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Prevalence of insect pests and their effects on growth and yield of mungbean grown under multipurpose trees

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Abstract: Insect infestation and yield performance of mungbean in association with Akashmoni (*Acacia auriculiformis*), Jhau (*Casuarina equisetifolia*), Sissoo (*Dalbergia sissoo),* and in the open field condition were studied during January to May 2008 in the field laboratory of Agroforestry Department, Bangladesh Agricultural University (BAU), Mymensingh. Twelve different insect species were identified in the mungbean field grown in association with three MPTs of which two were natural enemies i. e. insect predator. Highest insect population was recorded under Dalbergia sissoo (347) followed by Akashmoni (251), open field (159) and Jhau (141), respectively. Severe infestation was recorded in the vegetative stage followed by Pod maturation, pod initiation, flowering and pod filling stages, respectively. Highest yield was under Jhau tree (1.23 t ha^{-1}) which was statistically similar with yield in the open field (1.21 t ha^{-1}). Lowest yield was recorded under Sissoo tree (0.78 t ha^{-1}) which was statistically similar with yield under Akashmoni trees (0.89 t ha^{-1}). Compared with recommended mungbean yield (BINA, 2006), 36%, 12%, 46% and 14% yield reduced under Akashmoni tree, Jhau tree, Sissoo tree and in the open field condition, respectively.
Key words: MPTs, Agroforesry, mungbean, insect pests, growth and yield

Introduction

Agroforestry is a production system which has both productive and protective benefits and also improves socioeconomic condition. Multipurpose Trees (MPTs) is the essential component of groforestry where suitable crop component were inter cropped. Akashmoni (*Acacia auriculiformis*), Jhau (*Casuarina equisetifolia*) and Sissoo (*Dalbergia sissoo*) are three important MPTs. All of these three MPTs are suitable for agroforestry production systems.

Mungbean (*Vigna radiata* L.) is one of the major pulse crops grown in Bangladesh. The crop is also known as green gram, golden gram, sonamung, mungbean but commonly as 'Moog' in Bangladesh. It is an excellent source of easily digestible protein which complements the stable rich diet in the country. Mungbean seeds contain 51% Carbohydrate, 26% Protein, 10% Moisture, 4% Minerals and 3% Vitamins (Kaul, 1982). Hence, from nutritional point of view, mungbean is the best of all pulses (Khan *et al*., 1982).

Many sorts of insects occur in mungbean field. Among them, some are harmful or economical, but some can cause damage by reducing yield and even total crop failure if can't be managed properly. Yield potential of mungbean is generally lower than that of other grain legumes in Bangladesh. Various causes are responsible for lower yield of mungbean in Bangladesh, insect pests infestation one of them. There is an ample scope for increasing the yield of mungbean with improved insect pest management practices. Mungbean is very much susceptible to insect attack from seedling to maturation stage. Scanty information is available about the insects associated with Akashmoni, Jhau and Sissoo trees that are gaining economic importance as components of agroforestry systems. Many factors govern insect pest intensity in agroforestry and each factor may have a different effect on pests at different times under different situation. The net outcome will be the sum of favorable and unfavorable effects on pests. Host range, and biological control of insects are the most important factors in agroforestry production system. So, identification of insects pest and observation of their infestation would be helpful for mungbean based agroforestry production systems. This study investigates the insect pests prevalence, severity of infestation and effects of infestation on the yield contributing characters and yield performance of mungbean in association with different MPTs.

Materials and Methods

An experiment was conducted to investigate the insect pests and their effect on the growth yield of mungbean (cv. BINA Mung-5) grown in association with three MPTs during January to May 2008. Three multipurpose trees (MPTs) were Akashmoni (*Acacia auriculiformis*), Jhau (*Casuarina equisetifolia*) and Sissoo (*Dalbergia sissoo*) insect infestation and yield performance of mungbean was observed under these three MPTs and these were the treatments of this study. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 4 replications. The treatments were randomly distributed within the block separately for each species. Treatments were as: T_1- insect infestation and yield performance of mungbean under Akashmoni; T_2- insect infestation and yield performance of mungbean under Jhau; T_3- insect infestation and yield performance of mungbean under Sissoo and T_4- insect infestation and yield performance of mungbean in the open field condition. Except insect control, all necessary intercultural operations were done when required. The common insect pests of mungbean from the different treatments were sampled at different growth stages of mungbean. Sampling stages were vegetative, flowering, pod initiation, pod filling and pod maturation. Sampled insects were identified and confirmed with the help of specified person of the Department of Entomology, BAU, Mymensingh. Infested leaves of mungbean plants were counted only in the vegetative stage. Infested leaf counting was started from 30 days after sowing (DAS), every five days interval infested leaves was counted and continued upto 55 DAS (i. e., 30, 35, 40, 45, 50 and 55 DAS). Plant height (cm) was measured only just before the harvesting by meter scale. Number of pods per plants was counted after the pod maturation. yield of mungbean as grain were determined for each individual plots (4 m x 2.5 m i. e.,

10 m^2) and then converted to tha^{-1}. Finally treatments yields were compared with the recommended yield (BINA, 2006) of BINA mung-5. The collected data were analyzed statistically following the analysis of variance (ANOVA) technique and the mean differences were recorded by Duncan's Multiple Range Test (DMRT) using the statistical computer package programme, MSTAT (Russell, 1986).

Results and Discussion

Species composition of insect pests in mungbean field

In the experimental field, mungbean was infested by various insect pests. All the infested insects were identified in the laboratory of Entomology Department, BAU, Mymensingh. Total twelve (12) insect species were identified in the experimental field (Table 1) and these were Mungbean hairy caterpillar (*Spilaractia obliqua*), Mungbean leaf roller (*Omiodes indicata*), Cutworm (*Agrotis ipsilon*), Black leaf beetle (*Cerotoma trifurcata*), Mungbean semilooper (*Pseudoplusia includens*), Stink bug (*Nezara viridula*), Short horned grasshopper (*Hieroglyphus banian),* Spotted leaf beetle (*Monolepta nigroapicata*), Brown plant hopper (*Nilaparvata lugens*), and Mungbean pod borer (*Maruca testulalis*). Among this twelve insects species two were natural enemies, viz. Lady bird beetle and Spider. Natural enemies are economically beneficial because they are insect predator.

Table 1. Insect pests and natural enemies recorded in the mungbean field

Common name	Scientific name	Family	Order
A. Insect pest			
Mungbean hairy caterpillar	*Spilaractia obliqua*	Arctiidae	Lepidoptera
Mungbean leaf roller	*Omiodes indicata*	Pyralidae	Lepidoptera
Cutworm	*Agrotis ipsilon*	Noctuidae	Lepidoptera
Black leaf beetle	*Cerotoma trifurcate*	Chrysomelidae	Coleoptera
Mungbean semilooper	*Pseudoplusia includens*	Noctuidae	Lepidoptera
Stink bug	*Nezara viridula*	Pentatomidae	Hemiptera
Short horned grasshopper	*Hieroglyphus banian*	Acrididae	Orthoptera
Spotted leaf beetle	*Monolepta nigroapicata*	Chrysomelidae	Coleoptera
Brown plant hopper	*Nilaparvata lugens*	Cicadellidae	Homoptera
Mungbean pod borer	*Maruca testulalis*	Pyralidae	Lepidoptera
B. Natural enemies			
Lady bird beetle	*Micraspis spp.*	Coccinellidae	Coleoptera
Spider	*Oxyopes sp*.	Lycosidae	Aranae

Insect pests in different treatments at different growth stages of mungbean:

898 insects population were identified in all treatments of which highest (347) number of insects recoded under Sissoo trees followed by Akashmoni (251), open field (159) and Jhau (141), respectively (Fig. 1). Highest number of insects population were recorded in the vegetative stage followed by Pod maturation, pod initiation, flowering and pod filling stages, respectively (Fig. 2). Both Vegetative and Pod maturation stages number of insects increases as the order of Jhau < Open field < Akashmoni < Sissoo. Among the all treatments number of insects was almost similar and in the flowering and pod initiation and in the pod filling stage insects infestation was lowest (Fig. 1). These results indicate that most of the insect infestation occurred in the vegetation stage then gradually decrease upto pod filling stage and again slowly increase in the pod maturation stage. Mizutani *et al*. (2002) reported highest bean bug infestation in the vegetation stage of pulse crops. Shepard *et al*. (1999) also found highest number of insect population in the vegetation stage of soybean. Among the all treatments highest number of insects was observed under the Sissoo tree, medium infestation found under Akashmoni tree and lowest under Jhau which were almost similar with Open field condition (Fig. 1). Probable reasons for highest insects population under the Sissoo tree may be Sissoo is the host of identified insects, medium infestation under Akashmoni probably due to dense canopy and lowest insect population under Jhau may be due to it is act biological insect controlling agent (by birds).

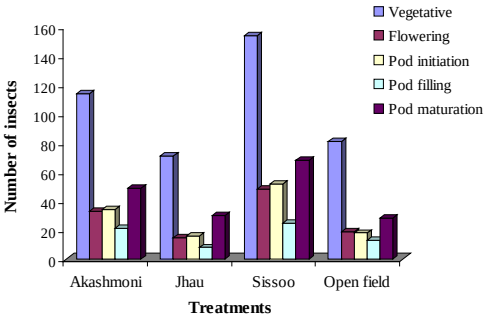

Fig. 1. Number of insect pests on mungbean under different treatments

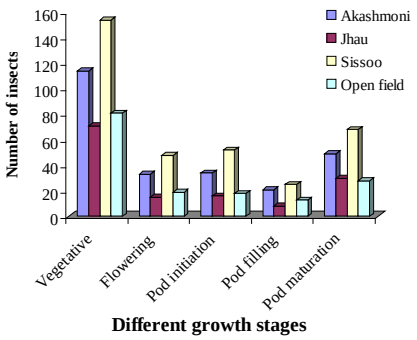

Fig. 2. Number of insect pests in the different growth stages of mungbean under different treatments

Infested leaves at vegetative stage of mungbean in different treatments

Most of the insects were observed in the vegetative of the mungbean. Flowering and pod formation largely depends on this stage. So, infestation in the vegetative stage of mungbean is more important than other stages. Due to above reasons leaves infested by different insects were recorded only in the vegetative of mungbean under Akashmoni, Jhau, Sissoo and open field condition. Significantly highest number of infested mugbean leaves per plant (2.01) was recorded under Sissoo trees upto 45 days after sowing (DAS) and second highest number of infested leaves per plant was observed under Akashmoni (1.90). Number of infested leaves per plant under Jhau (1.78) and in open field condition (1.82) was statistically similar (Table 2). Highest number of insect per plant also observed under Sissoo tree and followed by under Akashmoni, in the open field and under Jhau tree. So, it is clear number of infested leaves is directly correlated to Number of insects. After 45 DAS probably due to cutworm infestation this relationship was not exactly true.

Table 2. Infested leaves at vegetative stage of mungbean in different treatments

Treatment	Number of infested leaves plant^{-1}					
	30 DAS	**35 DAS**	**40 DAS**	**45 DAS**	**50 DAS**	**55 DAS**
Akashmoni (T_1)	1.45 c	1.65 b	1.73 b	1.90 b	1.74 a	1.71 b
Jhau (T_2)	1.51c	1.59 b	1.65 b	1.78 c	1.77 a	1.71 b
Sissoo (T_3)	1.76 a	1.84 a	1.97 a	2.01 a	1.81 a	1.97 a
Open field (T_4)	1.53 b	1.60 b	1.68 b	1.82 c	1.65 b	1.78 b
Level of Significance	**	*	**	*	*	**
CV (%)	2.63	5.64	5.41	3.00	3.17	3.29

In a column, figure having similar letter (s) or without letters do not differ significantly whereas figures bearing dissimilar letter (s) differ significantly as per DMRT.

** = Significant at 1% level of probability.

* = Significant at 5% level of probability.

Plant height and number of pods/plant of mungbean plants in different treatments

Significantly insect infestation and tree shade influenced the plant height and number of pods per plant of mungbean (Table 3). Highest average plant height (21.50 cm) was recorded under Akashmoni trees which was statistically similar with plant height under Jhau trees (20.06 cm) and lowest plant height observed under Sissoo tree (16.88 cm). Moderate plant height was observed in the open field condition (18.60 cm). Plant height lowest under Sissoo tree may be due to maximum insect infestation. Compared to open field tall plants were observed under Akashmoni and Jhau trees may be due to minimum insect infestation and shade influence. According to Hillman (1994) reduced light encouraged higher apical dominance resulting taller plants under shade condition. Average number of pods per plant was lowest under Sissoo tree (10.07) and highest number of pods per plant was found under Jhau trees (14.85) which were statistically similar with number of pods per plant in the open field condition (13.88). Moderate number of pods per plant was found under the Akashmoni tree (11.35, Table 3). Number of pods per plant lowest under Sissoo tree may be also due to maximum insect infestation.

Table 3. Plant height and number of pods/plant in the insect infested soybean plants in different treatments

Treatments	**Av. plant height (cm)**	**No. of pods plant^{-1}**
Under Akashmoni tree (T_1)	21.50a	11.35b
Under Jhau tree (T_2)	20.06a	14.85a
Under Sissoo tree (T_3)	16.88c	10.07c
Open field condition (T_4)	18.60b	13.88a
Level of Significance	**	**
CV (%)	2.43	4.57

In a column, figure having similar letter (s) or without letters do not differ significantly whereas figures bearing dissimilar letter (s) differ significantly as per DMRT.

** = Significant at 1% level of probability.

Effect of insect infestation tree shade on mungbean yield

Effect of insect infestation and tree shade influence was significant on the yield of mungbean in association with Akashmoni, Jhau, Sissoo trees and also in open field condition (Table 4). Highest yield

was found under Jhau tree (1.23 t ha^{-1}) which was statistically similar with yield in the open field (1.21 t ha^{-1}). Lowest yield was recorded under Sissoo tree (0.78 t ha^{-1}) which was statistically similar with yield under Akashmoni trees (0.89 t ha^{-1}, Table 4). Compared with recommended mungbean yield (BINA, 2006), 36%, 12%, 46% and 14% yield reduced under Akashmoni tree, Jhau tree, Sissoo tree and in the open field condition, respectively. Yield under Sissoo tree was lowest may be due to the cumulative effect of maximum insects infestation and tree shade effects. Ong *et al.* (1992) also reported shading by trees is responsible for poor yield of associated crops. Fourteen per cent yield reduction in the open field condition indicates insect infestation responsible for this yield reduction. Vicentini and Jimenez (1977) found 25% yield reduction by stink bug infestation in a group of pulse crops. Lowest yields reduction under Jhau tree (12%) probably due to lower shade cast by Jhau tree as well as Jhau tree keeps many birds which serves as biological insect controlling agent.

Table 4. Effect of insects infestation on yield of mungbean in association with Akashmoni, Jhau, Sissoo trees and open field condition

Treatments	Yield (t ha^{-1})	Recommended yield (t ha^{-1})
T_1	0.89 b	1.4 (BINA, 2006)
T_2	1.23a	
T_3	0.78c	
T_4	1.21 a	
Level of Significance	**	
CV (%)	5.43	

In a column, figure having similar letter (s) or without letters do not differ significantly whereas figures bearing dissimilar letter (s) differ significantly as per DMRT.
** = Significant at 1% level of probability.

In the present investigation, 'Sissoo and mungbean' based agroforestry production system were found susceptible to insect infestation; while 'Akashmoni and mungbean' based agroforestry production system moderately and 'Jhau and mungbean' and 'based agroforestry production system identified as more resistant to insect infestation. Therefore, mungbean may be cultivated in association with Jhau with minimum yield reduction due to insect-pests attack.

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