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VARIETIES AND WEATHER PARAMETERS AFFECTING THE INCIDENCE AND INFESTATION OF THRIPS ON MUNG BEAN

Md. Mohasin Hussain Khan[1]* and Mohammad Habib Ullah[2]

[1]Department of Entomology, Patuakhali Science and Technology University, Patuakhali, Bangladesh
[2]Research Officer (Agriculture), Bangladesh Water Development Board, Dhaka, Bangladesh.

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ABSTRACT

Evaluation of mung bean varieties was carried out against thrips under natural field condition to find out tolerant or least susceptible variety during January to April, 2016. Ten varieties were used as study materials. Results revealed that no variety was free from the attack of thrips. The number of thrips in each flower varied significantly among the flowering stages. The lowest thrips population was found in variety BU mung 1 and IPSA mung 5 showed less susceptible to thrips. BARI Mung- 6, BARI Mung -5 and GK Mung- 27 had highest population of thrips which indicated that these varieties were highly susceptible to thrips while IPSA Mung- 5 and BU Mung- 1 had the lowest population indicating less susceptible to thrips. The percent damaged flower plant^{-1} varied significantly among the flowering stages. The lowest per cent flower damage was in variety BU mung 1 (11.33%) at 50% flowering stage and in BARI mung 2 (20.00%) at 100% flowering stage. BARI Mung- 6, BARI Mung- 5 and GK Mung- 27 had highest number of damaged flower which indicated that these varieties were highly susceptible to thrips. BU Mung- 1 and IPSA Mung- 5 showed comparatively better resistance against thrips. The number of thrips was higher during high temperature and relative humidity. With the increase of flower infestation there was progressive fall in the yield. BU mung 1 and IPSA mung 5 were comparatively less susceptible varieties to thrips among tested varieties.

Keywords: Mung bean, variety, incidence, infestation, thrips

INTRODUCTION

Mung bean (*Vigna radiate* L. Wilezek) is one of the most important pulses crop belonging to the family Leguminosae grown in tropical and sub-tropical regions. Mung bean is an important source of protein and several essential micronutrients for both human and domestic animals. It contains 24.5% protein and 59.9%

*Corresponding author: *mohasin1965@pstu.ac.bd*

carbohydrate. It also contains 75 mg calcium; 8.5 mg iron and 49 mg β–carotene per 100 g of split dual (Bakr *et al*. 2004). The foliage and stem are also a good source of fodder for livestock as well as a green manure. Mung bean is cultivated with minimum land preparation and without fertilizer application even without insect, diseases or weed control. All these factors are responsible for low yield of mung bean. Despite its importance, mung bean yields are greatly reduced by a complex of biotic and abiotic factors of which insect pests are the most important. Approximately 64 insect species have been reported to attack mung bean in the field and thrips is one of the most devastating sucking pests which include thrips, jassids and whiteflies (Khattak *et al*. 2004). Among them thrips (*Megalurothrips distalis* Karny, *Megalurothrips usitatus* Bangall and *Caliothrips indicus* Bangall) are associated mostly with the damage of tender buds and flowers of mung bean. Thrips cause substantial damage during the vegetative and reproductive stages of the crop (Hossain *et al*. 2004, Rahman *et al*. 2000). The most common symptom of thrips infestation on mung bean is silver scarring on the leaf, which happens when thrips remove the cell content of leaf tissue (Duff 2012). *M. usitatus* was identified as one of the most economically devastating pests of the crop (Duraimu-rugan and Tyagi 2014). During the vegetative stage, *M. usitatus* prefers to suck plant juice from terminal buds and rasps the top unopened trifoliate leaves, which can quickly migrate to flowers, once formed during the flowering stage (Gitonga 1999). In the early stages of blossoming, male and female thrips are distributed at random in the flowers (Chang 1992). Both nymphs and adults feed on pollen and rasp flower parts and also suck the plant fluid leaking from the wounded plant parts (Hossain *et al*. 2004). The *M. usitatus* induces necrosis and early shed-ding of flower buds and blooms as a result of oviposition and feeding, which inhibits pod development, lowers the market value of the crop, and reduces yield output (Fan *et al*. 2013). *M. usitatus* causes mung bean production reduction ranging from 13 to 64% (Farajallah 2013). Some thrips species feed on the pollen and nectar produced by the flower, rather than attacking growing pods.

Different chemical pesticides are extensively used for controlling thrips of mungbean in recent years (Broughton and Herron 2009). Due to indiscriminate and frequent application of chemical pesticides resulted undesirable side effects including environmental pollution, pest resurgence, upset, resistance to pesticide, and develops high pesticide residues in food and other products (Ansari *et al*. 2014).

On the other hand, non-chemical control plays an important role in evolving an ecologically sound and environmentally acceptable method but not cost effective. Among the insect control options, host plant resistance by the use of resistant varieties is an effective and safe strategy in pest management with no additional cost to the growers by the plantation of resistant cultivars. However, investigation on the screening of the high-yielding varieties for insect pest resistance or tolerance is insufficient. The varieties of mung bean (*Vigna radiata* L. Wilczek) developed in Bangladesh also lack proper screening which can aid in insect pest management and increase the productivity of the crop. Insect pest is a major biotic barrier in mung bean production and accounts for 42 and 58% losses at the vegetative and reproductive stages, respectively (Malik 1992). Utilization of resistant host is one of the valuable management options for insect pest management. Under these circumstances, it becomes necessary to find out the most tolerant/ resistant variety/ varieties of mung bean against thrips.

MATERIALS AND METHODS

Field experiment was carried out at farmer's field in Sonakhali, Barguna sadar, Barguna to evaluate the resistance sources(s) among different verities of mung bean against thrips during the period from January to April 2016. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The total number of plots was 30 and the size of the individual plot was 3.0m x 2.0m. The distance between unit plots was 0.75m and between blocks was 1.0m. Ten varieties viz., BARI Mung- 2, BARI Mung- 5, BARI Mung- 6, BU Mung- 1, BU Mung- 2, IPSA Mung- 5, IPSA Mung- 12, GK Mung- 27, BINA Mung- 2 and local Mung were included in the study. All the seeds were subjected to germination test before sowing. In all cases, the rate of germination was more than 90%. The seeds were sown on 1 February 2016 at the rate of 20 kg ha^{-1}. The seeds were placed in the line continuously at a depth of 4-5cm and covered by loose soil by hand. The spacing was 15 cm between rows and 10 cm between plants. At first trifoliate stage seedling was carefully thinned to retain one seedling $hill^{-1}$. Seed germination occurred from 10^{th} day after sowing. Intercultural operations were done as and when necessary to ensure normal growth and development of crops. Irrigation was applied as and when needed. Proper drainage system was also developed for draining out excess water. First weeding was done at 30 DAS followed by once a week to keep

the plots free from weeds and to keep the soil loose and aerated for the whole period of the crop growth. Weekly data were collected and recorded by direct counting early in the afternoon (4.0 – 6.0 pm). The number of plants per m^2 was selected randomly from each plot. For taking the data on the number of thrips were recorded from infested flowers at three stages like at 50% flowering stage, at 100% flowering stage and at pod initiation stage, respectively. Thrips population was assessed from 20 opened flowers, which were randomly collected from two rows of each side of the plot avoiding border rows and the selected 1 m^2 area of the center of each unit plot. The collected flowers were immediately opened on the white paper board and counted the number of thrips. The selected 1 m^2 area of the centre of each unit plot was kept undisturbed for recording yield data. The percentage of thrips infested flowers was calculated from the number of infested and total flowers collected from 10 randomly selected inflorescences from each m^2 plot $^{-1}$ using the formula:

$$\% \text{ flower infestation} = \frac{\text{Total number of infested flowers}}{\text{Total number of flowers}} \times 100$$

Mung bean was harvested thrice at 65-72 DAS. First only ripen pods were harvested at 65 DAS (4th April 2016) when about 80% of the pods became black in color. After first picking, flowering appeared and pod formation occurred second time. These pods were harvested at 72 DAS (second time on 11th April 2016) after ripening. The harvested crop of 1 m^2 area from each unit plot was bundled separately. Grains were recorded from 1 m^2 area per plot and the yields were expressed in kilogram (kg) and per hectare.

Data on temperature and relative humidity were collected from Weather Observatory, Meteorological Department, Kalapara, Patuakhali. Data were analyzed following the analysis of variance (ANOVA) using WASP program and the mean differences were adjudged by CD (critical difference) values.

RESULTS AND DISCUSSION

Population of thrips on different varieties of mung bean: Number of thrips per flower was recorded at different stages of different mung bean varieties and is presented in Table 1. At 50% flowering stage, significantly the highest population

of thrips (7.0) was recorded in the variety BARI Mung- 6. The second highest number was recorded in BARI Mung- 2 (6.33) followed by GK Mung- 27 (6.00), BU Mung- 2 (5.67), BARI Mung- 5 (5.00) and BINA Mung- 2 (4.67). BARI Mung- 5 (5.67), BARI Mung- 2 (2.41) was statistically identical with GK Mung- 27 (5.67). However, the lowest number of thrips was found in the variety of IPSA Mung- 12 (4.0) which was statistically similar with BU Mung 1 (4.0) followed by local Mung (4.33) and IPSA Mung- 5 (4.33). Local Mung (4.33) was statistically identical with IPSA Mung- 5 (4.33).

At 100% flowering stage, the highest number of thrips was observed in the variety BARI Mung- 6 (5.0). The second highest number was recorded in BARI Mung- 2 (4.33) followed by BINA Mung- 2 (4.0), BARI Mung- 5 (4.0), BU Mung- 1 (4.0), IPSA Mung- 12 (3.67) and GK Mung 27 (3.67). BARI Mung 5 was statistically identical with BINA Mung 2. However, the lowest number of thrips was observed in the variety IPSA Mung 5 (2.67) followed by BU Mung 2 (3.0) and local Mung (3.33).

At pod initiation stage, significantly the highest number of thrips was observed in the variety BARI Mung 6 (4.0). The second highest number was recorded in BARIi Mung- 5 (3.0) which was statistically similar with GK Mung- 27 (3.00) followed by local Mung 2 (2.67), BINA Mung- 2 (2.333) and IPSA Mung- 5 (2.33). IPSA Mung- 5 was statistically identical with BINA Mung- 2. However, the lowest number of thrips was observed in the variety of IPSA Mung- 5 (1.0) which was statistically similar with BU Mung- 1 (1.0) followed by BARI Mung- 2 (2.0) and BU Mung- 2 (2.0).

The number of thrips in each flower varied significantly among the flowering stages (Table 1). From above results it was indicated that the thrips population varied in different varieties at different stages. All the varieties in respect of thrips population was evident and the BARI Mung- 6, BARI Mung -5 and GK Mung- 27 had the highest population level which indicated that these varieties were highly susceptible to thrips. Among all the tested varieties, none showed complete resistance against thrips however, IPSA Mung- 5 and BU Mung- 1 showed comparatively better resistance against thrips.

Table 1. Number of thrips at flowering and pod initiation stages of different varieties of mungbean

Varieties name	Number of thrips/flower			Mean
	At 50% flowering stage	At 100% flowering stage	At pod initiation stage	
BARI Mung - 2	6.33 ab	4.33	2.00 bc	4.22 b
GK Mung - 27	6.00 abc	3.67	3.00 ab	4.22 b
BINA Mung - 2	4.67 cde	4.00	2.33 bc	3.67 bcd
IPSA Mung - 5	4.33 de	2.67	1.00 c	2.67 d
IPSA Mung - 12	4.00 e	3.67	2.33 bc	3.33 bcd
BU Mung - 1	4.00 e	4.00	1.00 c	3.00 cd
BU Mung - 2	5.67 abcd	3.00	2.00 bc	3.56 bcd
BARI Mung - 5	5.00 bcde	4.00	3.00 ab	4.00 bc
Local Mung	4.333 de	3.33	2.67 ab	3.44 bcd
BARI Mung - 6	7.00a	5.00	4.00 a	5.33 a
Level of significance	**	NS	**	**
CV (%)	18.06	22.09	33.70	15.96

** Significant at 1 % level, NS- Non significant. Means within column followed by the same letter are not significantly different from one another by CD (critical difference) values. Values are average of three replications.

Flower infestation inflorescence^{-1} by thrips: Percent flower infestation by thrips at different stages of mungbean varieties varied significantly (Table 2). At 50% flowering stage, the highest percent damaged flower (23.67%) was recorded in the variety of BARI Mung- 6. The second highest percent damaged flower was recorded in BARI Mung- 5 (22.33%) followed by IPSA Mung- 12 (20.0%), BINA Mung- 2 (19.67%), BU Mung- 2 (19.67%), GK Mung- 27 (18.33%) and local Mung (16.67%). BINA Mung- 2 was statistically identical with BU Mung- 2 (19.67%). However, the lowest percent damaged flower was found in the variety of BU Mung- 1 (11.33%) followed by BARI Mung- 2 (13.33%) and IPSA Mung- 5 (14.0%).

At 100% flowering stage, the highest percent of damaged flower (32.33%) was recorded in the variety of BARI Mung- 6. The second highest percent damaged flower was recorded in BARI Mung- 5 (31.0%) followed by BINA Mung- 12 (32.67%), GK Mung- 27 (30.0%), IPSA Mung- 12 (24.33%), local Mung (23.67%) and BU Mung- 2 (22.67%). BINA Mung- 2 was statistically identical with BU Mung- 2 (19.67%). However, the lowest percent damaged flower was found in the

variety of BARI Mung- 2 (20.0%) followed by BARI Mung- 5 (20.33%) and BU Mung- 1 (21.0%).

At pod initiation stage, significantly the highest percent damaged flower (40.67%) was recorded in the variety of BARI Mung- 6. The second highest percent damaged flower was recorded in BARI Mung- 5 (38.33%) followed by GK Mung- 27 (36.67%). No significant differences was observed among the varieties BINA Mung- 2 (35.0%) and IPSA Mung- 12 (34.0%) followed by local Mung (32.33%), BU Mung- 2 (32.0%). However, the lowest number of damaged flower was found in the variety of BU Mung- 2 (24.33%) followed by IPSA Mung- 5 (27.33%) and BARI Mung- 2 (29.67%).

The percent damaged flower plant^{-1} varied significantly and differed among the flowering stages (Table 2). From above results, it was indicated that the number of damage flower varied in different varieties at different stages. All the varieties in respect of number of damage flower were evident and the BARI Mung- 6, BARI Mung- 5 and GK Mung- 27 had highest number of damage flower, which indicated that these varieties were highly susceptible to thrips. Among all tested varieties, none showed complete resistance against thrips. However, BU Mung- 1 and IPSA Mung- 5 showed comparatively better resistance against thrips.

Table 2. Percentage of flower infestation by thrips at flowering and pod initiation stages of mungbean

Varieties name	% Flower infestation/inflorescence		
	At 50% flowering stage	At 100% flowering stage	At pod initiation stage
BARI Mung - 2	13.33	20.00	29.67 cde
GK Mung - 27	18.33	30.00	36.67 abc
BINA Mung - 2	19.67	30.67	35.00 abcd
IPSA Mung - 5	14.00	31.00	27.33 de
IPSA Mung - 12	20.00	24.33	34.0 abcd
BU Mung - 1	11.33	21.00	24.33 e
BU Mung - 2	19.67	22.67	32.00 bcde
BARI Mung - 5	22.33	20.33	38.33 ab
Local Mung	16.67	23.67	32.33 bcde
BARI Mung - 6	23.67	32.33	40.67 a
Level of significance	NS	NS	**
CV (%)	31.87	23.17	14.59

** Significant at 1 % level, NS- Non significant. Means within column followed by the same letter are not significantly different from one another by CD (critical difference) values. Values are average of three replications.

Population fluctuation of thrips relation to temperature and relative humidity: The seasonal abundance of thrips per square meter plant is shown in the month of March (Fig. 1). It is revealed from the figure that thrips was the maximum as noticed on 6th March, 2016 and the prevalence was continued up to the 20th March, 2016. At the beginning of the season, a maximum thrips was found and then declined up to to the 20th March. After that time abundance of thrips was slightly decreased up to the 20th March. The prevailing temperature and relative humidity were 33-34^{0}C and 96-98% at the peak period, respectively. It was revealed that number of thrips was higher during high temperature and relative humidity.

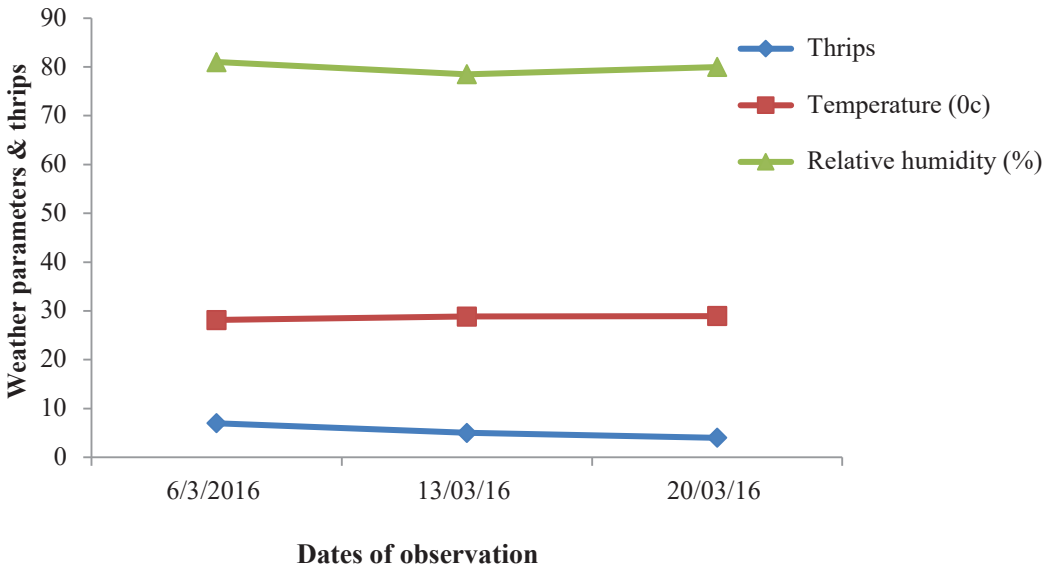


Fig. 1. Trend in population fluctuation of thrips with mean temperature (°C) & mean relative humidity (%) on highly susceptible variety of BARI Mung- 6.

Relationship between flower infestation and yield: A strong negative relationship between percent flower infestation and total yield was found in different varieties, which indicated that where the increase of flower infestation there was progressive fall in the yield. A linear regression was fitted between thrips infestation and total yield (Fig. 2). The correlation coefficient (r) was 0.95 and the contribution of the regression (R^2 = 0.9065, when Y = - 11.771x + 1006) was 90.65%.

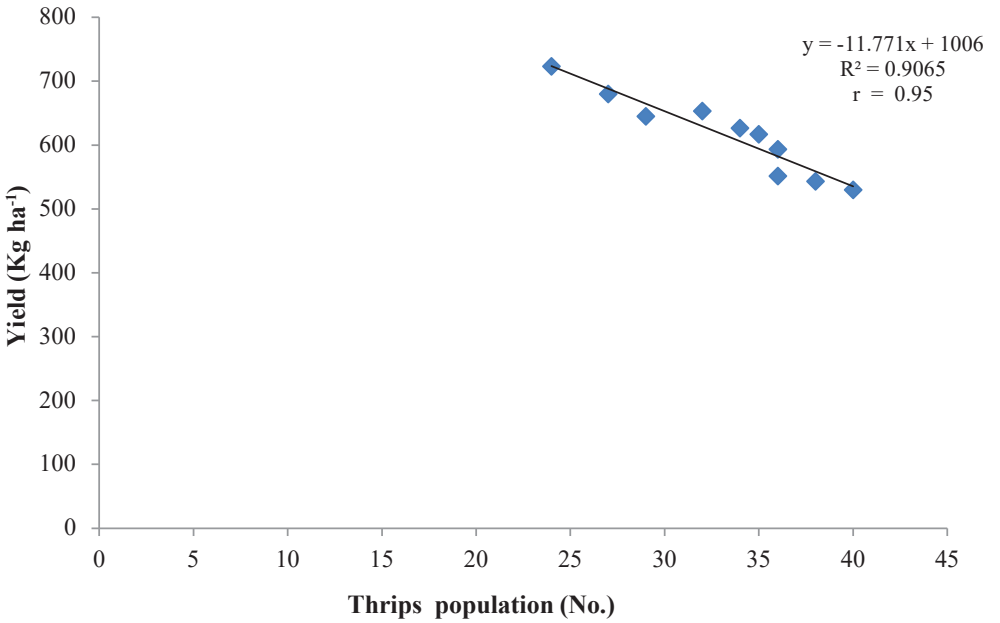


Fig. 2. Relationship between flower infestation and yield of different mung bean varieties.

Diverse biophysical and biochemical properties enhance the resistance in plants, but exceptions can happen depending on the type of crop and environment (Kosini *et al*. 2017). Plant biochemicals provide both direct and indirect defense function against insect pests (Roda and Baldwin 2003). Significant variations were detected in damaging the flower bud, flower infestation, and shedding by thrips which affected the yield of mung bean. Negative responses of thrips to the increasing trichomes, moisture, chlorophyll, phenol, and potassium in mung bean suggest the significance of these properties to develop resistant varieties against thrips (Yasmin *et al*. 2022). Nadeem *et al*. (2014) studied eight advanced mung bean genotypes in comparison with two check varieties against sucking pests under natural conditions. Findings showed that none of the tested genotypes have complete resistance against sucking pests like thrips, jassids and whiteflies. Previous researchers like Sahoo and Hota (1991), Chhabra and Kooner (1993) and Chhabara and Kooner (1994) evaluated mung bean cultivars against their resistance to insect pests and screened out a large number of mung bean genotypes for resistance/susceptibility against sucking pests. Naqvi *et al*. (1995) tested 10 genotypes of mung bean against

insects and found only two cultivars, M-8-20 and M-1030 resistant against insects compared to others. Khattak *et al*. (2004) screened five mungbean varieties *viz*., NM 92, NM- 98, NM-121-125, M-1 and NCM-2009 against sucking pests like whiteflies, jassid and thrips and observed that whitefly, jassid and thrips population was comparatively lower on NM-92 and NM-98, which enabled to get higher yield compared to other tested varieties. The results of the present study are supported by Khan *et al.* (2011) who recorded thrips populations from flowering to pod filling stage and found positive relationship of thrips population with prevailing weather conditions of temperature and relative humidity which are comparable with our results but Sedaratian *et al*. (2010) found negative correlation of rainfall, temperature and relative humidity with the thrips population. Khan *et al.* (2008) also found that abiotic factors have significant effects on the population of thrips which are comparable with the present findings.

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