Bangladesh J. Nuclear Agric. 33 & 34: 33-38 (December, 2020) *ISSN 0258-7130*

EVALUATION OF MUNGBEAN MUTANTS AGAINST YELLOW MOSAIC AND CERCOSPORA LEAF SPOT

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Abstract

Ten advanced Mungbean mutants were evaluated along with five varieties against yellow mosaic (MYM) and cercospora leaf spot (CLS) during Kharif-I season in 2014 and 2015 under field conditions at BINA sub-station, Ishurdi, Pabna. The mutant/varieties were categorized into resistant and susceptible depending upon severity of the diseases (0- scale). The induced mutants MBM-390-94-y, MBM-427-87-3, MBM-347-13 and MBM-07-y-1 were recorded as moderately resistant to yellow mosaic and the mutants MBM-390-94-y, MBM-656-52-2, MBM-427-87-3, MBM-347-13, MBM-07-y-1 and MBM-07-g-2 were found as moderately resistant to cercospora leaf spot. None of the mutants was found to be resistant to the diseases. Considering yield contributing characters, the mungbean mutants MBM-347-13 and MBM-07-y-1 were found superior than others and these were found to be moderately resistant to yellow mosaic ad CLS. Therefore, these two mutants could be used in breeding programme for the development of yellow mosaic and cercospora leaf spot resistant mungbean variety in Bangaldesh.

Key words: Mungbean, mutant, resistance, yellow mosaic, cercospora leaf spot.

Introduction

Mungbean (*Vigna radiata* L. wilczek) is one of the most important pulse crops in Bangladesh and the third most important pulse crop in south and southeast Asia. More than 90% of global mungbean production occurs in this region. As mungbean is a short duration crop and high demand, it can well fit as a cash crop between major cropping patterns in Bangladesh. It is grown two seasons (Kharif-I and Kharif-II) in a year covering 205700 ha area with total production of 225500 metric tons (Krishi Diary, 2017). It contributes 23% of total pulse area and 22% production in the country (Krishi Diary, 2017). It provides seed for human consumption and the plants fix substantial amount of nitrogen in addition of organic matter to the soil (Sharma and Prasad, 1999). Mungbean also can increase the yield of the following rice crop up to 8% through the fixation of nitrogen in the soil, and reduce pest and disease problems (Nair, 2012). Sprouts and green pods of mungbean are rich in vitamins and minerals, thus are good sources of dietary protein for people.

Among the diseases, mungbean yellow mosaic virus (MYMV) is considered to be the most destructive, widely distributed and that incurred significant yield reduction every year in Bangladesh, India, Pakistan, Philippines, Sri Lanka and Thailand (Jalaluddin and

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Shaikh, 1981; Malik and Bashir 1992). Yield loss due to mungbean yellow mosaic was recorded 63% in Bangladesh (Bakr, 1994), but may cause 10-100% yield loss depending on crop growth stage at the infection time (Marimuthu *et al.*, 1981). Mungbean yellow mosaic virus belonging to the genus begomovirus is transmitted by white-fly (*Bemisia tabaci*) and also causes the yellow mosaic disease in a number of economically important grain legumes and soybean. The virus causes irregular chlorotic yellow patches on the leaf lamina and with the spread of the virus the entire leaf lamina becomes yellow, reducing the agronomic yield due to the photosynthetic inefficiency (Verma and Sandhu, 1992). Resistance in mungbeam germplasm against MYMV has been recognized earlier by different workers using scale based disease severity (Jalaluddin and Shaikh, 1981; Jalaluddin *et al.*, 1999; Iqbal *et al.*, 2004; Bashir *et al.*, 2006, Khattak *et al.*, 2008).

Cercospora leaf spot (CLS) caused by the biotrophic fungi *Cercospora cruenta* and *C. canescens* Illis and Martin is also serious disease of mungbean. The disease causes serious losses to mungbean and 23% losses in yield have been reported (Quebral and Cagampang, 1970). Maximum loss of 61% was observed in case of grain yield (Iqbal *et al.*, 1995). The disease is widespread in south east Asia and especially devastating in the warm-wet growing season. The fungus initially causes small spotting on mungbean leaves, the spots increase in number and size during flowering, but the increment is the most rapid at the pod-filling stage. Depending upon the temperature and humidity, it spreads rapidly in susceptible varieties causing premature defoliation and reduction in size of pods and grains (Grewal *et al.*, 1980). Although the diseases can be controlled by spraying with insecticide and fungicide, the practice increases farmers' production costs and has adverse affects on human health and the environment. Moreover, regular spraying can cause development of chemical resistance in the pathogen. The use of resistant varieties is the most desirable strategy to manage the disease in an economical and environmentally-friendly way. Therefore, the present research work was undertaken to find out the resistant/tolerant sources of mungbean germplasms against yellow mosaic and cercospora leaf spot under field conditions.

Materials and Methods

Ten advanced mutants and five varieties were assessed for their resistance to yellow mosaic (MYMV) and cercospora leaf spot (*Cercospora cruenta* and *C. canescens*) diseases at BINA sub-station farm, Ishurdi, Pabna (24.12347688546462, 89.07926122479039) in kharif-I season of 2014 and 2015 under natural field condition. The seeds of the mutants and varieties were collected from Plant Breeding Division, BINA. The experiments were conducted in a randomized complete block design with three replications. The seeds were sown in rows apart from 30 cm apart and maintaining seed to seed distance 5 cm. The unit plot size was 4.0 m × 2.5 m each. Fertilizers were applied at the time of final land preparation as per recommended doses (Anonymous, 2012). Weeding was performed two times during the growing period of the crop at 25 and 40 days after sowing. No pesticides were applied in the field. Mungbean yellow mosaic severity was recorded from each plot at flowering and maturity stage following 0-9 scoring scale (Jalaluddin and Shaikh, 1981). Cercospora leaf spot severity was recorded using disease severity score (0-9) of Jalaluddin

(1984) at flowering and maturity stage. Data were recorded on days to maturity, plant height (cm), number of pods per plant, pod length (cm), number of seeds per pod and yield (kg ha^{-1}). Analysis of variance and LSD test were done to find out the significant difference among the treatment means using computer based program MSTATC.

Results and Discussion

The severity of yellow mosaic varied significantly among the tested mutants and varieties. The disease severities were higher in 2014 than 2015. The mean severities of yellow mosaic ranged from 3.0 to 6.5 in 2014 and 2.6 to 5.8 in 2015 (Table 1). The highest disease severity was recorded in the mutant MBM-80 and graded as susceptible to yellow mosaic. Three mutants (MBM-390-94-y, MBM-427-87-3, MBM-347-13 and MBM-07-y-1) and all the varieties were found to be moderately resistant and rest of the mutants were moderately susceptible against yellow mosaic according to the disease severity score.

The mean severity of cercospora leaf spot ranged from 3.0 to 7.0 in 2014 and 3.0 to 6.2 in 2015 (Table 1). The highest disease severity was recorded in the mutant MBM-80 and graded as susceptible. Six mutants (MBM-390-95-y, MBM-656-52-2, MBM-427-87-3, MBM-347-13, MBM-07-y-1 and MBM-07-g-2) and all the varieties were found to be moderately resistant and four mutants were moderately susceptible against cercospora leaf spot.

Table 1. Severities of yellow mosaic and cercospora leaf spot of mungbean mutants/varieties at Ishurdi during 2014 and 2015

Mutant/varieties	Yellow mosaic (0-9 score)			Cercospora leaf spot (0-9 score)		
	2014	2015	Disease reaction	2014	2015	Disease reaction
MBM-527-114	3.0	5.0	MS	4.8	4.0	MS
MBM-390-94-y	4.0	3.0	MR	4.3	3.8	MR
MBM-656-52-2	5.7	5.0	MS	4.4	3.7	MR
MBM-07-y-2	4.2	5.2	MS	4.0	4.7	MS
MBM-427-87-3	3.0	3.4	MR	4.3	3.6	MR
MBM-347-13	3.0	3.2	MR	3.6	4.2	MR
MBM-80	6.5	5.8	S	7.0	6.2	S
MBM-07-y-1	4.0	4.0	MR	4.0	3.2	MR
MBM-07-g-2	4.2	4.6	MS	3.0	4.0	MR
MBM-477-60	4.5	4.2	MS	5.0	4.5	MS
Binamoog-5	3.0	4.0	MR	3.6	3.0	MR
Binamoog-6	3.0	3.4	MR	3.5	3.0	MR
Binamoog-7	3.0	2.6	MR	4.0	3.0	MR
Binamoog-8	3.5	3.1	MR	4.2	3.0	MR
BARI Mung-6	3.0	3.6	MR	3.5	4.0	MR

MR = Moderately resistant, MS = Moderately susceptible, S = Susceptible.

The variation of disease reactio among the lines/varieties of mungbean against yellow mosaic and cercospora leaf spot under natural field conditions were reported by different workers (Mondal *et al.*, 2013; Paul *et al.*, 2013; Iqbal *et al.*, 2004; Jalaluddin *et al.* 2000;

Jalaluddin 1984). It is very difficult to maintain same weather condition in every year, that's why the resistant nature of germplasms not sustains in field conditions.

The mean data of two consecutive years reveal that significant variation was observed in all yield contributing characters (Table 2). The mungbean mutants and varieties were matured within 64 to 72 days. The early maturing mutant was MBM-347-13 where as MBM-80 took the highest days to mature. The plant height ranged from 40.7 to 48.4 cm. The mutant MBM-427-87-3 was recorded as the tallest followed by MBM-527-114 and MBM-07-y-1 while MBM-390-94-y was the shortest plant. The pod number, seed number in pod and individual seed weight are the most important attributes responsible for the increased yield. The number of pods per plant was ranged from 16.4 to 22.2. The highest number of pod per plant was recorded in the mutant MBM-80 followed by MBM-347-13. The lowest number pod per plant was recorded in MBM-07-g-2 and MBM-477-60. Pod length ranged from 7.50 to 8.55 cm. Significantly similar pod length was recorded in the mutant MBM-347-13 and variety Binamoog-8 while the shortest pods were recorded in MBM-80.

Table 2. Mean yield attributes of mungbean mutants/varieties at Ishurdi

Mutants/varieties	Plant height (cm)	Pods plant^{-1} (no.)	Pod length (cm)	Seeds pod^{-1} (no.)	Days to maturity	Seed yield (kg ha^{-1})
MBM-527-114	48.3 a	18.9 e	8.28 abc	10.9 hi	66 c	1615 efg
MBM-390-94-y	40.7 e	17.2 g	7.90 cde	10.7 i	65 ef	1527 h
MBM-656-52-2	42.3 d	19.6 cd	8.05 bcd	11.8 bcd	65 ef	1683 c
MBM-07-y-2	41.9 d	18.1 f	7.82 def	11.6 c-f	68 bc	1632 de
MBM-427-87-3	48.4 a	19.6 cd	7.98 cd	11.4 d-g	65 ef	1623 def
MBM-347-13	46.3 bc	20.3 b	8.55 a	12.1 ab	64 f	1795 a
MBM-80	48.1 a	22.2 a	7.50 f	10.2 j	72 a	1087 i
MBM-07-y-1	48.2 a	19.2 de	8.00 cd	11.9 abc	66 cde	1725 b
MBM-07-g-2	46.6 b	16.4 h	7.93 cde	11.5 c-f	67 bc	1592 fg
MBM-477-60	42.7 d	16.4 h	7.55 ef	11.3 e-h	66 def	1583 g
Binamoog-5	42.9 d	20.1 bc	7.98 cd	11.7 b-e	69 b	1643 de
Binamoog-6	42.1 d	19.1 de	8.12 bcd	11.1 fgh	64 f	1617 efg
Binamoog-7	41.9 d	19.2 de	8.28 abc	10.9 ghi	67 bc	1605 def
Binamoog-8	45.3 c	17.2 g	8.43 ab	12.2 a	67 bc	1658 cd
BARI Mung-6	45.5 c	16.7 gh	8.28 abc	11.8 bcd	68 bc	1612 efg

In a column, values with same letter(s) do not differ significantly at p = 0.05 by DMRT.

The number of seeds per pod varied from 10.2 to 12.2. The maximum seeds per pod were recorded in Binamoog-8 followed by MBM-347-13 and MBM-07-y-1. The lowest number of seeds per pod was recorded in MBM-80. The mean seed yield of genotypes was ranged from 1087 to 1795 kg per hectare. The mutant MBM-347-13 produced the highest seed yield followed by MBM-07-y-1 and the lowest seed yield was found in MBM-80. The results indicated that there are some mutants which have good yield potentiality than the tested varieties. Seed yield is a complex quantitative character controlled by many genes and is greatly influenced by environmental conditions.

The disease severity of yellow mosaic and cercopora leaf spot varied from year to year among the mutants. Therefore, the highest score obtained during the two years trial was considered for final grading of each mungbean mutant. Similar grading system was followed by Jalaluddin *et al.* (1999). None of the induced mutants of mungbean were found resistant to the diseases.

The mungbean mutants MBM-390-94-y, MBM-427-87-3, MBM-347-13 and MBM-07-y-1 were found to be moderately resistant to yellow mosaic and cercospora leaf spot the diseases. Considering yield contributing characters, the mutants MBM-347-13 and MBM-07-y-1 found superior than others. Therefore, these two mutants may be used in breeding programme for the development of yellow mosaic and cercospora leaf spot resistant mungbean variety or release as variety.

References

Anonymous. 2012. Unnata Krishi Progocti Porichiti (in Bengali). Bangladesh Institute of Nuclear Agriculture, Mymensingh. p. 33.

Bakr, M.A. 1994. Check list of pulse diseases in Bangladesh. Bangladesh J. Plant Pathol., 10(1&2): 13-16.

Bashir, M., Jamali, A.R. and Ahmed, Z. 2006. Genetic resistance in mungbean and mashbean germplasm against mungbean yellow mosaic begomoviruse. Mycopath., 4(2):1-4.

Grewal, J.S., Machendra, P. and Kulshrestha, D.P. 1980. Control of Cercospora leaf spot of green gram by spraying Bavistin. Indian J. Agric. Sci. 50: 707-711.

Iqbal, S.M., Ghafoor, A., Bashir, M. and Malik, B.A. 1995. Estimation of losses in yield components of mugbean due to Cersospora leaf spot. Pakistan J. Phytopathol. 7: 80-81.

Iqbal, S.M., Zubair, M. and Haqqani, A.M. 2004. Resistance in Mungbean to *Cercospora* Leaf Spot Disease. Int. J. Agril. Biol. 6(5): 792-793.

Jalaluddin, M. and Shaikh, M.A.Q. 1981. Evaluation of mungbean (*Vigna radiata* (L.) Wilczek) germplasm for resistance to yellow mosaic virus. SABRAO J. 13(1): 61-68.

Jalaluddin, M. 1984. Field evaluation of mungbean and blackgram germplasm for resistance to cercospora leaf spot and powdery mildew. SABRAO J., 16(1): 73-76.

Jalaluddin, M., Khalil, M.I. and Kashem, M.A. 1999. Field reaction of advanced mutants and strains of winter mungbean to yellow mosaic, cercospora leaf spot and powdery mildew. Bangladesh J. Nuclear Agric. 15: 1-6.

Khattak, G.S.S., Saeed, I. and Shah, S.A. 2008. Breeding high yielding and disease resistant mungbean {*Vigna radiata* (L.)Wilczek} genotypes. Pakistan J. Bot. 40: 1411-1417.

Krishi Diary. 2017. Agriculture Information Service. Department of Agricultural Extension, Ministry of Agriculture. Khamarbari, Framegate, Dhaka. p. 2.

Malik, B.A. and Bashir, M. 1992. Major diseases in food legume crops of Islamic country. In: FF Jamil, and SHM Naqvi, eds., Proc. COMSTECH-NIAB International Workshop of Agroclimatology Pest, Disease and Their Control, November 21-26, 1992, Faisalabad, Pakistan. pp. 25–38.

Marimuthu, T., Subramanian, C.L. and Mohan, R. 1981. Assessment of yield losses due to yellow mosaic infection in mungbean. Pulse Crop News Lett. 1: 104.

Mondal, M.E.A., Rahman, H., Rashid, M.H., Hossain, M.A. and Islam, M. M.. 2013. Screening of mungbean germplasm for resistance to Mungbean Yellow Mosaic Virus. Int. J. Sustain. Crop Prod. 8(1): 11-15.

Nair, R. M., Schafleitner R., Kenyon, L., Srinivasan, R., Easdown, W., Ebert A. and Hanson, P. 2012. Genetic Improvement of Mungbean productivity. Proc. the 12th SABRAO Congress on Plant Breeding towards 2025: Challenges in a Rapidly Changing World.

Paul, P.C., Biswas, M. K., Mandal, D. and Pal, P. 2013. Studies on host resistance of mungbean against mungbean yellow mosaic virus in the agro-ecological condition of lateritic zone of West Bengal. Bioscan. 8(2): 583-587.

Quebral, F.C. and Cagampang, I. C. 1970. Influence of Cercospora leaf spot control on yield of mungbean. Agriculture Los Banos 10: 7-12.

Sharma, S.N. and Prasad, R. 1999. Effects of sesbania green manuring and mungbean residue incorporation of productivity and nitrogen uptake of a rice-wheat cropping system. Bioresource Technol. 67(2): 171-175.

Verma, M.M. and Sandhu, S.S. 1992. Mungbean yellow mosaic disease. Proc. International Workshop, Bangkok, Thailand, 2-3 July 1991. pp. 28-37.