International Journal of Entomology Research
ISSN: 2455-4758; Impact Factor: RJIF 5.24
Received: 14-12-2020; Accepted: 15-01-2021; Published: 19-02-2021
www.entomologyjournals.com
Volume 6; Issue 1; 2021; Page No. 130-132

Biodiversity of insect pest complex infesting brinjal (*Solanum Melongena* L.) ecosystem

Rupashree Das*, Shabrin Sultana Ahmed
Department of Entomology, Assam Agricultural University, Jorhat, Assam, India

Abstract
A survey was undertaken in different farmer's field to study the diversity of major insect pests and their predators in brinjal ecosystem. The study revealed 6 species of herbivores and 9 species of predators in field. Among the herbivores *Aphis gossypii*, *Amrasca biguttula biguttula*, *Leucinodes orbonalis* and among the predators *Coccinella transversalis* were dominant during the study period. It was found that, species richness (R) of herbivores was highest at reproductive stage (2.073) followed by vegetative Stage (2.006) and lowest in harvesting stage (1.542).Whereas, the diversity index and evenness was more in harvesting stage (1.280 and 0.485) followed by reproductive stage (0.819 and 0.289) and lowest in vegetative Stage (0.505 and 0.197). Highest species richness of predator was found at reproductive stage (3.037) followed by vegetative Stage (2.968) and lowest at harvesting stage (2.730) while diversity index was maximum in vegetative Stage (2.442) and minimum in Harvesting stage. The predator evenness was recorded highest in harvesting stage (1.001) and lowest in reproductive stage (0.913).

Keywords: brinjal, species diversity, species richness, species evenness, pest, predators

Introduction
Brinjal (*Solanum melongena* L.) is one of the most important solanaceous vegetable cultivated in the country. It is grown as a vegetable throughout the tropical, sub-tropical and warm temperate areas of the world. In India, brinjal is an important and indigenous vegetable crop often known as the cash crop for the farmers (Mathur *et al*. 2012) [14]. The area under brinjal cultivation is 728,000 ha with an annual production of 12660,000 MT during 2018 – 19 (Anon, 2019) [1].

However, one of the major constraints for brinjal production is heavy infestations caused by several insect pests. In India, as many as 70 number insect species, of which brinjal shoot and fruit borer, *Leucinodes orbonalis* (Guenee); jassid, *Amrasca biguttula biguttula* (Ishida); aphid, *Aphis gossypii* (Glover); stem borer, *Euzophera perticella* (Ragonot), hadda beetle, *Henosepilachna vigintioctopunctata* (Fab.); white fly, *Bemisia tabaci* (Gennadius); lacewing bug, *Urentius hystricellus* (Richter) with non-insect pest red spider mite, *Tetranychus macfarlanei* (Baker & Pritchard) were recorded as the major pests of brinjal (Subbarathnam and Butani, 1982) [24]. In an experiment about 80-90% yield loss had been recorded due to attack of brinjal shoot and fruit borer (Patnaik, 2000; Misra, 2008) [15, 19]. Damage by the white fly, borers, and leafhoppers can reduce approximately 70-90% yield of brinjal (Rosaiah, 2001) [21]. Hence, there is a great scope to study on insect-pests of brinjal.Thus, before initiating proper management techniques and especially in case of implementation of biological control programmes, it is very essential to know the diversity of insect pests and their natural enemies of that ecosystem. Keeping this in view, the present investigation was carried out to know the diversity of Insects fauna of brinjal ecosystem. Moreover, this study will be helpful to conserve bicontrol agents to keep the insect pests below the economic threshold level under integrated pest management program

Materials and Methods
Survey was conducted in different farmer's field of Cachar district, Assam during *rabi* 2019 - 20. Monitoring of insect fauna was initiated at the seedling emergence of the crop and continued until the last picking. Observations on insect pests were recorded at weekly interval starting from 15 days after the sowing of crop. Different species of insect pests and natural enemies were collected by hand picking, using pheromone trap and insect collecting net. Sucking pests were preserved in 70 % alcohol in glass vials and pinning was done for comparatively large insects. The samples were sorted and identified under stereoscopic microscope and magnifying glass, and percent relative abundance was calculated using the formula proposed by Singh and Rai, (2000) [23]. The diversity indices viz. Margalef index (1958) [13] for species richness, Shannon-Weiner index (1949) [22] for species diversity and Pielou's Evenness Index (1966)" [20] for species evenness were calculated for both herbivores and predators in vegetative, reproductive and harvesting stages of the crop.

Results and Discussion
In the present study, total of six species of herbivores and nine species of predators were collected from the brinjal agroecosystem throughout the cropping season (Table 1 & Table 2). The occurrence and abundance of various insect fauna from vegetative to harvesting stages were different. Out of six insect pests attacked the crop, brinjal shoot and fruit borer, aphid and jassid were dominant and considered as major insect pests of brinjal whereas the hadda beetle, leaf roller and flea beetle were occurred in a negligible manner and it was considered as minor pest of brinjal. The major insect pest were observed frequently during each observation period, but minors were observed only one or two times. This present finding revealed that aphid (*Aphis gossypii*, 30.37 %, 25.84 %) and jassid (*Amrasca biguttula biguttula* 25.65 % and 18.80 %) were comparatively more

abundant species in vegetative and reproductive stages. Although brinjal shoot and fruit borer was also noticed in vegetative Stage (15.50 %) but maximum in ripening stage (20.25 %) followed by harvesting stage (18.55 %). Earlier, workers from different region of India reported a number of insect pests that attack the brinjal crop during different growth stages who observed that *A. gossypii*, *L. orbonalis*, *A. bigutulla bigutulla*, were the major pests of brinjal in India (Mote and Bhavikatti, 2003; Subbarathnam and Butani, 1982) [16] [24]. Bhadauria *et al*. (1999) [4] from Madhya Pradesh recorded 13 species of insect pests on brinjal. Similarly, from Himachal Pradesh, Patial and Mehta (2008) [18] reported that, 27 insect pest species were associated with brinjal crop during different stages of crop growth. A number of insect pests of brinjal were reported from Assam which included *A. bigutulla bigutulla*, *H. vigintioctopunctata*, *Monolepta signata*, *Altica cyanea*, *Psylliodes brettinghami*, *Agrotis ipsilon*, *L. orbonalis*, *Autoba olivacea*, *A. gossypii*, *Tetranychus neocaledonicus* (Isahaque, 1979, Deka and Saharia, 1981; Borah, 1990; Borah, 1994; Kalita, 1996) [10, 9, 5, 7, 11]. In a study from Assam, Borkakati *et al*. (2019) recorded *A. gossypii*, *A. biguttula biguttula*, *L. orbonalis*, *H. vigintiopunctata*, *Antoba olivaceae* and *M. signata* as insect pests of brinjal.

As regards to natural enemies, nine species of predators, viz., *Coccinella transversalis, Menochilus sexmaculatus, Micraspis discolour, Brumoides* sp., syrphid fly (*Episyrphus balteatus*), green lacewing (*Chrysoperla carnea*) and spider (*Oxyopes* sp.), dragonfly (unidentified) and damselfly (unidentified) observed in the present investigation and among them *C. transversalis* was dominant and considered as major predators of aphids and leafhoppers. Earlier, Kalita *et al*. (1998) also reported 5 cocccinellids (*C. transversalis*, *Coccinella septempunctata*, *M. sexmaculatus*, *M. discolor*, and *Harmonia dimidiata*) from Assam as natural enemies in brinjal ecosystem. Similarly, Borkakati *et al*. (2019) [8]; Borah and Saikia (2017) [6] observed coccinellid beetle (*C. transversalis, H. dimidiate, Cheilomenes propinquq, Adalia bipunctata, Brumoides* sp), syrphid fly (*E. balteatus*), green lacewing (*C. carnea*) and spider (*Oxyopes* sp.) as major natural enemies on insect pests of brinjal.

The experimental finding revealed that, species richness (R) of herbivores (2.073) was highest at reproductive stage followed by vegetative Stage (2.006) and lowest in harvesting stage (1.542). Whereas, the diversity index and evenness was more in harvesting stage (1.280 and 0.485) followed by reproductive stage (0.819 and 0.289) and lowest in vegetative Stage (0.505 and 0.197). Highest species richness of predator was found at reproductive stage (3.037) followed by vegetative Stage (2.968) and lowest at harvesting stage (2.730) while diversity index was maximum in vegetative Stage (2.442) and minimum in harvesting stage. The predator evenness was recorded highest in harvesting stage (1.001) and lowest in flowering stage (0.913). The present study indicated that the reproductive stage (flowering-fruiting stage) was more diversified than the vegetative and harvesting stages of the crop. This might be due to flourishing plants in or adjacent to a crop favours the maintenance and multiplication of several insect species (Balzan and Wackers, 2013; Bertolaccini *et al*. 2011) [2, 3]. Certain allelochemicals produced by the plant in flowering and fruiting stages found to attract both insect pests and their natural enemies. The colors of the flowers and the nectar also enabled the insects to get attracted towards them (Nguettia *et al*. 2017) [17].

Table 1: list of herbivores observed in the brinjal field and their relative abundance

Sl No	Common name	Order: Family	Scientific name	Relative abundance (%)			Status
				Vegetative stage	Reproductive stage	Harvesting stage	
1	Aphid	Hemiptera: Aphididae	*Aphis gossypii* (Glover)	30.37	25.84	18.75	+++
2	Jassid	Hemiptera: Cicadellidae	*Amrasca biguttula biguttula* (Ishida)	25.65	18.80	17.50	+++
3	Brinjal shoot and fruit borer	Lepidoptera: Pyralidae	*Leucinodes orbonalis* (Guenee)	15.50	20.25	18.55	+++
4	Epilachna beetle	Coleoptera:Coccinellidae	*Henosepilachna vigintioctopunctata* (F.)	4.05	4.05	3.35	+
5	Leaf roller	Lepidoptera: Noctuidae	*Antoba (Eublema) olivacea* (Walker)	4.05	3.37	2.29	+
6	Flea beetle	Coleoptera: Chrysomelidae	*Monolepta signata* (Olivier)	3.63	2.7	2.65	+

+ observed 1 or 2 times/ +++ observed frequently almost all time

Table 2: list of predators observed in the brinjal field and their relative abundance

Sl No	Order: Family	Scientific name	Relative abundance (%)			Prey	Status
			Vegetative stage	Reproductive stage	Ripening stage		
1	Coleoptera: Coccinellidae	*Coccinella transversalis* (F.)	16.50	14.63	14.45	Aphid. Jassid	+++
2	Coleoptera: Coccinellidae	*Menochilus sexmaculatus* (F.)	9.90	8.05	6.85	Aphid, Jassid	++
3	Coleoptera: Coccinellidae	*Micraspis discolor* (F.)	10.05	6.60	3.35		
4	Coleoptera: Coccinellidae	*Brumoides sp.* (F.)	0.17	0.36	0.20	Aphid	+
5	Diptera: Syrphidae	*Episyrphus balteatus* (De Geer),	0.50	0.45	-	Aphid	+
6	Neuroptera: Chrysopidae	*Chrysoperla carnea* (Stephens)	0.45	-		Aphid	+
7	Araneae: Oxyopidae	*Oxyopes* sp	0.42	0.67	0.92	Aphid, Jassid	+
8	Dragonfly	unidentified	1.54	0.65	0.45	Small insect	+
9	Damselfly	unidentified	1.05	0.35	0.25	Small insect	+

Table 3: Comparison of Diversity, Evenness and Richness of Major Insects in Brinjal Ecosystem

Taxon	Species richness (R)			Diversity index (H)			Evenness (E)		
	V	R	H	V	R	H	V	R	H
Herbivores	2.006	2.073	1.542	0.505	0.819	1.280	0.197	0.289	0.485
Predators	2.968	3.037	2.730	2.442	2.343	2.306	0.952	0.913	1.001

V-vegetative stage, R-Reproductive stage, H - harvesting stage

Conclusion

The present experiment revealed 6 species of herbivores and 9 species of predators in brinjal field. Out of them, brinjal shoot and fruit borer, aphid and jassid were dominant and considered as major pests of brinjal. Among the predators, *C. transversalis* was found as dominant predator of aphid and jassid in the field. Highest species richness of pests and predators were recorded in reproductive stage followed by vegetative and harvesting stages of crop. It was noticed that aphid and jassid were more abundant species in vegetative and reproductive stages while brinjal shoot and fruit borer was maximum in ripening stage. This type of study may be helpful in determining the most susceptible crop stage/ phenology to a particular pest species. Moreover, the study will give an idea about peak period of pests and their predator which may be helpful in developing pest management strategy.

Acknowledgement

I am thankful to the respondent farmers of Cachar district of Assam, who provided valuable information, immense help and cooperation during entire course of the survey.

References

1. Anonymous. Area and production of horticulture crops for 2018-19 (3rd Advance Estimates). National Horticulture Board. Ministry of Agriculture & Farmers Welfare. Govt of India, 2019.
2. Balzan MV, Wäckers FL. Flowers to selectively enhance the fitness of a host-feeding parasitoid: adult feeding by *Tuta absoluta* and its parasitoid *Necremnus artynes*. Biological Control. 2013; 67(1):21-31.
3. Bertolaccini I, Nunez-Perez E, Tizado EJ. Alternative plants hosts of legume aphids and predators, in the province of León (Spain). Ciencia e Investigación Agraria. 2011; 38(2):233-242.
4. Bhadauria NKS, Bhadauria NS, Jakhmola SS. Insect pest complex of brinjal, Solanum melongena Linn. In northwest Madhya Pradesh. Advances in Plant Sciences. 1999; 12(2):607-608.
5. Borah B. External morphological studies on the adults of some Coleopteran and Lepidopteran pests of brinjal (Solanum melongena L.) at Jorhat, Assam. M.Sc. (Agri.) Thesis, Assam Agricultural University, Jorhat, 1990.
6. Borah N, Saikia DK. Seasonal incidence of major insect pests of brinjal and their natural enemies. Indian Journal of Entomology. 2017; 79(4):449-455.
7. Borah RK. Influence of planting dates on the incidence of insect pests of brinjal in a hilly area of Assam. *JASS*. 1994; 7(2):209-211.
8. Borkakati RN, Venkatesh MR, Saikia DK Insect pests of Brinjal and their natural enemies. Journal of Entomology and Zoology Studies. 2019; 7(1):932-937.
9. Deka SN, Saharia D. Effectiveness of some insecticides against shoot and fruit borer of brinjal. Journal of Research, Assam. Agricultural University. 1981; 2(2):250-253.
10. Isahaque NMD. Studies on brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. Under Assam condition. Ph.D. Thesis, Gauhati University, Gauhati, 1979.
11. Kalita BJ. Biology of *Maruca testulalis* Geyer and its distribution pattern with special reference to sampling technique evaluation in pigeonpea. M.Sc. (Agri.) Thesis, Assam Agricultural University, Jorhat, 1996.
12. Kalita DN, DevRoy TC, Khound JN. Coccinellid predator on *Aphis gossypii*. Insect Environ. 1998; 3(4):107-108.
13. Margalef R. Information theory in ecology. General systematics. 1958; 3:36-71.
14. Mathur A, Singh NP, Meena M, Singh S. Seasonal incidence and effect of abiotic factors on population dynamics of major insect pests on brinjal crop. Journal of Environmental Research and Development. 2012; 7(1):431-435.
15. Misra HP. Bio-efficacy of chlorantraniliprole against shoot and fruit borer of brinjal, *Leucinodes orbonalis* Guenee. Journal of Insect Science. 2008; 24(1):60-64.
16. Mote UN, Bhavikatti S. Efficacy of chemical and nonchemical insecticides against major pests of brinjal in kharif season. Journal of Applied Zoological. Researchers. 2003; 14(1):54-56.
17. Nguettia CAM, Ngoran MSWO, Fatogoman S, Daouda K. Distribution of insects according to the phonological stages of okra (*Abelmoschus esculentus*) and phytosanitary practices in Anna (Bingerville, cote divoire). Journal of Agricultural and Biological Science. 2017; 12(5):174-181.
18. Patial A, Mehta PK. Pest complex of brinjal and their succession under mid hills of Himachal Pradesh. Journal of Insect Science. 2008; 21(1):67-71.
19. Patnaik HP. Flower and fruit infestation by brinjal shoot and fruit borer, Leucinodes orbonalis Guen damage potential vs. weather. Vegetable Science. 2000; 27:82-83.
20. Pielou EC. Mathematical Ecology. Wiley, New York, 1969, 374.
21. Rosaiah B. Evaluation of different botanicals against the pest complex of brinjal. Pestology. 2001; 25:14-16.
22. Shannon CE, Wiener W. The mathematical theory of communication. University Illinois press. Urban, 1949, 324.
23. Singh NN, Rai S. Relative abundance of different coccinellids in mustard ecosystem. Indian Journal of Entomology. 2000; 62(4):422-426.
24. Subbarathnam GV, Butani DK. Chemical control of Insect pest complex of brinjal. Entomon. 1982; 7:97-100.