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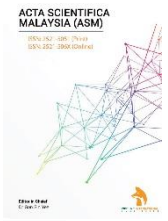

RESEARCH ARTICLE

PREVALENCE ON THE INFESTATION OF FLEA BEETLE (*Phyllotreta nigripes*) AGAINST DIFFERENT VARIETIES OF MUNGBEAN

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ABSTRACT

Mungbean is one of the important pulse crops in Bangladesh. More than 12 species of insect pests infest mungbean, among them flea beetle cause significant yield loss due to attack from seedling to vegetative stages. The experiment was conducted to find out tolerant and susceptible varieties of mungbean against flea beetle at the farmer's field of Patuakhali, Bangladesh from January to April 2016. Results revealed that BARI Mung-4 had the lowest abundance of flea beetle while BINA Moog-7 and BARI Mung-6 had the highest flea beetle abundance. Among the tested all varieties, significantly the lowest number (1.33) of infested plant by flea beetle was recorded in BARI Mung-4 followed by BINA Moog-4 (1.51) and the highest number (2.54) of infested plant by flea beetle was in BARI Mung-6 followed by (2.42) BINA Moog-7. The lowest percentage of leaf area damaged was on BARI Mung-4 (5.37%) while the highest on BARI Mung-6 (11.33%). Population of flea beetle showed a positive correlation (R^2= 0.019) with temperature and a negative correlation (R^2= -0.01) with relative humidity. BARI Mung-6 produced highest yield while Patuakhali local Mung produced the lowest followed by BARI Mung-4. Among tested varieties BARI Mung-4 showed comparatively more tolerant against flea beetle and BARI Mung-6 produced maximum yield in spite of being susceptile to flea beetle.

KEYWORDS

flea beetle, infestation, mungbean, relative humidity, temperature

1. INTRODUCTION

Pulses are a rich source of protein and also have documented proof of their beneficial micronutrient, bioactive and functional properties (Philanto and Korhonen, 2003). Mungbean (Vigna radiata L. Wilczek) belongs to the family Fabaceae and sub family Papilionaceae. It has protein content, good flavor and easily digestible. It may play an important role to supplement protein in the cereal-based low-protein diet of the people of Bangladesh. Besides providing protein in the diet, mungbean has the remarkable quality of helping the symbiotic root rhizobia to fix atmospheric nitrogen and hence to enrich soil fertility (Anjum et al., 2006).

It is a relatively drought-tolerant and low-input crop that grows in a wide range of climatic conditions. A warm humid climate with optimum temperature ranging from 25ºC to 35ºC depending upon season well distributed during the growing period of 60-90 days, is suitable for cultivation (BARC, 2013). It is sensitive to cloudy weather and cannot tolerate frost (Gowda and Kaul, 1982). It is widely grown in Indian subcontinent as a short duration catch crop between two principal crops. Insect pests are considered as the most important ones due to yield losses by insect pest complex. The severity of damage is related with the abundance of different insect pests and environmental conditions. A number of insect pests attack mungbean from seedling to harvest stages (Lal et al., 1981). Among major insect pests, flea beetle is the most damaging in the climatic condition of Bangladesh. Flea beetle adults were detected migrating into crops as early as the end of February and pest pressure was high by mid-March.

Flea beetles attack mungbean severely which first appear at the seedling stage of the crop and maintained their population upto pod formation. The larvae live in the soil and fed on root hairs and roots of the host plants and, dependent on soil temperatures, develop into the pupal stage within 8-10 weeks. A new generation of adults then emerges from the pupae. It is this generation that is particularly damaging, because newly emerged flea beetles have a strong propensity to feed (John Colvin, 2010). The adults feed on the cotyledons, making the severe innumerable round holes on leaves of young plants and ultimately dried the older damaged leaves. The damaged leaves dried up and the plant growth is rendered with few pods (Hossain, 2015). Therefore, the present research was conducted to assess 15 varieties including Patuakhali local variety of mungbean and to identify the influence of these varieties and weather parameters on the population mobility of flee beetle of mungbean.

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Plate: Presence of flea beetle on mungbean leaf

Plate: Damaged symptoms of infested leaf by flea beetle

2. Materials and Methods

The experiment was conducted at the farmer's field of sadar upazila of Patuakhali district, Bangladesh to screen mungbean varieties against flea beetle of mungbean during January to April 2016. It was located in between 22°14' and 22°29' North latitudes and in between 90°12' and 90°28' East longitudes (BANGLAPEDIA, 2015). It is adjacent to the Bay of Bengal. The area lies at 0.9 to 2.1 metre above mean sea level (Iftekhar and Islam, 2004). 15 mungbean varieties *viz*., BARI Mung-1, BARI Mung-2, BARI Mung-3, BARI Mung-4, BARI Mung-5, BARI Mung-6, BINA Moog-4, BINA Moog-5, BINA Moog-6, BINA Moog-7, BINA Moog-8, BU Mug-1, BU Mug-2, BU Mug-4 and Patuakhali local Mung were used as study materials. The seeds of these mungbean varieties were collected from Bangladesh Agricultural Research Institute (BARI), Gazipur, Bangladesh Institute of Nuclear Agriculture (BINA), Mymensingh, Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur and Patuakhali local Mung variety collected from farmers' of Patuakhali.

Experiment was laid out in Randomized Complete Block Design (RCBD) with three replications of each treatment. Each replication represented a block which was divided into 15-unit plots. The individual plot (4 m x 2.5 m) was made ready as per treatment design. The mungbean seeds were sown on the 29th January, 2016 at the rate of 30 kg ha^{-1} (BARI, 2011). Within the row, the seeds were sown continuously at a depth of 6-7 cm and covered by loose soil by hand keeping. Row to row distance was 30 cm. The fertilizers were applied as per fertilizers recommendation guide (BARI, 2011). Urea, triple super phosphate (TSP) and muriate of potash (MoP) were applied in the field uniformly @ 50, 85 and 35 kg ha^{-1}, respectively during the final land preparation. The plants were exposed to natural insect pests' infestation and insecticide was not applied during the experimental.

2.1 Number of Flea beetle

Population of flea beetle was recorded at an interval of 7 days commencing from first incidence. At vegetative and reproductive stage, data on number of flea beetle was collected 5 times (18, 25, 32, 39, 46 DAS) at early in the morning (6.30 a.m.-9.00 a.m.). All plants from each unit plot were observed individually.

2.2 Number of infested plants by flea beetle

The total number of infested plants was recorded from the selected $1m^2$ area of the center of each unit plot to determine the level of infestation by flea beetle. Data on number of infested plants were recorded at an interval of 7 days commencing from first incidence. The data were collected 5 times (18, 25, 32, 39, 46 DAS).

2.3 Percentage of leaf area damaged by flea beetle

For collecting data on the percentage of leaf area damaged by flea beetle, the percentage of leaf area damaged by flea beetle from 5 representative leaves of randomly selected 5 plants of each unit plot were measured separately by eye estimation and recorded at vegetative stage.

2.4 Yield data

The selected $1m^2$ area of the center of each unit plot was kept undisturbed for recording yield data. Mungbean was harvested thrice at 67, 74 and 82 DAS. Mature pods were harvested at 67 DAS when about 80% of the pods became blackish in colour. Second harvesting was done at 74 DAS. Final harvesting (third time) was done at 82 DAS. The harvested pods of 1 m^2 area from each unit plot were kept separately. Grains were recorded from 1 m^2 area per plot wise and the yields were expressed in kg ha^{-1}. During experimental period meteorological data on temperature and relative humidity were collected from the Patuakhali meteorological office.

2.5 Statistical analysis

The collected data was statistically analyzed through the analysis of variance using Web Agri Stat Package (WASP 1.0). The population data were transformed to square root ($\sqrt{x} + 0.5$) values. Means were separated by critical difference (CD) values at 5% level of significance.

3. Results

3.1 Abundance of flea beetle

Population of flea beetle per plot at 18, 25, 32, 39 and 46 days after sowing (DAS) of tested mungbean varieties is presented in Table 1. At 18 DAS, significantly the highest number of flea beetle per plot was recorded on BARI Mung-6 (2.04) which statistically similar to that of BINA Moog-7 (2.02). The lowest number of flea beetle per plot was observed on variety BARI Mung-4 (0.88) which statistically similar to that of BINA Moog-4 (0.88). At 25 DAS, significantly the highest number of flea beetle per plot was recorded on BARI Mung-6 (2.67). The second highest number was recorded in variety BINA Moog-7 (2.43) followed by that of BARI Mung-1 (2.30). The lowest number of flea beetle per plot was observed on variety BARI Mung-4 (1.56) which statistically similar to that of BINA Moog-4 (1.68). At 32 DAS, significantly the highest number of flea beetle per plot was recorded on BINA Moog-7 (3.91) followed by that of BARI Mung-6 (3.33).

The lowest number of flea beetle per plot was observed on variety BARI Mung-4 (2.27) which statistically similar to that of BU Mug-2 (2.27) and Patuakhali local Mung (2.27). At 39 DAS, significantly the highest number of flea beetle per plot was recorded on BARI Mung-6 (3.93) followed by that of BINA Moog-7 (3.81). However, significantly the lowest number of flea beetle per plot was observed in the variety BINA Moog-4 (2.10). At 46 DAS, significantly the highest number of flea beetle per plot was recorded on BARI Mung-6 (2.68) followed by that of BINA Moog-7 (2.53). The lowest number of flea beetle per plot was observed on variety BARI Mung-4 (1.39) which statistically similar to that of BARI Mung-5 (1.39). Usually, the flea beetle count was comparatively low at the vegetative stage of mungbean but increased gradually through the reproductive stage (Echezona et al., 2010). It was evident that the varieties BARI Mung-6 had the highest population of flea beetle which indicated that the variety was highly susceptible to flea beetle followed by that of varieties BINA Moog-7 and BINA Moog-6. On the other hand, variety BARI Mung-4 had the lowest population of flea beetle which indicated that the variety was the least susceptible to flea beetle. Among all the tested varieties, none showed complete resistance against flea beetle however, variety BARI Mung-4 showed tolerant against the attack of flea beetle.

Table 1: Mean number of flea beetle per plot on different mungbean varieties

Varieties	Mean Number of flea beetle per plot at DAS					Mean
	18 DAS	25 DAS	32 DAS	39 DAS	46 DAS	
BARI Mung-1	1.56 abc	2.30abc	2.55bcd	2.94cdef	2.04abcd	2.28bc
BARI Mung-2	1.52abc	1.74 cd	2.49 cd	3.53abc	1.95bcd	2.24bc
BARI Mung-3	1.05bc	1.72 cd	2.76bcd	2.45efg	1.84bcd	1.96bcd
BARI Mung-4	0.88 c	1.56 d	2.27 d	2.26 fg	1.39 d	1.67 d
BARI Mung-5	1.17bc	1.95bcd	3.12abc	3.58abc	1.39 d	2.24bc
BARI Mung-6	2.04 a	2.67 a	3.33ab	3.93 a	2.68 a	3.04 a
BINA Moog-4	0.88 c	1.68 d	3.02bcd	2.10 g	1.96abcd	1.93 cd
BINA Moog-5	1.27bc	1.76 cd	3.01bcd	2.42efg	2.04abcd	2.10bc
BINA Moog-6	1.68ab	1.77 cd	2.52bcd	3.36 abcd	2.15abc	2.29 b
BINA Moog-7	2.02 a	2.43ab	3.91 a	3.81ab	2.53ab	3.01 a
BINA Moog-8	1.05 bc	1.76 cd	2.45 cd	3.22abcd	1.77 cd	2.05bc
BU Mug-1	1.17bc	1.76 cd	2.59bcd	2.79defg	2.18abc	2.10bc
BU Mug-2	1.18bc	1.86 bcd	2.27 d	3.21abcd	2.33abc	2.17bc
BU Mug-4	1.17bc	1.74 cd	2.62bcd	2.80defg	2.26 abc	2.12bc
Patuakhali local Mung	1.27bc	1.77 cd	2.27 d	3.13bcde	2.03abcd	2.09bc
CV (%)	31.92	18.69	18.04	14.29	21.06	9.79
CD (0.05)	0.71	0.59	0.83	0.72	0.72	0.37

Note: In a column means having dissimilar letter(s) differ significantly as per 0.05 level of probability. CV- Coefficient of Variation, CD- Critical Difference, DAS- Days after Sowing

3.2 Number of infested plants by flea beetle in different varieties of mungbean

Number of infested plants by flea beetle in selected 1 m^2 area of each unit plot at 18, 25, 32, 39 and 46 days after sowing (DAS) of tested mungbean varieties is presented in Table 2. At 18 DAS, significantly the lowest number of infested plants was observed on variety BARI Mung-4 (0.71) which statistically similar to that of BARI Mung-5 (0.88), BINA Moog-4 (0.88), BINA Moog-5 (0.88) and BINA Moog-8 (0.88). The highest number of infested plant was recorded on BARI Mung-6 (2.11) followed by that of BINA Moog-7 (1.65). At 25 DAS, significantly the lowest number of infested plant was observed in the variety BARI Mung-4 (1.10) followed by BU Mug-2 (1.17). The highest number of infested plant was recorded on BINA Moog-7 (2.55) followed by that of BARI Mung-6 (2.26). At 32 DAS, significantly the lowest number of infested plant was observed in the variety BARI Mung-4 (1.56) followed by that of BINA Moog-4 (1.77) which statistically similar to that of BARI Mung-3 (1.78), BU Mug-4 (1.81) and BARI Mung-2 (1.86).

The highest number of infested plant was recorded on BARI Mung-6 (2.79) followed by that of BINA Moog-7 (2.59). At 39 DAS, significantly lowest number of infested plant was observed in the variety BINA Moog-4 (2.09) followed by BARI Mung-4 (2.22). The highest number of infested plant was recorded on BARI Mung-6 (3.76) followed by that of BINA Moog-7 (3.65). At 46 DAS, significantly the lowest number of infested plant was observed in the variety BINA Moog-4 (0.88) followed by BINA Moog-8 (1.00) which statistically similar to that of BARI Mung-4 (1.05). The highest number of infested plant was recorded on BARI Mung-6 (1.77) followed by that of BARI Mung-5 (1.68) which statistically similar to that of BINA Moog-7 (1.68) and BINA Moog-5 (1.65). From the mean of all varieties, it was evident that significantly the lowest number (1.33) of infested plant by flea beetle was recorded in BARI Mung-4 followed by BINA Moog-4 (1.51). The highest number (2.54) of infested plant by flea beetle was recorded in BARI Mung-6 followed by (2.42) BINA Moog-7.

Table 2: Mean number of infested plants by flea beetle per m^2 on different mungbean varieties

Varieties	Mean number of infested plants by flea beetle per m^2					Mean
	18 DAS	25 DAS	32 DAS	39 DAS	46 DAS	
BARI Mung-1	1.17 bc	1.68 bcde	2.41 abc	2.78 abcdef	1.58 abc	1.71 cde
BARI Mung-2	1.17 bc	1.56 bcde	1.86 cd	3.24 abcd	1.34 abcde	1.83 cd
BARI Mung-3	1.17 bc	1.88 abcd	1.78 cd	2.40 def	1.22 bcde	1.69 cde
BARI Mung-4	0.71 c	1.10 e	1.56 d	2.22 ef	1.05 de	1.33 e
BARI Mung-5	0.88 c	2.03 abc	2.39 abc	3.43 abc	1.68 ab	2.08 bc
BARI Mung-6	2.11 a	2.26 ab	2.79 a	3.76 a	1.77 a	2.54 a
BINA Moog-4	0.88 c	1.94 abcd	1.77 cd	2.09 f	0.88 e	1.51 de
BINA Moog-5	0.88 c	1.93 abcd	2.19 abcd	2.29 def	1.65 ab	1.79 cd
BINA Moog-6	1.17 bc	1.65 bcde	2.32 abc	3.14 abcde	1.46 abcd	1.95 c
BINA Moog-7	1.65 ab	2.55 a	2.59 ab	3.65 ab	1.68 ab	2.42 ab
BINA Moog-8	0.88 c	1.47 cde	2.09 abcd	3.03 abcdef	1.00 de	1.69 cde
BU Mug-1	1.00 bc	1.72 bcde	1.90 bcd	2.62 cdef	1.58 abc	1.76 cd
BU Mug-2	1.10 bc	1.17 de	2.39 abc	2.91 abcdef	1.17 cde	1.75 cd
BU Mug-4	1.00 bc	1.77 bcde	1.81 cd	2.73 bcdef	1.56 abc	1.77 cd
Patuakhali local Mung	1.29 bc	1.39 cde	2.26 abcd	2.88 abcdef	1.44 abcd	1.85 cd
CV (%)	37.00	26.49	19.57	20.94	20.10	13.10
CD (0.05)	0.71	0.77	0.70	1.00	0.48	0.40

Note: In a column means having dissimilar letter(s) differ significantly as per 0.05 level of probability. CV- Coefficient of Variation, CD- Critical Difference, DAS- Days after Sowing

The highest number of infested plant was recorded on BARI Mung-6 (2.79) followed by that of BINA Moog-7 (2.59). At 39 DAS, significantly lowest number of infested plant was observed in the variety BINA Moog-4 (2.09) followed by BARI Mung-4 (2.22). The highest number of infested plant was recorded on BARI Mung-6 (3.76) followed by that of BINA Moog-7 (3.65). At 46 DAS, significantly the lowest number of infested plant was observed in the variety BINA Moog-4 (0.88) followed by BINA Moog-8 (1.00) which statistically similar to that of BARI Mung-4 (1.05). The highest number of infested plant was recorded on BARI Mung-6 (1.77) followed by that of BARI Mung-5 (1.68) which statistically similar to that of BINA Moog-7 (1.68) and BINA Moog-5 (1.65). From the mean of all varieties, it was evident that significantly the lowest number (1.33) of infested plant by flea beetle was recorded in BARI Mung-4 followed by BINA Moog-4 (1.51). The highest number (2.54) of infested plant by flea beetle was recorded in BARI Mung-6 followed by (2.42) BINA Moog-7.

3.3 Percentage of leaf area damaged by flea beetle at vegetative stage

A significant variation was observed among the varieties with respect to the percentage of leaf area damaged by flea beetle. The percentage of leaf area damaged ranged from 5.37 to 11.33%. The lowest infestation of leaf area was observed on variety BARI Mung-4 (5.37%) which statistically similar to that of BINA Moog-4 (6.63%), BARI Mung-3 (6.67%) and BINA Moog-8 (7.00%). The highest infestation of leaf area was observed in BARI Mung-6 (11.33%) which was different from other varieties. The second highest was recorded in variety BINA Moog-7 (10.60%) followed by that of BARI Mung-1 (9.30%) which statistically similar to that of BINA Moog-6 (9.27%). These findings are presented in Figure 1.

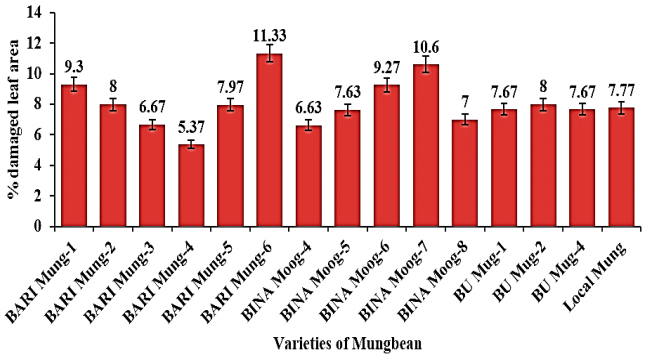

Figure 1: Percentage of damaged leaf area in different varieties of mungbean

3.4 Relationship between the population of flea beetle and number of leaves/plants

There was a positive correlation (R^2 = 0.691) between population of flea beetle and amount of leaves/plant. It indicates that the population of flea beetle was increased with increasing amount of leaves/plant. A linear regression was fitted between number of leaves/plant and population of leaf folder (Figure 2). The regression equation y = a + bx, where y = population of flea beetle, a = 0.871, b = 0.177 and x = number of leaves/plants, was obtained. The contribution of the regression (R^2 = 0.691) was 69.1%.

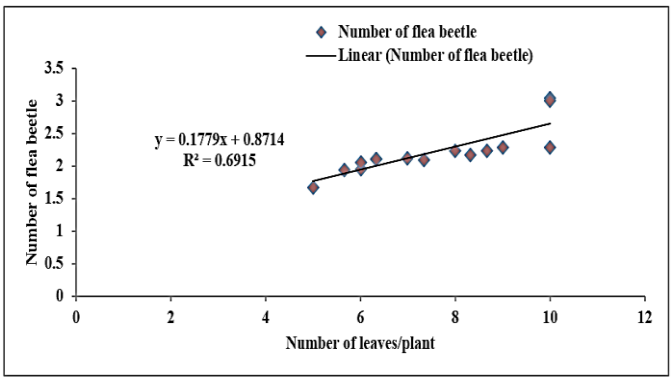

Figure 2: Relationship between the population of flea beetle and number of leaves/plant

3.5 Effect of weather parameters on incidence of flea beetle

There was a positive correlation (R^2 = 0.019) between the population of flea beetle and temperature. It indicates that the population of flea beetle was increased with increasing temperature. A linear regression was fitted between temperature and population of flea beetle (Figure 3). The regression equation y = a + bx, where y = population of flea beetle, a = -0.536, b = 0.099 and x = temperature. The contribution of the regression (R^2 = 0.019) was 1.9%. There was a negative correlation (R^2 = -0.01) between the population of flea beetle and relative humidity. It indicates that the population of flea beetle was decreased with increasing relative humidity. A linear regression was fitted between relative humidity and population of flea beetle (Figure 4). The regression equation y = a + bx, where y = population of flea beetle, a = 3.664, b = -0.019 and x = relative humidity. The contribution of the regression (R^2 = 0.01) was 1%.

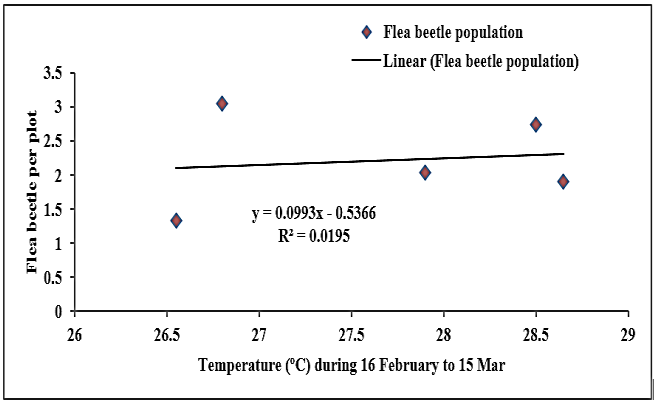

Figure 3: Relationship between the population of flea beetle and temperature

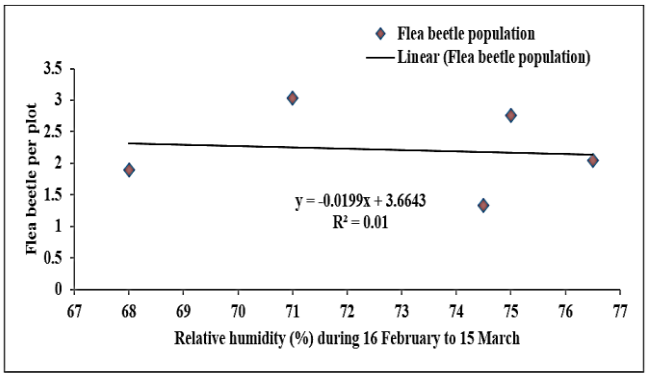

Figure 4: Relationship between the population of flea beetle and relative humidity

3.6 Yield performance among the tested mungbean varieties

The total yield with percentage at different harvest times and obtained from different mungbean varieties is presented in Table 3. At first harvest (67 DAS), the highest yield (524.00 kg ha^{-1}) was obtained from BARI Mung-6 followed by BINA Moog-7 (452.00 kg ha^{-1}), BU Mug-2 (435.00 kg ha^{-1}), BARI Mung-5 (432.00 kg ha^{-1}) and BINA Moog-8 (427.00 kg ha^{-1}). At first harvest, the lowest yield (221.00 kg ha^{-1}) was obtained from Patuakhali local Mung that was followed by BARI Mung-4 (231.00 kg ha^{-1}). These results revealed that BARI Mung-6 an early maturing variety had the highest yield during first harvest. Second harvest was done after 74 DAS and most of the varieties produced lower yield than the first harvest. The highest yield 366.00 kg ha^{-1} was obtained from BARI Mung-6 followed by BINA Moog-7 (315.00 kg ha^{-1}) and BARI Mung-5 (302.00 kg ha^{-1}) while it was the lowest (155.00 kg ha^{-1}) in Patuakhali local Mung followed by BARI Mung-4 (161.00 kg ha^{-1}). Table 3 further revealed that the highest yield (197.00 kg ha^{-1}) was obtained from BARI Mung-6 at the third harvest made after 82 DAS while the lowest yield was obtained from Patuakhali local Mung (83.00 kg ha^{-1}). On the basis of total yield obtained from the different varieties showed that variety BARI Mung-6 (1087.00 kg ha^{-1}) produced highest yield followed by BINA Moog-7 (937.00 kg ha^{-1}) and BARI Mung-5 (897.00 kg ha^{-1}) and variety Patuakhali local Mung produced lowest yield (459.00 kg ha^{-1}) followed by BARI Mung-4 (479.00 kg ha^{-1}) in Table 3.

Table 3: Yield of different mungbean varieties obtained from three consecutive harvests

Varieties	Three consecutive yield (kg ha^{-1})			Total Yield (kg ha^{-1})
	1st harvest (67 DAS)	2nd harvest (74 DAS)	3rd harvest (82 DAS)	
BARI Mung-1	409.00 bc	285.00 bcde	153.00 ab	847.00 bc
BARI Mung-2	385.00 cd	268.00 bcdef	145.00 abc	798.00 cd
BARI Mung-3	335.00 de	243.00 cdef	120.00 bc	698.00 de
BARI Mung-4	231.00 f	161.00 gh	87.00 c	479.00 f
BARI Mung-5	432.00 bc	302.00 abc	163.00 ab	897.00 bc
BARI Mung-6	524.00 a	366.00 a	197.00 a	1087.00 a
BINA Moog-4	317.00 e	222.00 efg	119.00 bc	658.00 e
BINA Moog-5	331.00 de	210.00 fgh	127.00 bc	668.00 e
BINA Moog-6	335.00 de	234.00 def	126.00 bc	695.00 de
BINA Moog-7	452.00 b	315.00 ab	170.00 ab	937.00 b
BINA Moog-8	427.00 bc	299.00 bc	161.00 ab	887.00 bc
BU Mug-1	322.00 de	225.00 efg	121.00 bc	668.00 e
BU Mug-2	435.00 bc	295.00 bcd	157.00 ab	887.00 bc
BU Mug-4	324.00 de	215.00 fgh	114.00 bc	653.00 e
Patuakhali local Mung	221.00 f	155.00 h	83.00 c	459.00 f
CV (%)	10.65	15.20	27.44	9.11
CD (0.05)	65.02	64.29	62.49	38.29

Note: In a column means having dissimilar letter(s) differ significantly as per 0.05 level of probability. CV- Coefficient of Variation, CD- Critical Difference, DAS- Days after Sowing

4. Discussions

Flea beetle is a serious pest of mungbean and causes a significant loss at different stages of the crops i.e. cotyledons and true leaved stage, thereby damaging leaves dried up and the plant growth is rendered with few pods. The population of flea beetle remained lower throughout the vegetative than the reproductive phase which was similarly observed (Echezona et al., 2010). The incidence and development of flea beetle is much dependent upon the prevailing weather conditions which showed agreement with (Khan et al., 2018). Similar findings are also observed who found that the incidence and population fluctuation of various insect pests was very much dependent on the prevailing climatic conditions of the cropping season (Hossain et al., 2012). However, the temperature was observed to have direct impact on the population infestation of flea beetle. Similar results were observed, while studying the seasonal incidence of mustard flea beetle in relation to weather parameters at different dates of sowing (Patel et al., 2017).

A group researcher observed that the severity of major insect pests on mungbean might be due to variable weather conditions in the two cropping seasons (Sarkar et al., 2008). Complete resistance against flea beetle was not observed in any of the tested variety, except BARI Mung-4 which showed comparatively lowest resistance among the tested varieties. The influence of weather parameters on incidence of flea beetle as noticed in this study was observed also by other authors. Temperature had significantly positive correlations with the dispersion of *Phyllotreta striolata* beetle while humidity weakly influenced their activity (Gao et al., 2005). The result of the present study indicated that the adults feed on the cotyledons and leaves of young plants making innumerable round holes (Hossain et al., 2012; Prodhan et al., 2008). It was revealed that BARI Mung-6 was superior mungbean variety among the studied varieties in terms of flea beetle infestation and showed the best performance regarding yield which is similar to the findings (Islam et al., 2008).

5. Conclusion

Results of the present findings lead towards a conclusion that, among the tested varieties, none of the variety showed complete resistance or immune reaction against flea beetle associated with weather parameters and high grain yield could be used for evaluating varieties in flea beetle prone areas.

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