasm

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## Abstract

Mungbean yellow mosaic virus (MYMV) is an important production constraint in mungbean cultivation in Pakistan. The yield further decreases if susceptible varieties are cultivated. By using cultivars resistant to MYMV, the losses can be reduced. As the host status of mungbean genotypes grown in Pakistan is not known, therefore, in the present study 23 varieties/lines of mungbean collected from various sources were tested for their relative resistance or susceptibility to MYMV under field conditions. The results revealed that none of the entries was found highly resistant. Six entries viz. BRM-325, BRM-345, BRM-363, BRM-364, BRM-366 and NM-2011 were found to be resistant and ten genotypes/lines namely BRM-311, BRM-312, BRM-321, BRM-331, BRM-335, BRM-365, BRM-378, BRM-382, BRM-343 and BRM-353 appeared as moderately resistant. On the contrary, five genotypes Chakwal-06, BRM-334, BRM-348, BRM-354 and BRM-356 were rated as moderately susceptible to the disease. Likewise, two entries each (BRM-349 and BRM-350) and (Mash bean and Pigeon pea) showed susceptible and highly susceptible responses to the virus respectively.

**Keywords:** *Vigna radiata*, Yellow mosaic virus, Tolerance, Resistance

## Introduction

Mungbean (*Vigna radiata* L.) belonging to family Fabaceae, is grown extensively in major tropical and subtropical countries of the world. Its grains contain significantly high amount of carbohydrates (51%), protein (26%), moisture (10%), and vitamins A, B and C (3%) (Asaduzzaman et al., 2008). It also increases the soil fertility though symbiotic interaction with *Rhizobium* species which fix the atmospheric nitrogen (Karamany, 2006). Mungbean has been extensively cultivated on thousands of hectares in Asia including Pakistan, India, Burma, Bangladesh, Thailand, and Philippines (Hafeez et al., 1988). It has been cultivated over an area of 13.6 thousand hectares in Pakistan with a total annual production of 89.3 thousand tons (GoP, 2012). The average per hectare yield of the crop in Pakistan is less than other mungbean producing countries of the world. Different biotic and abiotic factors have been found responsible for this low productivity. Among biotic factors diseases caused by fungi (Iqbal and Mukhtar, 2014; Iqbal et al., 2014), bacteria (Shahbaz et al., 2015), nematodes (Hussain et al., 2014; 2016; Kayani et al., 2017; Mukhtar et al., 2014, 2017a, b; Tariq-Khan et al., 2017) and viruses (Ashfaq et al., 2014a, b) affect the sustainable production of this crop.

Of several viral diseases,the yellow mosaic disease caused by Mungbean yellow mosaic virus (MYMV) is of prime significance. This is a serious and widespread disease in many Asian countries including Pakistan (Biswas et al., 2008; John et al., 2008).The virus

belongs to the family *Geminiviridae* and the genus *Begomovirus*. The virus was first identified in 1955 and is transmitted by whitefly (*Bemisia tabaci*). High incidence of the disease has been reported throughout the world (Nene, 1972; Bansal et al., 1984; Pathak and Jhamaria, 2004; Salam et al., 2011). MYMV causes serious yield losses in Pakistan and other countries of the world (Bashir et al., 2005). In the beginning, small yellow specks appear along the veins and then spread over the leaf. In severe conditions, the whole leaf becomes chlorotic which later on turns into necrotic region and ultimately results in the formation of shrunk and shriveled seeds (Qazi et al., 2007; Ilyas et al., 2010; Mohan et al., 2014). In Pakistan, its strains were reported for the first time in 1971 which cannot be transmitted though mechanical inoculation; however, some strains of MYMV can be mechanically transmitted in Thailand (Ahmad and Harwood, 1973; Shad et al., 2005).

Although management of disease by controlling its vector chemically was considered to be an effective way but due to development of resistance in insect vectors against chemicals, the latter are losing attraction and the incidence of the disease is still increasing. Furthermore, the use of chemicals is being discouraged as their continuous use creates hazardous impacts on environment and human health (Lopez et al., 2008).

In the recent years, research on mungbean enhancement aims to develop high yielding varieties with resistance to this disease. By using virus resistant or tolerant varieties, the incidence of MYMV can be significantly reduced. Though, some researchers have reported resistance among mungbean lines in other parts of the world (Pathak and Jhamaria, 2004; Salam et al., 2009; Iqbal et al., 2011), there is no information regarding the resistance among available mungbean germplasm in the country. Therefore, in the present studies evaluations were made to identify resistant genotypes to the disease.

## Materials and Methods

The screening of mungbean germplasm was carried out in mungbean field at Regional Agricultural Research Institute (RARI), Bahawalpur during mungbean growing season i.e. April to July, 2016. Twenty three mungbean varieties/advance lines were collected from Pulses Section of RARI to identify disease incidence under natural condition (Table 1).The experiment was conducted in Randomized Complete Block Design with 3 replications. During the first week of April, each test entry was sown in 4 rows of 3meter maintaining row to row distance of 30cm and plant to plant distance of 10cm. The distance between the blocks was 60cm. Two susceptible checks (Mash bean and Pigeon Pea) were sown in the trial to provide the maximum inoculum pressure. One susceptible check (Mash bean) was sown at the one side and the other susceptible check (Pigeon Pea) was sown at the other side of each test entry.

Recommended cultural practices were adopted throughout the growing season. No insecticide was applied to increase the white fly population for the spread of the disease by natural means. Fertilizers were applied at the time of final land preparation as per recommended doses. After germination, the crop was regularly monitored for the presence of whitefly and the development of yellow mosaic disease. Assessment of selected germplasm was carried out on the basis of percent disease infection at reproductive stage and was scored by using recommended 0-5 disease rating scale (Bashir et al., 2005).

Whitefly population was recorded with the help of wooden split cage (65 × 35 × 25 cm) (Chhabra and Kooncer, 1998). The box was kept in such a way that it covered 3 to 4 plants in each plot. Population was assessed at the mid period of the experiment. The disease rating scale used to find out the disease severity is shown in Table 2.

## Results and Discussion

Evaluation of twenty-three mungbean varieties/lines under field condition of RARI, Bahawalpur against mungbean yellow mosaic virus (MYMV) carried out on the basis of scale (Table 2) showed wide variations in reaction to MYMV disease under field conditions. The severity of tested mungbean varieties/lines increased with the increase in the age of plants. The results revealed that none of the entries was found to be highly resistant. Six entries viz. BRM-325, BRM-345, BRM-363, BRM-364, BRM-366, NM-2011 were found to be resistant and ten genotypes/lines namely BRM-311, BRM-312, BRM-321, BRM-331, BRM-335, BRM-365, BRM-378, BRM-382, BRM-343, BRM-353 appeared as moderately resistant. On the contrary, five genotypes Chakwal-06, BRM-334, RM-348, BRM-354, and BRM-356 were rated as moderately susceptible to the disease. Likewise, two entries each (BRM-349 and BRM-350) and (Mash bean and Pigeon pea) exhibited susceptible and highly

susceptible responses to the virus respectively. The population of whitefly was also recorded which subsequently increased along the crop season. The population ranged from 2 to 3.5 per leaf on six resistant mungbean lines/varieties whereas population ranging from 4.1 to 5.7 adults per leaf was observed in majority of the tested lines. In general no relationship was found between whitefly population and MYMV infection.

Earlier many researchers have screened mungbean germplasm against the virus and reported similar findings. Iqbal et al. (2011) found only four lines and Salam et al. (2009) three genotypes resistant to the disease. On the other hand, Habib et al. (2007) and Shad et al. (2006) screened mungbean germplasm and reported no resistance sources. Datta et al. (2012) also reported a resistant genotype IPM-02-03. Similarly, Asthana (1998) and Paul et al. (2013) also found PDM-139 (Samrat) as a resistant variety to yellow mosaic and recommended for use in disease resistance breeding programs. Mohan et al. (2014) screened 120 germplasm lines of mungbean under field conditions at two locations during kharif, 2013. Results revealed that most of the genotypes studied were categorized as moderately susceptible to highly susceptible in both the locations. None of the test entries appeared to be immune. It was observed that the genotype showed differential response against MYMV at these locations i.e. the genotype found to be resistant at one location was found to be susceptible at another location. The differential response of MYMV at different sites might be due to the presence of various strains of the pathogen. In addition to this, other factors like population pressure of the vector, genetic characteristics of the germplasm and environmental conditions at that location are also responsible for differential response of germplasm.

**Table 1: List of germplam evaluated for resistance to MYMV at RARI**

| Sr. No. | Germplasm | Sr. No | Germplasm |
|---|---|---|---|
| 1 | Chakwal-06 | 13 | BRM-350 |
| 2 | BRM-311 | 14 | BRM-353 |
| 3 | BRM-312 | 15 | BRM-354 |
| 4 | BRM-321 | 16 | BRM-356 |
| 5 | BRM-325 | 17 | BRM-363 |
| 6 | BRM-331 | 18 | BRM-364 |
| 7 | BRM-334 | 19 | BRM-365 |
| 8 | BRM-335 | 20 | BRM-366 |
| 9 | BRM-343 | 21 | BRM-378 |
| 10 | BRM-345 | 22 | BRM-382 |
| 11 | BRM-348 | 23 | NM-2011 |
| 12 | BRM-349 | | |

**Table 2: Disease rating scale for categorization of mungbean germplasm to MYMV (Bashir et al., 2005)**

| Disease severity scale | Percent infection | Reaction |
|---|---|---|
| 0 | 0% | Highly Resistant |
| 1 | 1-10% | Resistant |
| 2 | 11-20% | Moderately Resistant |
| 3 | 21-30% | Moderately Susceptible |
| 4 | 31-50% | Susceptible |
| 5 | More than 50% | Highly Susceptible |

**Table 3. Response of mungbean germplasm to Mungbean yellow mosaic virus**

| Disease severity Scale | %age infection | Reaction | No. of entries | Names of Varieties/lines |
|---|---|---|---|---|
| 0 | 0% | Highly resistant | 0 | Nil |
| 1 | 1-10% | Resistant | 6 | BRM-325, BRM-345, BRM-363, BRM-364, BRM-366, NM-2011 |
| 2 | 11-20% | Moderately resistant | 10 | BRM-311, BRM-312, BRM-321, BRM-331, BRM-335, BRM-365, BRM-378, M-382, BRM-343, BRM-353 |
| 3 | 21-30% | Moderately susceptible | 5 | Chakwal-06, BRM-334, BRM-348, BRM-354, BRM-356 |
| 4 | 31-50% | Susceptible | 2 | BRM-349, BRM-350 |
| 5 | >50% | Highly Susceptible | 2 | Mash bean, Pigeon pea |

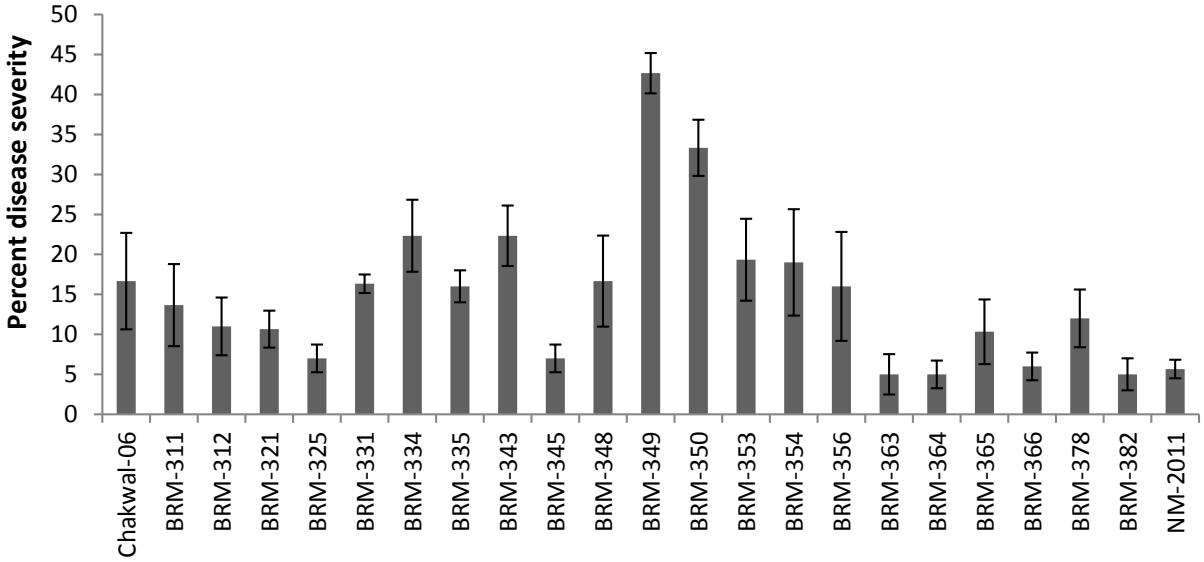


**Figure 1. Mean percent disease severity on different mungbean germplasm**

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