

ABUNDANCE AND FLUCTUATION PATTERNS OF INSECT PESTS IN COUNTRY BEAN

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(Available online at www.jsau.com.bd)

Abstract

A field study was conducted to assess the population abundance and fluctuation pattern of major insect pests of country bean under natural condition. The research was done in the farm field of the Department of Entomology, Sylhet Agricultural University, during summer and winter seasons of 2017-2018. Five insect species were found, among them aphid (*Aphis craccivora* Koch), pod borer (*Maruca testulalis* G.) and epilachna beetle (*Epilachna dodecastigma*) were recorded in both seasons and shoot borer (*Acrobasis caryae*) and field cricket (*Brachytrypes portentosus*) were found in winter and summer season, respectively. The highest number of accumulated populations of aphid was 408.74 and 205.89, pod borer was 249.99 and 95.45 and epilachna beetle was 57.69 and 43.5 plot⁻¹ in winter and summer season, respectively. The relative abundances of aphid were 55.58% and 59.24%; Pod borer was 33.92% and 27.46; Epilachna beetle was 7.76% and 12.42% in winter and summer country bean field, respectively. The major insect pest of bean aphid incidence varied among the vegetative, flowering and fruiting stages which were 120 and 85, 150 and 74 and 135 and 65 in winter and summer country bean plot⁻¹, respectively. Conversely, other major pest of country bean was pod borer mainly infesting flowering and fruiting stages and number was varied 15 and 13 and 235 and 85 in winter and summer, respectively plot⁻¹. Aphid and pod borer were found as major pests and field cricket, epilachna beetle and shoot borer were found as minor pest in country bean agroecosystem.

Keywords: *Lablab purpureus*, insect pest, natural conditions.

Introduction

The country bean (*Lablab purpureus* Lin.) is commonly known as “sheem” in Bangladesh. It is a most important leguminous crop in Bangladesh and grown in a significant acreage after brinjal and tomato. It is an income generating crop with year-round production of about 40,992 metric tons from 88,581 ha's of land (BBS, 2010). This crop is also important for its atmospheric nitrogen fixation (Karla, 2009). The fresh pods and green seeds are eaten after boil or used in curries. Mature seeds are used as pulse, often as soup. Mature seeds are occasionally sun-dried and stored for use as vegetables. But its production is hampered due to attack of a number of insect pests. Among them, bean aphid (*Aphis craccivora* Koch) and bean pod borer (*Maruca testulalis* Geyer), cause severe damage to country bean. The bean aphid, *A. craccivora* Koch is the most serious pest of bean plants from seedling to pod bearing stage, causing considerable yield losses and an important limiting factor in the cultivation of country bean (Malik *et al.*, 1988). Aphid causes damage directly by sucking cell sap of plant and indirectly by transmitting several viral diseases (Mckinlay *et al.*, 1992). Both the nymphs and adults of bean aphid cause injury by sucking sap from flowers, buds, pods and tender shoots of the plants and reduce the vitality of the bean and leguminous crops (Thakur *et al.*, 1984; Shrivastava and Singh, 1986). Bean pod borer is able to establish itself from vegetative to reproductive stage of country bean. At the early stage of plant growth, the bean pod borer, attack the crop making clusters of leaves, tendrils and young shoots of the plant and later at flowering and pod setting stages of plants the insect feeds internally (Karim, 1993). In Bangladesh, country bean is usually grown in winter. But recently, a number of photo-insensitive and summer varieties are developed, which help to promote the cultivation of country beans year-round including summer.

Country bean is grown in Dhaka, Jashore, Cumilla, Noakhali and Chattogram intensively but for the last ten years it has been extended to Khulna and Barishal regions (Aditya, 1990). Insect pest's community is severely influenced by ecological factors and their abundance varies geographical region to region and season to season. Considering the above facts, the present research was conducted to assess the population abundance and fluctuation pattern of insect pests in country bean field.

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Materials and Methods

The experiment was conducted at the field of Entomology Department in Sylhet Agricultural University, Sylhet, Bangladesh, which is situated in 1°54'07"E longitude and 24°54'33"N/24.909221° N and 91.901986°E latitude at an altitude of 9 meter above the sea level. The field experiment was set up on the medium high land of the experimental field. The land was prepared by spade and stubble, weeds were removed. The experiment was laid out in a Randomized Complete Block Design (RCBD) with three replications. The unit plot size was 3.0 m × 2.0 m accommodating single row and three pits per bed. Plant spacing was 1 m and 3 pits were prepared for seedling transplantation. Fifteen days old seedlings were transplanted in the well-prepared experimental plots. A total of 3 seedlings were planted in 1pit @ 9 seedlings plot⁻¹ and recommended doses of fertilizers were applied according to Rashid (1999). Seed of the varieties BARI sheem 1, BARI sheem 6, Goalgadda sheem and IPSA sheem 2 were used in winter season and seed of the varieties Sikribi sheem-1, Sikribi sheem-2, SB-003 and IPSA sheem 2 were used in summer season.

Arthropods data were collected by visual searching method. All of the 9 plants of each plot carefully observed for the identification of attacking insect pests. In every stage (vegetative, flowering and reproductive) every part of each plant viz. lower, middle and higher part four leaves was selected. The data were assembled over the season and average was calculated to provide an overall mean density plot⁻¹. The population density of each insect was expressed as number of individuals per 12 leaves of the plant. The data were collected at seven days interval throughout the both cropping seasons.

Observation of bean aphid; the top 10 cm apical twigs of 5 randomly selected inflorescence of selected plants were cut and brought to the laboratory in bags separately for counting the number of aphids' plant⁻¹ and also 5 randomly aphid infested pod of selected plants was collected by hand picking for counting of aphid plant⁻¹. The aphids were removed from the infested plant parts with the help of a soft camel hair brush and placed on a piece of white paper. Then the number of aphids was counted with the help of a magnifying glass and tally counter. The infested twigs and inflorescence were checked carefully. So that, single aphid could not escape at the time of counting.

Borer infested flowers; pods at each harvest were counted and tagged. The data were also recorded on the number of infested flowers, pods removed instead of tagging. Then larvae were counted using hand magnifying glass and calculated as plant⁻¹.

Relative abundance is the percent composition of an organism of a particular kind relative to the total number of organisms in the area (Angelo and Canencia, 2016). Relative abundance was calculated:

$$\text{Relative abundance} = \frac{\text{Total no. of each species}}{\text{Total no. of all species}} \times 100$$

Data were analyzed with R software (R Core Team, 2016). The data recorded on different parameters were subjected to analysis of variance (ANOVA) and the means were separated by Duncan Multiple Range Test (DMRT) at 5 % level of significance

Result and Discussion

Abundance of insect pests

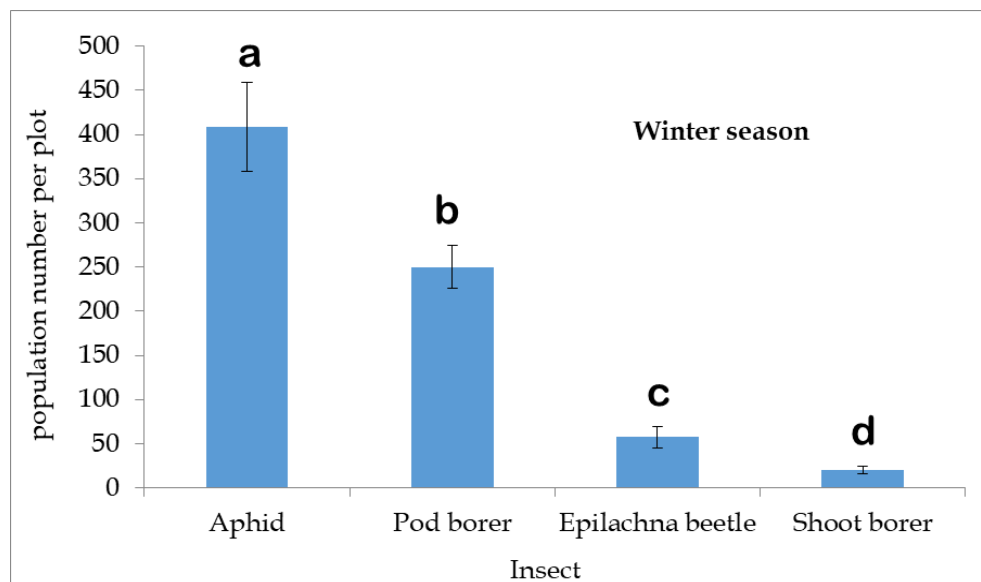
In year-round observation; five species of insect pests were found in country bean field. Among them three major pests were aphid (*Aphis craccivora*), pod borer (*Maruca testulalis*) and shoot borer (*Acrobasis caryae*) and two minor pests were epilachna beetle (*Epilachna dodecastigma*) and field cricket (*Brachytrypes portentosus*) (Table 1). Aphid is the insect of Hemiptera order and they attack during all stages of country bean. Pod borer and shoot borer are the member of Lepidoptera order, pod borer mainly attack in flower and pod in reproductive stage and shoot borer mainly damage the shoot and an orthopteran insect is field cricket which damage only in seedling stage. Phytophagous coleopteran insect is epilachna beetle which was found in vegetative to reproductive stages in country bean field. The current finding was supported by Begum (1993) who observed many pests attacking country bean field in Bangladesh among them, aphid was the most important and others were beetle, pod borer and mites.

Table 1. List of recorded insect pests

English Name	Scientific Name	Family	Order	Types of pests	Site of damage
Aphids	<i>Aphis craccivora</i>	Aphididae	Hemiptera	Major	Leaf, shoot, flower bud and fruit
Shoot borer	<i>Acrobasis caryae</i>	Pyrilidae	Lepidoptera	Major	Shoot
Pod borer	<i>Maruca testulalis</i>	Crambidae	Lepidoptera	Major	Flower bud & Pod
Epilachna Beetle	<i>Epilachna dodecastigma</i>	Coccinellidae	Coleoptera	Minor	Leaf
Field cricket	<i>Brachytrypes portentosus</i>	Gryllidae	Orthopteran	Minor	Seedling

Total population density

The individual population of different insect pests in country bean field was significantly different from each other. Aphid was most abundantly occurred pest species during the both seasons and the second highest was pod borer which was followed by epilachna beetle (Figure 1 and 2). The accumulated population density of insect pests in country bean agro ecosystem during winter in 2017-2018, was declining rank order of aphid (408.74) > pod borer (249.99) > epilachna beetle (57.69) > shoot borer (20.66) (Figure 1). Similarly, the accumulated population density of summer season the rank order was aphid (205.89) > pod borer (95.45) > epilachna beetle (43.5) > field cricket (3.0) (Figure 2). The finding of Sahoo and Senapati (2000) was almost similar to the present study for the population of pod borer.

**Fig. 1. Accumulated population density of insect pest species per plot in winter season**

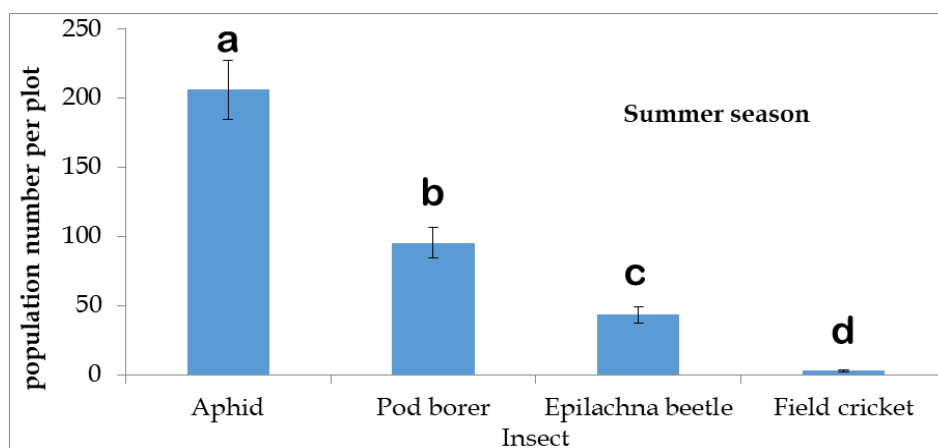


Fig. 2. Accumulated population density of insect pest species per plot in summer season

Relative abundance

The relative abundance of insect pests in country bean agro ecosystem during winter season 2017-2018 was in the order of aphid (55.58%) > pod borer (33.92%) > epilachna beetle (7.76%) > shoot borer (2.73%). Similarly, the relative abundance of insect pests of summer country bean was ranked as aphid (59.24%) > pod borer (27.46%) > epilachna beetle (12.42%) > field cricket (0.87%) (Table 2). Sing and Allen (1980) reported the similar results in relative abundance of pod borer.

Table 2. Relative abundance of insect pest in country bean plot during winter and summer seasons

Winter season		Summer season	
Insect species	Relative abundance (%)	Insect species	Relative abundance (%)
Aphid	55.58	Aphid	59.24
Epilachna Beetle	7.76	Epilachna Beetle	12.42
Shoot borer	2.73	Field cricket	0.87
Pod borer	33.92	Pod borer	27.46

Fluctuation pattern of different arthropods in country bean agro ecosystem in winter and summer seasons

The population of the different insect pest species significantly varied among vegetative stage, flowering and reproductive stages of the country bean.

In winter

For aphid population; the highest number of aphid (150) was recorded in flowering stage, which was followed by reproductive stage (135) and the lowest number aphid was found in vegetative stage (120) (Figure 3). For the population of epilachna beetles and shoot borer; the highest population of epilachna beetle was found in flowering stage and the lowest in vegetative stage that was a declining rank of order of the number of epilachna beetles as flowering stage (31) > reproductive stage (25) > vegetative stage (24). In case of the number of shoot borer the highest number was found in vegetative stage (12) and it was followed by flowering stage (7), and the lowest number shoot borer was recorded in reproductive stage (1) in winter season. In flowering stage, the huge number pod borer (235) was recorded for which it was considered as the key pest of country bean and it was followed by flowering stage (15) but any pod borer was not found in vegetative stage in winter season (Figure 3).

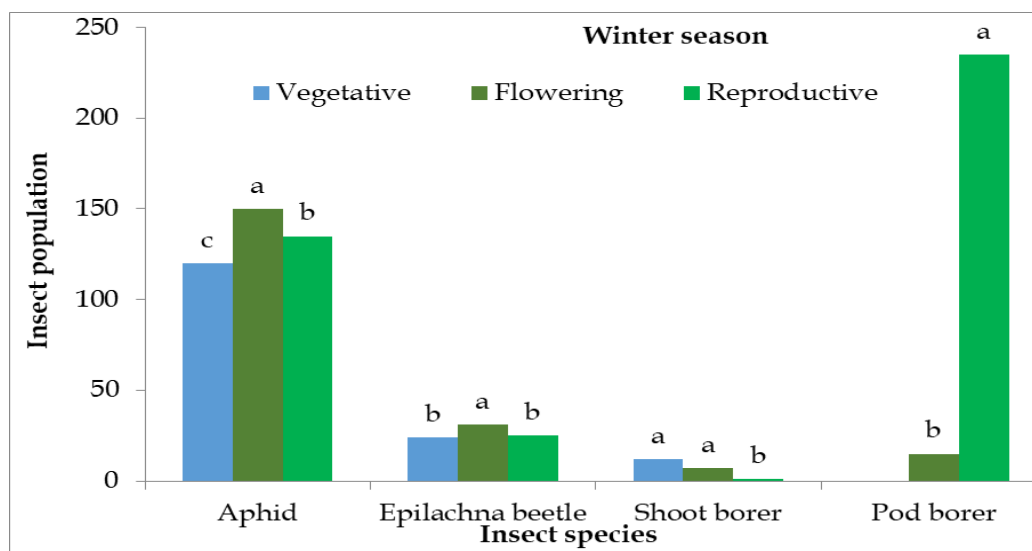


Fig. 3. Fluctuation pattern of insect pest species in different stages of country bean field in winter season

In summer

For aphid population; the highest number of aphids were observed in vegetative stage (85), which was followed by the flowering stage (74) and reproductive stage (65), respectively. For epilachna beetle; the highest number of beetles were found in vegetative stage (30), followed by flowering stage (29) and reproductive stage (11). For field cricket and pod borer; field cricket was found only in the seedling stage (3). The highest pod borer was found in reproductive stage (85) and the lowest number was recorded in flowering stage (13) (Figure 4). The identical result was found by Veeranna *et al.*, (1997) who observed that the infestation on terminal shoots, flower buds and pod during rabi season (1992) and in summer (1993), on terminal shoots, flower buds and pods as well as infestation in kharif (1993) on terminal shoots, flower buds and pods.

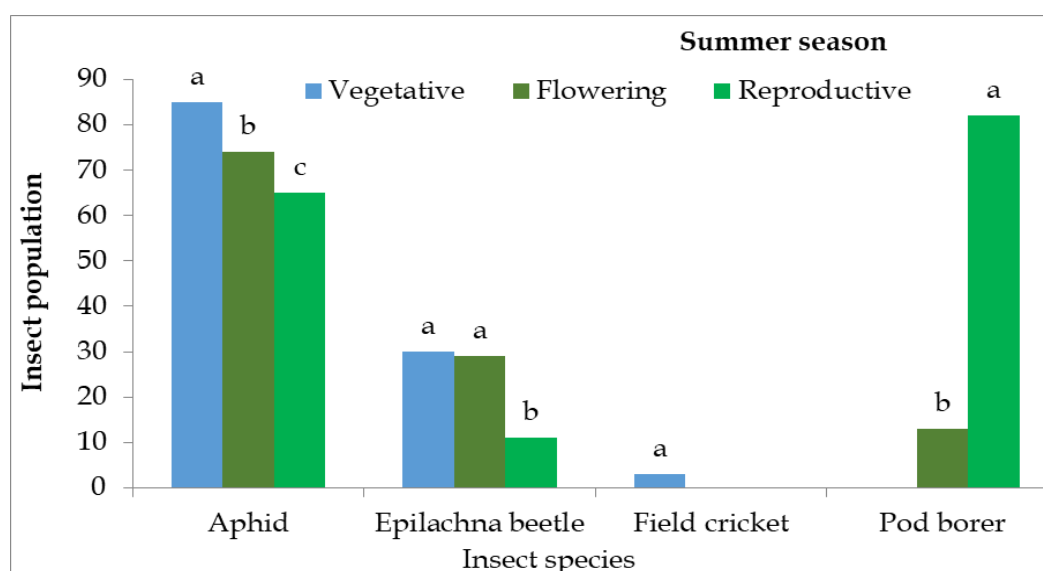


Fig. 4. Fluctuation pattern of insect pest species in different stages of country bean field in summer season

The present study represents that in whole year observation, five insect pest species were found in country bean agro ecosystem. Aphid, pod borer and epilachna beetle were common pest against country bean throughout the two seasons. Bean aphid incidence varied in almost all the growth stages of bean plant (vegetative, flowering and fruiting). Pod borer mainly infested in flowering and fruiting stages. Aphid and pod borer were acting as major pests and field cricket, epilachna beetle and shoot borer were playing as minor pest in country bean agro ecosystem.

Acknowledgement

The first author is indebted to the authority of the Ministry of Science and Technology of the Government of the People's Republic of Bangladesh for giving him the financial supports as National Science and Technology (NST) fellowship which helped to complete the author's higher studies and research works smoothly and fruitfully.

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