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# Evaluation of mungbean genotypes for resistance against *Cercospora* leaf spot and Yellow Mosaic diseases under field condition

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*Cercospora* leaf spot and Mungbean Yellow Mosaic (MYMV) are the two most important diseases of mungbean in West Bengal. One hundred thirty six genotypes were evaluated for two consecutive years to assess reactions against the above two diseases. Of the 136 genotypes, 2 genotypes fell under highly resistant, 52 resistant, 26 moderately resistant, 19 susceptible and 37 highly susceptible categories against *Cercospora* leaf spot disease. When the same 136 genotypes were evaluated in search of resistance to MYMV disease, 43 genotypes fell under resistant category, 55 moderately resistant, 25 moderately susceptible, 9 genotypes susceptible and 4 highly susceptible categories while none of the genotypes fell under immune category.

**Key words:** Evaluation, mungbean, genotypes, *Cercospora,* Yellow Mosaic, resistance

## INTRODUCTION

The mungbean [*Vigna radiata* (L.) Wilczek, native to India-Burma region and the third most important pulse crop of India after chickpea and pigeon pea, is grown principally for its high protein content (24%). The crop is grown under many abiotic and biotic constraints that limit its production and productivity. Diseases caused by fungi, viruses and bacteria are considered most important biotic constraints of this crop. Of the fungal diseases, *Cercospora* leaf spot is one of the important and serious diseases of mungbean causing yield losses to the tune of 23-61 % (Quebral and Cagampang, 1970; Iqbal *et al.*, 1995). Among all the virus diseases recorded, the disease caused by mungbean yellow mosaic virus (MYMV) is the most important and destructive one. Mungbean yellow mosaic disease on mungbean was first reported from New Delhi in 1960 and was found to transmit principally by whitefly, *Bemisia tabaci* (Genn.) and grafting but not by sap, seed or soil. Control of *Cercospora* leaf spot (Singh and Naik, 1977; Singh and Singh, 1978) as well as vector-borne MYMV (Pathak and Jamaria, 2004; Salam, 2005) diseases with the application of synthetic chemicals is the common practice and which may lead to the increment in cost of control, sometimes leads to the resurgence of resistance amongst plant pathogens and vectors, destruction of non-target beneficial micro-organisms and deterioration of soil health and environment. But the use of resistant genotypes/ cultivars against these diseases and or vectors has been considered best to take care of the ill effects of unabated and indiscriminate use of synthetic chemicals and can augment yield substantially by bringing down the amount of crop loss caused by them. Identification of resistant genotype(s) against these diseases has also immense utility in breeding programme. Earlier, screening for identification of resistant germplasms against the *Cercospora* leaf spot (Basandrai *et al.*, 1999; Raje and Rao, 2002) and MYMV diseases of mungbean (Basandrai *et al.*, 1999; Raje and Rao, 2002) has

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been attempted under diverse locations. Considering the changes in disease and pest spectrums in the contest of climate change, apprehending threat from the evolution of new strains of pathogens and or vector and knowing the existence of variations in reaction responses of genotypes to these diseases and vector in different geographical locations, evaluation of genotypes in search of resistance is needed to be done location or zonewise and to be renewed continuously. Keeping the above utilities of screening of genotypes against diseases in mind and considering the very meager information available in this regard from this zone, the present research work on the evaluation of mungbean genotypes against *Cercospora* leaf spot and MYMV diseases has been conducted in the Gangetic alluvial zone of West Bengal, India in order to assess the level of resistance present within the existing genotypes, to categorize them according to the level of resistance and to prepare a cafeteria of resistant genotypes for their immediate uses in the replacement of highly susceptible genotypes(s) and their future uses in the breeding programme.

## MATERIALS AND METHODS

An experiment was conducted during 2010 – 12 at Kalyani Simanta Research Farm (22'57" N latitude, 88'20" longitude, and 7.8 m above mean sea level elevation) of Bidhan Chandra Krishi Viswavidyalaya with 136 genotypes obtained from All India Coordinated Research Project (AICRP) on MULLaRP on a plot size of 1.5 m x 1.5 m following randomized block design with two replications. For growing of crop, seeds, fertilizers and manures were applied as per recommended doses. After germination and thinning, plant stands were maintained with a spacing of 30 cm x 10 cm. Intercultural operations like weeding, irrigation *etc.* were undertaken as and when necessary. Mungbean genotypes were allowed to expose to natural incidence of *Cercospora* leaf spot and MYMV diseases. The severity of *Cercospora* leaf spot disease was recorded at maturity stage using an arbitrary scale of 1-5 [ 1= tiny spots covering less than 10% leaf area (highly resistant), 2= 1-25% leaf area covered (resistant), 3= 26-50% leaf area covered (moderately resistant), 4= 75% leaf area covered (susceptible), 76-100% leaf area covered (highly susceptible)] proposed by Park (1978). The data on disease severity of MYMV were recorded at maturity following 0-9 scale [0 = No infection (immune), 1 = Below 10% of foliage affected (resistant), 3 = 30% of foliage affected (moderately resistant), 5 = 50% of foliage affected (moderately susceptible), 7 = 70% of foliage affected (susceptible) and 9 = Above 70% of foliage affected (highly susceptible)] proposed by Mayee and Datar (1986). Per cent disease index (PDI) for *Cercospora* leaf spot and MYMV were then calculated following the formula given by McKinney (1923):

$$PDI = \frac{\text{Sum of individual disease rating}}{\text{Number of samples X Maximum value of scale/grade}} \times 100$$

## RESULTS AND DISCUSSION

A total of 136 mungbean genotypes were screened for *Cercospora* leaf spot and MYMV diseases. It was observed that the genotypes varied considerably in the degree of resistance against the *Cercospora* leaf spot and MYMV diseases. The genotypes when evaluated for *Cercospora* leaf spot disease severity, the highest mean PDI value of 83.80 % was recorded in the germplasm SML-395, followed by TM 99-50 and ML-5 whereas the least mean PDI value of 0.60 % was recorded in the genotype 122-4 (Table 1). All 136 genotypes were then grouped into five categories based on disease reaction. Of the five categories, 2 genotypes fell under highly resistant category, 52 under resistant, 26 under moderately resistant, 19 under susceptible and 37 were under highly susceptible category (Table 2). The results obtained from the present studies corroborate the findings of Basandrai *et al.* (1999) wherein they identified 18 genotypes as resistant out of 100 germplasms of mungbean considered for evaluation. Similar opinion was put by Raje and Rao (2002) when they reported174 resistant germplasms out of 200 germplasms screened against *Cercospora* leaf spot. However, the findings of the present experiment contradicts with results obtained by Haque *et al.* (1997) when they could not find a single genotype showing resistance to *Cercospora* leaf spot. In the present study, it has been observed that majority of the genotypes *i.e* 52 genotypes fall under resistant categories while only two genotypes are under highly resistant group.

**Table 1 :** Reactions of mungbean genotypes to Cercospora leaf spot disease

| Sl No. | Genotypes | Mean PDI[1] (%) | Sl. No. | Genotypes | Mean PDI[1] (%) | Sl. No. | Genotypes | Mean PDI[1] (%) |
|---|---|---|---|---|---|---|---|---|
| 1 | WBM- 1222 | 22.8 (28.49)* | 47 | ML-538 | 15.4 (23.09) | 93 | 39-24 | 56.2 (48.58) |
| 2 | 1224-1 | 10.3 (18.69) | 48 | PS-16 | 45.5 (42.40) | 94 | 39-12 | 59.1 (50.27) |
| 3 | 1224-2 | 3.0 (9.82) | 49 | SM-302 | 19.5 (26.18) | 95 | 31-27 | 55.5 (48.19) |
| 4 | 1224-52 | 0.6 (4.08) | 50 | KM-125 | 7.8 (16.20) | 96 | 48-4-1 | 9.1 (17.54) |
| 5 | 1224-4 | 0.8 (4.93) | 51 | TM- 99-50 | 83.0 (65.63) | 97 | 31-30 | 19.0 (25.82) |
| 6 | Samrat | 14.3 (22.23) | 52 | TM- 99-37 | 23.0 (28.68) | 98 | 44-3 | 17.2 (24.51) |
| 7 | PDM 96-282 | 37.2 (37.58) | 53 | A-2 | 5.9 (14.02) | 99 | 50-2 | 9.4 (17.79) |
| 8 | KM- 139 | 13.9 (21.91) | 54 | A-64 | 3.9 (11.40) | 100 | 31-26 | 33.2 (35.17) |
| 9 | PDM-11 | 4.4 (12.04) | 55 | Pusa -9632 | 17.3 (24.55) | 101 | 26-13 | 36.6 (37.23) |
| 10 | TM 94-91 | 19.8 (26.40) | 56 | HUM-7 | 25.5 (30.30) | 102 | 31-5 | 28.1 (32.00) |
| 11 | ML-881 | 46.6 (43.06) | 57 | TM -99-35 | 39.4 (38.87) | 103 | 45-9 | 18.6 (25.53) |
| 12 | SML-475 | 15.3 (23.03) | 58 | Sukumar-sal | 3.9 (11.40) | 104 | 25-2 | 20.2 (26.70) |
| 13 | A-61 | 25.3 (30.19) | 59 | Maskali | 67.0 (54.92) | 105 | 44-12 | 20.8 (27.16) |
| 14 | K-851 | 17.1 (24.38) | 60 | Kalimung | 71.0 (57.41) | 106 | 31-6 | 47.6 (43.61) |
| 15 | HUM-112 | 19.8 (26.45) | 61 | B-105 | 47.0 (43.25) | 107 | 31-18 | 14.8 (22.58) |
| 16 | MH -98-1 | 52.8 (46.60) | 62 | WBM 04-5 | 49.0 (44.42) | 108 | 44-8 | 30.9 (33.76) |
| 17 | KM-49 | 57.5 (49.33) | 63 | Bireshwar | 5.8 (13.96) | 109 | 45-11 | 42.1 (40.47) |
| 18 | MH -96-1 | 48.6 (44.19) | 64 | Sonali | 1.9 (7.96) | 110 | 48-4 | 33.7 (35.47) |
| 19 | VM- 44-97 | 39.3 (38.82) | 65 | Sukumar | 7.8 (16.23) | 111 | 32-2 | 17.2 (24.52) |
| 20 | SML- 302 | 48.8 (44.29) | 66 | HUM-8 | 29.0 (32.59) | 112 | 28-14 | 38.1 (38.13) |
| 21 | TM 96-2 | 29.4(32.81) | 67 | UMMG-9901 | 23.0 (28.63) | 113 | 35-2 | 22.3 (28.14) |
| 22 | A-22 | 59.1(50.26) | 68 | SML- 668 | 14.5 (22.41) | 114 | 51-10 | 57.2 (49.17) |
| 23 | ML-5 | 73.2 (58.82) | 69 | KM -36 | 27.0 (31.31) | 115 | 31-14 | 16.7 (24.08) |
| 24 | A-142 | 35.2(36.41) | 70 | KM -44 | 32.7 (34.87) | 116 | 39-20 | 27.5 (31.64) |
| 25 | PM-2 | 13.0(21.12) | 71 | Pusa -9632-5 | 11.4 (19.69) | 117 | 36-9 | 23.9 (29.24) |
| 26 | TM -99-37 | 23.7(29.10) | 72 | OUM- 45 | 8.7 (17.13) | 118 | 36-5 | 29.7 (33.01) |
| 27 | BM-4 | 16.6 (24.01) | 73 | Pusa- 9872 | 7.7 (16.01) | 119 | 31-27 | 43.3 (41.12) |
| 28 | Pusa -9922 | 13.4 (21.48) | 74 | KM- 52 | 5.2 (13.09) | 120 | 38-3 | 20.9 (27.19) |
| 29 | TM 9957-1 | 14.3 (22.23) | 75 | BDYR- 52 | 11.0 (19.35) | 121 | 41-20 | 22.2 (28.06) |
| 30 | IIPRM -3 | 26.5 (30.95) | 76 | UPM -98-1 | 58.1 (49.65) | 122 | PDM 99-28 | 53.2 (46.85) |
| 31 | SML-489 | 66.9 (54.87) | 77 | SML- 66 | 58.8 (50.08) | 123 | 34-2 | 42.4 (40.62) |
| 32 | UPM -99-39 | 28.9 (32.50) | 78 | UPM -99-2 | 50.0 (44.99) | 124 | 42-17-1 | 15.7 (23.28) |
| 33 | PDM- 89-226 | 34.7 (36.08) | 79 | PDM -91-943 | 9.8 (18.14) | 125 | 44-5-1 | 45.9 (42.66) |
| 34 | SML-395 | 83.8 (66.27) | 80 | AKM -96-2 | 18.7 (25.60) | 126 | 42-9 | 29.5 (32.89) |
| 35 | A-34 | 40.9 (39.77) | 81 | 2-KM- 22 | 40.5 (39.51) | 127 | 47-8 | 11.9 (20.12) |
| 36 | Pusa -2031 | 42.7 (40.81) | 82 | HUM- 12 | 15.3 (23.03) | 128 | 39-16 | 8.7 (17.18) |
| 37 | A-82 | 21.9 (27.88) | 83 | SML- 475 | 35.2 (36.40) | 129 | 46-4 | 26.0 (30.62) |
| 38 | PDM-216 | 24.9 (29.94) | 84 | MH- 98-7 | 9.1 (17.51) | 130 | 44-12-1 | 17.0 (24.36) |
| 39 | BDYR-2 | 39.1 (38.71) | 85 | PDM -99-21 | 5.7 (13.79) | 131 | 33-5 | 6.7 (14.93) |
| 40 | BDYR-1 | 43.5 (41.25) | 86 | TM -99-30 | 16.6 (24.04) | 132 | 41-22 | 13.0 (21.10) |
| 41 | GM-9630 | 37.8 (37.91) | 87 | 36-2 | 52.4 (46.40) | 133 | 33-9 | 4.7 (12.52) |
| 42 | KM 21-92 | 41.0 (39.81) | 88 | 47-9 | 51.7 (45.97) | 134 | 41-21 | 30.8 (33.73) |
| 43 | ML-936 | 35.1 (36.31) | 89 | 39-17 | 7.1(15.41) | 135 | 49-6 | 11.0 (19.33) |
| 44 | MSJ-116 | 32.8 (34.93) | 90 | 41-6 | 5.3 (13.20) | 136 | 43-3-1 | 46.5 (42.98) |
| 45 | MSJ-118 | 32.2 (34.58) | 91 | 25-4 | 26.8 (31.19) | | | |
| 46 | WBM-659 | 20.8 (27.14) | 92 | 51-9 | 62.6 (52.29) | | | |

SEm.= ±2.824; LSD .05 = 7.862**; * Values within parenthesis indicate arch-sine transformed values.

PDI[1] (Per cent disease index) = Mean of the PDI values of two years averaged over 10 plants per replication

The disease severity of MYMV was recorded highest in the genotype B-105 with a mean PDI value of 82.62 % followed by the lines SML-475 and A-2 while the lowest severity was recorded in the genotype Pusa- 9922 with a mean PDI value of 0.78 % (Table 3). When the genotypes were grouped into different reaction categories, 43 genotypes fell under resistant category, 55 under moderately resistant, 25 under moderately susceptible, 9 genotypes under susceptible and 4 under highly susceptible category while none of the genotypes fell under immune category (Table 4) indicating existence of considerable variations in the level of resistance against MYMV disease. Results of the present experiments are in agreement with Singh *et al.*, (1996) where they screened 126 greengram

**Table 3 :** Reactions of mungbean genotypes to MYMV disease

| Sl. No. | Genotypes | Mean PDI[1] (%) | Sl. No. | Genotypes | Mean PDI (%) | Sl. No. | Genotypes | Mean PDI (%) |
|---|---|---|---|---|---|---|---|---|
| 1 | WBM -1222 | 36.04 (36.89).* | 47 | ML-538 | 6.46 (12.43) | 93 | 39-24 | 14.78 (22.59) |
| 2 | 1224-1 | 41.04 (39.83) | 48 | PS-16 | 48.97 (44.41) | 94 | 39-12 | 1.56 (06.74) |
| 3 | 1224-2 | 19.44 (26.05) | 49 | SM-302 | 5.90 (14.05) | 95 | 31-27 | 38.87 (38.57) |
| 4 | 1224-52 | 15.45 (23.13) | 50 | KM-125 | 53.21 (46.84) | 96 | 48-4-1 | 7.44 (15.80) |
| 5 | 1224-4 | 48.42 (44.09) | 51 | TM- 99-50 | 65.41 (53.98) | 97 | 31-30 | 3.83 (11.24) |
| 6 | Samrat | 11.18 (19.51) | 52 | TM -99-37 | 36.33 (37.06) | 98 | 44-3 | 35.48 (36.56) |
| 7 | PDM 96-282 | 24.78 (29.84) | 53 | A-2 | 72.58 (58.63) | 99 | 50-2 | 04.16 (11.76) |
| 8 | KM- 139 | 17.05 (24.36) | 54 | A-64 | 24.78 (29.84) | 100 | 31-26 | 23.94 (29.29) |
| 9 | PDM-11 | 39.50 (38.93) | 55 | Pusa 9632 | 21.62 (27.70) | 101 | 26-13 | 15.17 (22.46) |
| 10 | TM 94-91 | 78.35 (62.32) | 56 | HUM-7 | 19.00 (25.83) | 102 | 31-5 | 18.82 (25.70) |
| 11 | ML-881 | 3.75 (10.44) | 57 | TM 99-35 | 10.62 (19.01) | 103 | 45-9 | 12.17 (20.40) |
| 12 | SML-475 | 80.70 (63.95) | 58 | Sukumar-sal | 17.10 (24.40) | 104 | 25-2 | 4.79 (12.63) |
| 13 | A-61 | 39.25 (38.79) | 59 | Maskali | 21.22 (27.42) | 105 | 44-12 | 18.82 (25.70) |
| 14 | K-851 | 33.24 (35.16) | 60 | Kalimung | 60.82 (51.25) | 106 | 31-6 | 7.10 (15.45) |
| 15 | HUM-112 | 9.70 (17.93) | 61 | B-105 | 82.62 (65.50) | 107 | 31-18 | 33.93 (35.61) |
| 16 | M 98-1 | 1.90 (07.34) | 62 | WBM 04-5 | 13.18 (21.23) | 108 | 44-8 | 8.06 (16.47) |
| 17 | KM-49 | 9.50 (17.76) | 63 | Bireshwar | 9.06 (17.52) | 109 | 45-11 | 27.04 (31.32) |
| 18 | MH 96-1 | 26.30 (30.84) | 64 | Sonali | 60.47 (51.04) | 110 | 48-4 | 10.62 (19.01) |
| 19 | VM- 44-97 | 9.73 (18.16) | 65 | Sukumar | 29.41 (30.25) | 111 | 32-2 | 26.61 (31.05) |
| 20 | SML- 302 | 22.71 (28.38) | 66 | HUM-8 | 40.05 (39.26) | 112 | 28-14 | 16.11 (23.66) |
| 21 | TM -96-2 | 48.44 (44.11) | 67 | UMMG-9901 | 11.12 (19.46) | 113 | 35-2 | 9.17 (17.62) |
| 22 | A-22 | 62.17(52.06) | 68 | SML- 668 | 13.38 (21.46) | 114 | 51-10 | 18.00 (25.10) |
| 23 | ML-5 | 8.32 (16.69) | 69 | KM- 36 | 20.77 (27.11) | 115 | 31-14 | 6.05 (14.22) |
| 24 | A-142 | 10.71 (19.04) | 70 | KM- 44 | 01.95 (07.98) | 116 | 39-20 | 0.94 (05.56) |
| 25 | PM-2 | 15.96 (23.47) | 71 | Pusa- 9632-5 | 05.11 (13.03) | 117 | 36-9 | 6.57 (14.85) |
| 26 | TM 99-37 | 14.28 (22.19) | 72 | OUM- 45 | 25.93 (30.58) | 118 | 36-5 | 18.65 (25.58) |
| 27 | BM-4 | 14.15 (22.10) | 73 | Pusa- 9872 | 05.95 (14.11) | 119 | 31-27 | 28.21 (32.07) |
| 28 | Pusa -9922 | 0.78 (05.01) | 74 | KM -52 | 48.43 (44.10) | 120 | 38-3 | 38.09 (38.10) |
| 29 | TM -9957-1 | 6.62 (14.91) | 75 | BDYR- 52 | 33.82 (35.56) | 121 | 41-20 | 9.57 (18.00) |
| 30 | IIPRM -3 | 34.04 (35.68) | 76 | UPM -98-1 | 24.39 (29.59) | 122 | PDM 99-28 | 10.62 (19.01) |
| 31 | SML-489 | 21.71 (27.77) | 77 | SML- 66 | 15.44 (23.13) | 123 | 34-2 | 14.32 (22.22) |
| 32 | UPM 99-39 | 00.88 (04.88) | 78 | UPM- 99-2 | 02.25 (08.39) | 124 | 42-17-1 | 37.89 (37.98) |
| 33 | PDM 89-226 | 26.88 (31.22) | 79 | PDM- 91-943 | 01.50 (06.61) | 125 | 44-5-1 | 45.96 (42.68) |
| 34 | SML-395 | 09.28 (17.73) | 80 | AKM- 96-2 | 35.60 (36.62) | 126 | 42-9 | 29.56 (32.93) |
| 35 | A-34 | 05.72 (13.790 | 81 | 2-KM- 22 | 00.94 (05.50) | 127 | 47-8 | 15.38 (23.07) |
| 36 | Pusa 2031 | 11.66 (19.96) | 82 | HUM -12 | 04.49 (12.13) | 128 | 39-16 | 57.81 (49.64) |
| 37 | A-82 | 22.82 (28.52) | 83 | SML- 475 | 37.65 (37.83) | 129 | 46-4 | 3.29 10.29) |
| 38 | PDM-216 | 05.34 (13.31) | 84 | MH- 98-7 | 02.88 (09.71) | 130 | 44-12-1 | 10.49 (18.89) |
| 39 | BDYR-2 | 35.89 (36.80) | 85 | PDM- 99-21 | 29.55 (32.93) | 131 | 33-5 | 10.71 (19.04) |
| 40 | BDYR-1 | 33.95 (35.63) | 86 | TM- 99-30 | 04.40 (12.01) | 132 | 41-22 | 1.75 0(7.44) |
| 41 | GM-9630 | 26.04 (30.68) | 87 | 36-2 | 01.95 (07.88) | 133 | 33-9 | 10.11 (18.53) |
| 42 | KM 21-92 | 00.81 (04.93) | 88 | 47-9 | 02.55 (09.16) | 134 | 41-21 | 62.13 (52.05) |
| 43 | ML-936 | 13.43 (21.50) | 89 | 39-17 | 59.75 (50.62) | 135 | 49-6 | 20.10 (26.32) |
| 44 | MSJ-116 | 36.05 (36.89) | 90 | 41-6 | 04.00 (11.49) | 136 | 43-3-1 | 18.38 (25.18) |
| 45 | MSJ-118 | 62.70 (52.37) | 91 | 25-4 | 5.61 (13.63) | | | |
| 46 | WBM-659 | 71.52 (57.75) | 92 | 51-9 | 13.17 (21.22) | | | |

SEm = ± 3.181; LSD.05 = 8.898**; Values within parenthesis indicate arch-sine transformed values.

PDI[1] (Per cent disease index) = Mean of the PDI values of two years averaged over 10 plants per replication

genotypes for resistance against MYMV disease and found thirteen resistant genotypes. Similarly, Ganapati *et al* (2003) obtained five entries which were resistant to MYMV out of 71 entries evaluated. Pathak and Jhamaria (2004) evaluated fourteen mungbean cultivars for resistance against yellow mosaic virus and found two cultivars resistant to this viral pathogen.

Based on the findings of results of the experiment, it can be proposed that the genotypes identified as highly resistant/ resistant against *Cercospora* leaf spot and MYMV diseases may be used to replace some of the highly susceptible/ susceptible cultivars or could be used as source of resistance in breeding programmes for development of *Cercospora* leaf spot and MYMV resistant varieties of mungbean.

**Table 2 :** Grouping of mungbean genotypes based on the reactions to *Cercospora* leaf spot disease

| Reaction categories | Disease scale | No. of genotypes | Genotypes |
|---|---|---|---|
| Highly Resistant | 1 | 2 | 1224-52, 1224-4 |
| Resistant | 2 | 52 | 1224-1, Samrat, KM - 139, PDM-11, TM 94-91, SML-475, K-851, HUM-112, PM-2, BM-4, Pusa -9922, TM 9957-1, ML-538, SM-302, KM-125, A-2, A-64, Pusa – 9632, Sukumar -sal, Bireshwar, Sonali, Sukumar, SML-668, Pusa -9632-5, OUM -45, Pusa -9872, KM - 52, BDYR -52, PDM -91-943, AKM- 96-2, HUM - 12, MH-98-7, PDM -99-21, TM -99-30, 39-17, 41-6, 48-4-1, 31-30, 44-3, 50-2, 45-9, 31-18, 32-2, 31-14, 42-17-1, 47-8, 39-16, 44-12-1, 33-5, 41-22, 33-9, 49-6 |
| Moderately resistant | 3 | 26 | WBM-1222, A -61, TM -96-2, TM -99-38, IIPRM -3, UPM-99-39, A-82, PDM -216, WBM -659, TM -99-37, HUM-7, HUM -8, UMMG -9901, KM -36, 25 -4, 31 -5, 25-2, 44-12, 35-2, 39-20, 36-9, 36-5, 38-3, 41-20, 42-9, 46-4 |
| Susceptible | 4 | 19 | 1224-2, PDM -96-282, VM -44-97, A -142, PDM -89-226, BDYR -2, GM -9630, ML -936, MSJ -116, MSJ -118, TM -99-35, KM -44, SML -475, 31 -26, 26 -13, 44-8, 48-4, 28-14, 41-21 |
| Highly susceptible | 5 | 37 | ML-881, MH-96-1, SML-302, A-34, Pus-2031, BDYR-1, KM -21-92, PS -16, B -105, WBM -04-5, 2 -KM-22, 31-6, 45-11, 31-27, 34-2, 44-5-1, 43-3-1, KM -49, A-22, ML -5, SML -489, SML -395, BDYR -2, TM -99-50, Maskali, Kalimung, UPM -98-1, SML -66, UPM -99-2, 36-2, 47-9, 51 -9, 39-24, 39-12, 31-28, 51-10, PDM-99-28 |

**Table 4 :** Grouping of mungbean genotypes based on the reactions to MYMV.

| Sl. No. | Reaction grade | Disease severity | No. of genotypes | Genotypes |
|---|---|---|---|---|
| 1 | Immune | 0 | 0 | - |
| 2 | Resistant | 1 | 43 | ML-881, HUM-112, M-981, KM-49, VM- 44-97, ML-5, Pusa 9922, TM - 9957-1, UPM - 99-3, SML-395, A-34, PDM- 216, KM - 21-92, ML -538, SM -302, Bireshwar, KM- 44, Pusa 9632 -5, Pusa 9872, UPM - 99-2, PDM-91-943, 2-KM- 22, HUM- 12, MH- 98-7, TM - 99-30, 36-2, 47-9, 41-6, 25-4, 39-12, 48-4-1, 31-30, 50-2, 25-2, 31-6, 44-8, 35-2, 31-14, 39-20, 36-9, 41-20, 46-4, 41-22 |
| 3 | Moderately resistant | 3 | 55 | 1224-2, 1224-52, Samrat, PDM- 96-282, KM- 139, MH-96-1, SML- 302, A-142, PM-2, TM 99 -38, BM-4, SML-489, PDM - 89-226, Pusa - 2031, A-82, GM -9630, ML-936, A-64, Pusa 9632, HUM-7, TM-99-35, Sukumar-sal, Maskali, WBM- 04-5, Sukumar, UMMG-990, SML- 668, KM- 36, OUM- 45, UPM- 98-1, SML- 66, PDM- 99-21, 51-9, 39-24, 31-26, 26-13, 31-5, 45-9, 44-12, 45-11, 48-4, 32-2, 28-14, 51-10, 36-5, 31-27, PDM-99-28, 34-2, 42-9, 47-8, 44-12-1, 33-5, 33-9, 49-6, 43-3-1 |
| 4 | Moderately susceptible | 5 | 25 | WBM- 1222, 1224-1, 1224-4, PDM-11, A-61, K-851, TM- 96-2, IIPRM -3, BDYR-2, BDYR-1, MSJ-116, PS-16, TM- 99-37, HUM-8, KM -52, BDYR- 52, AKM- 96-2, SML- 475, 31-28, 44-3, 31-18 , 38-3, 42-17-1, 44-5-1 |
| 5 | Susceptible | 7 | 9 | A-22, MSJ-118, KM-125, TM- 99-50, Kalimung, Sonali, 39-17, 39-16, 41-21 |
| 6 | Highly susceptible | 9 | 4 | TM 94-91, SML-475, WBM-659, B-105 |

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