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Studies on Insect Pest Succession and their Natural Enemies in Brinjal

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

The Present investigation was carried out at College of Agriculture, Vijayapura, Karnataka to study insect - pests succession and their natural enemies on brinjal during 2021-22. Studies revealed that, four species of insect pests and one coccinellid predatorwere observed at different crop growth stages. The first attack on the crop appeared at one week after transplantation and continued up to till crop reached fruiting and maturity stage. Pests that found attacking on the crop were leaf hopper (*Amrasca biguttulabiguttula* Ishida), aphids (*Aphis gossypii* Glover), whitefly (*Bemisia tabaci* Gennadius), shoot and fruit borer (*Leucinodes orbonalis* Guenee) and coccinellid predator, *Cheliomenes sexmaculata* (Fabricius). Brinjal shoot and fruit borer (*L. orbonalis*) was identified as amajor pest among them.From the seedling stage to fruiting and maturity stage, the populations of Jassids, aphids, coccinellids were observed, white flies were observed from vegetative stage to fruiting and maturity stage, while the population of shoot and fruit borer were observed and recorded during the vegetative stage to fruiting and maturity stage of the crop. Leaf hoppers, aphids and whitefly were found to damage the crop moderatelyand extent of damage caused by *L. orbonalis* was created much economic loss.

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1. INTRODUCTION

"Brinjal (*Solanum melongena* L.) belongs to the family Solanaceae is one of the most important vegetable crop which grown in South-East Asia where hot and wet climate condition prevails" [1]. "India is the second largest producer of vegetables in the world, next to the China. Brinjal is the most consuming vegetable among the vegetarian people. It is one of the main sources of cash crop for many farmers" [2].

"After China, India is second in terms of area (730,4000 ha), production (12800.8 metric tonnes), and productivity (17.5 metric tons/ha). Bihar, Orissa, Karnataka, Andhra Pradesh, Maharashtra, West Bengal, and Uttar Pradesh are the major states in India where brinjal is grown. It is grown on 7.1 lakh ha in India, with a yield of 19.1 MT/ha and a production of 135.58 lakh MT. Among the states that cultivate brinjal, Bihar produces the most, with a net sown area of 57,500 ha with the production of 12.40 lakh MT, and 21.6 MT/ha productivity. It is cultivated in Madhya Pradesh over an area of 51,35 thousand hectares, yielding 1073.63 metric tonnes" [3].

Brinjal is a long season crop, it has been attacked by many insect pests during different stages of the crop growth. The information about the incidence of insect pests on crop during different stages at different weather conditions is scanty. Brinjal is most popular vegetable in northern dry zone of Karnataka.

"Brinjal is also known as 'Poor man's vegetable' since it is available at reasonable prices. Now a days cultivation is becoming a menace to the farmer because of attack of insect pests causing damage to the crop from seedling stage upto its maturity. Various pests are observed from seedling to harvesting stage and the loss caused by brinjal pests vary from season to season depending on environmental factors" [4].

Gangawar et al. [5] investigated on "brinjal pests during *Kharif* and revealed that, a total of eight insect species were found associated with brinjal crop at different crop growth stages. The first attack on the crop appeared one week after transplantation and continued till crop harvested. Pests found attacking on the crop were jassids (*Amrasca biguttula biguttula*), aphids (*Aphis gossypii*), whitefly (*Bemisiatabaci*), leaf roller (*Eublemma olivacae*), shoot and fruit borer (*Leucinodes orbonalis*), epilachna beetle (*Epilachna vigintioctopunctata*), leaf webber (*Psara bipunctalis*) and grass hopper (*Chrotogonus* spp.)". "Among them, brinjal shoot and fruit borer (*L. orbonalis*) was recorded as major pest. Jassids (*Amrasca biguttulabiguttula* Ishida), aphid (*Aphis gossypii* Glover.) and epilachna beetle (*E. viginitioctopunctata*) were found to damage the crop moderately" [6].

Nasif and Siddiquee [7] reported on "the succession of different insect pests and among different insect pests revealed that, brinjal shoot and fruit borer was the major insect pest causing significant reduction in economic yield followed by epilachna beetle, aphid, jassids and whitefly".

"The first attack of pests on the crop appeared in 1st week after transplantation and continued till crop harvested. Pests which were found attacking on the crop were jassids (*Amrasca biguttula biguttula,* Ishida), aphids (*Aphis gossypii,* Glover), white fly (*Bemisiatabaci,* Gennadius), Leaf roller (*Eublemma olivacae* Walker), Shoot and fruit borer (*Leucinodes orbonalis,*Guenee), Epilachna beetle (*Epilachna vigintioctopunctata,* Fabricius), Leaf webber (*Psara bipunctalis,* Fabricius) and Grass hopper (*Chrotogonusspp* Blanchard). Among them, brinjal shoot and fruit borer (*L.* orbonalis) was recorded as major pest. Jassids (*A. biguttulabiguttula*), aphid (*A. gossypii*) and epilachna beetle (*E. viginitioctopunctata*) were found to damage the crop moderately. Other insect pests recorded on the crop were of less importance and extent of damage caused by them was found without much economic loss" [8].

2. MATERIALS AND METHODS

The studies on "Insect pest succession and their natural enemies on brinjal during 2021-22." were conducted on brinjal hybrid 'Super mahyco - 10' at College of Agriculture,Vijaypura, Karnataka, India. The plot size was 46.08m^{2}with 120 cm x 60 cm spacing.Randomly ten selected plants forming representative samples were tagged and observation on population of following insect pests of brinjal were recorded (Plate 1) at weekly interval right from transplanting till harvest of crop by adopting standard operational procedures. The extent of damage caused by various insect pests was recorded to assess the economic status of the pests. Observations were also recorded on

natural enemies (Plate 2) at weekly interval from 10 randomly selected plants. The Insect- pests and natural enemies collected were preserved and identified by expert taxonomists and later their population was correlated with weather parameters.

1A. *Amarsca biguttula biguttula* (Ishida)

1B. *Bemesia tabaci* (Gennadius)

1C. *Aphis gossypii* (Glover)

1D. *Leucinodes orbonalis* (Guenee) (Shootdamage)

1E. *Leucinodes orbonalis* (Guenee) (Fruitdamage)

Plate 1. Population of insect pests of brinjal

2.1 Observations Recorded

1. **White fly –** Number of Adults / Nymphs per three leaves (Each from top, middle and bottom of the plant)
2. **Hoppers** - Number of Adults / Nymphs per three leaves (Each from top, middle and bottom of the plant.)
3. **Aphids -** Number of Adults / Nymphs per three leaves (Each from top, middle and bottom of the plant.)
4. **Fruit and shoot borer** – Percentage shoot and fruit damage.

Natural enemies - Adults and grubs of predators were enumerated and expressed as a mean number per plant from ten randomly selected plants.

Plate 2. Natural enemies recorded during studies on succession and population dynamics

3. RESULTS AND DISCUSSION

3.1 Leaf hopper, *Amrasca biguttula bigutulla* (Ishida) (Hemiptera: Cicadellidae)

In current study leaf hopper occurrence was first noted on the crop at seven days after transplanting, and it persisted until the crop has reached reproductive stage (fruiting stage)*i.e* 46th SMW to 13th SMW (Nov 7th - Apr 4th) (Table 1).

Both nymphs and adults suck the sap from lower surface of leaves. The infested leaf curl upward along the margins, which turn yellowish and show burnt up patches. Fruit setting is adversely affected by the infestation. In the later stages reduction in size of leaves, conversion of floral parts into leafy structures is observed, plants become bushy, fruiting is rare are the symptoms of 'little leaf of brinjal' transmitted by leaf hopper.

Present findings are in accordance with Gangwar and Singh [5] and Sheojat et al. [9] According to

their reports, leaf hopper population started to appear one week after transplanting and keep on increasing as the crop grow. According to Sahu [10], the jassid was first noticed on the crop at 10 days after transplanting and remained until crop reached maturity.

Thokcham et al. [11] noticed the leaf hopper population when the crop was 30 days old (vegetative stages), they were active from November to March of 2021, and there were heavy populations of jassid with a relative abundance of 37.5 per cent and they persisted until the crop reached maturity.

3.2 Aphid, *Aphis gossypii* (Glover) (Hemiptera: Aphididae)

The aphid population was initially noticed on the crop at seven days after transplantingand it continued to persist through the entire cropping season from 46th to 13th SMW(Nov 7th- Apr 4th) (Table 1).

The tiny pests are found in the colonies of hundreds on abaxial leaf surface and tender shoots. Both nymphs and adults suck cell sap from tender leaves, which gradually became curled and fade and ultimately dry up. Sooty moulds developed on honey dews.

The results of the present study are consistent with Ghose et al. [12] where they have reported that *Aphis gossypii* as an important sucking pest of brinjal. Jiaswal [13] observed the peak infestation of aphid during 35 days after transplanting vegetative stage and found to be continued up to 175 days after transplanting (harvesting stage). Nasif et al. [7] reported that, aphid infestation was seen during November to March and population peaked during February (fruiting stage). According to Sheojat et al. [9] population of aphids reached peak during the first week of January (flowering stage) and the infestation decreased from February to the last week of March (reproductive stage).

3.3 Whitefly, *Bemisiatabaci* (Gennadius) (Hemiptera: Aleyrodidae)

Whitefly activity was first seen on the crop at twenty-one days after transplanting and continued until the crop had reached fruiting and maturity stage (48th SMW to 13th SMW) (Nov 23th - Apr 4th)(Table 1).

Nymphs and adults cause severe damage to plants by feeding on sap and the affected leaves turn yellowish, curl downwards and are ultimately shed. Plants show stunted growth, Honey dew excreted by nymphs leads to formation of sooty molds which form black coating on leaves and reduces the photosynthetic activity.

The present findings are in similarity with Patial and Mehta [14] who reported whitefly as a moderate pest.According to Gangwar and Singh [5] whitefly is an important pest of brinjal ecosystem. Shrivastava [15] who conducted a field study on the incidence of whiteflies and reported that pest was first noticed on a crop at 21 DAT during the *rabi* season. Jiaswal [13] observed the population of whitefly 16 DAT and continued up to second fortnight of March (reproductive stage).

3.4 Shoot and Fruit Borer, *Leucinodes orbonalis* (Guenee) (Lepidoptera: Pyraustidae)

The first shoot damage was observed at 36 days after transplanting *i.e* 50th SMW and continued to occur until 10th SMW (Dec 7th – Mar 7th). Fruit damage was recorded between 4th SMW and continued until 13th SMW (Jan 18th – Apr 4th) (Table 1).

The incidence of shoot and fruit borer was seen 45 days after transplanting and continued up to fruit harvesting stage. Larva bores into tender shoots resulting in drooping/ drying of tips. It also bores into developing fruits and bore hole is plugged with excreta. Damaged fruits are unfit for marketing.

The present findings are in agreement with Nirmali and Saikia (2017) where they reported that *L. orbonalis* as major pest infecting during vegetative and reproductive phase. Nasif et al. [7] revealed that, a significant decline in economic production was caused by the main pest, the brinjal shoot and fruit borer. Sheojat et al. [9] recorded shoot and fruit borer on the crop at 35 days after transplanting (vegetative stage) and it was continued to be active until the last week of April (Fruiting stage). Thokcham et al. [11] observed that, shoot and fruit borer incidence was observed throughout the year mainly during the fruiting stage from December to March, with the highest relative abundance of 49.95 percent.

Table 1. Succession of major insect pests of brinjal

		Insect pest		Order	Family	Crop age (Days)	Crop stage
		Common name	**Scientific name**				
	Nov7-Nov 15	Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		Seedlingstage
46		Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae	7	
		Ladybird beetle	*Cheilomenes sexmaculata* (Fabricius)	Coleoptera	Coccinellidae		
47	Nov16-Nov	Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		Vegetative
	22	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae	14	stage
		Ladybird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
	Nov23-Nov	Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		Vegetative
48	29	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae	21	stage
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		
		Ladybird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
49	Nov30-Dec 6	Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		
		Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae	28	Vegetative
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		stage
		Ladybird beetle	*Cheilomenes sexmaculata*(Fabricius).	Coleoptera	Coccinellidae		
50	Dec7-Dec 13	Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae	35	Vegetative stage
		Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		
		Shoot and fruit borer (Shoot damage)	*Leucinodes orbonalis* (Guenn.)	Lepidoptera	Pyraustidae		
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius)	Coleoptera	Coccinellidae		
51	Dec14-Dec20	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae	42	
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		Reproductive
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		stage
		Shoot and fruit borer (Shoot damage)	*Leucinodes orbonalis* (Guenn.)	Lepidoptera	Pyraustidae		
		Ladybird beetle	*Cheilomenes sexmaculata* (Fabricius)	Coleoptera	Coccinellidae		
	Dec21-Dec27	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae	49	
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		Reproductive
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		stage

		Insect pest		Order	Family	Crop age (Days)	Crop stage
		Common name	**Scientific name**				
52		Shoot and fruit borer (Shoot damage)	*Leucinodes orbonalis*(Guenn.)	Lepidoptera	Pyraustidae		
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius)	Coleoptera	Coccinellidae		
1	Dec28-jan 3	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae	56	
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		Reproductive stage
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		
		Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		
		Shoot and fruit borer (Shoot damage)	*Leucinodes orbonalis* (Guenn.)	Lepidoptera	Pyraustidae		
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
	Jan 4 –Jan	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		
2	10	Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae	63	
		Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		Reproductive stage
		Shoot and fruit borer (Shoot damage)	*Leucinodes orbonalis*(Guenn.)	Lepidoptera	Pyraustidae		
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
	Jan 11–Jan	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		
	17	Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae	70	
3		Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		Fruiting and maturity stage
		Shoot and fruit borer (Shoot damage)	*Leucinodes orbonalis* (Guenn.)	Lepidoptera	Pyraustidae		
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
4	Jan 18–	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		
	Jan24	Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae	77	
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		Fruiting and maturity stage
		Shoot and fruit borer (Shoot and fruit damage)	*Leucinodes orbonalis* (Guenn.)	Lepidoptera	Pyraustidae		
		Lady bird beetle	*Cheilomenessexmaculata*(Fabricius)	Coleoptera	Coccinellidae		

		Insect pest		Order	Family	Crop age (Days)	Crop stage
		Common name	**Scientific name**				
		.					
5	Jan 25– Jan31	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae	84	
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		Fruiting and maturity
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		stage
		Shoot and fruit borer (Shoot and fruit damage)	*Leucinodes orbonalis*(Guenn.)	Lepidoptera	Pyraustidae		
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius)	Coleoptera	Coccinellidae		
6	Feb 1 – Feb 7	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		Fruiting and maturity
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		stage
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		
		Shoot and fruit borer (Shoot and fruit damage)	*Leucinodes orbonalis*(Guenn.)	Lepidoptera	Pyraustidae	91	
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
7	Feb 7 – Feb14	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		Fruiting and maturity
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae	98	stage
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		
		Shoot and fruit borer (Shoot and fruit damage)	*Leucinodes orbonalis*(Guenn)	Lepidoptera	Pyraustidae		
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
8	Feb 15– Feb 21	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		Fruiting and maturity
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		stage
		Shoot and fruit borer (Shoot and fruit damage)	*Leucinodes orbonalis*(Guenn.)	Lepidoptera	Pyraustidae		
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae	105	
9	Feb 22 – Feb28	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae	112	
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		
		Shoot and fruit borer	*Leucinodes orbonalis* (Guenn.)	Lepidoptera	Pyraustidae		Fruiting and maturity

		Insect pest		Order	Family	Crop age (Days)	Crop stage
		Common name	Scientific name				
		(Shoot and fruit damage)					stage
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
	Mar1 – Mar 7	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		Fruiting and maturity
10		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae	119	stage
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		
		Shoot and fruit borer (Shoot and fruit damage)	*Leucinodes orbonalis*(Guenn.)	Lepidoptera	Pyraustidae		
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
11	Mar8– Mar14	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		Fruiting and maturity
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		stage
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		
		Shoot and fruit borer (Fruit damage)	*Leucinodes orbonalis*(Guenn.)	Lepidoptera	Pyraustidae	126	
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
12	Mar15– Mar28	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		Fruiting and maturity
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		stage
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		
		Shoot and fruit borer (Fruit damage)	*Leucinodes orbonalis*(Guenn.)	Lepidoptera	Pyraustidae	133	
		Lady bird beetle	*Cheilomenes sexmaculata* (Fabricius).	Coleoptera	Coccinellidae		
	Mar28– Apr 4	Aphid	*Aphis gossypii* (Glover)	Hemiptera	Aphididae		Fruiting and maturity
13		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		stage
		Whitefly	*Bemesia tabaci* (Gennadius)	Hemiptera	Aleyrodidae		
		Shoot and fruit borer (Fruit damage)	*Leucinodes orbonalis*(Guenn.)	Lepidoptera	Pyraustidae	140	
		Leaf hopper	*Amrasca bigutuula biguttula* (Ishida)	Hemiptera	Cicadellidae		

3.5 Lady bird beetle, *Cheilomenessex maculatus* (Fabricius) (Coleoptera: Coccinellidae)

Lady bird beetle activity was first observed on the crop at seven days after transplanting and persisted through the fruiting and maturity stage (46th SMWto 13th SMW) (Nov 7th - Apr 4th) (Table 1).

Its population fluctuated with the population of its aphid prey.

Naik et al. [16] reported the presence of predatory coccinellid beetle, *Cheilomenessex maculatus* on brinjal. Jaiswal et al. [13] noted lady bird beetle population during 10 DAT which continued up to end of the March 30th (reproductive phase). Thokcham et al. [11] revealed that, coccinellid population was observed during vegetative stage of the crop and they are usually seen where the aphid infestation was high and are noticed during Nov to Feb, 2021 and they continue until the fruiting stage of the crop and these observations are in conformity with the findings of the current study [17].

Brinjal is cultivated round the year, therefore it is very susceptible to be damaged by many insect pests throughout the growth period especially sucking insects which are having many alternative hosts including weeds and by shoot and fruit borer which can survive both in shoots as well as fruits.

4. CONCLUSION

On the basis present investigation of study on insect pest succession and their natural enemies of brinjal crop ecosystem concluded that a total of four insect species and one natural enemy found associated with brinjal crop at different crop growth stages. Aphids, leaf hoppers and coccinellids were observed during seedling phase and continued until fruiting and maturity stage. Whereas, white fly and shoot and fruit borer were observed during vegetative stage and continued until fruiting and maturity stage. Among the four insect pests brinjal shoot and fruit borer as the major dominating pest at vegetative as well as fruiting and maturity stage of the crop. ladybird beetle was fund to be predominating species predating the aphid at 55 days old crop. The pests are so destructive leading to reduction of brinjal production.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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