International Journal of Advanced Research in Biological Sciences
ISSN: 2348-8069
www.ijarbs.com
DOI: 10.22192/ijarbs Coden: IJARQG (USA) Volume 8, Issue 9 -2021

Research Article

DOI: http://dx.doi.org/10.22192/ijarbs.2021.08.09.011

Development of Mungbean Yellow Mosaic Virus Resistant Genotypes in Blackgram

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Abstract

Mungbean Yellow mosaic disease is a main destructing viral diseases in urdbean caused by Mungbean Yellow Mosaic Virus (MYMV) which leads to severe sometime 100 per cent yield reduction and it necessitates for developing MYMV resistant lines urdbean. The present investigation was carried out with an objective of evolution of MYMV resistant progenies through incorporating resistant genes from available sources. Twenty two lines were tested during Kharif 2014, Kharif 2015, Kharif 2016 and Kharif 2017 for yellow mosaic virus resistance along with yield. Out of twenty two entries, five lines namely VMBG03, VMBG05, VMBG07, VMBG08 and VMBG18 showed completed resistance against Mungbean Yellow Mosaic Virus. The entry VMBG18 has recorded highest grain yield of 994 kg/ha followed by VMBG-03 (983 kg/ha) and VMBG 09 recorded 915 kg/ha.

Keywords: Urdbean- Yellow Mosaic Virus Resistant lines - Yield

Introduction

Urdbean bean *(Vigna mungo* L.) and Mungbean is an important pulse crop in developing countries of Asia especially India, China, Japan , Myanmar and other countries and Latin America where it is consumed as dry seeds, fresh green pods. (Karuppanapandian *et al.*, 2006). Pulses serves as vital source of vegetable protein (19.1-28.3%), mineral (0.18-0.21%) and vitamins. It is a native of India-Burma and is cultivated extensively in Asia (Khattak *et al.*, 2007). Green gram and Black gram crops are major pulse crops of Tamil Nadu State. The less production of Green gram and Black gram is mainly attributed to low genetic yield potentiality, indeterminate growth habit, canopy architecture, low partitioning efficiency, cultivation in marginal land, biotic and abiotic stresses. Among biotic stresses, leaf spot, powdery mildew and mungbean yellow mosaic virus (mymv) are major diseases and have been found to appear in the epiphytotic form thereby causing immense loss in farmers' field of Tamil Nadu State.

Depending upon crop variety and location, disease incidence of MYMV was from 4% to 40% in Pakistan (Bashir et al., 2006). In several cases, leaves and other plant parts become completely yellow and the losses may be as high as 100% (Malik, 1991; Bashir et al., 2006). Singh et al., (2000) reported an incidence ranging from 0% to 58.5 % among various varieties during their evaluation program for resistance against MYMV from Uttar Pradesh. MYMV disease leads to severe yield reduction not only in India, but also in Pakistan, Bangladesh and areas of South East Asia (Malathi *et al.*, 2008 and Biswas *et al.*, 2012) in Black gram India Vigna breeding especially in mungbean

and urdbean improvement research has elaborately taken by mungbean breeders in India (Pandiyan *et al*. 2010, 2012, 2006), covers up to 55% of the total world acreage and 45% of total production (Rishi, 2009). Among the biotic sources plant viruses are responsible for a significant proportion of crop disease (Prajapat *et al.,* 2011). It causes serious economic losses in many major crops by reducing economic part like seed yield and quality (Kang *et al.*, 2005). It causes severe yield reduction in all mungbean growing countries in Asia including India (Biswass *et al.,* 2008). MYMV belongs to the family Geminiviridae (Fauquet *et al.,* 2003).

Conventional breeding methods are unsuccessful in developing Yellow Mosaic Virus (YMV) resistant mungbean lines due to rapid explosion of new isolates and also the complexity of mechanism in controlling the resistance to MYMV (Selvi *et al.,* 2006). The major problem encountered by scientists to develop the MYMV resistant variety is the identification of MYMV resistant lines in segregating population. Identifying the resistant lines is very complicated task due to the lack of reliable screening protocol for assessing the resistance/susceptibility against MYMV. Hence the scientists are in need of any biological/molecular tool that can lead to screening of the resistant or susceptible lines for MYMV. Developing host resistance to the disease or the vector has therefore been considered as the only solution to control this disease (Kang *et al.*, 2005). Plant genetic transformation is of particularly benefit to molecular genetic studies and crop improvement programmes (Darbani *et al.*, 2008). The entry VMGG012-005 is a extra early duration genotype, tolerant to high temperature with drought. If improve this culture for high level of MYMV resistant which can be used directly as variety and also used as donor for short duration, drought tolerant and high temperature resistant along with MYMV donar.

Materials and Methods

Plant materials:

The experimental material for the present investigation consisted of 22 blackgram genotypes tested for yield performance and also Mung bean Yellow Mosaic Virus resistance (Table 1.)

Table.1. Blackgram genotypes used for this study

Sl. No	Genotypes	Parentage
1.	VMBG01	*VBN1 x VBN3*-1
2.	VMBG02	*VBN1 x VBN3*- 5
3.	VMBG03	*VBN1 x VBN3*- 8
4.	VMBG04	*VBN1 x Silvestris8*- 5
5.	VMBG05	*VBN1 x Silvestris8*- 12
6.	VMBG06	*VBN1 x Silvestris8*-15
7.	VMBG07	*VBN1 x Silvestris8*- 18
8.	VMBG08	*VBN1 x Silvestris8*-20
9.	VMBG09	*VBN1 x Silvestris8*-21
10.	VMBG10	*VBN1 x Silvestris8*- 25
11.	VMBG11	*Silvestris* xADT3- 5
12.	VMBG12	*Silvestris* xADT3- 8
13.	VMBG13	*Silvestris* xADT3- 15
14.	VMBG14	*Silvestris* xADT3- 20
15.	VMBG15	*Silvestris* xADT3- 28
16.	VMBG16	*Silvestris* xADT3- 35
17.	VMBG17	*Silvestris* derivative line
18.	VMBG18	*VBN1 x Silvestris8*-1 (Branch type)
19.	VMBG19	*VBN1 x Silvestris8*-3 (Multi pod)
20.	VMBG20	*VBN1 x Silvestris8*- 13 (Stem pod)
21.	VMBG21	*VBN1 x Silvestris8*-14 (Multi pod)
22.	VMBG22	*VBN1 x Silvestris8*-22 (Multi pod)

The crop was raised during Kharif 2014, kharif 2015, kharif 2016 and kharif 2017 at Agricultural Research Station, Virinjipuram Vellore and adopted normal spacing of 30 x10 cm with recommended dose of fertilizer. The MYMV score also recorded as per the standard scoring methods.

Results and Discussion

Most of the farmers accepted mungbean and urdbean varieties are susceptible to MYMV. It necessitates for developing MYMV resistant varieties because urdbean is important pulse food crop in Tamil Nadu. The yield performance of genotypes showed in the table 2 and MYMV resistant blackgram genotypes in Table 3. Five genotypes namely VMBG03, VMBG05, VMBG07, VMBG08 and VMBG18 showed highest level of MYMV resistance along good yield with yield. Out of 22 entries studied six entries recorded highest grain yield above 800 kg/ha while other entries recorded below 800 kg/ha . The VMBG18 recorded 944 kg/ha followed by VMBG07 (841 kg/ha), VMBG016 (839 kg/ha), VMBG09 (834 kg/ha), VMBG03 (809 kg/ha) and VMBG02 (809 kg/ha) during Kharif 2014. 12 out yielded entries raised during Kharif 2015. The six entries recorded highest grain yield ranged above 850 kg/ha while other entries recoded below 850 kg/ha. The VMBG08 recorded 947 kg/ha followed by VMBG07 (947 kg/ha), VMBG018 (914 kg/ha), VMBG09 (879 kg/ha), VMBG06 (867 kg/ha) and VMBG03 (850 kg/ha). During kharif 2016 all the six entries recorded highest grain yield above 850 kg/ha. The VMBG09 recorded 985 kg/ha followed by VMBG18 (944 kg/ha), VMBG03 (943 kg/ha), VMBG08 (898 kg/ha), VMBG07 (883 kg/ha) and VMBG05 (854 kg/ha). The best three entries, the entry VMBG18 has recorded highest grain yield of 994 kg/ha followed by VMBG 03 (983 kg/ha) and VMBG 09 recorded 915 kg/ha in all the seasons.

Table 2: Performance of blackgram genotypes for yield contributing characters

Sl. No.	Code No	Duration (days)	Plant stand (%)	Plant height (cm)	No. of pods/plant	100 grain weight	Yield (kg/ha)
1.	VMBG01	68.0	88.3	14.0	20.3	2.8	740
2.	VMBG02	65.3	82.3	22.0	19.3	3.2	809
3.	VMBG03	71.3	81.7	14.2	17.8	3.6	834
4.	VMBG04	67.7	89.3	15.0	25.0	4.2	748
5.	VMBG05	70.7	85.3	23.0	24.0	5.6	694
6.	VMBG06	71.7	87.0	17.8	20.8	4.8	781
7.	VMBG07	72.3	90.3	15.0	19.3	4.8	841
8.	VMBG08	70.3	82.7	28.4	16.3	4.0	809
9.	VMBG09	67.7	77.7	11.6	19.0	5.2	787
10.	VMBG10	68.0	89.0	14.2	30.3	5.0	706
11.	VMBG11	71.0	76.3	21.8	22.8	3.2	697
12.	VMBG12	65.0	85.3	11.4	25.0	5.6	742
13.	VMBG13	72.3	76.7	22.8	19.8	4.4	677
14.	VMBG14	67.7	79.3	10.7	17.0	4.0	710
15.	VMBG15	75.0	89.3	19.8	18.8	5.6	706
16.	VMBG16	72.7	86.0	18.0	20.3	4.0	839
17.	VMBG17	67.7	88.3	18.0	22.3	5.2	647
18.	VMBG18	65.0	85.0	13.0	21.3	4.4	944
19.	VMBG19	68.0	87.0	21.0	22.7	4.0	722
20.	VMBG20	65.7	78.3	11.7	19.0	5.0	610
21.	VMBG21	75.0	79.3	15.8	17.8	4.6	606
22.	VMBG22	71.7	82.0	16.0	19.3	5.0	639

Table 3: MYMV field resistant genotypes during Kharif 2014 to 2017 (Leaf % affected)

Sl. No.	Code No	Kharif 2014	Kharif 2015	Kharif 2016	Kharif 2017
1	VMBG03	1	1	2	1
2	VMBG05	2	1	2	1
3	VMBG07	2	2	1	2
4	VMBG08	1	2	1	1
5	VMBG18	1	2	2	1

The same results were revealed by Bashir *et al.* (2006) resistance in mungbean and mashbean germplasm against mungbean yellow mosaic begomovirus, Biswas *et al.* (2012) virus disease of mungbean and urdbean, Malathi, and John (2008) for Mungbean yellow mosaic virus resistance, Malik 1991 studied resistance to MYMV in greengram, Singh *et al*. (2000) studied for mungbean varieties against yellow mosaic virus . Identification of MYMV resistant lines through conventional breeding method relies on field screening. Even though it is the time consuming one and requires evaluation at hot spot area (Selvi *et al.*, 2006) and Djanaguiraman *et al.* 2005 in tomato, Yu Takahashi *et al.* (2019) resistance to biotic stresses, Bisht *et al* . (2004) in sesame, Pandiyan *et al*. (2006) in greengram, Pandiyan *et al*. (2007) germplasm for mungbean yellow mosaic virus. Irulappan Mariyammal et al. 2019, mymv and bruchid resistant genotypes identified, Pandiyan, *et al.* (2018), high yielding MYMV disease resistant blackgram variety VBN 8, Pandiyan *et al.* (2012) in greengram germplasm for constituting of core collection to screen MYMV resistant genotypes.

In greengram MYMV resistant genes for identifying the real resistant source and combination with plant breeding approaches will likely to be needed for the improvement of crops (Roy *et al.*, 2011) and Karthikeyan *et al* (2012) and Pandiyan *et al* (2010, 2012) and in blackgram Bashir *et al.* (2006). resistance in mungbean and mashbean germplasm against mungbean yellow mosaic begomovirus, *Biswas et al* (2012) virus disease of mungbean and urdbean, Malathi and John(2008) for Mungbean yellow mosaic virus resistance, Malik (1991) studied resistance to MYMV in greengram, Singh, *et al.* (2000) studied for mungbean varieties against yellow mosaic virus. In greengram VGGru1 and VGGru 2 MYMV resistant entries developed in greengram and in blackgram VBN6, VBN7 and VBN8. This results agreed with Pandiyan *et al*. (2005, 2006, 2008, 2010, 2010, 2012, 2012, 2012, 2018). In greengram no infection was recorded on Resplant 3, Resplant 6, Resplant 7, Resplant 9, Resplant 13, Resplant 19, Resplant 25, Resplant 37, Resplant 40 and Resplant 43 as that of blackgram resistant entries VMBG03, VMBG05, VMBG07, VMBG08 and VMBG18. This results reported early same as Pandiyan *et al*. (2005, 2006, 2008, 2010, 2010, 2012, 2012, 2012, 2018) in greengram and Bashir e*t al*. (2006). resistance in mungbean and mashbean germplasm against mungbean yellow mosaic begomovirus, Biswas *et al (*2012) virus disease of mungbean and urdbean, Malathi, and John (2008) for Mungbean yellow mosaic virus resistance, Malik (1991) studied resistance to MYMV in greengram, Singh *et al.* (2000) studied for mungbean varieties against yellow mosaic virus.

The MYMV resistant lines namely VMBG03, VMBG05, VMBG07, VMBG08 and VMBG18 in blackgram were developed and previous study showed same results in greengram Resplant 9 (22.05 %) and Resplant6 (52.33) recorded the lowest average infection in the strains VA 239. These findings are nearly in close conformity with the reports Usharani *et al.* (2005) in agroinoculating mungbean with 71 to 95% of MYMV. Karthikeyan *et al* .(2012, 2014) and Pandiyan *et al*. (2005, 2006, 2008, 2010, 2010, 2012, 2012, 2012, 2018). and Sudha *et al.* (2013, 2015) and Basandrai *et al.* (1999) in Blackgram (*Phaseolus mungo*) screened for mymv resistant in blackgram, Raje and Rao2002 screening of mungbean (*Vigna radiata* L. Wilczek) germplasm for yellow mosaic virus, Pathak and Jhamaria. 2004 in mungbean (*Vigna radiata* L.), Obaiah *et al.* 2013. resistant geneotypes in blackgram, Muhammad Hanif Munawwar, *et al*. (2014) for MYMV resistant lines identified in mash bean and in blackgram MYMV by Basandrai *et al*. (2003).

These VMBG03, VMBG05, VMBG07, VMBG08 and VMBG18 entries are in accordance with the reports of Karthikeyan *et al*.(2012) and Sudha *et al* (2012) indicating the presence of asymptomatic plants with coat protein specific primers for the DNA A and B

components. Karthikeyan *et al*. (2012, 2014) and Sudha *et al* (2013, 2015). The identified resistant individuals namely, VMBG03, VMBG05, VMBG07, VMBG08 and VMBG18 will be utilized in the breeding programme.

Conclusion

The results of this study the entry VMBG18 has recorded highest grain yield of 994 kg/ha followed by VMBG 03 (983 kg/ha) and VMBG 09 recorded 915 kg/ha. Five lines namely VMBG03, VMBG05, VMBG07, VMBG08 and VMBG18 with higher level of Yellow Mosaic Virus resistant in blackgram. These five progenies lines using future breeding programmes.

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DOI:10.22192/ijarbs.2021.08.09.011	

How to cite this article:
M. Pandiyan and S. Geetha. (2021). Development of Mungbean Yellow Mosaic Virus Resistant Genotypes in Blackgram. Int. J. Adv. Res. Biol. Sci. 8(9): 91-98.
DOI: http://dx.doi.org/10.22192/ijarbs.2021.08.09.011