

ORIGINAL ARTICLE

Seasonal Incidence of Major Insect Pests and their Natural Enemies in Ecological Engineering Brinjal (*Solanum melongena*) Field

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ABSTRACT

The field experiment was carried out at Organic, Ecological Engineering Research Farm, NIPHM, Rajendranagar, Hyderabad during kharif season 2017 to observe the seasonal incidence of major insect pests and natural enemies of brinjal crop. Organic fertilizers like Vermicompost, Vermiwash, Mycorrhizae, Phosphate solubilizing bacteria, Potash mobilizing bacteria and Zink solubilizing bacteria were used to enrich the soil and treated with neem cake containing biopesticides (*Trichoderma harzianum*+ *Pseudomonas fluorescense*) to control soil borne diseases. The incidence of hadda beetle, Leaf miner and whitefly infestation was started during 30th S.W (3 weeks after transplanting). Aphid population appeared during 31st and 32nd S.W only. Afterwards the infestation was completely disappeared. The maximum hadda beetle per cent infestation (46.36) was observed during 32 S.W i.e. 5 weeks after transplanting. There after the infestation was gradually declined but persisted up to 36th S.W (9 weeks after transplanting). The incidence of Coccinellids were observed during 31 S.W i.e., 0.5 number per plant and reached peak as 0.6 number per plant in following week and persisted up to 9 weeks after transplanting (36th S.W). While, Spiders incidence were observed 34th and 36th S.W only as 0.20 and 0.30 number per plant respectively. The studies revealed the pest and natural enemy interactions and the way natural enemies are controlling the pests in organically maintained ecological engineering field which encourages farmers to go for Organic farming with ecological engineering as key component for sustainable agriculture.

Keywords: Brinjal, Bio pesticides, Bio fertilizers, Hadda beetle, Leaf miner, Whiteflies, Aphids and Natural enemies

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INTRODUCTION

Brinjal, *Solanum melongena* (L.) also known as eggplant, belongs to family *solanaceae*. It is native of India and is grown throughout the country except in higher altitudes [3]. Brinjal occupies an important position in every day diet due to its high nutritive value as it contains vitamins A, B, C and also rich in minerals like iron, phosphorus and calcium [7].

In India vegetables are cultivated in an area of 9,541,000 ha with production of 168,300,000 MT and productivity of 17.3MT ha⁻¹ during 2014-15 (Horticultural Statistics at a Glance 2015). In India brinjal is grown in 6,80,000 ha land with production touching 12,706,000 MT and productivity 18.7 MTha⁻¹.

The brinjal crop is attacked by a number of insect-pests from germination to harvesting of the crop viz., shoot and fruit borer, *Leucinodesor bonalis* (L.) Guen., jassid, *Amrasca biguttula biguttula* (Ishida), aphid, *Aphis gossypii*(Glover), Leaf miner, *Liriomyza trifolii* (Burgess), *Spodoptera litura* (Fabricius), lace wing bug, *Urentius echinus*(Distant), Epilachna/Hadda beetle, *Epilachna vigintioctopunctata* (Fab.) and stem borer, *Euzophera perticella* (Ragonot) [11]. The yield loss due to the major pests is to the extent of 70-92 per cent [1, 2, 11, 5].

MATERIAL AND METHODS

An area of 1125 m² was raised with brinjal variety “Kalyani” to study Seasonal incidence of major insect pests and their natural enemies on brinjal crop during Kharif season, 2017 Research Farm, NIPHM, Rajendranagar, Hyderabad.

Organic fertilizers like Vermicompost, Vermiwash, Mycorrhizae, Phosphate solubilizing bacteria, Potash mobilizing bacteria and Zinc solubilizing bacteria were used to enrich the soil and treated with neem cake containing biopesticides (*Trichoderma harzianum*+ *Pseudomonas fluorescense*) to control soil borne diseases.

Organic field at NIPHM, maintained since 4 years with poly culture and good insectary plants belonging to Compositae, Leguminosae, Umbelliferae, Brassicaceae etc. families created favourable environment for pollinators and natural enemies. Around the brinjal field corn was planted as border crop and attractant plants like sunflower, cosmos and many shrubs were planted to attract natural enemies and pollinators. Repellent plants like Ocimum/Basil were grown to repel borers. Nectar rich plants with small flowers i.e. mustard, sunflower, cowpea, sesame, sun hemp etc., are planted to provide shelter and food to the adults of parasitoids and bees. Mary gold was maintained as trap crop for *Helicoverpa armigera* eggs and to repel beetles and nematodes. Castor was planted in the field to trap *Spodoptera litura*. No external inputs like chemical fertilizers and pesticides were used in the field. Sustainable ecosystems were developed with natural inputs like Farm yard manure, vermi compost, biofertilizers like Mycorrhiza, phosphate solubilizing bacteria, Potassium solubilizing bacteria and zinc solubilizing bacteria, mulching. Bio pesticides like *Trichoderma harzianum*, *Pseudomonas fluorescense*, were used for bio priming. Polyphagous pests like *S. litura* and *H. armigera* were monitored using pheromone traps.

Brinjal seedlings were transplanted at a distance of 60 x 60 cm. The experimental plot was kept unsprayed during the course of investigation and all agronomical practices were adopted to render suitable crop growth. The pest and natural enemy population was recorded in this un-protected plot of brinjal at 7 days interval from the occurrence or initiation of the pest infestation and was continued till the incidence of pest was negligible. A total of 10 plants were selected and tagged for recording the observations. The percent Hadda beetle, fruit and Leaf miner infestation were calculated by below formulae

Per cent Hadda beetle and Leaf miner infestation = $\frac{\text{Number of damaged leaves}}{\text{Total number of leaves}}$

Per cent Fruit infestation = $\frac{\text{Number of damaged fruits}}{\text{Total number of fruits}}$

The pest population of sucking complex like aphids, *Aphis gossypii* (Glover) and whiteflies, *Bemisia tabaci* (Gennadius) both nymphs and adults were recorded during the vegetative, flowering and fruiting stage on three leaves (1 top + 1 middle + 1 bottom) per plant. The remaining insects like hadda beetle, *S. litura*, Coccinellids and spiders were recorded per plant basis.

RESULTS AND DISCUSSION

The seasonal incidence of major insect pests of Brinjal crop at Rajendranagar, Hyderabad during 2017 has been presented in Table 1. The data showed that hadda beetle infestation was appeared first during 30th S.W. with mean per cent infestation of 9.00 %. Thereafter infestation was gradually raised and attained a peak (46.36%) during 32nd S.W. i.e. 1st week of August, after that the population gradually declined up to 39th S.W. as 5.99 %. The corresponding number of hadda beetle per plant at the time of initiation of infestation (30 S.W) was recorded as 0.40 while at the time of peak infestation (32nd S.W) the number of hadda beetle per plant was recorded as 1.0. After 32nd S.W the number of hadda beetle per plant was decreased and attained low in number during 39th S.W as 0.10 per plant. Thereafter, hadda beetle number completely disappeared. Selvamuthukumran and Jayakumar, [12] found that the *Epilachna* grubs abundance started from sixth standard week to 14th standard week. Kalaiyarasi *et al.*, [6] stated that the incidence of *H. vigintioctopunctata* is found active throughout the year while the extent of damage varied in different stages of the crop. The adult and larval populations of hadda beetle in brinjal was found peak in mid-August and reached zero level by last week of October [13].

The minor pests like leaf miner damage appeared only during 30th S.W (3 weeks after transplanting) as 4.00 %. Thereafter infestation completely disappeared. Whereas, *S. litura* infestation was recorded only 33 S.W as 0.10 number plant.

The periodical week wise data on seasonal incidence of whitefly population (Table 1) revealed that the population was recorded in the range of 1.00 to 1.50 whiteflies per three leaves from 30th S.W. (last week of July) to 32nd S.W. (First week of August) only. It was observed from the data that population of whiteflies was high during 31st S.W. as 1.50 number per 3 leaves. The whitefly population completely disappeared 5 weeks after transplanting. Whereas, the aphid population per 3 leaves recorded only two

standard week's i.e. 31st and 32nd as 3.20 and 6.90 number respectively. After 32nd S.W the aphid population was completely disappeared. Selvamuthukumran and Jayakumar [12] found that white fly population increased from early season. According to Indira kumar *et al.*, [4] the incidence of white fly (*Bemisia tabaci*) was maximum in 2nd SW and lowest was recorded in 12th SW while overall incidence was more during January. Raveesh and Singh [9] found that the infestation of aphid was reduced from August to last week of December while the occurrence of whitefly was recorded from last week of July to mid-December.

The per cent fruit borer infestation was observed during 38th (32.00) and 39th S.W (38.33) while mealy bugs was appeared only during 39th S.W (2nd week of October) as 23.10 number per plant. Whereas, Cowbug infestation was recorded at final stage of crop i.e 40th S.W as 0.60 number per plant.

The pests like fruit borer, Mealybug and Cowbugs were observed at the final stage of crop while, leaf miner, whiteflies and aphids were recorded during early stage of crop when crop was green and succulent. Whereas, Hadda beetle was observed through the crop period. Further, coccinellids were observed through the crop period while spider population was started middle of the crop and persisted up to end of the crop.

The Seasonal incidence of natural enemies in Brinjal crop at Rajendranagar, Hyderabad during 2017 presented Table 2. The appearance of coccinellids population per plant was observed from 30th S.W. (first week of September) with a mean population of 0.20 per plant, thereafter coccinellids population gradually increased and attained peak during 32nd S.W. with a mean population of 0.60 per plant. After this, the insect population decreased up to 38th S.W. Once again coccinellids population increased during 39th S.W. after that gradually decreased. Whereas, the spider population was recorded in 34th and disappeared in 35th S.W. and reappeared up to 40th S.W. Unusually spider peak population was observed during 39th and 40th S.W as 0.50 and 0.70 number per plant. Preeti [8] stated that lady bird beetles were present on the crop during the vegetative stage and remained available up to the maturity stage of the crop.

Many Hymenopteran Bee species like *Apis florea* (Fabricius, 1787), *Apis ceranaindica* (Fabricius, 1793), *Apis mellifera* (Linnaeus, 1758), *Apis dorsata* and *Tetragonulairidipennis* (Smith, 1854) belongs to family Apinae, *Xylocopa violacea* (Linnaeus, 1758) and *Xylocopa fenestrata* (Fabricius, 1798) belongs to family Xylocopinae, *Pseudapisoxy beloides* (Smith, 1875) and *Nomia* sp. belongs to family Halictinae, *Nomadaluteoloides* (Robertson, 1895 and *Nomada* sp. belongs to family Nomadinae, *Halictus* sp. belongs to family Halictinae, *Megachile* sp. belongs to family Megachilinae and *Amegilla cingulate* (Fabricius, 1775) belongs to family Apidae were recorded in the brinjal field indicating the diversity in naturally maintained ecological engineering field.

Table 1: Seasonal incidence of major insect pests of Brinjal crop at NIPHM, Rajendranagar, Hyderabad during 2017-18

Date	*SW	WAT	Hadda beetle infestation	No. of Hadda beetle per plant	Spodoptera larvae number per plant	Leaf miner infestation	No. of whiteflies per 3 leaves/plant	No. of aphids per 3leaves/plant	Fruit borer infestation	No. Of Mealybugs per plant	Cowbugs per plant
26/07/2017	30	3	9.00	0.40	0.00	4.00	1.00	0.00	0.00	0.00	0.00
02/08/2017	31	4	38.81	1.00	0.00	0.00	1.50	3.20	0.00	0.00	0.00
07/08/2017	32	5	46.36	1.00	0.00	0.00	0.70	6.90	0.00	0.00	0.00
17/08/2017	33	6	40.62	0.90	0.10	0.00	0.00	0.00	0.00	0.00	0.00
24/08/2017	34	7	39.60	0.70	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31/08/2017	35	8	26.91	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
07/09/2017	36	9	18.41	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
14/09/2017	37	10	15.38	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
27/09/2017	38	11	7.44	0.10	0.00	0.00	0.00	0.00	32.00	0.00	0.00
04/10/2017	39	12	5.99	0.10	0.00	0.00	0.00	0.00	38.33	23.10	0.00
11/10/2017	40	13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.60

*SW=Standard Week

* Weeks after transplanting

Table 2: Seasonal incidence of natural enemies in Brinjal crop at Rajendranagar, Hyderabad during 2017-18

Date	*SW	WAT	Coccinellids per plant	Spider
26/07/2017	30	3	0.20	0.00
02/08/2017	31	4	0.50	0.00
07/08/2017	32	5	0.60	0.00
17/08/2017	33	6	0.40	0.00
24/08/2017	34	7	0.40	0.20
31/08/2017	35	8	0.30	0.00
07/09/2017	36	9	0.30	0.30
14/09/2017	37	10	0.20	0.30
27/09/2017	38	11	0.10	0.20
04/10/2017	39	12	0.50	0.50
11/10/2017	40	13	0.30	0.70

*SMW=Standard Meteorological Week, * Week after transplanting

CONCLUSION

The field being maintained without the use of artificial external inputs such as chemical fertilizers and pesticides achieved self - sustainability with respect to control of diseases and insect pests. No major diseases were observed on the crop throughout the season. Shoot and fruit borer, *Leucinodes orbonalis*, which is major pest of brinjal, was not recorded during the entire season. Polyphagous pests like *S. litura* and *H. armigera* were also under check. Organic farming in India could be considered as future farming system as most of farmers are now tired with chemical farming. The diversity of pollinator bees indicate that ecological engineering for pest management in Agriculture ecosystem has both human and ecological value.

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