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Seasonal abundance of brinjal shoot and fruit borer, *leucinodes orbonalis* guen., in relation to weather parameters

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ABSTRACT

The incidence of *L. orbonalis* to shoots showed two peaks of infestation, first during 4th week of August (35th SMW) (33.33%) and second during 3rd week of September (38th SMW) (17.14%) whereas peak fruit infestation observed (28.26%) during 2nd week of November. Significant negative association of sunshine and non-significant negative association of maximum temperature (MaxT) as well as with morning relative humidity (RH_1) was observed with shoot infestation but highly significant positive correlation found with minimum temperature (MinT), morning vapour pressure (VP_1), evening vapour pressure (VP_2) and mean vapour pressure (VP_2). There was highly significant positive association between incidence of *L. orbonalis* and maximum temperature (MaxT) as well as mean temperature (MT) in fruiting period, whereas, it was significant positive correlation with minimum temperature (MinT) and morning vapour pressure (VP_1). BSS, VP_2 and MVP showed non-significant positive correlation.

Key words : *Brinjal Shoot and fruit borer, Weather parameters, Correlation*

Introduction

Brinjal, *Solanum melongena* L., is one of the most commonly grown and economically important vegetables of Gujarat and shoot and fruit borer, *Leucinodes orbonalis* Guenee is the key insect limiting the production and productivity of this vegetable crop. Although, the insect is active throughout the year in places having moderate climate, the severity of infestation is however reported to vary with locations, seasons and crops varieties (Muthukumar and Kalyanasundaram, 2003; Singh and Singh, 2003; Patnaik, 2000). The investigations were therefore, undertaken to find out the impact of the environmental factor on the incidence of this pest in North Gujarat condition.

Materials and Methods

Field experiment was conducted at Horticultural Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Banaskantha, Gujarat-385506 during *kharif* 2012. The brinjal seedlings of *var.* GOB-1 were transplanted in the field of 20m × 20m size at 75cm × 60cm plant spacing. All the crop management practices except the insecticide applications were followed for maintain healthy crop growth. Observations were recorded at weekly interval. Shoot damage was recorded on 10 randomly selected plants from 10 DAT (Day after transplanting). The fruit damage on number as well as weight basis was observed during each picking by counting the total healthy as well as

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infested fruits to work out the per cent fruit infestation. Fruit damage on number and weight basis at each picking were recorded from five randomly selected spots of 1m × 1m (four plants/spot) area. Weather parameter also recorded at weekly interval and statistically correlated with the meteorological conditions.

Results and Discussion

Shoot damage

The data (Column 4 in Table 1, Figure 3) indicated that the incidence of *L. orbonalis* in shoots was commenced from 2nd week of August *i.e.*, 33rd Standard Meteorological Week (SMW) and continued till 4th week of October (43rd SMW). The infestation ranged from 0.80 to 33.33 per cent during this period. The infestation (14.29%) which initiated in 2nd week of August (33rd SMW), showed first peak (33.33%) during 4th week of August (35th SMW), decreased and again reached at the second peak level (17.14%) during 3rd week of September (38th SMW) and then gradually decreased during 4th week of September to 4th week of October and disappeared from the 5th week of October. Thus, it is clear from the data that relatively higher (0.80 to 33.33%) infestation to shoot due to *L. orbonalis* was observed during 2nd week of August to 4th week of October (33th to 43rd SMW). Thus, the infestation showed two peaks with the highest peak (33.33%) during 4th week of August.

Table 1. Incidence of shoot and fruit borer, *L. orbonalis* on brinjal

Months	Weeks	Standard Meteorological Weeks	Damage (%)	
			Shoot	Fruit
1	2	3	4	6
July	IV	30	0.00	0.00
	V	31	0.00	0.00
August	I	32	0.00	0.00
	II	33	14.29	0.00
	III	34	26.32	0.00
	IV	35	33.33	0.00
September	I	36	28.57	0.00
	II	37	14.43	0.00
	III	38	17.14	0.00
	IV	39	13.33	0.00
October	I	40	13.01	0.00
	II	41	8.86	0.00
	III	42	4.18	0.00
	IV	43	0.80	18.75
	V	44	0.00	19.04
November	I	45	0.00	21.21
	II	46	0.00	28.26
	III	47	0.00	23.33
	IV	48	0.00	21.43
December	I	49	0.00	17.19
	II	50	0.00	14.29
	III	51	0.00	6.52
	IV	52	0.00	0.00

The peak population of *L. orbonalis* was recorded during 3rd week of August and resumed a serious status during September (Mall *et al.*, 1992). While as per the report of Bharadiya and Patel (2005), the highest shoot damage was observed during 4th week of September. At Anand region, the shoot damage was reported highest (2.97%) during last week of October (Bhatt, 2003). The shoot infestation was initiated from 4th week of August and resumed a serious status during September till November 2nd week (Shukla and Khatri, 2010).

Overall, the trend of damage to shoot caused by *L. orbonalis* found during present investigation tally with the above report.

Effect of weather parameters on shoot damage

The data on correlation coefficient (Column 3 in Table 2 and Figure 3) indicted that all the abiotic factors except morning, evening and mean relative humidity (RH_1, RH_2 and MRH) and maximum temperature (MaxT) as well as rainfall (RF) under studied showed significant impact on the incidence of *L. orbonalis*. There was significant negative correlation between incidence of *L. orbonalis* and bright sunshine hours (BSS), with the "r" value -0.6753* whereas it was negative correlation with maximum temperature (MaxT) and morning relative humidity (RH_1) with "r" value -0.3864 and -0.2974, respectively. Minimum temperature (MinT), and morning vapour pressure (VP_1), evening vapour pressure (VP_2) and mean vapour pressure showed highly significant positive association whereas mean temperature (MT) and wind speed (WS) showed significant positive association with incidence of *L. orbonalis* on shoots (r = 0.8959, 0.8616, 0.8750, 0.8764, 0.6727 and 0.6183, respectively). There was non-significant but positive correlation found between incidence of *L. orbonalis* and rainfall (r = 0.2502).

There was negative association of MaxT and rainfall, while positive of relative humidity and rainfall (RF) with the incidence of *L. orbonalis* was observed at Kanpur in Uttar Pradesh (Mall, *et al.*, 1992). Bhatt (2003) found the positive and significant correlation

of shoot damage due to *L. orbonalis* with environmental factors, MaxT(r = 0.7045), MinT (r = 0.6166), MT (r = 0.6851), RH_1 (r = 0.2847), VP_1 (r = 0.5903) and VP_2 (r = 0.3456), respectively. Non-significant negative correlation between temperature (both maximum and minimum) and larval incidence was observed in *summer* season which was favourable for the activity of parasite, *Trathalia flavo-orbitalis* (Patnaik *et al.* 2010). There was non-significant but positive correlation found in between wind speed and shoots damage (Meena *et al.* 2012). Thus, the findings of present investigation more or less collaborate with other reports.

Fruit damage

The data on fruit damage due to *L. orbonalis* are summarized in Table 1 (Column 6) and depicted in Fig. 3, clearly showed that there was no incidence of *L. orbonalis* in fruits till 3rd week of October (42nd SMW). The damage to fruits commenced from 4th week of October (43rd SMW) and continued till the end of the crop (4th week of December) and ranged from 6.52 to 28.26 per cent. The damage to fruits (18.75%) due to *L. orbonalis* initiated from the 4th week of October (43rd SMW), showed increasing and reached to a peak (28.26%) during 2nd week of November (46th SMW). Thereafter, the incidence decreased during 3rd week of November (23.33%) and disappeared from 4th week of December.

Highest damage to fruits by this pest has been reported during 3rd week of November at Kanpur in Uttar Pradesh (Mall *et al.*, 1992), 2nd week of December at Anand in Gujarat (Bhatt, 2003) and 3rd week of November in North Gujarat (Bharadia and Patel, 2005) and damage to fruits was at peak (22.05%) during 3rd week of October (Shah *et al.*, 2011). The variation in periods of high activity of pest as reported above might be due to the variation in the transplanting periods or different climatic conditions at various places.

Effect of weather parameters on fruit damage

The impact of various abiotic factors on the activity of *L. orbonalis* in fruit was also worked out and presented in Table 2 (Column 4) and depicted in Figure 3. All environmental factors except BSS, RH_1, RH_2, MRH, VP_2, MVP and WS showed significant impact on the incidence of *L. orbonalis*. MaxT (r= 0.7795**) and MT (r= 0.7653**) were highly significantly and positively associated with the pest infestation. Whereas, VP_1 (0.7102*) and MinT (0.6440*) showed significant positive correlation with *L. orbonalis*. There was non-significant but positive correlation found between incidences of *L. orbonalis* and BSS (r= 0.2674), VP_2 (r= 0.3080) and MVP (r= 0.6017), respectively. Non-significant but negative association was observed between incidences of *L. orbonalis* and RH_1 (r= -0.2424), RH_2 (r= -0.1347), MRH (r= -0.2188) and WS (r= -0.2544). Overall, *L. orbonalis*. was highly active during 2nd week of August to 3rd week of December (33rd to 51st SMW) in brinjal crop. The present findings are in conformity with the report of Mall *et al.* (1992) so far temperature and relative humidity concerned. There was significant positive role of temperature with the fruit damage but negatively significant correlation was observed in be-

Table 2. Correlation between infestation of *L. orbonalis* and weather parameters in brinjal

Sl. No.	Weather parameters	Correlation coefficient (r)	
		Shoot damage	Fruit damage
1	2	3	4
1	Bright Sunshine Hours, $hrday^{-1}$ (BSS)	-0.6753*	0.2674
2	Maximum Temperature, ^0C (MaxT)	-0.3864	0.7795**
3	Minimum Temperature, ^0C (MinT)	0.8959**	0.6440*
4	Mean Temperature, ^0C (MT)	0.6727*	0.7653**
5	Morning Relative Humidity, % (RH_1)	-0.2974	-0.2424
6	Evening Relative Humidity, % (RH_2)	0.3670	-0.1347
7	Mean Relative Humidity, % (MRH)	0.1029	-0.2188
8	Morning Vapour Pressure, mm of Hg (VP_1)	0.8616**	0.7102*
9	Evening Vapour Pressure, mm of Hg (VP_2)	0.8750**	0.3080
10	Mean Vapour Pressure, mm of Hg (MVP)	0.8764**	0.6017
11	Wind Speed, $kmhr^{-1}$ (WS)	0.6183*	-0.2544
12	Rainfall, mm (RF)	0.2502	——

Notes: "*" Significant at 5% level ; "**" Significant at 1% level

tween fruit damage and minimum relative humidity as well as rainfall (Singh *et al.*, 2000). Borer infestation showed a significant positive correlation with maximum temperature, minimum temperature; mean temperature and minimum relative humidity whereas with maximum relative humidity the correlation was negative but non-significant (Ghosh and Senapati, 2009). The pest activity in fruit had significant positive correlation with BSS (r=0.8934), MaxT (r=0.8104) and MT (r=0.7854) while significant negative correlation with RH_2 (r=-0.6753) and RF (r=-0.9134) at Anand in Gujarat (Shah *et al.*, 2011).

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