International Journal of Entomology Research
ISSN: 2455-4758; Impact Factor: RJIF 5.24
Received: 13-05-2020; Accepted: 25-05-2020; Published: 14-06-2020
www.entomologyjournals.com
Volume 5; Issue 3; 2020; Page No. 152-155

Population fluctuation of brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee) in brinjal fruits under field conditions at Larkana Pakistan

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Abstract
The experiment was carry out at Farmer's field near Shaheed Zulfiquar Ali Bhutto Agricultural College, Dokri Larkana, Campus of Sindh Agriculture University, Tandojam Pakistan for evaluating the Brinjal Fruit and Shoot Borer (*Leucinodes orbonalis* G.) population fluctuation under field conditions throughout year 2019-20. Brinjal shoot and fruit borer (*L. orbonalis* G.) population started developing in the last week of May 2019 and observed throughout the year. High temperature favor the population development; maximum damaged fruits were observed in the month of September 2019 (11.75), maximum larva inside damaged fruits were observed in the month of June 2019 (85.18%) population started decreasing as the temperature started going down. Minimum damage was recorded 2.40% in the month of February 2020minimum larva inside fruits was recorded in the month of February 2020 (2.40%) January (2.50%) as the temperature gone lower the infestation was recorded at minimum level. Overall average of Healthy fruits, Damaged fruits and Larva found inside damaged fruits were (44.65±3.91, 5.34±3.91 and 3.92±3.32) respectively. The results shown that the (10.69±7.82%) damage throughout year was done by Brinjal Fruit and Shoot borer (*L. orbonalis* G.) to Brinjal fruits.

Keywords: fluctuation, *Leucinodes orbonalis*, Agriculture, conditions

Introduction

Solanum melongena L. belongs to family Solanaceae is commonly known as aubergine, brinjal, melongene, garden egg and guinea squasha (Tsao and Lo, 2006) [17]. extensively sophisticated vegetable in Asia and Africa (Hazra *et al*. 2003) [7] Eggplant restrain nutrients such as dietary fiber, foliate, ascorbic acid, vitamin K, niacin, vitamin B6, pantothenic acid, potassium, iron, magnesium, manganese, phosphorus, and copper (USDA 2009). 28 species of insect pests and mites have been description to be associated with brinjal, of which the brinjal shoot and fruit borer (*Leucinodes orbonalis* G.), jassid (*Amrasca biguttula* Ishida and *Amrasca devastans* Distant), hadda beetle (*Henosepilachna* (Epilachna) *vigintioctopunctata* Fabricius), aphids (*Aphis gossypi* Glover), white flies (*Bemisia tabaci* Gennadius and *Trialeurodes vaporariorum* Westwood), brinjal leaf roller (*Eublemma olivacea* Walker), brinjal mealy bug (*Phenacoccus insolitus* Green) are found to be abundant on this crop (Patial and Mehta, 2008) [13] brinjal shoot and fruit borer (*L. orbonalis* G.) reduce its yield up to 70% - 75% (Mainali 2015) [10] In 1854, brinjal shoot and fruit borer was first designated as Leucinodes orbonalis by Guenee; Whereas, in 1859, it was first selected as the type species of the genus by Walker (Capps, 1948) [4]. It is considered as the most obnoxious and damaging pest of the eggplant, *S. melongena* (Raju *et al*., 2007) [18]. A single female could lay 5 to 242 eggs in her life time. Eggs were laid mostly singly and sometimes in the batches of 2 to 4 eggs. Females preferred to lay eggs on the lower surface of the tender leaves or the twigs of plant, flowers, calycies of the fruits. Eggs were oval or somewhat elongated in shape and creamy white in colour which changed to orange (Kavitha *et al*., 2008) [8]. Larva is the only damaging stage of this pest which feeds inside the fruit and form large exit holes in the fruits for pupation after complete development, later decreasing the market value of the fruits and rendering them unfit for human consumption (Alam *et al*., 2003) [1]. Larva of this insect has unique nature of feeding on monophagous diet (Sharma, 2002) [8]. Larval feeding inside shoots result in wilting of the young shoot. Presence of wilted shoots in an eggplant field is the surest sign of damage by this pest. The damaged shoots ultimately wither and drop off. This reduces plant growth, which in turn, reduces fruit number and size. New shoots can arise but this delays crop maturity and the newly formed shoots are also subject to larval damage. Larval feeding inside the fruit results in destruction of fruit tissue. (Atwal, 1976) [2]. For instance, farmers in certain areas of Philippines spray chemical insecticides up to 56 times during a cropping season; the total quantity of pesticide used per hectare of eggplant was about 41 liters of different brands belonging to the four major pesticide groups (Gapud and Canapi 1994; Orden *et al*. 1994) [6, 12]. In Bangladesh, some farmers spray about 180 times during a cropping season (SUSVEG-Asia 2007) [23]. Pesticide misuse has adverse effects on the environment and human health and also increases the cost of production. The share of the cost of pesticide to total material input cost was 55% for eggplant compared with cabbage (49%) and tomato (31%) in the Philippines (Orden *et al*. 1994) [12], and accounted for 40–50 percent in Bangladesh (SUSVEG-Asia 2007) [23]. Many farmers refrain from growing eggplant due to the cost of pesticides (Gapud and Canapi 1994) [6]. It is one of the real facts that when the farmers get low price of produce they don't prefer to apply

any kind of pest protection measures, with this not only the crop is damaged and takes more time to recover, but it helps in development of pest infestations also, at same time that condition suits to parasites, parasitoids and predators for activation, current study is being carried out to find the Brinjal Fruit and Shoot Borer (*Leucinodes orbonalis* L.) infestation in eggplant fruits under field conditions.

Materials and methods

The experiment was conducted at Farmer's field near Shaheed Zulfiquar Ali Bhutto Agricultural College, Dokri Larkana, Campus of Sindh Agriculture University, Tandojam Pakistan for evaluating the Brinjal Fruit and Shoot Borer (*Leucinodes orbonalis* G.) Population fluctuation under field conditions throughout year.

Seed Nursery was sown at the farmer's field in the month March of 2019, Transplanted in the field on 15th April2019. Data recording started as the plant started bearing fruits in the Month of May 2019.

The data was recorded throughout the year. Weekly 50 fruits were randomly collected from the field and observed at laboratory of entomology department Shaheed Zulfiquar Ali Bhutto Agricultural College, Dokri Larkana to evaluate the infestation of Brinjal Fruit and Shoot Borer (*L. orbonalis* G.) in brinjal Fruits. Damaged fruits were recorded and opened for finding the pest larva inside fruits. Healthy Fruits, Damaged Fruits, and the larva found inside fruits were recorded weekly. Damage percentage recorded by following method of percentage.

$$\frac{\text{Total Damaged Fruits X100}}{\text{Total Healthy Fruits}}$$

Similarly for Larva same percentage formula applied

$$\frac{\text{Total Larva inside damaged fruits X100}}{\text{Total Damaged Fruits}}$$

The Metrological data was also recorded throughout the experiment; in the end data was analyzed.

Results and discussion

Brinjal shoot and fruit borer (*Leucinodes orbonalis* G.) population started developing in the last week of May 2019 and was observed throughout the year. Metrological factors played very important role in population fluctuation under field conditions, High temperature favor the population development of Brimjal fruit and shoot borer (*L. orbonalis* G.) maximum damaged fruits were observed in the month of September 2019 (11.75), maximum larva found inside damaged fruits were observed in the month of June 2019 (85.18%) population started decreasing as the temperature started going down. Minimum damage was recorded 2.0% in the month of February 2020 (1.20) followed by January (1.25) minimum larva inside fruits was recorded in the month of February 2020 (2.40) as the temperature gone lower the infestation was recorded at minimum level. Overall average of Healthy fruits, Damaged fruits and Larva found inside damaged fruits were (44.65±3.91, 5.34±3.91 and 3.92±3.32) respectively. The results shown that the (10.69±7.82%) damage throughout year was done by Brinjal Fruit and Shoot borer to Brinjal fruits. See Table (01).

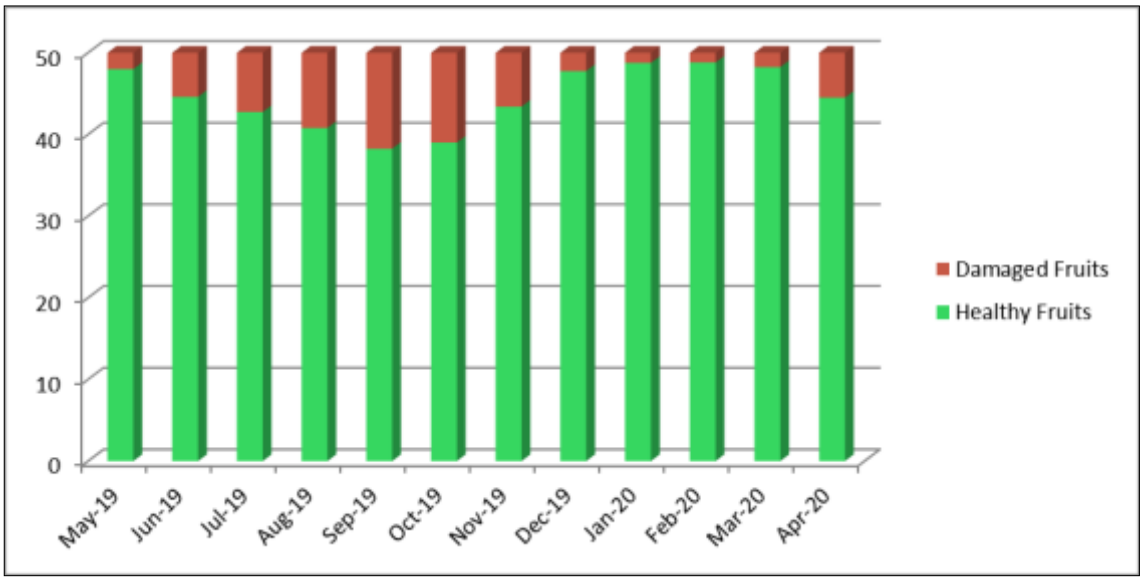
Table 1: Mean of Brinjal shoot and fruit borer (*Leucinodes orbonalis* G.) infestation recorded throughout Year

Month	Total Fruits	Healthy Fruits	Damaged Fruits	Damage Percentage	Larva in Fruits	Larva percentage
May - 2019	50	49	2	4.0	0	0
June- 2019	50	44.60	05.40	10.80	04.60	85.18
July- 2019	50	42.75	07.25	14.50	05.00	68.96
August - 2019	50	40.80	09.20	18.40	07.40	80.43
September- 2019	50	38.25	11.75	23.50	09.50	80.85
October- 2019	50	39.00	11.00	22.00	08.25	75.00
November - 2019	50	43.40	06.60	13.20	05.20	78.78
December- 2019	50	47.75	02.25	04.50	01.00	44.44
January 2020	50	48.75	01.25	02.50	00.75	60.00
February – 2020	50	48.80	01.20	02.40	00.40	33.33
March -2020	50	48.25	01.75	03.50	00.75	42.85
April - 2020	50	44.50	05.50	11.00	04.25	77.27
Mean	-	44.57	5.34	10.58	3.92	60.59
S.D.	-	3.82	3.82	7.82	3.32	25.73

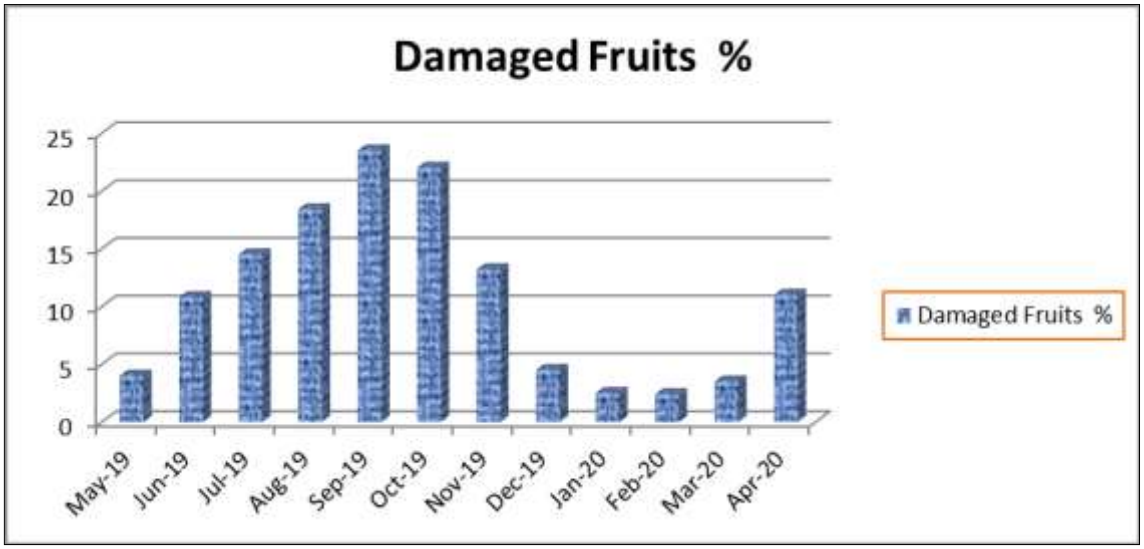
Table 2: Monthly Average Temperature and humidity recorded in Larkana Sindh Pakistan

S. No	Month	Temperature		Humidity %	
		Minimum ºC	Maximum ºC	08:00AM	05:00PM
1	May-2019	27.17	41.25	55.67	28.77
2	June -2019	29.6	44.33	61	35.1
3	July -2019	28.85	42.32	71.54	45.83
4	August-2019	28.04	38.54	71.54	45.83
5	September-2019	28.12	39	76.25	56.45
6	October-2019	22.83	33.79	76.24	53.19
7	November-2019	16.01	27.65	78.36	59.53
8	December -2019	8.78	21.61	75.64	52.9
9	January-2020	8.75	21.72	76.35	52.16
10	February -2020	10.23	23.3	78.57	52.96
11	March-2020	15.83	25.74	76.61	55.16
12	April-2020	23.62	39.65	65.36	40.63

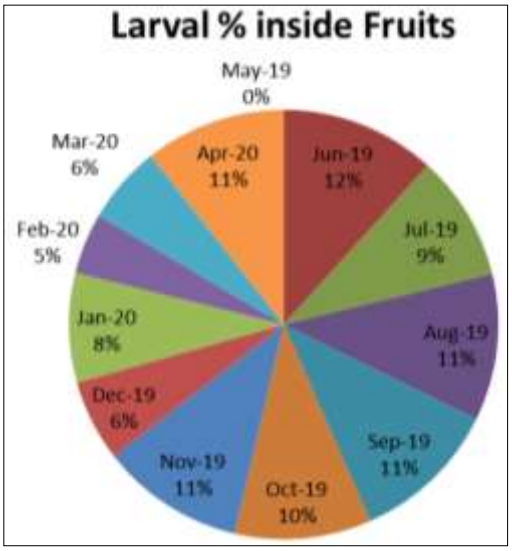
Source: Metrology Office Larkana



Graph 1: Fruits Damaged by brinjal shoot and fruit borer (*Leucinodes orbonalis* G.) under field Conditions



Graph 2: Larval Parentage Found inside the damage fruits randomly collected from field



Graph 3: Larva of brinjal shoot and fruit borer (*Leucinodes orbonalis* G.) found inside the fruits of Brinjal

Sandeep *et al*., (2018) [19] noticed that the larval population was low during the month of November and varied between 0.30 to 4.10 larvae/plant. Natrajan *et al*., 2009 also reported the mean shoot damage ranged from 1.1 per cent (2nd week of February). Prabhjot *et al.* (2009) studied maximum numbers of larvae (10 larvae/90 plants) were recorded in the 39th and 40th standard weeks of 2009. Singh *et al*., (2000) [22] noticed 73.33 per cent infestation of the top shoots during the end of August by *L. orbonalis*, which peaked 86.66 per cent in the third week of September with an intensity of 2.09/plant. Shukla (2010) [21] & Bhushan (2011) [3] studied the losses caused by this pest may vary from season to season. This is because moderate temperature and high humidity favor the population build-up of Brinjal Fruit and Shoot Borer and cause heavy losses during hot and humid condition. Malik and Pal (2013) [9] studied the seasonal incidence of shoot and fruit borer, L. orbanalis on forty brinjal germplasm at Kalyanpur. The infestation of shoot borer appeared in 43rd standard week (18–24 October). Maximum temperature played positive role in multiplication of shoot borer.

The results reveal that the similar type of results was found in old times as well. Parkash (1978) [14] reported that a maximum population (10 larvae/10 fruits) of BSFR on brinjal shoots as well as fruits was observed during the

months of July-September when the mean atmospheric temperature was above 30ºC and % RH ranged between 60-70%, respectively. Patel *et al.* (1988) [15] and Dhamdhere *et al.* (1995) [5] found moderate temperature and high humidity favoring the BSFR population build-up during the summer 1987.

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