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Effect of transplanting dates on incidence of brinjal (*Solanum melongena*) shoot-and fruit-borer [*Leucinodes orbonalis* (Guenee)]

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Abstract

The field experiment was conducted to study the incidence of brinjal (*Solanum melongena* L.) shoot-and fruit-borer [*Leucinodes orbonalis* (Guenee)] on different transplanting dates at the College of Agriculture, CAU, Imphal, during 2021-22. The incidence of *L. orbonalis* on brinjal was noticed on different dates. The third transplanted crop recorded relatively higher shoot damage with a mean of (25.9 per cent), followed by the second, fourth and first transplanted crop with a mean of, 20.7, 16.5 and 11.7 per cent, respectively. Similarly, third transplanted crop recorded highest mean fruit damage (25.0 per cent on a number basis and 23.40 per cent on a weight basis), followed by second, fourth and first transplanted crop recorded with mean fruit damage (21.7 per cent on a number basis and 20.8 per cent on weight basis, 18.0 per cent on number basis and 16.7 per cent on weight basis and 12.2 per cent on number basis and 11.9 per cent on a weight basis).

Key words: Transplanting dates, Shoot infestation, Fruit infestation, Incidence, Shoot-and fruit-borer

Brinjal (*Solanum melongena* L.) is infected by 26 different types of insects and mites (Vevai, 1970). In Manipur, brinjal cultivation is done in 129 hectares of land with a production of 1641 tonnes (Anonymous, 2021). Different insect pests attack brinjal right from the seedling stage to the final harvesting stage. Some important insect pests of brinjal, which cause enormous damage to this crop are brinjal shoot-and fruit-borer (*L. orbonalis*), hadda beetle (*Epilachna* spp), jassid (*Amrasca bigutella bigutella*), aphid (*Aphis gossyppii*) and white fly (*Bemisia tabaci*) (Latif *et al.* 2009). Among these, brinjal shoot-and fruit-borer, *L. orbonalis* is considered to be the most destructive pest of brinjal (Saimander and Gopal 2012, Choudhary *et al.* 2024) and is found in all brinjal- growing countries (Dutta *et al.,* 2011; Tomar and Saha, 2018). Brinjal shoot-and fruit-borer *L. orbonalis* (Guenee) is responsible for crop losses of 20-90 per cent in different regions of the country (Raju *et al.,* 2007; Haldhar and Maheshwari, 2018 and 2021; Chiranjiv *et al.,* 2023; Halder *et al.,* 2023).

This pest is active during rainy and summer seasons and has a distinct feeding pattern. The larva bores into shoots during early stages of crop growth, causing drooping, withering, and drying of affected shoots due to disruption of the vascular system and translocation of food materials. The larvae bore through the calyx and later into the flower buds and fruits at later stages of plant growth, and the bored holes are invariably plugged with excreta (Haldhar *et al.,* 2013; Haldhar and Deshwal, 2017).

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The time of transplanting is an important cultural practice having a bearing on the population build-up of the associated pest complex in brinjal. Pest attacks can be suppressed or escaped by altering the transplanting dates. In this way, the most vulnerable period of crop growth may not synchronize with the peak activity of the pest organism. Thus, manipulation of the date of transplanting of this crop may reduce the incidence of this pest and indirectly it may lessen the number of spray applications for its management. Keeping in view the economic importance of the crop, and the quantum of damage caused by the shoot and fruit borer, the study was carried out.

MATERIALS AND METHODS

The experiment was conducted at the College of Agriculture, CAU (24°45’ N latitude and 93°56’ E longitudes), Imphal, which is located at an altitude of 790 MSL. The climate of Imphal is subtropical, tempered by altitude, with mild, dry winters from November to February and a long, hot and rainy period from April to October 2022. For the seasonal incidence of shoot-and fruit-borer, four different transplanting planting dates (2 September, 12 September, 22 September and 2 October during 2022) were taken during 2022-2023. The soil at the experiment site had a clay loam texture and was acidic in response, with a pH of 5.5. One month before transplanting, experimental field was ploughed extensively with a tractor, followed by three crossing ploughings with a power tiller. After that, the soil was pulverized and the plot was appropriately levelled. Before transplanting, the soil was completely integrated with well-decomposed farmyard manure (FYM) at a rate of 20 tonnes per hectare, Urea, single superphosphate, and murate of potash were used to apply N, P_2O_5 and KO to the experimental crop at 80:40:60 kg/ha, respectively. On the day of the last harrowing of the field, the complete dose of P_2O, and KO, as well as one-third dose of N, were applied uniformly to all plots as a basal dose. After one month of transplanting and at the start of the flowering stage, the remaining N was split into two halves and applied as a side dressing.

The total field area of 144 m^2 was laid out in uniformly sized plots measuring 2m × 2.5 m (5m^2) with twenty plots for the experiment with different dates of the transplanted crop. With five replications, the experiment was set up in Randomized Block Design (RBD). The crop was planted (variety: Pusa Purple Long) on four different dates, at ten days intervals. The plot area was 2m x 2.5m in size, with (60 cm x 45 cm) spacing. The shoot/ fruits were split open wherever necessary to note the pinkish-coloured larvae. The crop was left for natural infestation of *L. orbonalis*.

The observations were recorded on shoot infestation at weekly intervals and fruit infestation at each picking. For fruit infestation, a total number of fruits and infested fruits were recorded per plot during each harvesting from each replication. The meteorological parameters (maximum, minimum and mean temperatures, morning, evening and mean relative humidity and rainfall) were taken from the meteorological observatory, ICAR complex, Imphal for computing. Simple correlations between shoot and fruit infestations and weather parameters (maximum, minimum and mean temperatures, morning, evening and mean relative humidity, rainfall) were computed.

$$\text{Yield Loss (\%)} = \frac{\text{Average damaged fruit yield}}{\text{Average total matured fruit yield}} \times 100$$

$$\text{Percentage Damaged Parts} = \frac{\text{Number of damaged plant}}{\text{Total number of plants of served}} \times 100$$

The per cent age of infested shoot/fruit was recorded and data recorded were analyzed by using OPSTAT online software and two factor ANOVA was performed in Randomised Block Design to compute CD value. The treatments with a significant difference were also separated using Tukey's honestly significant difference post Hoc test using IBM SPSS software.

RESULTS AND DISCUSSION

Effects of transplanting on infestation

Among the four different transplanting dates, first transplanting showed owest shoot-and fruit-borer infestation, while third transplanting recorded highest shoot and fruit infestation (Table 1). In the first transplanting (2 September 2022), shoot infestation started from 39th SMW and persisted up to the 48th SMW and infestation varied from 2.39 to 24.03%. The peak shoot infestation (24.03%) was observed in the 43rd SMW. In fruit infestation (at each picking) on a number basis, infestation started from 42nd SMW and sustained up to the 50th SMW, which varied from 4 to 24.08%. The peak fruit infestation (24.08%) was noticed in 46th SMW. The fruit infestation (weight basis) started from 42nd SMW and sustained up to 50th SMW and the infestation varied from 3.52 to 26.07%.

The peak fruit infestation (26.07%) was noticed in 46th SMW. In third transplanting (22 September 2022), shoot infestation started from 43rd SMW and it remains up to the 52nd SMW. Infestation varied from 9.26 to 43.65% with a peak of 43.65% in the 47th SMW. Fruit infestation (number basis) started from the 46th SMW and persisted up to the 2nd SMW and infestation varied from 7.33 to 41.55%. The highest fruit infestation (41.55%) was observed in the 50th SMW. The fruit infestation (weight basis) started from 46th SMW and sustained up to second SMW and infestation varied from 7.04 to 39.56%. The peak fruit infestation (39.56%) was noticed in 50th SMW.

The present findings are partially in agreement with reports of Singh *et al.* (2017) that the maximum incidence of shoot borer was recorded after 2 months of crop growth; among the 4 different dates of transplanting, 3rd date of transplanting recorded maximum shoot borer incidence; whereas, the crop transplanted on the 1st date recorded lowest infestation. Singh *et al.* (2011) observed that the infestation of *L. orbonalis* on the brinjal crop started from the early vegetative stage and continued up to the crop maturity. The first infestation appeared on shoots from

Table 1. Effect of different transplanting dates on the incidence of shoot and fruit borer

Treatment	Date of transplanting	Shoot infestation	Fruit infestation (No. basis)	Fruit infestation (Wt. basis)
T_1	2 September 2022	0.117	0.122	0.119
T_2	12 September 2022	0.207	0.217	0.208
T_3	22 September 2022	0.259	0.250	0.234
T_4	2 October 2022	0.165	0.180	0.167
	S.E(m)	0.0024	0.0048	0.0065
	CD(p=0.05)	0.0073	0.0148	0.0199

the first week of October and peaked in the first week of November.

The investigations conformed with the findings of (Meena, 2014) who reported that the infestation of shoot borer on shoots of brinjal crop, commenced in the last week of August *i.e.*, two weeks after transplanting which gradually increased and reached its peak in the last week of September. Thereafter, it started declining and persisted up to the second week of October and the incidence was found to be a positive significant relationship with RH and a negative non-significant relationship with temperature and rainfall.

Effects of weather on its incidence of shoot and fruit borer of brinjal

Shoot infestation in first transplanting date revealed a positive relationship: all weather parameters (maximum temperature, minimum temperature, mean temperature, evening relative humidity, and rainfall). Morning relative humidity and mean relative humidity showed a negative relationship. In the case of fruit infestation (both number and weight basis) showed a negative relationship with minimum temperature, mean temperature, morning relative humidity, evening relative humidity, mean relative humidity and rainfall whereas maximum temperature showed a positive relationship with fruit infestation (Table 2). Shoot infestation in second date of transplanting revealed that minimum temperature, mean temperature, morning relative humidity, evening relative humidity and mean relative humidity showed a negative relationship, whereas maximum temperature and rainfall showed a positive relationship.

In fruit infestation (both number and weight basis), maximum temperature, minimum temperature, mean temperature, morning relative humidity and mean relative humidity showed a positive relationship and other factor showed a negative relationship. In third date of transplanting, the minimum temperature, evening relative humidity, mean relative humidity and rainfall showed a negative relationship and maximum temperature, mean temperature and morning relative humidity showed a positive relationship with shoot infestation.

In fruit infestation (on number basis) the maximum temperature, minimum temperature, mean temperature, evening relative humidity, mean relative humidity showed a positive relationship and morning relative humidity, rainfall showed a negative relationship with fruit infestation. In the case of fruit infestation (on weight basis) the morning relative humidity showed a negative relationship and other all factors showed a positive

Table 2. Correlation coefficient (r) between shoot-and fruit-borer infestation and weather parameters

BSFB Infestation	Temperature(°C)			Relative humidity (%)			Rainfall (mm)
	Maximum	Minimum	Mean	Morning	Evening	Mean	
First date of transplanting							
Shoot infestation	0.082	0.091	0.093	-0.564	0.018	-0.169	0.046
Fruit infestation (no. basis)	0.071	-0.244	-0.143	-0.058	-0.412	-0.396	-0.148
Fruit infestation (wt. basis)	0.122	-0.171	-0.076	-0.188	-0.384	-0.446	-0.117
Second date of transplanting							
Shoot infestation	0.086	-0.191	-0.106	-0.370	-0.441	-0.612	0.075
Fruit infestation (no. basis)	0.380	0.192	0.293	0.299	-0.203	0.044	-0.549
Fruit infestation (wt. basis)	0.420	0.287	0.364	0.246	-0.142	0.051	-0.506
Third date of transplanting							
Shoot infestation	0.421	-0.018	0.186	0.135	-0.546	-0.358	-0.559
Fruit infestation (no. basis)	0.367	0.502	0.467	-0.084	0.180	0.128	-0.188
Fruit infestation (wt. basis)	0.332	0.509	0.453	-0.076	0.226	0.169	0.140
Fourth date of transplanting							
Shoot infestation	0.319	0.428	0.399	0.119	0.250	0.246	-0.219
Fruit infestation (no. basis)	-0.618	-0.143	-0.367	0.814*	0.557	0.661	0.640
Fruit infestation (wt. basis)	-0.572	-0.136	-0.342	0.779*	0.500	0.605	0.552

relationship with fruit infestation. In the fourth date of transplanting, all the factors were showed a positive relationship except the rainfall with shoot infestation. Fruit infestation (both number and weight basis), morning relative humidity showed a positive significant relationship and evening relative humidity, mean relative humidity, rainfall showed a positive relationship and other factors negatively related with fruit infestation.

The result is in the line of Naqvi *et al.* (2009), who reported that relative humidity showed a positive significant effect on the shoot and fruit borer, but rainfall showed a negative relationship with shoot and fruit. The maximum shoot borer infestation (33.31%) was recorded in present experiment as compared to 75.02 per cent (Patnaik 2000), 38.01 per cent (Singh *et al.*, 2017), 26.18 per cent (Jat *et al.*, 2002) in different regions of the country. The present investigations are in conformity with the findings of Singh *et al.* (2009) who reported that shoot infestation occurred during fourth week of August and the incidence was found to be non-significant relationship with temperature, relative humidity and rainfall.

Singh *et al.* (2011) reported that the peak infestation of this pest on shoots was observed in the first week of June and fourth week of May while the peak incidence on fruits was observed during the second week of June and third week of June in two successive cropping seasons, respectively. Nandi *et al.* (2017) and Kumar *et al.* (2017) have also reported positive correlation of brinjal shoot and fruit infestation with temperature. They have also reported positive correlation between relative humidity and pest infestation on harvestable fruit while Yadav *et al.* (2015) reported a negative correlation which is only observed between flower and squares infestation in the present study.

Conclusion

The shoot-and fruit-borer infestation peaked on the initial transplanting in 43rd and 46th SMW, respectively. All meteorological factors during that time, with the exception of maximum temperature, showed a negative link with infestation. Fruit infestation was positively connected with highest temperature. Shoot-and fruits-borer infestation on shoots and fruit peaked in the 45th and 48th SMW after the second transplanting. The 47th and 50th SMW of the third transplanting saw highest shoot and fruit borer infestation levels on shoot and fruit.

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