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IDENTIFICATION OF RESISTANCE IN MUNGBEAN AND MASHBEAN GERMPLASM AGAINST MUNGBEAN YELLOW MOSAIC VIRUS

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ABSTRACT:- To identify sources of resistance against mungbean yellow mosaic (begomo) virus (MYMV), 64 lines of mungbean and 21 of mashbean were evaluated under field conditions. Out of 64 mungbean lines, 6 were found as resistant (R) and 35 moderately resistant (MR). Sixteen accessions were graded as susceptible (S) whereas 7 were found highly susceptible (HS). In mashbean, 12 out of 21 accessions were resistant (R) and 8 moderately resistant (MR), whereas, only one was susceptible. Although resistance against MYMV in mungbean and mashbean has been previously reported, but this study reports some additional new sources of resistance to be included in breeding programme to develop MYMV-resistant varieties in the country.

Key Words: Mungbean; Mashbean; Accessions; Begomovirus; Mosaic Virus; Resistance; Pakistan.

INTRODUCTION

Mungbean (*Vigna radiata* (L.) Wilczek.) and mashbean (*Vigna mungo* L.) are two short duration pulse crops grown in summer season (July-October) in Pakistan. Mungbean yellow mosaic disease caused by mungbean yellow mosaic begomovirus (MYMV) is the most destructive viral disease of mungbean and mashbean not only in Pakistan but also in India, Bangladesh, Srilanka and adjacent area of Southeast Asia (Bakar, 1981; Jayasekera and Ariyarantne, 1988; Malik, 1991). Depending upon crop variety and location, disease incidence of MYMV ranged from 4% to 40% in Pakistan, leading to 100% yield losses (Malik, 1991; Bashir et al., 2006). Mungbean yellow mosaic is widely distributed throughout the country and attacks not only mungbean and mashbean but also other pulse crops such as cowpea (*Vigna unguiculata*), moth beans (*Vigna aconitifolia*) and common beans (*Phaseolus vulgaris*). Due to introduction of MYMV-resistant cultivars of mungbean in the country, the disease is now more serious on mashbean than mungbean. Due to importance of MYMV, it has been studied by many investigators (Ahmad and Harwood, 1973; Bashir and Malik, 1988; Malik, 1991; Bashir and Zubair, 2002). This virus has a wide host range and is transmitted by whitefly (*Bemisia tabaci* Genn.) and not through seed, sap and soil (Nene, 1972). In severe cases, the leaves and other plant parts become completely yellow and the losses may be as high as 100% (Malik, 1991). The exotic large seeded varieties from Asian Vegetable Research and Development

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Centre (AVRDC), Taiwan when tested in Pakistan are highly susceptible to this disease and failed to survive during summer months (Ahmad, 1975; Malik et al., 1988). Aftab et al. (1993) reported MYMV infection on *Vigna unguiculata* sub spp. sesquipedalis at Islamabad, Pakistan. The disease spread rapidly with increase in whitefly population. Plant height, number of pods, seeds and yield plant^{-1} were reduced by 10.3%, 50.5%, 44.7% and 49.2%, respectively. Bhagat (1999) carried out the quantitative assessment of growth and yield parameters of three bhendi cultivars against bhendi yellow vein mosaic virus (BYVMV) incidence. He found that, yield and other attributes such as number of fruits per plant, number of leaves, plant height, length, girth and fruit weight were less affected in the resistant cultivar. 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. Ahmed (1991) reported a yield loss of 83.9% and a maximum growth reduction of 62.94 % in *Vigna radiata* cv. Pusa baisakhi due to mungbean yellow mosaic virus infection. He also concluded that early infection reduced more yield than the late infection. Peerajade et al. (2004) tested 85 genotypes against MYMV at MARS, Dharwad, and two genotypes GG 41 and GG 42 were found resistant while the genotype GG 52 showed moderate resistance. Pathak and Jhamaria (2004) evaluated 14 mungbean varieties for resistance against yellow mosaic virus and found ML-5 and MUM-2 resistant with only 2.22% and 3.12% infection as against 100% infection in K-851, a check cultivar. Ganapathy et al. (2003) evaluated 71 urdbean genotypes to identify resistance against mungbean yellow mosaic virus, urdbean leaf crinkle virus and leaf curl virus. Five genotypes namely RU 2229, VBG 86, 2KU 54, VBG 89, SU16 were highly resistant to MYMV.

Resistant cultivars offer the best means for the control of MYMV. Out of 157 local and exotic mungbean varieties screened in 1975 against MYMV, no resistant variety was found. Only six out of 34 local collections showed some tolerance to the disease (Ahmad, 1975). Later some mungbean cultivars (e.g. NM-28, NM 121-25, NM.19-19, NM 20-21, NM-13) resistant to MYMV were developed and released through mutation breeding by Nuclear Institute for Agriculture and Biology (NIAB), Faisalabad for commercial cultivation during 1983-86 (Malik, 1991; Sarwar and Rajput, 1999). Out of 132 breeding lines of mashbean when evaluated against MYMV, 53 showed resistance under field conditions (Bashir and Zubair, 2002). This study was conducted to identify some more sources of resistance from local breeding material to develop resistant cultivars, at National Agricultural Research Centre (NARC), Islamabad, Pakistan during summer 2013.

MATERIALS AND METHOD

During summer season of 2013, 64 mungbean and 21 of mashbean germplasm accessions acquired from Pulses Programme, NARC were evaluated against MYMV under natural field conditions. Each test entry was planted in a 4m row with 40 cm row to row distance during mid of

July, 2013. One row of a susceptible check (Burma mash) was planted after every two test entries in addition to two rows of susceptible check all around the experiment. Recommended agronomical practices were followed to maintain the experiment except that insecticide sprays were not given to encourage the whitefly population for spread of the disease. Disease infection was scored on 0-5 scale at the time when all the check lines got severely infected and turned completely yellow. The scoring scale of 0-5 (Table 1) was followed to determine the response of mungbean and mashbean lines to MYMV infection.

RESULTS AND DISCUSSION

Viral diseases including MYMV drastically reduce the yield of numerous legume crops. Screening of mungbean genotypes in response to MYMV under field conditions determines the greater susceptibility of genotypes to MYMV, which may be associated to favorable environmental conditions for the disease development owing to the presence of enormous vector population in the field. The susceptible check lines after every two test entries resulted in enhanced vector population. The MYMV vector, whitefly (*Bemisia tabaci*) appeared to inhabit plant soon after the emergence and remained till maturity and with the passage of time, disease severity increased significantly. In summer season, high temperature favored vector dispersion, since it required opportunity of multiplication on host crop (Shakoor et al., 1977). The symptoms of yellow mosaic started to appear on the susceptible check lines about 30 days after planting. Scattered yellow specks of mild intensity were first observed on young leaves in susceptible lines. After one week, alternate yellow and green patches with irregular margins developed in the first fully-formed trifoliate leaf next to the apex. The intensity of disease increased with passage of time. In severe infection at the end of August, all the check lines turned completely yellow with 5-10 white flies per plant. Similar spread of yellow mosaic pattern has been reported by Jalaluddin and Sheikh (1981). The infected pods also turned yellow and a few shriveled

Table 1. Disease scoring scale (0-5) for MYMV

Disease severity	Percent infection	Infection category	Reaction group
0	0	Highly resistant	HR
1	1-10	Resistant	R
2	11-20	Moderately resistant	MR
3	21-30	Moderately susceptible	MS
4	31-50	Susceptible	S
5	More than 50	Highly susceptible	HS

seeds were observed. The most susceptible plants bore a few pods (1-2 pods plant^{-1}) with few seeds (2-3 seeds pod^{-1}).The natural disease infection was quite severe.

On the basis of disease severity recorded, the mungbean and mashbean genotypes were classified into six groups (Table 1). Out of 64 mungbean accessions, 6 were found resistant (R) and 35 were moderately resistant (MR).while 23 accessions were found susceptible to highly susceptible (Table 2).

In mashbean, 11 accessions were resistant (R), 8 were moderately resis-

Table 2. Distribution of mungbean and mashbean lines in various infection categories of MYMV

Infection category	Disease severity	No. of genotypes	Accessions
Highly resistance (HR)	0	0	**Mungbean:** Nil
		0	**Mashbean:** Nil
Resistant (R)	1	06	**Mungbean:** AZRI-1, NCM-15-11, NCM-21, NCM-11-8, 14063, AZRI-06
		12	**Mashbean:** NCH-1-2-06, NCM-3-4, NCH-7-5, NCH-9-2, NCH-9-5, NCH-10-1, Mash-97, 9092, Shakargarh, VH9440039-8, VH9440039-1, VH9440039-2
Moderately resistance (MR)	2	35	**Mungbean:** C-2-94-4-36, DERA AZRI-07, AZMH-2, NM-9, NM-10, NCM-257-2, NCM-209, NCM-23, NCM-251-12, NCM-251-16, NCM-252-1, NCM-252-2, NCM-252-3, NCM-252-10, NCM-254-2, NCM-254-7, NCM-255-2, NCM-257-10, NCM-258-10, NM-06, NCM-11-5, NCM-11-9, NCM-11-4, NCM-11-3, MSPS-104, MSPS-106, 13957, MSPS-109, MSPS-115, MSPS-117, MSPS-119, MSPS-120, MSPS-121, MSPS-122, M-06
		08	**Mashbean:** NCH-9-3, NCH-9-9, VH9440034-1, VH9440034-6, VH9440034-9, VH9440039-3, VH9440039-4, 95017 (b)
Moderately susceptible (MS)	3	16	**Mungbean:** AZMH-10, MUNG303-8, NCM-24, NCM-251-4, NCM-254-3, NM-11, NCM-11-1, NCM-11-7, 14132, 13988, MSPS-112, MSPS-111, 141-27, 141-28, 13965, MSPS-124
		01	**Mashbean:** NCH-102
Susceptible (S)	4	07	**Mungbean:** NCM-257-3, 17070, MSPS-107, 14065, 14147, MSPS-118, NM-11
		0	**Mashbean:** Nil

tant (MR), whereas only one line was susceptible. Due to planting of the most susceptible check after every two test entries, and due to good build-up of white fly population (5-10 whiteflies plant^{-1}) there were good chances of spread of disease minimizing the chances of disease escape. At the end of the experiment, all the check lines turned completely yellow showing maximum disease severity ensuring good evaluation of mung and mash germplasm against yellow mosaic.

In mungbean, six lines (8 %) were found resistant (R) to yellow mosaic whereas, in mashbean, 11 accessions out of 21(almost 50%) were resistant (R). The local lines of mashbean grown by small farmers in the country are highly susceptible to yellow mosaic, which depending on the severity of the disease may inflict to heavy losses (Bashir and Malik, 1988). The disease is caused by a virus transmitted by vector, whitefly (*Bemisia tabaci*) (Ahmad and Harwood, 1973). High temperature from June to August favours the spread of the vector, which provides greater opportunity to multiply on the host. Due to inadequate plant protection measures, mash as well as mungbean is infested by whitefly and additional damage to this crop is caused by the MYMV transmitted by the whitefly vector (Shakoor et al., 1977). Complete genetic resistance to MYMV has not been reported from the local as well as exotic mungbean and mashbean germpalsm evaluated at national and international research institutes (Ahmad, 1975). Due to introduction of high yielding and MYMV resistant mungbean and mashbean cultivars such as Mash-1, Mash-2, Mash-3, Mash-97, NM-92, NM-98 and Chakwal, Mung-97 by provincial and federal research institutes in the country, the crop situation is being improved and the local lines of mungbean and mashbean which are susceptible to MYMV are being replaced by the newly developed disease resistant cultivars. The seed of resistance lines of mungbean and mashbean is available for use in breeding programme.

LITERATURE CITED

Aftab, M., S. Asad, K.M. Khokhar, M.A. Ayub, and T.B. Butt. 1993. Effect of mungbean yellow mosaic virus on the yield and growth components of asparagus bean. Pakistan J. Phytopathol. 5(1-2): 58-61.

Ahmad, M. 1975. Screening of mungbean (*Vigna radiata*) and urdbean (*Vigna mungo*) germ-plasm for resistance to mung-bean yellow mosaic. J. Agric. Res. 13(1): 349-354.

Ahmad, M., and R.F. Harwood. 1973. Studies on whitefly transmitted yellow mosaic of urdbean (*Phaseolus mungo*). Plant Dis. Rep. 57 (9): 800-802.

Ahmed, Q. 1991. Growth attributes and grain yield of mungbean plants affected by mungbean yellow mosaic virus in field. Indian Phytopathol. 43(4): 559-560.

Bakar, A.K. 1981. Pest and disease problems of mungbean in West Malaysia. Malaysian Agric. J. 53: 29-33.

Bashir, M., A.R. Jamali, and Z. Ahmed. 2006. Genetic resistance in mungbean and mashbean germplasm against mungbean yellow mosaic begomovirus.

Mycopath. 4(2): 1-4.

Bashir, M., and B. A. Malik. 1988. Diseases of major pulse crops in Pakistan–A Review. Tropical Pest Management. 34(3): 309-314.

Bashir, M., and M. Zubair. 2002. Identification of resistance in urdbean (*Vigna mungo*) against two different viral diseases. Pakistan J. Bot. 34(1): 49-51.

Bhagat, A. P. 1999. Effect of bhendi yellow vein mosaic virus (BYVMV) on growth and yield of bhendi. J. Mycol. Plant Pathol. 30(1): 110-111.

Ganapathy, T., R. Kuruppiah, and K. Gunasekaran. 2003. Identifying the source of resistance for mungbean yellow mosaic virus (MYMV), urd bean leaf crinkle virus and leaf curl virus disease in urdbean (*Vigna mungo* (L.) Hepper). In: Annual Meeting and Symposium on Recent Developments in the Diagnosis and Management of Plant Diseases for Meeting Global Challenges, December 18-20, 2003, University of Agricultural Sciences, Dharwad, 30p.

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

Jayasekera, S.J.B.A., and H.P. Ariyaratne. 1988. Current status of mungbean improvement for the farming system in Srilanka. In: Shanmungasundrum, S. (ed.). Mungbean: Proceedings of the Second International Symposium. November, 16-20, 1987. Bangkok, Thailand published by AVRDC, Taiwan.

Malik, I.A. 1991. Breeding for resistance to MYMV and its vector in Pakistan. In: Green, S.K. and Kim, D. (eds.), Mung-bean Yellow Mosaic Disease: Proceedings of an Inter-national Workshop. Bangkok, Thailand. July 2-3, 1991. AVRDC, Taiwan. 79p.

Malik, I.A., Y. Ali, and M. Saleem. 1988. Incorporation of tolerance to mungbean yellow mosaic virus from local germplasm to exotic large seeded mungbean. In: Shanmungasundrum, S. (ed.), Mungbean: Proceedings of the Second International Symposium. November, 16-20, 1987. Bangkok, Thailand published by AVRDC, Taiwan. p. 297-307.

Nene, Y.L. 1972. A survey of viral diseases of pulse crops in Uttar Pradesh. Research Bulletin 4.G.B. Pant University of Agriculture and Technology, Pantnagar, India. 191p.

Pathak, A.K. and S. L. Jhamaria. 2004. Evaluation of mungbean (*Vigna radiata* L.) varieties to yellow mosaic virus. J. Mycol. Plant Pathol. 34(1): 64-65.

Peerajade, D.A., R.L. Ravikumar, and M.S.L. Rao. 2004. Screening of local mungbean collections for powdery mildew and yellow mosaic virus resistance. Indian J. Pulses Res. 17(2): 190-191.

Sarwar, G., and M.A. Rajput. 1999. Role of nuclear technology in the development of new high yielding mungbean varieties. Proceedings of New Genetical Approaches to Crop Improvement III. Plant Genetic Division, Nuclear Institute for Agriculture, Tandojam, Sindh, Pakistan. p. 37-46.

Shakoor, A., M.A. Haq, M.S. Sadiq, and M. Sarwar. 1977. Induction of resistance to yellow mosaic

virus in mungbean through induced mutation. Plant Dis. 214: 293-302.

Singh, B. R., S. Chandra, and S. Ram. 2000. Evaluation of mungbean varieties against yellow mosaic virus. Annals Pl. Prot. Sci. 8(2): 233-280.