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OCCURRENCE AND DIVERSITY OF INSECT PESTS ATTACKING BU MUNG BEAN 4

N. Tanzum[1], A. Mrong[1], M. R. U. Miah[1], M. Ahiduzzaman[2] and M. S. Hossain*[1]

Abstract

The study was conducted during March to June 2021 in the field and laboratory of Bangabandhu Sheikh Mujibur Rahman Agricultural University (BSMRAU), Gazipur to know the prevalence of the insect pests and their status on mung bean variety BU Mung-4. In total 12 species of insects were found as pest, of which 4 species were hemipteran, 3 species were lepidopteran, 2 species were coleopteran, 2 species were dipteran, and one species was thysanopteran. Pod borer (84.4%), flea beetles (66.6%), thrips (48.8%), jassid (37.7%) and whitefly (25.2%) were found as major pests. Leaf miner, aphid, epilachna beetle, green stink bug, hairy caterpillar and stem fly were categorized as minor pests having 13.3%, 8.8%, 17.7%, 2.2%, 15.5%, 11.1% infestation, respectively. The pest insects were most abundant in middle April (94.9±6.1) when the plants were at seedling to pre-flowering. Both the richness and diversity of the insect pests were the maximum during early May (1.2±0.1 and 1.7±0.1, respectively). The abundance did not show any change in relation to temperature and relative humidity but influenced only by the growing stages of the crop.

Keywords: Insect pests, prevalence, infestation, stink bug, caterpillar, beetle, weather factors.

Introduction

Mung bean (*Vigna radiata* L. Wilczek) is one of the leading legume crops widely grown in Bangladesh during Rabi season as well as in many tropical and subtropical countries of the world (Asante *et al*., 2002). It is a good source of proteins, carbohydrates and vitamins for the human race all over the world. It contains 51% carbohydrate, 26% protein, 10% water, 4% minerals and 3% vitamins (Kaul, 1982) like other pulses widely used as 'Dal' in Bangladesh.

In Bangladesh, the area under pulse crops in Bangladesh is 0.372 million hectares with a production of 0.425 million tons but 0.041 million hectares of land are under mung bean cultivation where its production is 0.044 million tons (BBS, 2021) which is lower than any major vegetables. It is considered as a quality pulse in the country but production per unit area is very low (931 kg/ha) as compared to other countries of the world (BBS, 2021). It ranks fifth both in acreage and production and contributes 6.5% of the total pulse production in Bangladesh (Alam *et al*., 2021).

[1]Department of Entomology, [2]Department of Agro-Processing, Bangabandhu Sheikh Mujibur Rahman Agricultural University, Gazipur 1706, Bangladesh.
*Corresponding author: shamim.bsmrau@gmail.com

A number of insect pests adversely affect the production of mung bean. According to the report of Rahman *et al.* (2000), more than twelve species of insect pests were found to infest mung bean in Bangladesh among which stemfly, flea beetles, flower thrips and pod borers cause serious damage. These insect pests attack the crop from seedling to fruiting stage and are responsible to cause significant yield loss (Hossain, 2015). The infestation of these insect pests inflicts serious economic loss causing annual yield loss about 27.03 to 38.06% in India (Duraimurugan and Tyagi, 2014).

The most damaging insect pests of mung bean recorded so far are stem fly (Rahman, 1987; Lal, 1985), jassid (Baldev *et al*., 1988; Chaudhary *et al*., 1980), whitefly (Rahman *et al.*, 1981; Srivastava and Singh, 1976), thrips (Chhabra and Kooner, 1985), hairy caterpillar (Rahman *et al.*, 1981) and pod borer (Nair, 1987). The maturation of pods as well as seed is greatly hampered due to the infestation of pod borer resulting severe loss of the crop (Bakr, 1998). The yield loss caused by pod borer complex in mung bean is about 36.41% (Umbarkar *et al.*, 2011). Larvae of stem fly feed inside the main stem and finally tunnels even up to roots. In mung bean; upto 97% plants were found to be infested by stem fly (Rahman, 1989). Among the sap sucking insects, aphid, leafhoppers, whitefly, stink bug are reported to infest mung bean frequently (Kumar *et al.*, 2019; Yadav and Singh, 2013). These insects are responsible to transmit viral diseases and also affect crop yield through the reduction of photosynthesis by the development of sooty mold (Jones, 2003). So, the study of occurrence and diversity of insect pests in mung bean is barely necessary.

But recently no study has been done on the status of insect pests infesting mung bean in Bangladesh. The knowledge of seasonal incidence of insect pests at different growth stages of mung bean crop will be helpful in evolving proper management schedule. Climatic changes may lead to increase the severity of these pests in many regions of the country (Dhaliwal *et al.,* 2010). In Bangladesh, a complete and recent pest status of this crop with their species richness, diversity and seasonal abundance is highly necessary for making a sound pest management decision.

Materials and Methods

Study site and the cultivation of mung bean

The experiment was conducted in the experimental field of the Department of Entomology, BSMRAU, Gazipur-1706 during March to June 2021. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 replications having a total of 18 plots (3×2 m^2) separated by 1m and block to block distance of 2m. The seeds of BU Mung-4 were sown at 15 March 2021 in the well-prepared field as continuous line sowing at about 5 cm depth from the soil surface by maintaining a 30 cm distance from row to row. Before seed sowing, the land was well-prepared by deep ploughing followed by laddering. After the germination of seedling, thinning of seedling was done keeping the seedling as 6 cm distance from each plant to plant in a row. Application of manures and fertilizers was done according to the recommended fertilizer doses for mung bean production (BARC, 2012). Intercultural operations were done whenever necessary.

Observation of insect pests attacking mung bean

The observations on the abundance of insect pests were made visually with the help of magnifying lens at 15 days interval recorded from their appearance on plants and continued until final harvest. The leaves of a plant having the squiggly line symptom of leaf miner infestation were considered as the presence of single leaf miner. In case of pod borer, both larvae and adult were counted. Larvae were counted by dissecting the infested pod of mung bean. Sample was taken randomly from a row out of six rows in a plot and number of healthy and infested plants for each insect pest were recorded, then converted to per plot (3×2 m^2) for expressing rate of plant infestation and also the number of arthropods pests per plot. The insect pests were identified through comparing to museum specimens as well as by relevant literature and photographs. Curating and preparation of specimens was followed after Kwon's method (Kwon, 1988). The arthropod pests were categorized as major (>25%) and minor (<25%) according to the rate of infestation (Hasan *et al*., 2021).

Calculation of diversity indices

Relative species abundance was calculated by dividing the number of species from one group by the total number of species from all groups. Shannon-Weaver diversity index (Shannon and Weaver, 1963) and Margalef's richness index (Margalef, l958) were calculated for the insect pests recorded in different observation days.

The indices were computed using the following formulae:

Shannon-Weaver diversity index (H'),

$$H' = -\sum_{i=1}^{S} (Pi)(In\ Pi)$$

Where, S = Total number of species = Species richness, Pi = The relative abundance of each species. P is the proportion (n/N) of individuals of one particular species found (n) divided by the total number of individuals found (N), ln is the natural log, and Σ is the sum of the calculations.

Margalef's species richness index (D^{mg}),

$$D^{mg} = \frac{S-1}{In\ N}\ or\ D^{mg} = \frac{S-1}{\log e\,(N)}$$

Where, S = Total number of species, N = Total number of individuals in the sample, ln = Natural logarithm.

Data analysis

The weather data were collected from the weather station of BSMRAU. The changing pattern of insect abundance in relation to the recorded temperature and relative humidity was graphically presented. The data were analyzed statistically by analysis of variance (ANOVA) and the means were separated by using Tukey HSD posthoc statistic using IBM SPSS 20.0 software.

Results and Discussion

Pest status of the identified insect pests of mung bean

In total 12 insect species were found as pests of mung bean field during Kharif-1 season 2020-21 (Table 1), among the pests, four species were in the Order Hemiptera, namely aphid (*Aphis craccivora*, Aphididae), jassid (*Empoasca kerri,* Cicadellidae), whitefly (*Bemisia tabaci,* Aleyrodidae), green stink

Table 1. Insect pests prevailed in the mung bean (BU Mung-4) field during Kharif-1 season at Gazipur, Bangladesh

Common name	Scientific name	Family	Order
Aphid	*Aphis craccivora* (Koch, 1854)	Aphididae	Hemiptera
Jassid	*Empoasca kerri* (Pruthi, 1940)	Cicadellidae	Hemiptera
Whitefly	*Bemisia tabaci* (Gennadius, 1889)	Aleyrodidae	Hemiptera
Green stink bug	*Nezara viridula* (Linnaeus, 1758)	Pentatomidae	Hemiptera
Leaf miner	*Liriomyza brassicae* (Riley, 1885)	Agromyzidae	Diptera
Stem fly	*Ophiomyia phaseoli* (Tryon, 1895)	Agromyzidae	Diptera
Thrips	*Megalurothrips usitatus* (Bagnall, 1913)	Thripidae	Thysanoptera
Flea beetles	*Phyllotreta* spp.	Chrysomelidae	Coleoptera
Epilachna beetle	*Epilachna dodecastigma* (Mulsant, 1977)	Coccinellidae	Coleoptera
Hairy caterpillar	*Spilosoma oblique* (Walker, 1855)	Erebidae	Lepidoptera
Pod borer complex	*Euchrysops cnejus* (Fabricius, 1798) *Maruca vitrata* (Fabricius, 1798)	Lycaenidae Crambidae	Lepidoptera Lepidoptera

bug (*Nezara viridula,* Pentatomidae); two species were in the Order Diptera namely leaf miner (*Liriomyza brassicae,* Agromyzidae), stem fly (*Ophiomyia phaseoli,* Agromyzidae); two species were in the Order Coleoptera namely flea beetles (*Phyllotreta* spp., Chrysomelidae), epilachna beetle (*Epilachna dodecastigma,* Coccinellidae); one species in the Order Thysanoptera namely Thrips (*Megalurothrips usitatus*, Thripidae); three species were in the Order Lepidoptera Hairy caterpillar (*Spilosoma oblique,* Erebidae), Pod borer complex (*Euchrysops cnejus,* Lycaenidae), (*M. vitrata,* Crambidae).

A study in India by Lal (1985) reported a total of 64 species of insects to attack mung bean in the field; among them, whitefly, *Bemisia tabaci* Genn, leaf hopper, *Empoasca kerri* Pruthi, black aphid, *Aphis craccivora* Koch, Bihar hairy caterpillar, *Diacrisia obliqua* (WIK), galerucid beetle, *Madurasia obscurella* Jacoby, stem fly, *Ophiomyia* (*Melanagromyza*) *phaseoli* (Tryon), lycaenid borer, *Euchrysops cnejus* Fabr, and spotted caterpillar, *Maruca testulalis* Geyer, were included. According to some other research reports, the most serious insect pests of mung bean include whitefly, thrips, jassid, gram pod borer and legume pod borer (Kooner *et al.,* 2006; Singh and Singh, 2015; Kharel *et al.,* 2016; Kumar *et al.*, 2019).

Leaf miner was found to infest the crop from seedling stage. Aphid, flea beetles, whitefly, jassid, green stink bug and hairy caterpillar were found to infest the crop from seedling to pre-flowering stage, where epilachna beetle and Stem fly were found from seedling to harvesting stage. Jassid infestation was found from seedling to fruiting stage whereas thrips was found at post-flowering stage. Pod borer complex was found only at after fruiting stage of mung bean growing season. According to the rate of plant infestation, pod borer complex (84.4%), flea beetles (66.6%), thrips (48.8%), jassid (37.7%) and whitefly (25.2%) were categorized as major pests. Leaf miner,

aphid, epilachna beetle and green stink bug, hairy caterpillar and stem fly were categorized as minor pests having plant infestation 13.3%, 8.8%, 17.7%, 2.2%, 15.5%, 11.1%, respectively (Table 2).

Stem fly attack mainly the crop by feeding on tender stems at seedling stage, although it may attack at any stage of the crop. In mung bean; up to 97% plants were found to be infested by stem fly (Rahman, 1989). The sap-sucking insects such as *Aphis craccivora*, *Empoasca* spp., *Cicadella viridis*, *Bemisia tabaci* (whitefly) are the major pests of mung bean (Isman, 2008). These insects not only reduce the vigour of the plant by sucking the sap, but also transmit diseases which reduce the rate of photosynthesis and ultimately cause a reduction in yield (Asawalam and Anumelechi, 2014). Among them aphids, *Aphis* spp. and pod borer, *Helicoverpa armigera* H., are the most serious pests. Insect pests are responsible for 42% and 58% losses at pre-flowering and post-flowering stages, respectively of mung bean (Malik, 1992).

Abundance of the insect pests on mung bean

The relative seasonal abundance of insect pests on mung bean (BU Mung 4) is presented in Table 3. Among the insect pests, leaf miner, aphid and flea beetle were found during early April to May but were not present in rest of the cropping season. Whitefly, epilachna beetle, hairy caterpillar, jassid and stem fly were found during mid-April, among them only whitefly was found throughout the season. Thrips was found during the month of May and remained in the field up to first week of June. Pod borers were found in only during the month of June and green stink bug infestation was observed only in first week of May. The mean number of leaf miner, aphid cluster, flea beetle, whitefly, epilachna beetle, green stink bug, hairy caterpillar, jassid, stem

Table 2. Status of the insect pests prevailed the in mung bean (BU Mung-4) field (3×2 m² plots) during Kharif-1 season at Gazipur, Bangladesh

Common name	Crop stage of infestation	Initiation of infestation	Rate of plant infestation (%)	Status
Leaf miner	Seedling	10 DAS	13.3	Minor
Aphid	Seedling to pre-flowering	11 DAS	8.8	Minor
Flea beetles	Seedling to pre-flowering	12 DAS	66.6	Major
Whitefly	Seedling to pre-flowering	15 DAS	25.2	Major
Epilachna beetle	Seedling to harvesting	15 DAS	17.7	Minor
Green stink bug	Seedling to pre-flowering	18 DAS	2.2	Minor
Hairy caterpillar	Seedling to pre-flowering	25 DAS	15.5	Minor
Jassid	Seedling to fruiting	18 DAS	37.7	Major
Stem fly	Seedling to harvesting	25 DAS	11.1	Minor
Thrips	Flowering stage	35 DAS	48.8	Major
Pod borer complex	Post-fruiting	60 DAS	84.4	Major

Note: *DAS= Days after Sowing.

Table 3. Seasonal abundance of insect pests in mung bean (BU Mung-4) field (3×2 m² plots) during Kharif-1 season at Gazipur, Bangladesh

Insect pests	Cropping Season						
	01 April	15 April	01 May	15 May	01 June	15 June	Mean
Leaf miner	36.0	18.0	0.0	0.0	0.0	0.0	9.0
Aphid cluster	24.0	18.0	18.0	0.0	0.0	0.0	10.0
Flea beetles	120.0	180.0	60.0	0.0	0.0	0.0	60.0
Whitefly	0.0	360.0	348.0	216.0	154.0	45.0	187.1
Epilachna beetle	0.0	48.0	48.0	0.0	0.0	0.0	16.0
Green stink bug	0.0	0.0	18.0	0.0	0.0	0.0	3.0
Hairy caterpillar	0.0	42.0	30.0	24.0	0.0	0.0	16.0
Jassid	0.0	348.0	302.0	176.0	102.0	0.0	154.6
Stem fly	0.0	30.0	32.0	24.0	0.0	0.0	14.3
Thrips	0.0	0.0	132.0	264.0	198.0	0.0	99.0
Pod borer complex	0.0	0.0	0.0	0.0	228.0	342.0	95.0

fly, thrips and pod borer complex was 9.0, 10.0, 60.0, 187.1, 16.0, 3.0, 16.0, 154.6, 14.3, 99.0 and 95.0, respectively in six observations during the month of April to June.

Diversity indices of the insect pests of mung bean

The abundance, richness and diversity of the insect pests of mung bean are presented in Table 4. The abundance of insect pests was the maximum (94.9±6.1) during the mid-April, followed by early May (89.8±5.8). The lowest abundance was found at the early growing period of the crop during the beginning of April (16.4±1.3), followed by mid-June (35.1±2.8). The abundance during mid-May to early June was 64.0±4.7 to 62.0±4.0, respectively. The richness of the insect pests was the maximum (1.2±0.1) during early May followed by mid-April (1.0±0.0). The lowest richness of the insect pests was found at the end of growing season during the mid-June (0.2±0.0) followed by early April (0.4±0.0), early June (0.5±0.0) and mid-May (0.5±0.0). The diversity of the insects was the maximum (1.7±0.1) during early May followed by mid-April (1.5±0.1), mid-May (1.3±0.0) and early June (1.0±0.0) while the lowest diversity was found during the mid-June (0.3±0.0) followed by early April (0.9±0.0).

Data expressed as mean ± SE. Means of the pests are taken from six observation dates. Data expressed as mean ±SE. Means within a row followed by same letter(s) are not significantly different according to Tukey HSD posthoc statistic at < 0.05.

Table 4. The average abundance, richness and diversity of insect pests in mung bean field (BU Mung-4) during Kharif-1 season at Gazipur, Bangladesh

Observation days	Abundance	Richness	Diversity
01 April	16.4±1.3d	0.4±0.0ab	0.9±0.0ab
15 April	94.9±6.1a	1.0±0.0a	1.5±0.1a
01 May	89.8±5.8a	1.2±0.1a	1.7±0.1a
15 May	64.0±4.7b	0.6±0.0ab	1.3±0.0a
01 June	62.0±4.0b	0.5±0.0ab	1.0±0.0ab
15 June	35.1±2.8c	0.2±0.0b	0.3±0.0b
CV (%)	11.34	14.74	7.28

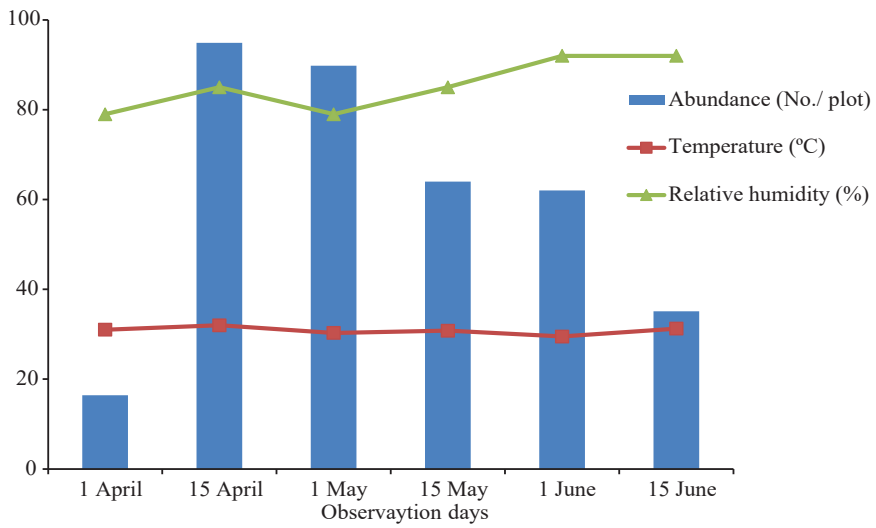

Fig. 1. Mean abundance of insect pests on mung bean in relation to temperature and relative humidity during Kharif-1 season at Gazipur, Bangladesh.

The mean abundance of insect pests on mung bean during Kharif-1 season 2021 in relation to existing temperature (ºC) and relative humidity (%) is presented in Figure 1. The abundance did not show any change in relation to temperature and relative humidity but influenced only by the growing stages of the crop.

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