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Ramkinkar Sahu
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad,
Uttar Pradesh, India

Ashwani Kumar
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad,
Uttar Pradesh, India

Hadi Husain Khan
Regional Plant Quarantine Station, Amritsar, India

Dharmveer Habil
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad,
Uttar Pradesh, India

Narendra Singh Dhaked
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad,
Uttar Pradesh, India

Huma Naz
Department of Plant Protection,
Faculty of Agricultural Sciences,
Aligarh Muslim University,
Aligarh, U.P., India

Correspondence
Ramkinkar Sahu
Department of Entomology,
Naini Agricultural Institute,
Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad,
Uttar Pradesh, India

Seasonal incidence of *Leucinodes orbonalis* Guenee in Allahabad, U.P., India: A review

Ramkinkar Sahu, Ashwani Kumar, Hadi Husain Khan, Dharmveer Habil, Narendra Singh Dhaked and Huma Naz

Abstract
The pest poses a serious problem because of its higher productive potential, rapid turnover of generations and intensive cultivation of brinjal both in wet and dry seasons of the year. It is reported to be attacked by about 140 species of insect pests, of which the shoot and fruit borer (*Leucinodes orbonalis* Guen.) is the most important one. The maximum population of brinjal shoot and fruit borer, *Leucinodes orbonalis* in Allahabad, U.P. was observed in 5th and 2nd week of December during 1st and 2nd year respectively. The brinjal shoot and fruit borer incidence showed positive correlation with maximum relative humidity, rainfall and wind speed during 1st year and with maximum relative humidity and sunshine hours in 2nd year. The damaged fruit and fruit weight loss varied from 3.76 to 45.45 percent and 3.00 to 67.71 percent in 1st year and 5.71 to 44.26 percent and 3.00 to 51.33 percent in 2nd year. Many scientist observed that seasonal incidence of shoot and fruit borer, *Leucinodes orbonalis* Guen. (on shoot) was more prevalent during vegetative phase of the crop up to the 3rd week of September. The role of temperature, rainfall, relative humidity (Morning) in increasing infestation and intensity on shoot and fruits was very conductive but RH (%) (Evening) responded negatively on borer.

Keywords: Borer, humidity, brinjal, *Leucinodes orbonalis*

Introduction
Brinjal (*Solanum melongena* L.) is one of the widely used vegetable crops by most of the people and is popular in many countries *viz.*, Central, South and South East Asia, some parts of Africa and Central America (Harish *et al.*, 2011) [6]. It is native of India and is grown throughout the country (Choudhary, 1970; Pareet, 2006) [3, 12]. Brinjal (*Solanum melongena*) belongs to the family Solanaceae and genus *Solanum*. It bears a fruit commonly used as avegetable which is available throughout the year at cheaper rate. The major constraint in the production of Brinjal is biotic and abiotic factors. Among biotic factors, loss due to pests is more pronounced. As Brinjal crop, is subjected to attack by number of insect pests right from nursery stage till harvesting (Regupathy *et al.*, 1997) [15]. It is reported to be attacked by about 140 species of insect pests, of which the shoot and fruit borer (*Leucinodes orbonalis* Guen.) is the most important one (Frempong, 1978) [4]. This crop isregularly and simultaneously attacked by several insect pests like leafhopper (*Amrasca bigutulla bigutulla* Ishida), whitefly (*Bemisia tabaci* Gennadius) and brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee (Bhadauria *et al.*, 1999) [1]. Brinjal shoot and fruit borer is regarded as one of the most destructive pest attacking brinjal crop right from nursery stage to harvesting. The pest poses a serious problem because of its higher productive potential, rapid turnover of generations and intensive cultivation of brinjal both in wet and dry seasons of the year. The yield loss caused by this pest has been estimated upto 70-92 percent (Chakraborti and Sarkar, 2011) [2]. Larvae of pest bore into tender shoots make zig zag feeding tunnels in fruits, which are clogged with frass that make fruits unfit for consumption and marketing.

Seasonal incidence of *Leucinodes orbonalis* Guenee
Mall *et al.* (1992) [9] observed seasonal incidence of jassid, aphid, *Epilachna* beetle and shoot borer (on shoot) were prevalent during vegetative phase of the crop upto the 3rd week of September when the average temperature and humidity were more than 28 ^{o}C and 80 percent respectively. These conditions were more conductive for *Epilachna* beetle and shoot and fruit borer (on shoot). At the initiation of fruiting phase in October, the intensity of jassid and aphid was increased along with the shifting of borer infestation from shoots to fruits at average temperature and humidity ranging between 20-25 ^{o}C and 50-72 percent, respectively, were

responsible for more multiplication of jassid and aphis while rainfall played negative role for these pests. Fruits infestation was maximum at the initial stage of fruiting which declined slowly with the advent of winter during December. The extent of losses due to shoot and fruit borer was calculated to be 13.13 percent on fruits, out of which only 3.60 percent may be considered as unconsumable.

Singh *et al.* (2000) [18] noticed brinjal shoot and fruit borer, *Leucinodes orbonalis* Guen. to infest 73.33 percent of the top shoots during the end of August on brinjal cv. Azad Kranti, which peaked 86.66 percent in the third week of September with an intensity of 2.09/plant. On initiation of the flowering, the pest infestation continuously declined on the shoots and reached to zero level in the end of October, but this critical stage the borer infestation shifted over to flowers and fruits which was 33.33 percent in the beginning of October and reached at 66.66 percent with a week and gradually decreased in the subsequent pickings with the advent of winter season. There was a positive role of temperature in the multiplication of the pest and relative humidity responded negatively. The extent of apparent losses of the borer was only 21.30 percent, but its total losses in production were as high as 48.30 percent, out of which 45.90 percent were the avoidable losses. The economic injury of shoot and fruit borer was determined 0.67 percent in fruits and 0.91 percent on its shoots.

Prabhu *et al.* (2005) [13] studied the effect of nitrogen and phosphorus on the incidence of the fruit borer *Leucinode sorbonalis*in brinjal hybrid C08H 1 during *kharif* and *rabi* seasons of 2000-01. The fruit damage caused by *L. orbonalis* weight basis ranged from 11.01- 31.00 percent. Both the seasons the fruit damage had a positive response with the level of increase in nitrogen. At the same time high levels of phosphorus promoted the early maturity and hardening of plant tissues which enabled the plants to escape the Injuries of the borer.

Ghosh and Senapati (2009) [5] found in the sub-himalayan region of West Bengal, India the pest to be most active during summer and the rainy season, particularly during May-August, and caused 49.5–81.0% damage to fruits. Peak infestation (81.0% fruit damage) was noticed in the first week of June (22nd standard week), when the mean temperature, mean relative humidity and weekly rainfall were 27.8 ºC, 79.2% and 81.2 mm respectively. The pest became less active during winter months particularly in December–January. Borer infestation showed a significant positive correlation (P = 0.05) with maximum and mean temperature, minimum and mean relative humidity and rainfall, whereas with maximum relative humidity the correlation was negative but non-significant. The insecticides evaluated in the field for *L. orbonalis* control on eggplant revealed that avermectin (Vertimec 1.9 EC; 0.5 ml/l) was the most effective in suppressing dead heart caused by the pest, closely followed by *Beauveria bassiana* (Biorin 107 conidia/ml; 1 ml/l) and *Bacillus thuringiensis* Berliner (Biolep 5 9 107 spores/ml; 1 g/l). Significantly lower levels of fruit damage were recorded after avermectin treatment, closely followed by DDVP (0.05%) (Nuvan 76 SL; 2 ml/3 l) when compared with the untreated control. The other insecticides tested, including a neem formulation (Neemactin 0.15 EC; 2.5 ml/l) and malathion (0.05%) (Malathion 50 EC; 1.0 ml/l), were less effective. None of the insecticides evaluated produced satisfactory results against *L. orbonalis*. However, avermectin, besides being environmentally safe, was effective for a longer duration and could thus be recommended for Integrated Pest Management programmes on eggplant.

Singh *et al.* (2009) [17] observed the incidence of fruit borer *(Leucinodes orbonalis)* in terms of shoot infestation during 4th week of August, 2008 and the Incidence had non-significant relationship with temperature, relative humidity and rainfall but significant relationship with coccinellids and spiders. The results of chemical control trial Indicated that Protenfos @0.1% and Spinosad @0.01% were most effective in reduction of shoot Infestation of *Leucinodes orbonalis* besides recording higher brinjal fruit yield. Among the nine treatments tested, Profendos was the most effective followed by Spinosad individually and their combinations with Novaluran In reducing the population as well as in giving higher yield.

Varma *et al.* (2009) [20] studied in two year that, maximum population of brinjal shoot and fruit borer, *Leucinodes orbonalis* in Allahabad, U.P. was observed in 5th and 2nd week of December during 1st and 2nd year respectively. The brinjal shoot and fruit borer incidence showed positive correlation with maximum relative humidity, rainfall and wind speed during 1st year and with maximum relative humidity and sunshine hours in 2nd year. The damaged fruit and fruit weight loss varied from 3.76 to 45.45 percent and 3.00 to 67.71 percent in 1st year and 5.71 to 44.26 percent and 3.00 to 51.33 percent in 2nd year. One larval parasitoid of brinjal shoot and fruit borer, *Eriborus argentiopilosus* (Hymenoptera: Ichneumonidae) was identified. The extent of parasitization ranged from 2.01 to 24.61 percent. Most effective treatment was application of Chlorpyriphos followed by NSKE (5%) and Nerium (10%).

Rao and Bhavani (2010) [14] conducted a field experiment for assessing the association between weather variables and brinjal shoot and fruit borer. Since the climate change projections for India indicate a change in temperature and rainfall, an attempt has been made here to study the impact of the likely changes in temperature on the shoot and fruit borer in brinjal. The results revealed that the percent fruit borer incidence on brinjal had a positive correlation with maximum and minimum temperatures and also sunshine. Maximum relative humidity and rainfall had a negative correlation with fruit borer infestation. The brinjal borer infestation is likely to be influenced by maximum temperature. The prevalence of low temperatures can be expected to lengthen the life cycle of the pest and at elevated temperatures the pest is likely to complete the life cycle comparatively at a shorter duration and increase their population and thereby the incidence. At elevated temperatures, due to climatic change, the borer incidence in brinjal may rise slightly during summer but likely to decrease to a marginal extent during monsoon season.

Shukla and Khatri (2010) [16] recorded the infestation and intensity of *Leucinodes orbonalis* Guenee on young plants by counting infected and healthy shoots on randomly selected ten plants. The results of two consecutive years revealed that the adults population of brinjal shoot and fruit borer *Leucinodes orbonalis* Guenee fluctuated to a great deal not only from year to year but also in different months. Adult increased considerably in the month of October and November and decreased in subsequent weeks of December. The maximum temperature and abundance of moth showed a positive correlation (r = 0.319) during both the years. The correlation coefficient of minimum temperature and moth trapping also came out was positive (r = 0.3893) indicating the minimum temperature plays an important role in building up of moth population.

Mathur *et al.* (2012) [10] observed the effect of abiotic factors on the seasonal incidence of major insect pests on brinjal crop during *rabi* 2009. The incidence of shoot and fruit borer, *Leucinodes orbonalis* Guenee was observed during Nov. – Dec. with peak infestation during Feb. (6th and 7th SW). The percent shoot damage was positively correlated with both maximum and minimum temperature, rainfall and wind speed while negatively correlated with mean relative humidity. While percent fruit infestation revealed a non significant positive correlation with maximum and minimum temperature, rainfall and wind speed exhibited negative correlation with mean relative humidity. The statistically significant values indicated that occurrence of insect pests population was due to the prevailing ecological conditions. Thus the management of brinjal pest complex during rabi sown brinjal should therefore be promoted and tailored from November onwards using an integrated approach.

Meena *et al.* (2012) [11] recorded the observations of *Leucinodes orbonalis* Guenee on brinjal at weekly intervals starting from the 30 days of transplanting of till last picking in the end of April. The shoot and fruit borer infestation was started from 4th to 11th standard week. The peak period of shoot infestation was observed in 9th standard week (5.4 %) and 7th standard week (4.6 %) followed by 8th standard week (4.5 %). The incidence of fruit borer was started from 10th standard week and continued till last picking. Peak infestation of fruit borer was observed in 18th standard week (43.3 %) and 17th standard week (40.1%). The average extent of shoot damage ranged 1.4 to 4.0 % and fruit damage 14.9 to 35.2 % were recorded.

Tiwari (2012) [19] revealed that the population of *Amrasca biguttula biguttula* and *Bamisia tabaci* showed positive correlation with maximum, minimum and average temperature. Aphid population showed significantly positive correlation with sunshine hours. Maximum temperature and sunshine hours with *Urentius sentis* population showed significant positive correlation during 1st year while, 2nd year only maximum temperature showed positive correlation. The maximum, minimum and average temperatures, RH and rainfall showed significant positive relationship with *Epilachna vigintioctopunctata* population during two years. Maximum and average temperature of 1st year and maximum, minimum and average temperature and sunshine hours of 2nd year showed significant positive correlation with *Eublema olivacea* population. The incidence of *Leucinodes orbonalis* revealed significant positive correlation with sunshine hours.

Kumar and Singh (2013) [7] observed that seasonal incidence of shoot and fruit borer, *Leucinodes orbonalis* Guen. (on shoot) was more prevalent during vegetative phase of the crop up to the 3rd week of September. On initiation of fruiting stage there was a continuous decline in the infestation on shoots and it disappeared during fruiting stage of the crop in end of October, as the borer infestation shifted to the fruits reaching in the 2nd week of October. It gradually declined with the advent of winter season and completely wiped out by the end of November. The role of temperature, rainfall, relative humidity (Morning) in increasing infestation and intensity on shoot and fruits was very conductive but RH (%) (Evening) responded negatively. The economic injury level of shoot and fruit borer on brinjal shoots was recorded as 0.96 & 0.90 percent during 1st and 2nd year respectively and on brinjal fruits as 0.81 & 0.72 percent during 1st and 2nd year.

Malik and Pal (2013) [8] evaluated a total of 40 germplasm of brinjal for their reaction against fruit and shoot borer. The infestation of shoot borer appeared in 43rd week (18-24 October). The shoot infestation mean varied between 0 to 20 %. Six genotypes *viz.* Shoot infestation was correlated with weather parameters prevailing during the crop season. Maximum temperature played positive role (r=0.34 to 0.928) in multiplication of shoot borer of brinjal while minimum temperature was negative correlated (r=-0.5 to-0.819). The relative humidity exhibited its negative significance on pest multiplication. The wind velocity and rainfall showed no significance in multiplication of this pest, while evaporation rate showed significant positive effect (r=0.249 to 0.959) on the multiplication of infesting shoot. General Equilibrium position of fruit borer varied between 14.18 to 53.19% fruit infestation on different genotypes. Minimum fruit infestation being 14.18% was observed on germplasm HMB 10, followed by 18.54, 24.01, 24.07 and 24.29% fruit infestation onSM195, Long Green and S-15-1 genotypes, respectively. Maximum infestation of 53.19% was noticed on H-129. As regard the impact of whether parameters on fruit infestation temperature (maximum r=0.029 to 0.769, minimum (r=0.038 to -0.0678) had negative impact on the pest infestation, while relative humidity showed its positive significance. Likewise shoot infestation, wind velocity and rainfall did not show their significance on fruit infestation in brinjal, while sunshine hour played significant negative role (r=0.03 to -0.682) in infestation of this pest.

References

1. Bhadauria NKS, Bhadauria NS, Jakhmola SS. Insect pest complex of eggplant, S. melongena L in North West M P. Adv. Pl. Sci., 1999; 12:607-08.
2. Chakraborti S, Sarkar PK. Management of *Leucinodes orbonalis* Guenee on Eggplants During the Rainy Season in India Journal of Plant Protection Research. 2011; 51(4):325-328.
3. Choudhary B. Vegetables. National Book Trust, India, 1970, 25-50.
4. Frempong E. The nature of damage to egg plant in Ghana by two important pests *Leucinodes orbonalis* and *Euzophera villore.* Bulletin de Institllte Fundamental de Afrique. 1978; 41(2):408-416.
5. Ghosh SK, Senapati SK. Seasonal fluctuation in the population of *Leucinodes orbonalis* Guen.in the sub-himalayan region of West Bengal, India and its control on eggplant (*Solanum melongena* L.). Precision Agric., 2009; 10:443-449.
6. Harish DK, Agasimani AK, Imamsaheb SJ, Patil SS. Growth and yield parameters in brinjal as influenced by organic nutrient management and plant protection conditions. Research Journal of Agricultural Sciences. 2011; 2(2):221-225.
7. Kumar S, Singh D. Seasonal incidence and economic losses of brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee. Agric. Sci. Digest. 2013; 33(2):98-103.
8. Malik YP, Pal R. Seasonal Incidence of Brinjal fruit and Shoot Borer (*Leucinodes orbonalis* Guen.) on different Germplasm of Brinjal in Central U.P. Trends in Biosci., 2013; 6(4):389-394.
9. Mall NP, Pandey RS, Singh SV, Singh SK. Seasonal incidence of insect pests and estimation of losses caused by shoot and fruit borer on brinjal. Ind. J Ent. 1992; 54(3):241-247.
10. Mathur A, Singh NP, Meena M, Singh S. Seasonal

incidence and effect of abiotic factors on population dynamics of major insect pests on brinjal crop. J Env. Res. Dev. 2012 b; 7(1A):431-435.

11. Meena GS, Pachori RK, Panse R. Extent of damage and seasonal incidence of *Leucinodes orbonalis* (Guen.) on brinjal. Ann. Pl. Protec. Sci. 2012; 20(1):114-116.
12. Pareet DJ. Bio-rational approaches for the management of brinjal shoot and fruit borer. M.Sc. (Agri.) Thesis, University of Agricultural Sciences, Dharwad, Karnataka, India, 2006.
13. Prabhu M, Veeraragavathatham D, Srinivasan K, Kannan K. Effect of nitrogen and phosphorus application on the incidence of fruit borer in hybrid brinjal COBH 1.Agric. Sci. Digest., 2005; 25(4):301-302.
14. Rao BB, Bhavani B. Climate change – Likely effects on the population dynamics of brinjal shoot and fruit borer (*Luecinodes orbonalis* Guen.). Ind. J Dryland Agric. Res. & Dev. 2010; 25(2):58-62.
15. Regupathy A, Palanisamy S, Chandramohan N, Gunathilagaraj K. A guide on crop pests. Sooriya Desk Top Publishers, Coimbatore, 1997, 264-267.
16. Shukla A, Khatri SN. Incidence and abundance of brinjal shoot and fruit borer Leucinodes orbonalis guenee. The Bioscan. 2010; 5(2):305-308.
17. Singh OK, Singh R, Datta SD, Singh SK. Seasonal incidence and insecticidal management of shoot and fruit borer (*Leucinodes orbonalis* Guenee) in brinjal. Ann. Horti. 2009; 2(2):187-190.
18. Singh SV, Singh KS, Malik YP. Seasonal abundance and economic losses of shoot and fruit borer, *Leucinodes orbonalis* on brinjal. Ind. J Ent. 2000; 62(3):247-252.
19. Tiwari G, Prasad CS, Kumar A, Nath L. Influence of weather factors on population fluctuation of pest complex on brinjal. Ann. Pl. Protec. Sci. 2012; 20(1):68-71.
20. Varma S, Anandhi P, Singh RK. Seasonal incidence and management of brinjal shoot and fruit borer, Leucinodes orbonalis. J Ent. Res. 2009; 33(4):323-329.