Original Research Article

Morphological Screening of Black Gram Genotypes with reference to Mung bean yellow Mosaic virus

Abstract

One of the most devastating diseases affecting blackgram productivity in India is mung bean yellow mosaic. It is transmitted by whitefly (*Bemisia tabaci*). The current investigation was carried out to identify the blackgram genotypes resistant against the Mung bean yellow Mosaic virus (MYMV) through field screening at natural condition. The genotypes were screened using the infector row method. Twelve blackgram genotypes namely VBN-2, VBN-3, VBN-5, VBN-6, VBN-7 VBN-8, VBN-9 VBN-10, VBN-11, ADT-5, ADT-6 and CO-5 were used for screening during summer 2022. The genotypes *viz.*, VBN-6, VBN-10 and VBN-11 were found to be resistant and moderately resistant *viz.*, VBN-4, VBN-5, VBN-7, and VBN-8. It implies that utilization of these genotypes as YV resistance donors for results in the production of high yielding MYMV resistant varieties through backcrossing or marker assisted backcrossing by introgression of the genes to agronomically potential genotypes that were susceptible to MYMV.

Key words: Screening, Black gram, Mung bean yellow mosaic virus, Resistant, Susceptible.

Introduction:

Blackgram is a significant legume crop of the family Leguminaceae that is primarily grown in Indian subcontinent. Blackgram is highly priced when compared with other pulse crop. It is regarded as a nutritious food for human diet and a rich source of protein, potassium, iron, calcium, thymine (B1), niacin (B3), riboflavin (B2). It also helps in fixing atmospheric nitrogen to the soil. In addition to the Kharif (autumn) season, blackgram can also be grown in the Rabi (sprig) and summer seasons in India. In Indian subcontinent Yellow Mosaic Disease (YMD) is infected by two types virus species namely Mung bean Yellow Mosaic India Virus (MYMIV) is frequently found in the northern part of India, whereas Mung bean Yellow Mosaic Virus (MYMV) is exclusively found in southern India [1]. In black gram, irregular yellow patches of different sizes that eventually combine to form larger patches of bright yellow colour are the first signs of yellow mosaic disease [2]. This is also accompanied by a general stunting of plant

height. In extreme circumstances, almost entire leaf surface may turn yellow, plants produce fewer flowers, have smaller pods with immature seeds showing poor germination [3].

In India, MYMV cannot be spread mechanically but it is easily be transmitted by the whitefly, *Bemisia tabaci* Gennadius [4]. Due to a lack of resistant cultivars, land is diverted from growing black gram crops to other cereal crops [5]. However, breeding with resistant cultivars is an effective and environmentally beneficial method of managing MYMV in the production of urdbeans [6]. Researchers have made multiple attempts to identify YMV resistant urdbean cultivars since it is crucial to find more number of resistant blackgram varieties that perform well in all growing seasons [7]. Given the aforementioned information, the current study was aimed to screen the MYMV resistant blackgram varieties under natural field conditions.

Materials and methods

The present research work was carried out on the farm of Adhiparasakthi Agricultural College, Kalavai, Ranipet, Tamil Nadu and India. Experimental materials include 12 genotypes of black gram collected from the National Pulse Research Centre, Vamban. The details of genotypes were listed in Table 1. The genotypes were raised in the flat bed method with a spacing of 30 x 10 cm in Randomized Block Design (RBD) under the irrigated condition with two replications. Varieties were selected for MYMV screening. For testing the genotypes, infector row method was followed for providing MYMV infection. The blackgram varieties CO 5 and VBN 10 were used as susceptible and resistant checks respectively. Agronomic practices such as hand weeding, irrigation, application of fertilizer and herbicide were provided for successful crop growth. No insecticide was sprayed to ensure natural whitefly population. Scoring was conducted after 80% of the plant displayed incidence based on 1-9 modified scale of All India Coordinated Research Project on MULLARP proposed by Alice and Nadarajan [8].

Table 1. Modified MULLARP scale (0-9)

Scales	Description
0	No visible symptoms on leaves
1	Very minute yellow specks on leaves
2	Small yellow specks with restricted spread covering 0.1-5% leaf area of plant
3	Yellow mottling of leaves covering 5.1-10% leaf area of plant

4	Yellow mottling of leaves covering 10.1-15% leaf area of plant
5	Yellow mottling and discolourations of 15.1-30% leaf area of plant
6	Yellow discolourations of 30.1-50% leaf area of plant
7	Pronounced yellow mottling and discolourations of leaves and pods, reduction in leaf size and stunting of plants covering 50.1-75% foliage of plant
8	Severe yellow discolourations of leaves covering 75.1-90% of foliage, stunting of plants height and reduction in pod size
9	Severe yellow discolourations of leaves covering above 90.1% of foliage of plants, stunting of plants and no pod formation

The categories used for assessing the resistant genotypes against yellow mosaic virus was given in the following table [3].

Table 2. Disease Severity Rating and reaction

Percent Disease Severity Rating	Rating	Reaction
0.1-5	1 - 2	Resistant
5.1-15	2.1 - 4	Moderately Resistant
15.1-30	4.1 - 5	Moderately Susceptible
30.1-75	5.1 - 7	Susceptible
75.1-100	7.1 - 9	Highly Susceptible

The formula provided by Wheeler [9] was used to determine the percentage disease index.

$$\text{Percent disease index (PDI)} = \frac{\text{Sum of numerical rating}}{\text{Total number of leaves observed x Maximum grade}} \times 100$$

Table 3: Screening of black gram genotypes against MYMV

Genotypes	Rating	Reaction	Number of genotypes
VBN-6, VBN-10, VBN-11	1 to 2	Resistant	3
VBN-4, VBN-7, VBN-8, VBN-5	2.1 to 4	Moderately Resistant	4
VBN-3, VBN-2	4.1 to 5	Moderately Susceptible	2
ADT-4, ADT-5	5.1 to 7	Susceptible	2
CO-5	7.1 to 9	Highly Susceptible	1

Plate 1. Field trials of blackgram genotypes against yellow mosaic disease

Result and discussion

The MYMV disease affecting the leguminous crops can effectively be controlled by using the resistant varieties. Screening varieties against the MYMV under field conditions with naturally occurring *Bemisia tabaci* infection is the foremost step in identifying the resistant

varieties. Several genotypes that showed MYMV resistance have already been examined but lack of durable resistance is observed. Therefore, continuous screening is necessary for identifying sources against the MYMV resistance. On the basis of a 0–9 scale, 12 genotypes of urdbean were evaluated in the field condition against the MYMV, and the percent disease incidence was calculated. After every test entry, the presence of most susceptible check CO-5 and good population of whitefly in summer minimizes the chance of disease escape. Genotypes: VBN-6, VBN-10 and VBN-11 were resistant, while VBN-4, VBN-7, VBN-8 were moderately resistant and VBN-5 VBN-3 and VBN-2 were moderately susceptible, each of ADT-4 and ADT-5 were susceptible, CO-5 was highly susceptible at summer season 2022. The findings of the previous study [1, 10, 11, 12, 13] were consistent with the results of present investigation in blackgram.

Conclusion

On the basis-analyzed results it is concluded that the genotypes namely VBN-6, VBN-10 and VBN-11 were resistant and moderately resistant *viz.,* VBN-4, VBN-7, VBN-8, and VBN-5 at summer season, 2022. It implies that utilization of these genotypes as YMV resistance donors results in the development of high yielding YMV resistant varieties through backcrossing or marker assisted backcrossing by introgression of the genes to agronomically potential genotypes that were susceptible to MYMV. Based on the priority, the local varieties which are well adapted to the specific environmental conditions which otherwise give high yield can be improved by incorporating the resistant genes, however a thorough research is needed for further developing resistant varieties.

References

[1] Shamim, M.Z and Pandey, A. 2014. Identification of Yellow Mosaic Virus (YMV) resistant Black Gram (*Vigna mungo* L.) genotypes for cultivation in Northern India. Journal of Agroecology and Natural Resource Management, 1 (2): 48-50.

[2] Mohan S, Sheeba A, Murugan E, Ibrahim SM. Screening of Mung bean Germplasm for Resistance to Mung bean Yellow Mosaic Virus under Natural Condition. Indian Journal of Science and Technology. 2014; 7(7):891-896

[3] Nene YL. A survey of viral diseases of pulse crops in Uttar Pradesh. Research Bulletin-4. 1972; 87:1-191.

[4] Zubir M, Bashir M. Identification of resistance in urdbean against two different viral diseases. Pak J Botany. 2002; 34:49-49.

[5] Mohan S, Sheeba A, Murugan E, Ibrahim SM. Screening of Mung bean Germplasm for Resistance to Mung bean Yellow Mosaic Virus under Natural Condition. Indian Journal of Science and Technology. 2014; 7(7):891-896.

[6] Tamilzharasi M, Vanniarajan C, Karthikeyan A, Souframanien J, Arumugam pillai M, Meenakshisundram P. Evaluation of urdbean (*Vigna mungo*) genotypes for mung bean yellow mosaic virus resistance through phenotypic reaction and genotypic analysis. Legume Research an International Journal. 2018; 0:1-7.

[7] Subedi S, Neupane S, Ghimire TN. 2016.Screening of mung bean and black gram genotypes as sources of genetic resistance against Mung bean Yellow Mosaic Disease. Nepalese Journal of Agricultural Sciences; 14:148- 155.

[8] Alice D and Nadarajan N 2007. Screening techniques and assessment methods for disease resistance, Department of Pulses, TNAU. All India Coordinated Research Project on MULLaRP-Tamil Nadu Agricultural University Kasturi Graphics and Printers, Coimbatore-24.

[9] Wheeler BEJ. An Introduction to plant disease. John Wiley and Sons Ltd, London, 1969, 9-364.

[10] Ganapathy, T., Kuruppiah, R and Gunasekaran, K. 2003. Identifying the source of resistance for mungbean yellow mosaic virus (MYMV), urd bean leaf crinkle virus and leaf curl virus disease in urd bean (*Vignamungo (L.) Hepper*). In AnnualMeeting and Symposium on recent Developments in the diagnosis and Management of Plant Diseases for Meeting Global Challenges, December 18-20.University of Agricultural Sciences, Dharwad, p.30.

[11] Gopi, P., Satyanarayana, A., Krishna, A.R., Rao, K.R.S.S. 2016. Evaluation of Blackgram Germplasm for Resistance against YMV. Journal of Plant Pathology and Microbiology, 7: 368.

[12] Obaiah, S., Reddy, B.V., Reddy, N.P. and Siva Prasad, Y. 2013. Screening of some blackgram (*Vigna mungo* (L.) *Hepper*) genotypes for resistance to yellow mosaic virus. Current Biotica, 7(1and2): 96-100.

[13] Pathak, A.K and Jhamaria, S.L. 2004. Evaluation of mungbean (*Vigna radiata L.*) varieties to yellow mosaic virus. Journal of Mycology and Plant Pathology, 34: 64-65.