

## FIELD EVALUATION OF PROMISING MUTANTS OF MUNGBEAN AGAINST FLEA BEETLE, APHID AND POD BORER

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### ABSTRACT

Experiment was conducted at the Agricultural Farm of Patuakhali Science and Technology University to know the morphological characteristics of different mutants of mungbean and to find out tolerant/least susceptible mutant(s) against flea beetle, aphid and pod borer based on the reaction of insect pests to promising mutants of mungbean during the period from April to June, 2015. The mutant MBM-07(S)-2 was found to be the tallest (32.57 cm) with highest number of branches/plant (5.03), highest number of leaves/plant (11.06) among all mutants and check variety while MBM-07-Y-2 (23.4 cm) was the shortest plant height, MBM-656-51-2 had the lowest number of branches/plant (3.73), MBM-347-13 (7.03) had the lowest number of leaves/plant. The mutant MBM-427-87-3 had the highest number of pods (5) compared to other mutants but MBM-656-51-2 had the lowest number of pods/plant (3.09). Mutant MBM-347-13 had the lowest population of flea beetle (18) and pod borer (2) compared to all other mutants while the lowest number of aphid/plant was observed in mutant MBM-07-Y-1 (1). In case of infestation, the mutant MBM-347-13 had the lowest percentage of infestation (20.69%) by flea beetle, (3.18%) by pod borer but the lowest infestation by aphid (3.33%) was recorded in the mutant MBM-390-94-Y while the mutant MBM-427-87-3 had the highest percentage of plant infestation (37.8%) by flea beetle, pod damage (9.69%) by pod borer and variety BARI moog-6 had the highest percentage (34.45%) of plant infestation by aphid. Mutant MBM-347-13 was least susceptible to flea beetle and pod borer while mutant MBM-427-87-3 was highly susceptible to flea beetle and pod borer. However, mutant MBM-390-94-Y and MBM-07-Y-2 were less susceptible to aphid while BARI moog-6 and mutant MBM-427-87-3 were highly susceptible to aphid.

**Keywords:** Aphid, Flea beetle, Mungbean, Mutant, Pod borer

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## INTRODUCTION

Mungbean (*Vigna radiata* L. Wilczek) belonging to the family Leguminosae is an important pulse crop having a rich source of protein (22-24%) according to Nazir (1994). It is a native to Indian subcontinent and mainly grown in China, India, Philippines, Burma, Bangladesh, and Pakistan. It is a short duration crop and is widely cultivated in the southern part of Bangladesh immediately after harvesting rabi crops. It is cultivated for seed, edible purpose and fits well in any cropping system. As mungbean is an important legume crops, fix the atmospheric nitrogen, which becomes the source of fertilizer in the soil (Hafeez et al., 1988). After chickpea, mungbean is called as poor people diet due to its protein content and is meeting the major protein demand of the people (Shafique et al., 2009). Biomass of mungbean is a good source of fodder for animals and also used as green manuring to produce good quality organic matter in soil. It is grown on all types of soils in both rain fed and irrigated conditions of the country twice a year i.e., both in rabi and kharif seasons.

Mungbean crop is vulnerable to different species of insect pests which occurs at any stage from seedling to harvest. There are 64 species of insects attacking on mungbean crop (Lal, 1985). A total of 16 species have been reported to attack on mungbean in Bangladesh (Hossain et al., 2004). Several insect pests have been reported to infest mungbean damaging the crops during seedlings, leaves, stems, flowers, buds and pods causing considerable losses (Sehgal and Ujagir, 1988; Rahman and Miah, 1988). Among them aphid, whitefly, hairy caterpillar (Rahman et al., 1981), pod borer, thrips (Rahman et al., 1981; Hossain et al., 2004), jassid (Hossain et al., 2009) stem fly (Lal, 1985) are considered major ones. Both nymphs and adults of *Aphis craccivora* suck sap from young leaves and stems at the seeding stage, vegetative stage and continue to flowering stage while spotted pod borer, *Maruca vitrata* damage flower buds, flowers and pods of mungbean (Rahman, 1991). The flea beetle, *Phyllotreta nigripes* feeds on the cotyledons and leaves of young plants making innumerable round holes (Prodhan et al., 2008; Hossain et al., 2012). The population of flea beetle remained lower throughout the vegetative stage (Echezona et al., 2010). The incident and development of flea beetle is much dependent upon the prevailing weather conditions (Khan et al., 2018).

Different control strategies are in practice in the field for the control of insect pests of mungbean. Among the insect control strategies, host plant resistance using resistant varieties is an effective and safe strategy in pest management with no additional cost to the growers by the plantation of resistant cultivars. Chhabara and Kooner (1994) have evaluated mungbean cultivars against their resistance to insect pests. Naqvi et al. (1995) has tested 10 genotypes of mungbean against insects and found only two cultivars, M-8-20 and M-1030 resistant against insects compared to others. Khattak et al. (2004) has screened five mungbean varieties viz., NM 92, NM- 98, NM-121-125, M-1 and NCM-2009 against sucking pests, whiteflies, jassid and thrips and found

that whitefly, jassid and thrips population was comparatively lower on NM-92 and NM-98 which enables to get higher yield compared to other tested varieties. Now many promising lines or mutants of mungbean are available in Bangladesh which is not evaluated to screen against insect pests. All varieties or mutants are not equally infested by insects. Therefore, it is urgent need to find out suitable tolerant mutants to withstand the attack of insect pests. BARI and BINA have developed some varieties of summer mungbean, which are high yielding, insect pest resistant, but farmers are reluctant to mungbean cultivars for asynchronous pod maturity. Recently, BINA has developed some summer mungbean mutants, which are high yielding. These mutants need to be assessed for their resistance to insect pest among the existing summer mungbean varieties. The use of resistant varieties in the pest management is economical and safer as compared to the chemical control method. In view of this requirement, the present research programme was undertaken to observe the morphological characteristics of different mutants of mungbean, to know the reaction of insect pests to promising mutants of mungbean and to find out tolerant/least susceptible mutant(s) against major insect pests attacking mungbean.

#### MATERIALS AND METHODS

The experiment was conducted at the Agricultural Farm of Patuakhali Science and Technology University, Dumki, Patuakhali during the period from April to June, 2015. Geographically the experiment field was located at N latitude and E longitude at a height of 3.5 m above the mean sea level. Nine mutants viz., MBM-07-Y-1, MBM-07-Y-2, MBM-656-51-2, MBM-527-114, MBM-07-(S)-2, MBM-347-13, MBM-390-94-Y, MBM-427-87-3, MBM-80 (Local) and a check variety BARI moog-6 were used as study materials. The seeds were collected from Plant Breeding Division, Bangladesh Institute of Nuclear Agriculture, Mymensingh. The seeds were sown on the 02<sup>nd</sup> April, 2015 at the rate of 11 kg/ha under natural field conditions. Experiment was planned in Randomized Complete Block Design with three replications. Unit plot size was 3 m × 2 m. The distance between two-unit plots was 0.75 m and between block to block was 1 m. Standard agronomic practices including weeding, irrigations and fertilizers were carried out according to the crop requirements. Weeding was done twice. First weeding was done at 22 days after sowing (DAS) and second weeding was done at 35 DAS. Irrigation was done once at 30 days after sowing. The fertilizers were applied as per fertilizers recommendation guide (BARI, 2011). Urea, TSP and MP were applied @ 50, 85 and 35 kg ha<sup>-1</sup>, respectively during final land preparation. No plant protection measures were adopted throughout the crop growing period. All plants from each unit plot were observed individually and the number of flea beetle, aphid and pod borer per plant were recorded at different days after sowing (DAS) in case of flea beetle at 14, 21 and 30 DAS, aphid at 37 and 47 DAS and for pod borer at 50, 57 and 65 DAS from podding to harvesting stages. The total number of infested and healthy plants was recorded from 15 randomly selected plants of each plot to determine the level of infestation by flea beetle and aphid.

$$\text{Percentage of plant infested} = \frac{\text{Number of infested plants}}{\text{Total number of plants checked}} \times 100$$

Data on the percentage of pod borer infested pods; the number of damaged and total pods from 10 randomly selected plants from each plot was counted. The data were collected three times (50, 57 and 65) from pod development to harvest.

$$\text{Pod damage (\%)} = \frac{\text{Total number of damaged pods per plant}}{\text{Total number of pods per plant}} \times 100$$

### Statistical analysis

Data were analyzed in the computer by using MSTAT program following RCBD. Means of different significant parameters were separated by using Duncan's Multiple Range Test (DMRT).

## RESULTS AND DISCUSSION

### Morphological characteristics of mutants

The results of important plant parameters are presented in Table 1. It was observed from the results that all the six characters had significant differences among the mutants and a check variety BARI moog-6. Plant height of MBM-07(S)-2 was found to be the tallest (32.57 cm) among all mutants and check variety which was statistically like that of MBM-427-87-3 (32.27 cm) followed by BARI moog-6 (30.90 cm), MBM-527-114 and MBM-390-94-Y. However, MBM-07-Y-2 (23.40 cm) was the shortest plant height among all mutants including check that was statistically similar to that of MBM-656-51-2 followed by MBM-80 (LOCAL), MBM-347-13 and MBM-07-Y-1. In case of number of branches/plant, the mutant MBM-07(S)-2 had also the highest number of branches compared to other mutants and it was statistically similar to all other mutants except the mutant MBM-656-51-2 which had the lowest number of branches/plant. Significant difference was observed in the number of leaves/plant. MBM-07(S)-2 had the highest number of leaves/plant (11.06) which was statistically similar to MBM-07-Y-1 (10.99) followed by MBM-390-94-Y (10.03). The lowest number of leaves/plant was in mutant MBM-347-13 (7.03) which was statistically similar with MBM-527-114 (7.4) and BARI moog-6 (7.67) but BARI moog-6 was statistically identical to MBM-80 (LOCAL) (7.67) followed by MBM-427-87-3 (7.99) and MBM-07-Y-2 (8.26). In case of pods/plant, the mutant MBM-427-87-3 had the highest number of pods (5) compared to other mutants followed by BARI moog-6 (4.69), MBM-07-Y-1 (4.5), MBM-07(S)-2 (4.4) followed by MBM-347-13 (4.29) and MBM-07-Y-2 (4.2). On the other hand, the mutant MBM-656-51-2 had the lowest number of pods/plant (3.09) followed by MBM-390-94-Y (3.23), MBM-80 (LOCAL) (3.76) and MBM-527-114 (3.83).

Significantly the highest pod length was recorded in the mutant MBM-07-Y-1 (6.37 cm) followed by MBM-07-Y-2 (6.23 cm), MBM-427-87-3 (6.13 cm), MBM-527-114 (5.96 cm), MBM-390-94-Y (5.96), MBM-07(S)-2 (5.63 cm) and BARI moog-6 (5.59 cm). Conversely, the lowest pod length (5.19 cm) was found in the mutant MBM-80 (LOCAL) followed by MBM-656-51-2 (5.23 cm) and MBM-347-13 (5.29 cm) (Table 1).

Similarly, the highest number of seeds/pod was recorded in the mutant MBM-07-Y-1 (8.5) followed by MBM-527-114 (7.65), MBM-427-87-3 (7.53), MBM-07(S)-2 (7.32) and MBM-07-Y-2 (7). However, the lowest number of seeds/pod was found in the mutant MBM-390-94-Y (5.34) which was statistically similar to MBM-656-51-2 (5.62) followed by MBM-80 (LOCAL) (5.74) and BARI moog-6 (5.93) (Table 1).

Table 1. Morphological characteristics of different promising mutants of mungbean

Mutants Name	Plant height (cm)	No. of branch/plant	No. of leaves/plant	No. of pod/plant	Pod length (cm)	No. of seed/pod
MBM-07-Y-1	28.40cd	4.87ab	10.99a	4.5ab	6.37a	8.5a
MBM-07-Y-2	23.40f	3.96ab	8.26bc	4.2abc	6.23ab	7abc
MBM-656-51-2	23.61ef	3.73b	9.16abc	3.09d	5.29bc	5.62d
MBM-527-114	30.4b	4.26ab	7.4c	3.83bcd	5.96abc	7.65ab
MBM-07(S)-2	32.57a	5.03a	11.06a	4.4ab	5.63abc	7.32abc
MBM-347-13	27.14d	3.87ab	7.03c	4.29abc	5.23bc	5.78bc
MBM-390-94-Y	28.53c	4.26ab	10.03ab	3.23cd	5.96abc	5.34d
MBM-80 (LOCAL)	24.83e	4.12ab	7.67c	3.76bcd	5.19c	5.74cd
MBM-427-87-3	32.27a	4.69ab	7.99bc	5a	6.13abc	7.53abc
BARI moog-6	30.90b	4.46ab	7.67c	4.69ab	5.59abc	5.93bcd
LSD (5%)	1.293	1.297	2.143	1.098	1.024	1.872
CV (%)	4.21	4.15	5.23	2.81	2.19	3.12

Within columns means followed by same letter (s) are not significantly different at 5% level by DMRT.

### Mean number of flea beetle, aphid and pod borer per plant on different mutants

Figure 1 revealed that the highest number of flea beetle per plant was observed in the mutant MBM-427-87-3 (2.19) followed by MBM-80 (LOCAL) (2.12), MBM-527-114 (2.09) and MBM-07(S)-2 (1.85) while the lowest number of flea beetle per plant was in MBM-347-13 (1.2) followed by MBM-07-Y-2 (1.23) and MBM-390-94-Y (1.53). From this finding it is evident that the mutant MBM-427-87-3 was highly susceptible to flea beetle and the mutant MBM-347-13 was least susceptible to flea beetle.

In case of aphid, the highest number of aphid per plant was observed in BARI moog-6 (14.16) followed by the mutant MBM-427-87-3 (10.5), MBM-656-51-2 (5) while the lowest number of aphid per plant was in the mutant MBM-390-94-Y (1.5) followed by MBM-07-Y-2 (2) and MBM-527-114 (3). From this finding it is evident that BARI moog-6 and the mutant MBM-427-87-3 were highly susceptible to aphid and the mutant MBM-390-94-Y and MBM-07-Y-2 were less susceptible to aphid (Fig. 1).

Figure 1 also revealed that the mutant MBM-427-87-3 had the highest number of pod borer/plant (0.59) followed by MBM-07(S)-2 (0.5) and BARI moog-6 (0.4) while the mutant MBM-347-13 had the lowest number of pod borer/plant (0.2) followed by MBM-07-Y-2 (0.25), MBM-656-51-2 (0.26) and MBM-390-94-Y (0.26). From this finding it is evident that the mutant MBM-427-87-3 was highly susceptible to pod borer and the mutant MBM-347-13 was least susceptible to pod borer.

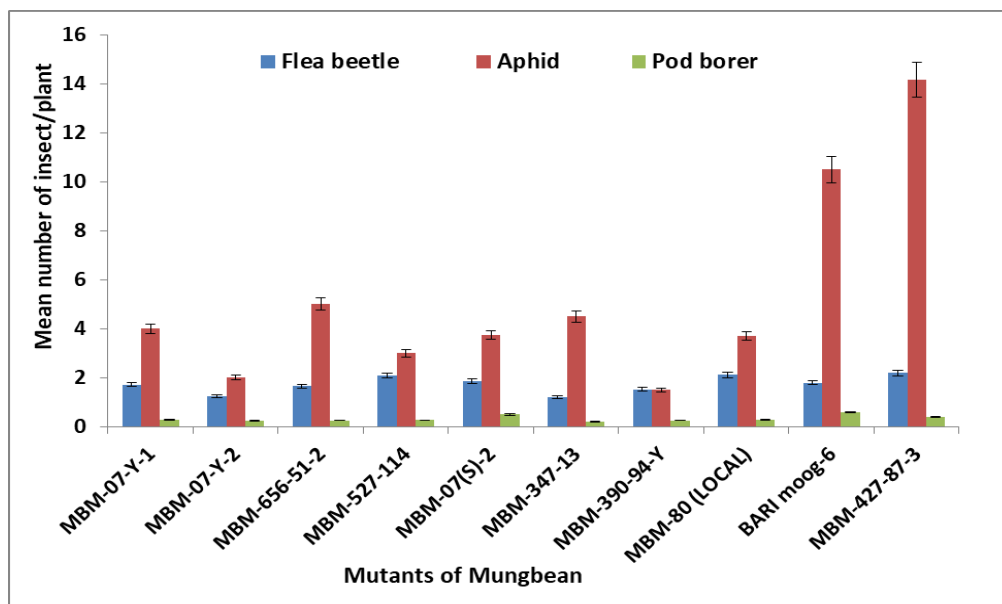


Figure 1. Mean number of flea beetle, aphid and pod borer per plant in different mutants of mungbean

### Reaction of promising mutants of mungbean to insect pests

Significant differences were observed among the mutants of mungbean in respect to percent plant infested by flea beetle, aphid and to percent pod damage by pod borer (Table 2). In case of flea beetle, the lowest percentage of infestation (20.69%) was recorded in the mutant MBM-347-13 which was statistically similar to MBM-07-Y-2 (21.19%) followed by MBM-656-51-2 (25.16%), MBM-390-94-Y (26.42%) and MBM-07-Y-1 (26.56%) while the mutant MBM-427-87-3 had the highest percentage of plant infestation (37.80%) which is statistically similar to MBM-80 (LOCAL) (36.52%) and MBM-527-114 (36.14%) followed by MBM-07(S)-2 (31.93%) and BARI moog-6 (31.66%).

In case of aphid, the lowest percentage of infested plant/plot was recorded in the mutant MBM-390-94-Y (3.33%) which is followed by MBM-07-Y-2 (5%), MBM-527-114 (8.33%) and MBM-07-Y-1 (9.45%) while the highest percentage of plant infestation was recorded in the variety BARI moog-6 (34.45%) which is significantly different from all other mutants. The second highest percentage of plant infestation was recorded in the mutant MBM-427-87-3 (26.11%) followed by MBM-656-51-2 (12.22%) which was statistically identical to MBM-347-13 (12.22%) and similar to MBM-07(S)-2 (11.12%) and MBM-80 (LOCAL) (10.25%) (Table 2).

In case of pod borer, the lowest percentage of pod damage/plot was recorded in the mutant MBM-347-13 (3.18%) which was statistically similar to MBM-390-94-Y (3.21%), MBM-656-51-2 (3.22%), MBM-07-Y-2 (3.34%) followed by MBM-80 (LOCAL) (4.36%), MBM-527-114 (5.07%) and MBM-07-Y-1 (5.39%) while the mutant MBM-427-87-3 had the highest percentage (9.69%) of pod damage/plot which was significantly different from all other mutants followed by MBM-07(S)-2 (8.56%) and BARI moog-6 (7.45%) (Table 2).

The findings of the present study agree with the results of Islam et al. (2021) where they stated that varieties did not show complete resistance against major insect pests of mungbean. Our results are also in comparison to work of the previous researchers (Sahoo and Hota, 1991; Naqvi et al. 1995; Yadav and Dahiya, 2000; Singh and Singh, 2014) who reported that the findings regarding screening of mungbean cultivars against sucking pests are in the line of the results that we have attained in our study. Our present findings are in accordance to the results reported by Khattak et al. (2004) who have screened five mungbean varieties viz., NM-92, NM-98, NM-121-125, M-1 and NCM-2009 against sucking pests viz., whiteflies, jassids and thrips. They observed that whitefly, jassid and thrips population was comparatively lower on Nm-92 and NM-98 which enables to get higher yield compared to other tested varieties. Several insect pests viz., chrysomelids, pod borer and aphids have been reported to infest mungbean damaging the seedlings stage and leaves, stems, flowers, buds and pods causing considerable losses (Sehgal and Ujagir, 1988). Rani et al. (2014) screened ten green gram cultivars against *Maruca* and reported LGG-450 was highly susceptible while LGG 497 was highly tolerant. They also reported that the

differences in pod length among different cultivars were also found to influence pod damage by *M. vitrata*. The correlation between pod length and incidence was positive and significant. Swarnalatha (2007) evaluated 25 green gram genotypes and reported that LGG 505, ML267, LGG 502, LGG 407, LGG 460 and LGG 485 were resistant to *M. testulalis* than other genotypes. Rani et al. (2008) evaluated 12 OVT green gram entries against *Maruca* in Rabi season and reported that the entries MGG 358, MGG 359, MGG 360, MGG 364, MGG 366, MGG 367 were tolerant, but in the present study these genotypes showed contrary results as they were moderately susceptible due to *Maruca*. It indicated that seasonal variation might play role in the green gram genotypes against *Maruca*. Nadeem et al. (2014) tested 8 advance mungbean genotypes in comparison with two check varieties against sucking insect pests under natural field conditions and found that none of the tested genotypes have complete resistance against sucking pests i.e., whiteflies, thrips and jassids. Among all the tested genotypes, MH 3153 was found least affected by sucking insects and gave the higher yield compared to check varieties.

Table 2. Reaction of promising mutants of mungbean to flea beetle, aphid and pod borer

Mutants/variety	Plant infested (%) by flea beetle/plot	Plant infested (%) by aphid/plot	Pod infested (%) by pod borer/plot
MBM-07-Y-1	26.56c	9.45cd	5.39c
MBM-07-Y-2	21.19d	5e	3.34d
MBM-656-51-2	25.16c	12.22c	3.22d
MBM-527-114	36.14a	8.33d	5.07c
MBM-07(S)-2	31.93b	11.12c	8.56ab
MBM-347-13	20.69d	12.22c	3.18d
MBM-390-94-Y	26.42c	3.33f	3.21d
MBM-80 (LOCAL)	36.52a	10.25c	4.36cd
MBM-427-87-3	37.80a	26.11b	9.69a
BARI moog-6	31.66b	34.45a	7.45b
LSD (5%)	2.97	1.65	1.71
CV (%)	8.56	4.36	3.74

Within columns means followed by same letter (s) are not significantly different at 5% level by DMRT

### CONCLUSION

Mutants did not show complete resistance against flea beetle, aphid and pod borer. Among all the tested mutants, MBM-347-13 was found less susceptible to flea beetle and pod borer and mutant MBM-390-94-Y to aphid.



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