

INCIDENCE OF INSECT PESTS AND NATURAL ENEMIES IN DIFFERENT GROWTH STAGES OF SOYBEAN CROP (*Glycine max*)

MA Malek^{1*}, R Kamrunnaher², M Jabunnaher³, Lutfunnahar⁴, M Jahan⁵, KS Islam⁵ and M Asaduzzaman⁶

Present address

¹Senior Instructor, ATI, Ishurdi, Pabna ²Additional Agriculture Officer, Ishurdi, Pabna ³Senior Monitoring and Evaluation Officer, SPCB Project, DAE, Khamarbari, Dhaka ⁴Additional Agriculture Officer, Gouripur, Mymensingh ⁵Department of Entomology, BAU, Mymensingh and ⁶Dept. of Entomology, PSTU, Potuakhali

Correspondence*

malek_uao@yahoo.com

Accepted: 21 November, 2017

Abstract

A field experiment was conducted to determine the insect fauna associated with soybean plants at different growth stages at Agricultural Field Laboratory, Bangladesh Agriculture University, Mymensingh. A total of 20 insect species belonging to 6 orders and 13 families were recorded in the soybean crop field. The insect pests were abundant throughout the growth period. The natural enemies were also found throughout the crop growth period. Though only ten species of natural enemies were enlisted but many others were not included as quite few numbers of those species found scattered way. The number of insect fauna reached to highest peak at vegetative stage. The semi looper population relatively higher (15.29%) and the occurrence of ladybird beetle populations were frequent in every stages of growth and comparatively higher (43.48%) than that of other insect pests. Total 2145 numbers of insect individuals and 453 numbers of natural enemies were found at different growth stages of soybean crop. Both insect pest and natural enemies were most number observed at vegetative stage in soybean field. A total number of insect pests were 2145 at different crop growth stages in which 548 only at vegetative stage. A total number of natural enemies were 453 at different growth stages of soybean in which 197 found only at vegetative stage. Soybean semi looper, soybean hairy caterpillar, green stink bug were the most abundant in soybean field. Among the natural enemies two species of ladybird beetle, carabid beetle and two species of spiders were the most prevalent in soybean field. The insect, cutworm (0.49%) and natural enemies parasitic wasp (1.10%) were less abundant in soybean field.

Keywords: Growth stages, insect pests, natural enemies, abundance, soybean crop, *Glycine max*

Introduction

Soybean, *Glycine max* (L.) is one of the most important leguminous oil seed crops of great economic value, occupying an important position in the world trade. The cultivated soybean belongs to the family Leguminosae, sub-family Papilionaceae and the genus *Glycine*. It is a protein food, and oil seed, a fodder crop and is also used in industry for a number of purposes. *Glycine max* originated from China (Vivilov, 1951) with *Glycine max* is an probable progenitor. Although China is the centre of origin of soybean, the largest acreage with the highest production is in the USA. Bangladesh is self-sufficient neither in edible nor in industrial oil. As a result, a huge amount of foreign currency is being drained every year for importing oil of both categories. The people of Bangladesh are now adapted to use

soybean oil. In our country soybean could not become popular as a staple food item whole seed or split "dal". However, soybean seeds are used for preparing some food items, such as, soyabread, soya biscuits, soyachapati, soyaflour, soyakhichuri, soya-milk, soya-curd, soya-dal and roasted soybean snacks etc. Its milk is comparable to cow's milks, but it contains higher quality of specific nutrients (Smith, 1975). The statistical information regarding the acreage under soybean cultivation and production in Bangladesh is not available in organized forms. In fact, soybean was introduced in Bangladesh around 1942, but its cultivation did not expand satisfactorily. It is one of the leading oil seed crops of the world. As a good source of protein, unsaturated fatty acids, mineral like Ca and P including vitamin A, B, C and D, soybean can meet up different nutritional

needs (Rahman, 1982). The soybean seed contain about 42-45% protein 20-20% edible oil, provide around 60% of the world supply of vegetative protein and 30% of edible oil (Fehr, 1989). Hence it is referred as "the protein hope of the future" as well as the "miracle golden bean". Several insect pests attack this crop resulting in heavy reduction of yield of soybean. Insect population of economic importance includes looper, *Pseudoplusia includens* walker, a leaf roller, *Lamprosema indicata* Fb., different species of bugs and others which are observed in the soybean field causing serious damage to soybean crops by direct feeding as well as by transmitting various viral diseases (Daugerty, 1967). The soybean may be grown throughout the year. Soybean is very much susceptible to insect attack from seedling to mature stage. All parts of the plant including plant leaves, stems and pods are subjected to attack by different species of insects in Bangladesh. The relative abundance of different species of soybean insect is not identical in all seasons. The severeness of damage is related with the abundance of different insect and natural enemies. From seed germination to harvest, a soybean crop is under constant attack from a variety of insects. Soybean plants can compensate for substantial levels of insect injury. Losses depend greatly on the stage of plant growth, so pest economic thresholds vary with the stage of plant development. The information on soybean pest is inadequate in Bangladesh and the pests are not enlisted properly with taxonomical position. Therefore, present study was under taken to the insect fauna which are common in soybean crop field. The objectives of this present study are: (i) to identify the different insect species and their natural enemies and (ii) to find out the relation between different growth stage and pest status of soybean crops.

Materials and Methods

The study was carried at the Agricultural Field Laboratory, Plot No. 45(1), Bangladesh Agricultural University, Mymensingh. The experimental plots were prepared with proper ploughing and laddering using fertilizers. The variety of soybean PB-1 was used. Intercultural operations were performed as and when necessary. Irrigation and insecticide was not applied in the experimental fields. Fertilizers

were applied at the rate of 9, 10, 55, 10.5 and 5.5 kg of NPKSZn respectively per hectare. All fertilizers except half portion of urea were applied at the time of final land preparation. The remaining half of the urea was applied as top dressing at vegetative stage.

Collection of insect and natural enemies and their identification

The number of insect and natural enemies was collected from seedling to maturing stage of soybean using sweep net. Sweeping was done from the plant canopy level including the interspaces between plants as well as back and forth over the soybean field as far as possible. Ten complete sweeps were taken to collect the insect pests and their natural enemies. The following stage including seedling, vegetative, flowering, pod initiation, pod filling and maturing stage were considered as sampling period. Sampling was done during morning and afternoon hours at all study fields on all sampling dates. The following equipments were used during collection and preservation of sample: Sweepnet, plastic container, poly bag, brush, petridish, pencil, scale, forceps, alcohol, formalin solution, bamboo stick and paper sheet etc. The sampling was carried out with help of visual eye, ground sheet method plant shaking method and sweep net at different stages of soybean plants. The ground sheet technique is primarily used to survey for stink bugs and caterpillars. This method uses an off white paper sheet measuring 36 x 42 inches. The sheet was placed between the two rows and vigorously plants were shaken all the plants with that area. The sweep net method having a standard one inch diameter sweep net was used for sampling. TI consecutive (180 degree) sweeps were made while walking through the fields, swinging the net from side to side across the row with each step. At vegetative stage three times and maturing stage two times sampling was done. For observation and counting insect pest and natural enemies 10 areas were select, randomly which has 4 m x 2.5 m. This area was bounded by nylon ropes with the help of bamboo stick in 4 crners of the selected area. At seedling stage collection and sampling was started on 23th March 2005 followed by vegetative stages on 30th March 2005, flowering stage on 20th April 2005, panicle initiation stage on 27th April 2005, pod filling stage, 03th May

2005, and maturing stage on 12th May 2005. The samples were kept in bag with marking and brought back to the laboratory. The insects we collected from the field identified in the laboratory on the basis of their characters (Linsenmaier, 1998; Hill, 1975; Nair, 1975, Atwal, 1976 and Vander, 1995; Shepard *et al.*, 1999).

Relative abundance of arthropods

Relative abundance of insect pests and natural enemies was calculated using the following formula:

$$\text{Relative abundance (\%)} = \frac{\text{Total number of each species}}{\text{Total number of all species}} \times 100$$

Results and Discussion

Incidence of insect pest and natural enemies in soybean field

The insect pests and natural enemies found in soybean crop with their order and family are presented in Table 1 and Table 2 respectively. Twenty soybean insect pests viz. soybean semi looper, *Psuedoplusia includens*; soybean pod borer, *Etiella zinckenella*; soybean pod bug, *Ripton linearis*; soybean hairy caterpillar, *Spilarctia obliqui*; soybean leaf roller, *Omiodes indicata*; green leafhopper, *Nephotettix virescens*; white leaf hopper, *Cofana spp.*; soybean aphid, *Aphis fabae*; Flea beetle *Monolepta Signata*; Green stink bug, *Nezara viridu*; legume shield bug, *Piezodorus hybneri*; spotted leaf beetle, *Monolepta nigroapicata*; green jassid, *Empoasca sp.*; short homed grasshopper, *Hieroglyphus banian*; long homed grasshopper, *Ucirtus spp.*; black leaf beetle, *Cerotoma trifurca*; cutworm, *Agrotis ipsilon*; brown planthopper, *Nilaparvata lugens*; soybean stem fly, *Melanagromyza sojae*; stripped leaf beetle, *Acalymi vittatum* and natural enemies species namely, lady bird beetle, *Micraspis spp.*; carabid beetle, *Ophior interstitialis*; preying mantids, *Mantis religion*; ground beetle, *Calleida sp.*; predatory crick, *Metioche sp.*; polistes wasp, *Polistes sp.*; Spider *liumnina* and lynx spider, *Siler sp.*; *Oxyopes*; braconid parasitoid, *Glyptapanteles phytometraei*; parasitic wasp, *Microplitis similis*; and braconid wasp, *Opius sp.*

Abundance of insect pest in soybean field at different growth stages

Total 2145 number of insect pests was found in the soybean field (Table 1). From the present study it was confirmed that semi looper reached

the highest population (328) compared to the other insect species at different growth stages of soybean. This insect attacked more in vegetative stages. Pod borer and stink bugs are the most economically important because they feed directly on pods. Saha and Sharia (1983) compiles a list of 32 insect among them soybean hairy caterpillar (*S. obliqua*) and green stink bug (*N. viridula*) are most devastating. Soybean hairy caterpillar was the second highest population (233) in soybean field (Table I). This insect was found all the stages of soybean except seedling stages. According to Adamu *et al.* (1999) green stink bug is most abundant in reproductive phase of soybean. During the study period it was observed that this insect attack in pod initiation, pod filling and maturing stage. No attack was found in seedling, vegetative and flowering stage. Number of green stink bug in soybean field was 80. Bundy and Mcpherson (2008) also observed the more abundance insect in soybean field is *N. viridula*. Soybean pod borer and soybean pod bug also attacked only reproductive stage. No infestation was found in vegetative stage.

The number of population of soybean pod borer and soybean pod bug 124 and 126 respectively (Table I). Soybean leaf roller was observed that insect attacked more in vegetative stage. Total number of soybean leaf roller was 210 (Table 1). The number of insect pest in different growth stages of soybean viz. in seedling stages (91) is followed by vegetative stages (548), flowering stages (298), pod initiation stage (321), pod filling stages (384), maturing stages (503) (Fig. 1). On the other hand, total number of natural enemies in different growth stages of soybean viz. in seedling stages (32), followed by vegetative stages' (224), flowering stages (73), pod initiation stages (41), pod filling stages (28) and maturing stages (55) (Fig. 1). The highest number of insect pest in vegetative stage (548) and natural enemies in vegetative stages (224) respectively (Fig. 1).

Short homed and long homed grasshoppers attack at the same stage of soybean crop but more abundant the short homed grasshopper. These insects were not found in seedling stage but abundant at maturity stage. Total number of short homed grasshopper and long homed grasshopper found at different growth stages of soybean were 43 and 27 respectively (Table 1). Green and white leafhoppers were found in all

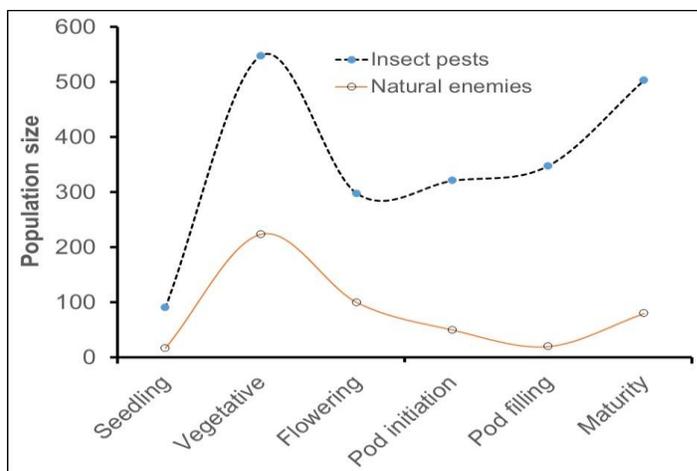


Fig. 1. Growth stage of crop influences the abundance of insect pests and natural enemies in soybean (*Glyxine max*) field

the stages except seedling stage. The population of two hoppers were distributed almost in similar pattern. The number of green leaf hopper and white leaf hopper were 233 and 148 respectively (Table 1). Soybean aphid is another important pest of soybean. More, number soybean aphid was found in seedling and vegetative stages. Total number of soybean aphid was found in different growth stage of soybean was 121 (Table 1). The insect brown plant hopper was found in seedling, vegetative and flowering stage of soybean and total number of brown plant hopper was 12. The abundance of spotted leaf beetle was medium in soybean field. The insect attacked all the stages soybean but more in vegetative stages. The population number of spotted leaf beetle was 93. The insect cutworm was found only seedling and vegetative stages of soybean but higher abundance was observed at seedling stage. Larvae girdle soybean seedlings belt the cotyledons, reducing plants stand. Larvae may

feed on foliage. Only 8 number of cutworm was found in soybean field (Table 1). Soybean stem fly was found in abundance at vegetative stage. Total 145 number of soybean stem fly was found in different growth stages soybean (Table 1). There was less abundance stripped leaf beetle in soybean field. Only 26 number of stripped leaf beetle was found in soybean field (Table 1). Green jassid is one of the important pest soybean. More number of green jassid was found in vegetative stage. Total number of green jar population was 161 at different growth stages soybean (Table 1). It was found that legume bug attack only

reproductive stage of soybean. Sixty six (66) number of this insect was found (Table 1). The insect flea beetle was found in all the growing stages of soybean except seedling stage. The insect was more abundant in vegetative stage. Total number of this insect was 78 at different growth stages of soybean (Table 1).

Abundance of natural enemies in different growth stages of soybean crop

Total number of natural enemies were 453 at different growth stages of soybean. Among these natural enemies, the lady bird beetle was most abundant in soybean field. There two species of lady bird beetle (*Micraspis spp.*, *Menochelus sexmaculatus*) were found in soybean crop. Total number of lady bird beetle was 197 at different growth stages of soybean. Lady bird beetle was more abundant in vegetative stages. Carabid beetle was the second highest population (101) in the soybean field (Table 2). The population of preying mantid, polistes wasp and predatory cricket were medium in soybean field. Total number of population of preying mantid, polisteds wasp and predatory cricket were 16, 14 and 13 respectively at different growth stages of soybean. Two species of spider (*Siler sp.*; lynx spider; *oxyopes sp.*) were found in the soybean field. Total number of individual of spider was 51 (Table 2). The predator, ground beetle found all of the stages of soybean but more number in vegetative stages. Braconid parasitoid was the less abundance in soybean field. Total number of braconid parasitoid individual was 12 at different growth stages of soybean (Table 2). Parasitic wasp was the lowest number of natural

Table 1. List of the insect pests of soybean from experimental site, agricultural farm, Bangladesh Agricultural University, Mymensingh

Common name	Scientific name	Family	Order	Total	Relative abundance (%)
Soybean semi looper	<i>Psuedoplusia includens</i>	Noctuidae	Lepidoptera	328	15.29
Soybean pod borer	<i>Etiella zinckenella</i>	Pyralidae	Lepidoptera	124	5.78
Soybean pod bug	<i>Riptortus Linearis</i>	Alydidae	Hemiptera	126	5.87
Green leafhopper	<i>Nephotettix virescens</i>	Cicadellidae	Homoptera	233	3.44
White leaf hopper	<i>Cofana spp</i>	Cicadellidae	Homoptera	148	3.72
Green jassid	<i>Empoasca spp.</i>	Cicadellidae	Homoptera	74	7.5
Green stink bug	<i>Nezara viridula</i>	Pentatomidae	Hemiptera	80	9.79
Soybean aphid	<i>Aphis fabae</i>	Aphididae	Homoptera	121	5.64
Soybean hairy caterpillar	<i>Spilarctia obliqua</i>	Aractidae	Lepidoptera	78	10.86
Soybean leaf roller	<i>Omiodes indicata</i>	Pyralidae	Lepidoptera	210	6.89
Flea beetle	<i>Monolepta signata</i>	Chrysomelidae	Coleoptera	66	3.63
Spotted leaf beetle	<i>Monolepta nigroapicata</i>	Chrysomelidae	Coleoptera	93	4.33
Black leaf beetle	<i>Cerotoma trifurcata</i>	Chrysomelidae	Coleoptera	161	1.91
Short horned grasshopper	<i>Hieroglyphus banian</i>	Acrididae	Orthoptera	43	2.0
Long horned grass hopper	<i>Ucirtus sp</i>	Tettigonidae	Orthoptera	27	1.25
Cutworm	<i>Agrotis ipsilon</i>	Noctuidae	Lepidoptera	41	0.49
Stripped leaf beetle	<i>Acalymma vittatum</i>	Chrysomelidae	Coleoptera	9	1.21
Brown plant hopper	<i>Nilaparvata lugens</i>	Delphacidae	Hemiptera	12	0.55
Soybean stem fly	<i>Melanagromyza sojae</i>	Agromyzidae	Diptera	145	6.75
Legume shield bug	<i>Piezodorus hybneri</i>	Pentatomidae	Hemiptera	26	3.07
Total				2145	100

enemies in the soybean field. Braconid parasitoid wasps was found only vegetative and flowering stages of soybean. Braconid wasp found all the stages of soybean except seedling and maturing stages, but more in vegetative stages. Total number of braconid wasp was 10 at different growth stages (Table 2).

Relative abundance of insect pests and natural enemies in soybean field

The relative abundance of insect pest in soybean field was also quantified. The first rank of order occupied by soybean semi looper (15.29%) followed by soybean hairy caterpillar (10.86%), green stink bug (9.79%), green jassid (7.50%), soybean leaf roller (6.89%), soybean stem fly (6.75%), soybean pod bug (5.87%), soybean pod

borer (5.78%), soybean aphid (5.64%), spotted leaf beetle (4.33%), white leaf hopper (3.72%), flea beetle (3.63%), green leafhopper (3.44%), legume shield bug (3.07%), short horned grasshopper (2.00%), black leaf beetle (1.91%), long horned grasshopper (1.25%), stripped leaf beetle (1.21%), brown plant hopper (0.55%) and cutworm (0.49%) (Table 1). The relative abundance of natural enemies in the soybean field was determined. The first rank order occupied by lady bird beetle (43.48%) followed carabid beetle (22.29%), spider (11.25%), ground beetle (7.5%), preying mantid (3.53%), polistes wasp (3.09%), predatory cricket (2.86%), braconid parasitoid (2.68%), Braconid wasp (2.20%) and parasitic wasp (1.10%) (Table 2).

Table 2. List of natural enemies associated with the insect pests of soybean, Agricultural farm, Banglade Agricultural University, Mymensingh

Common name	Scientific name	Family	Order	Total	Relative abundance (%)
Lady bird beetle	<i>Micraspis spp.</i>	Coccinellidae	Coleoptera	197	43.48
Carabid beetle	<i>Ophlonea interstitialis</i>	Carabidae	Coleoptera	101	22.29
Preying mantids	<i>Mantis religiosa</i>	Mantidae	Dictyoptera	16	3.53
Ground beetle	<i>Calleida sp.</i>	Carabidae	Coleoptera	34	7.50
Predatory cricket	<i>Metioches sp.</i>	Gryllidae	Orthoptera	13	2.86
Polistes wasp	<i>Polistes spp.</i>	Vespidae	Hymenoptera	14	3.09
Spider	<i>Siler sp.</i>	Salticidae	Araneae	51	11.25
	<i>Oxyopes sp.</i>	Oxyopidae			
Braconid	<i>Glyptapanteles</i>	Braconidae	Hymenoptera	12	2.64
Parasitoid	<i>Phytometrae</i>	Braconidae	Hymenoptera		
Parasitic wasp	<i>Miroplitis similis</i>	Braconidae	Hymenoptera	5	1.10
Braconid wasp	<i>Opius sp.</i>	Braconidae	Hymenoptera	10	2.20
Total				553	100

Conclusion

Diversity indices of insect pests and natural enemies differed according to crop growth stages. In this study, vegetative stage showed the highest diversity the highest abundance and diversity of insect pests in soybean field. Similarly population of natural enemies recorded highest at vegetative stage of crop. From this report, it is concluded that abundance and diversity of arthropod fauna varied with crop growth stages according to their feeding guilds.

References

- Adamu RS, Dike MC and Ogunlana MO. 1999. Insects associated with soybean-(*Glycine max* L. Merrill) in Northern Nigeria. J. of Sustainable Agricultural Env. 1(2): 272-278.
- Atwal AS. 1986. Agricultural Pests of India and South-East Asia. Kallyani Publishers, Darya Ganj, New Delhi, India. 529 p.
- Bundy CS and Mcpherson R M. 2000. Dynamics and seasonal abundance of stink bug (Heteroptera: Pentatomidae) in a cotton soybean ecosystem. J. Econ. Entom. 93(3):697-706.
- Daugerty DM. 1967. Pentatomidae, as a vector of yeast spot disease on soybean. J. Econ. Entom. 60(1):147-152.
- Fehr WR. 1989. Soybean, in oil crops of the world by Rolobelin, G. Downey, R. K. and Ashri, A Maaraw Hill pub. Co., London. 553 p.
- Hill O S. 1975. Agricultural Insect Pests of the Tropics and their Control. Cambridge University. Press. Cambridge, Uk. 746 p.
- Linsenmaier W. 1972. Insect of the World. In McGrawLittle V A. General and Applied Entomology. Oxford and IBH Publishing Company. New Delhi. 525 p.
- Nair MR. 1975. Insect and Mites of Crops in India. Indian council Agrilture Research, 2nd edition. New Delhi, India. 404 p.
- Rahman L. 1982. Cultivator of soybean and its uses. First edition. City press, Dhaka. 507 p.
- Pradhan S. 1969. Insect Pests of Crops, 2nd edition. Green Park, New Delhi. 238 p.
- Shepard B M, Camer G R, Barron A T, Ooi P A C and Van den Berg H. 1999. Insect and their Natural Enemies Associated with Vegetable and Soybean in South East Asia. Orangeburg, S C 29116-1106, USA.
- Smith R G. 1975. Composition of foods raw processed, prepared. In Smith R G. Agriculture Hard book No.8. Agricultural Service. Home Economist, MCC, Washington DC. 42-45 pp.
- Vander P A. 1981. Pests of Crops in Indonesia. In vander Laan PA. Elsevier, Netherland. 701 p
- Vivilov N I. 1951. The origin, Variation immunity and breeding of cultivated plants. 2nd edition. The Roland Press Co., New York, USA. 364 p.