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Population dynamics of shoot and fruit borer, *Leucinodes orbonalis* Guenee during *Rabi* season on brinjal in relation to abiotic stress

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Abstract
The experiment was carried out during two consecutive years 2021-22 and 2022-23 at Regional Horticultural Research Station, Navsari Agricultural University, Navsari to study the population of shoot and fruit borer, *Leucinodes orbonalis* Guenee during *Rabi* season on brinjal. Number of *L. orbonalis* larvae per brinjal plant reached peak at 4th Std. week (2.1 larvae/plant) and (2.2 larvae/plant) *i.e*., last week of January during 2021-22 and 2022-23 respectively. The correlation matrix indicated a significant negative correlation with minimum temperature (r = -0.582) and evaporation (r = -0.518) and significant positive correlation with maximum temperature (r = 0.663), Av. temperature (r = 0.666) with shoot and fruit borer infestation during 2021-22. However, Min temperature (r = -0.498) was significantly negative correlation, and max temperature (r = 0.663) and Av. Temperature (r = 0.685) were significant positive correlation with brinjal shoot and fruit borer.

Keywords: Shoot and fruit borer, Rabi, brinjal, population dynamics

Introduction
Vegetables are defined as edible herbaceous plants consumed either raw, after cooking and preserved. Brinjal (*Solanum melongena* L.) belongs to family Solanaceae, which includes over 2450 species divided into 95 genera (Mabberley, 2008) [5] being native of the Indo-Burma region. It is grown extensively in France, Italy, India, China, Spain, USA, Korea, Japan *etc*. In India, It is widely cultivated in the states of West Bengal, Maharashtra, Bihar, Madhya Pradesh, Andhra Pradesh, Uttar Pradesh, Karnataka, Tamil Nadu, Orissa, Gujarat, and Chhattisgarh. The area and production of brinjal cultivation in India is 736 thousand ha and 12777 thousand MT respectively with productivity of 17.36 MT/ha. In Gujarat, the area under brinjal cultivation is 71370 thousand ha with the total production of 14.37 lakh MT with a productivity of 20.14 MT/ha (Anon., 2019) [2]. Brinjal plant is erect, semi erect or prostate, herbaceous and branched in nature which is about one meter or lower in height. A wide variety of pests and mites attack on brinjal from nursery stage to till harvesting including jassid (*Amrasca biguttula biguttula* Ishida), shoot and fruit borer (*Leucinodes orbonalis* Guenee), aphid (*Aphis gossypii* Glover), whitefly (*Bemisia tabaci* Gennadius), Hadda spotted beetle (*Henosepilachna vigintioctopunctata* Fabricius), brinjal mealy bug (*Phenacoccus insolitus* Green), thrips (*Thrips palmi* Karny) and non-insect pest includes red spider mite (*Tetranychus urticae* Koch). Out of these, brinjal shoot and fruit borer, *L. orbonalis* is the key pest throughout Asia. Brinjal shoot and fruit borer, *L. orbonalis* Guenee (Lepidoptera: Pyralidae) is the most destructive, regular pest and also responsible for deterioration of fruit quality which affect the market value of the fruits. It is known to damage the shoot and fruit of brinjal in all stages of its growth. The yield loss due to this pest is to the extent of 70 to 92 per cent (Chakraborty and Sarkar, 2011) [3]. Weather parameters play an important role on the population dynamics and distribution of brinjal shoot and fruit borer.

Materials and Methods
Experiment was conducted at Regional Horticultural Research Station, Navsari Agricultural University, Navsari during two consecutive years 2021-22 and 2022-23 with GNRB-1 variety of brinjal for the study of population dynamics of shoot and fruit borer *L. orbonalis* infesting brinjal in relation to abiotic factors. For this purpose, 20 plants were randomly selected from net plot area. The observation number of larvae per plant was counted from selected plants. The observations were taken regularly at weekly interval from first week after transplanting till

harvest. The data on weather parameters were obtained from meteorological observatory college farm, N. M. college of Agriculture, Navsari Agricultural University, Navsari for the investigation. Correlation with weather parameters and number of larvae per plant of shoot and fruit borer.

Results and Discussion

The studies on shoot and fruit borer of brinjal crop were made in *Rabi* seasons of two consecutive years *i.e.,* 2021-22 and 2022-23. Number of larvae of shoot and fruit borer were recorded to find out the effect of weather conditions on infestation of shoot and fruit borer on brinjal. The data presented in Table -1 and Figure-1 declared that population of *L. orbonalis* fluctuated from 0.05 to 2.1 larvae per plant. *L. orbonalis* population increased during 49th Std. *i.e.*, first week of December, gradually increased up to February and highest peak at 4th Std. week (2.1 larvae/ plant). *i.e.*, last week of January and then after, infestation decreased in the month of March during 2021-22. The result on correlation between number of larvae of *L. orbonalis* and weather parameters during 2021-22 revealed that minimum temperature (r = -0.582) and evaporation (r = -0.518) were significant negative correlation. maximum temperature (r = 0.663) and Av. temperature (r = 0.666) were significant positive correlation. The remaining parameters morning RH, evening RH, Av. RH, wind velocity and BSSH were positively correlated but results were non-significant.

In the second-year infestation of shoot and fruit borer on brinjal the data presented in Table -2 and Figure-2 declared that the population of *L. orbonalis* fluctuated from 0.3 to 2.2 larvae per plant during 2022-23. *L. orbonalis* population increased during 50th Std. *i.e.,* second week of December, gradually increased up to February and highest peak at 4th Std. week (2.2 larvae/ plant). *i.e.*, last week of January and then after, infestation decreased in the month of March. During 2022-23, The result on correlation revealed that Min temperature (r = -0.498) was significantly negative correlation, and max temperature (r = 0.663) and Av. Temperature (r = 0.685) were significant positive correlation. The remaining parameters morning RH and wind velocity were positively correlated whereas, evening RH, Av. RH and Evaporation were negatively correlated but results were non-significant.

Anjali *et al*. (2012) [1] recorded that the incidence of shoot and fruit borer, was observed during Nov.-Dec. with peak infestation during Feb (6th and 7th SW). Kumar *et al.* (2018) [4] also concluded that the number of larvae of shoot and fruit borer per plant varied from 0.30 to 5.30 and the pest population increased from 28th December to 17th January and reached its peak (5.30 larvae/plant) on first week of January. Sharma *et al*. (2022) [8] found that *L. orbonalis* was commenced from 3rd standard week (January Third week) with an average 1.67 larvae per plant and reached peak level of 4.33 larvae per plant at 6th standard week (February second week).

Table 1: Correlation of number of larvae per plant with weather data by *L. orbonalis* in brinjal in 2021-22

SW	No. of larvae per plant	Min. Temp.	Max. Temp.	Av. Temp.	Morn. RH	Eve. RH	Av. RH	Wind Velocity	BSSH	Evaporation
47	0	33.67	20.57	27.12	93.26	55.71	74.48	3.08	6.40	2.80
48	0	31.79	15.67	23.73	77.55	50.29	63.92	3.87	6.97	2.60
49	0.05	28.83	16.84	22.84	93.49	58.75	76.12	3.65	4.97	2.29
50	0.2	30.36	15.50	22.93	85.70	50.22	67.96	2.81	6.19	2.91
51	0.4	29.50	11.14	20.32	88.95	47.70	68.33	3.02	7.51	2.71
52	0.65	28.85	14.76	21.81	94.02	52.59	73.31	3.38	6.90	2.53
1	1.1	31.90	17.49	24.69	93.75	57.51	75.63	2.70	5.60	2.44
2	1.3	26.43	12.73	19.58	90.33	45.76	68.04	3.85	6.96	2.57
3	1.65	29.79	14.09	21.94	86.87	47.87	67.37	3.37	8.07	2.90
4	2.1	27.00	12.21	19.61	82.47	44.82	63.64	4.49	7.26	2.00
5	1.8	30.24	12.79	21.51	92.32	38.08	65.20	2.52	9.27	2.46
6	1.25	29.64	13.03	21.34	95.33	39.80	67.56	2.74	8.76	2.41
7	1.05	30.61	14.60	22.61	89.89	41.32	65.60	3.05	9.73	2.61
8	0.9	32.73	13.43	23.08	95.33	33.92	64.63	2.31	9.66	2.86
9	0.55	34.90	15.09	24.99	85.27	26.85	56.06	2.38	9.71	3.10
10	0.35	36.83	18.31	27.57	76.04	31.57	53.81	2.61	7.93	3.89
11	0	38.67	18.14	28.41	67.74	20.78	44.26	2.80	9.53	5.21
12	0	36.91	20.86	28.89	74.73	30.76	52.75	3.02	7.11	4.00
Correlation		-	-	-	0.376	0.046	0.209	0.194	0.271	-
Coefficient		0.582 *	0.663 **	0.666 **						0.518 *

Table 2: Correlation of number of larvae per plant with weather data by *L. orbonalis* in brinjal in 2022-23

SW	No. of larvae per plant	Min. Temp.	Max. Temp.	Av. Temp.	Morn. RH	Eve. RH	Av. RH	Wind Velocity	BSSH	Evaporation
47	0	31.8	14.8	23.3	75.1	30.4	52.8	3.4	9.3	3.1
48	0	33.3	16.9	25.1	80.0	38.7	59.3	2.1	8.3	2.9
49	0	32.8	17.6	25.2	85.2	43.1	64.1	2.5	5.3	3.5
50	0.3	33..1	20.1	26.6	85.4	44.0	64.7	2.7	6.0	3.6
51	0.55	33.2	17.8	25.5	81.4	35.5	58.4	2.5	8.3	4.1
52	0.80	30.0	11.7	20.9	94.1	39.9	67.0	1.8	7.9	2.8
1	1.25	29.1	15.2	22.2	80	41	60	5.3	5.9	2.6
2	1.40	29.8	12.8	21.3	83	35	59	2.8	7.4	3.0
3	1.75	29.3	10.9	20.1	88	38	63	2.1	8.6	3.3
4	2.20	27.5	12.7	20.1	83	36	59	3.8	5.3	3.0
5	1.95	30.8	16.7	23.8	86	43	64	4.6	4.2	3.5
6	1.40	33.6	13.6	23.6	87	30	58	2.4	9.4	3.2
7	1.05	35.1	13.5	24.3	75	20	47	3.1	10.0	3.1
8	1.00	36.1	13.7	24.9	87	24	56	2.2	9.4	4.4
9	0.75	35.9	15.4	25.7	88	27	57	2.0	9.1	3.9
10	0.50	36.3	18.6	27.4	66	32	49	3.6	5.9	3.7
11	0	36.1	20.0	28.0	72	39	55	3.7	4.2	4.1
12	0	30.9	19.0	29.0	94	56	75	3.7	7.3	3.1
Correlation Coefficient		- 0.498 *	- 0.663 **	- 0.685 **	0.211	-0.024	0.209	0.202	-0.044	-0.214

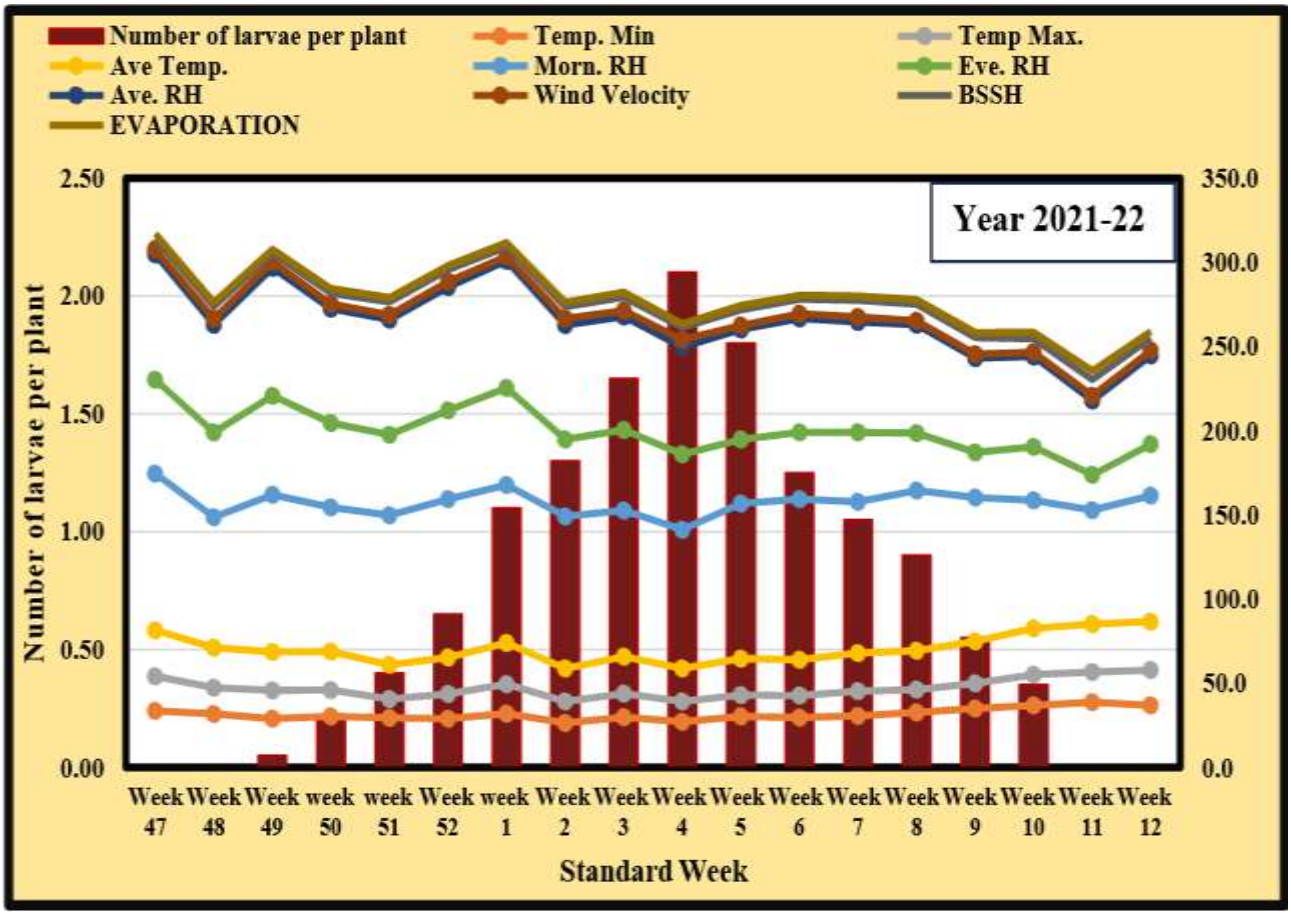

Fig 1: Correlation of number of larvae per plant with weather data by *L. orbonalis* in brinjal 2021-22

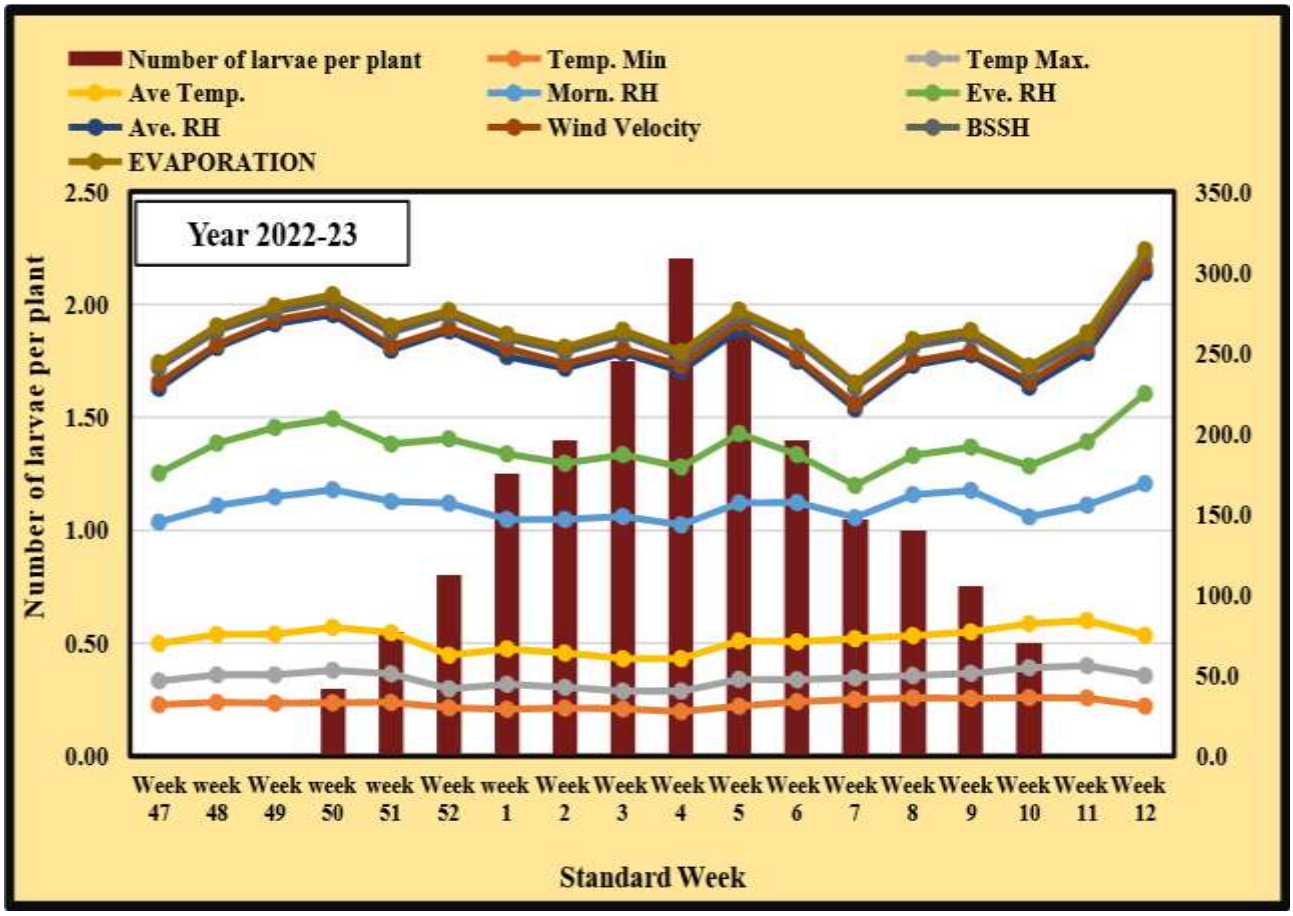

Fig 2: Correlation of number of larvae per plant with weather data by *L. orbonalis* in brinjal 2022-23

According to Yadav *et al*. (2005) [9] found mean temperature showed a positive correlation, while relative humidity and rainfall showed negative correlation on the population of the shoot and fruit borer. Saty *et al*. (2018) [7] also noted that minimum temperature, evening relative humidity and rainfall showed negative correlation on the incidence of *L. orbonalis*. Larval population was found that shoot was negatively correlated with maximum temperature (r = -0.3314) and sun shine hours (r = -0.0905) and per cent fruit infestation had negative correlated with maximum temperature (r = -0.5170) and sun shine hours (r = -0.1279); whereas it had negative correlated with relative humidity (r = -0.0291) observed by (Mahajan *et al*., 2020) [6]. The results of present investigation are in confirmation with past reports.

Conclusion

Population increased of shoot and fruit borer was recorded in terms of 0.05 mean number of larvae at 49th Std. *i.e*., first week of December in 2021-22 whereas, during 2022-23 it was observed 0.3 mean number of larvae 50th Std. i.e., second week of December. The maximum population gradually increased and reached at peak on 4th Std. week *i.e.*, 2.1 larvae/ plant and 2.2 larvae/ plant at last week of January during 2021-22 and 2022-23 respectively. Infestation of shoot and fruit borer was decreased in the month of March after 9th Std. in 2021-22 and 2022-23. The correlation matrix indicated that minimum temperature (r = -0.582) and evaporation (r = -0.518) were significant negative correlation. Maximum temperature (r = 0.663) and Av. temperature (r = 0.666) were significant positive correlation in 2021-22. During 2022-23 results revealed that Min temperature (r = -0.498) was significantly negative correlation, and max temperature (r = 0.663) and Av. Temperature (r = 0.685) were significant positive correlation.

Conflict of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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