Original Research Article

Role of agrometeorological factors in regulating the abundance of Brinjal shoot and fruit borer (*Leucinodesorbonalis)*inKupwara

Abstract

The study on Role of agro meteorological factors in regulating the abundance of Brinjal shoot and fruit borer (*Leucinodesorbonalis*) in Kupwara revealed that at all the locations of District Kupwara, first adult male moth of *Leucinodesorbonalis* was trapped during 24 SW. Moth population increased and peaked during 34 SW (4.0 moths/trap), thereafter population declined and reached to zero level during last week of September. Correlation studies between abiotic factors and adult moth catch of *Leucinodesorbonalis* from three locations of District Kupwara*viz*Langate,Chowgal and Handwarahad positive and significant correlation with minimum temperature(0.469,0.461 and 0.462) but positive and non-significant with maximum temperature (0.406,0.401 and 0.410), rainfall (0.032,0.058 and 0.035), relative humidity evening(0.434,0.418 and 0.421), though negative and non-significant with relative humidity morning (-0.149,-0.123 and -0.166) respectively . Multiple regression analysis revealed minimum temperature as major contributor in population buildup of the pest followed by relative humidity (evening) while as relative humidity (morning) had least effect in population buildup of the pest.

Key words: Brinjal,*Leucinodesorbonalis*, relative humidity and abiotic factors

Introduction

Brinjal or Eggplant (*Solanummelongena*L.), is one of the commonly consumed popular vegetables grown throughout the globe and its native of India (Choudhary, 1970). It is also referred as "King of vegetables" which belongs to the "Solanaceae" family with chromosome no. 2n = 24. Generally fruits are moderate sources of vitamins (Vitamin A and B) and minerals like phosphorous, calcium, iron and nutritive value varies from variety to variety.

Brinjal production is in threat in recent years, due to increased cost of production on management of insect pest and disease complex right from germination till harvest. In a brinjal ecosystem, among the insect pests, brinjal (eggplant) fruit and shoot borer (*Leucinodesorbonalis*Guenee) is the most destructive and key pest of eggplant (Latif*et al*., 2010; Chakraborti and Sarkar, 2011; Saimandir and Gopal, 2012) inflicting sizeable damage in almost all the eggplant growing areas (Dutta*et al*., 2011).The pest remains active throughout the year with many overlapping generations. The Crop losses have been reported to a tune of 20-89 percent from various parts of country (Raju*et al*., 2007) and poses a serious problem because of its high reproductive potential, rapid turnover of generations and intensive cultivation of brinjal both in wet and dry seasons of the year. Eggplant shoot fruit borer (ESFB) is practically monophagous but attacks other plants which belong to solanaceae family and attained global importance in recent years (Ahmad *et al*., 2007). The adult moth of ESFB lays eggs on the leaf and hatched larvae move into the fruits. The young larvae are an

internal feeder that bore and damages the tender shoots and fruits adversely affecting plant growth, yield and fruit quality making it unfit for human consumption and unmarketable. In India, it causes yield reduction upto to 88.70 percent (Haseeb*et al*., 2009).

Excessive pesticide use raises production costs and has negative health and environmental consequences (Kouser and Qaim, 2013; Muriithi*et al*. 2016). Pesticide use is also a major contributor to the decline of natural pollinator populations as well as harming the biodiversity (Hackenberg, 2007).Therefore, there is an urgent need to adaptation of non-chemical management practices to reduce the incidence of target pests on a particular crop. Usage of eco-friendly methods are of vital importance to develop ecologically safe IPM programme for *Leucinodesorbonalis*. This approach will also provide safety to the natural enemies and result in quality produce without any insecticidal residues in the produce for the safe consumption by the people at present. In order to reduce the pesticide load in the environment and to be abreast with sustainability, certain behavioural chemicals, use of sex pheromones could be harnessed. Sex pheromones have been used for monitoring insect pests and determining their seasonal activity (Patil*et al.,* 1992). Trap catches not only provide meaningful index for estimating population densities of pests but also such catches in relation to field infestation and environmental factors are crucially important for decision making process Therefore, keeping in view the severity of pest, the present investigation was planned to evaluate the Seasonal abundance of Brinjal shoot and fruit borer in the District Kupwara during the Kharif season.

Materials and Methods

Seasonal abundance of Brinjal shoot and fruit borer was studied at three locations *viz*Langate, Chowgal and Handwara of District Kupwara and all the locations were surveyed at weekly interval throughout brinjal cropping season during the Kharif season. Commercial lure of Brinjal shoot and fruit borer (BFSB) – Lucin lure was used for pest monitoring. Each lure was baited in a polyethylene funnel trap and the trap was erected over the crop canopy. The lure was changed after every 15 days and polyethylene funnel traps after one month. The trap height was important for the moth catch and the crop height was the optimal height for trap placement. The observations were recorded after fifteen days of transplanting and continued till the crop attained senescence and harvesting got completed. The adult moth catch was recorded once in every week till the final harvest. Weekly meteorological data on temperature, rainfall and relative humidity throughout the experimental period was procured from the Meteorological section, Division of Agronomy, Faculty of Agriculture Wadura SKUAST-K. The correlation and multiple regression studies between adult moth catch and some abiotic factors was also worked out so as to determine the impact of weather parameters on pest build up.

Results

To record seasonal variation of Brinjal shoot and fruit borer (*Leucinodesorbonalis*), three polyethylene funnel trap baited with Leucin lure were installed at all the three locations of district Kupwara.Perusal of data in Table-1 revealed that at all the locations of District Kupwara, first adult male moth of *Leucinodesorbonalis*was trapped during 15th of June (24 SW). In the subsequent weeks, moth population increased and peaked during 34 SW (4.0 moths/trap), spanning over eighteen weeks of observations, thereafter population declined and reached to zero level during last week of September (Fig 1). The correlation between male moth catch and abiotic factors was determined to study influence on population build-up of *Leucinodesorbonalis*(Table 2). A non-significant but positive correlation was observed

with maximum temperature (°C), rainfall (mm) and evening relative humidity (%) at all the locations. Minimum temperature, however, was significant and positively correlated at all the locations in District Kupwara*i.e.*Langate (r = 0.469), Chowgal (r = 0.461) and Handwara (r = 0.462) but morning relative humidity (%) negative and non-significantly correlated at all the three locations under investigation.

The multiple regression between abiotic factors and male moth catch of Brinjal shoot and fruit borer *Leucinodes orbonalis* was determined.Perusal of data in Table 3 revealed that at Langate, 65.32 per cent variation in adult moth catch was contributed by the abiotic factors under study (R^2 = 0.653). Among such factors minimum temperature made the major contribution *i.e.* 39.71 per cent towards the moth population fluctuation followed by evening relative humidity (24.24%) and maximum temperature (18.02%) while the other parameters had negligible effect. Similarly at Chowgal, out of total 67.54 per cent variation in adult moth catch by abiotic factors (R^2 = 0.675), minimum temperature made the major contribution of 50.60 per cent towards the moth population fluctuation followed by relative humidity (evening) with 29.61 per cent and maximum temperature (12.12%) contributions. At Handwara, the overall impact of these abiotic factors on the male moth population was worked out to be 56.42 per cent (R^2 = 0.564) where in both minimum temperature and relative humidity (evening) played a major role *i.e.* 45.25 and 27.98 per cent, respectively.

Discussion

The abundance of *Leucinodesorbonalis*in relation to some abiotic factors revealed that first adult male moth was trapped during 24th SW from all the locations of District Kupwara*viz;*Langate, Chowgal and Handwara. The peak population of adult moth was observed during 34th SW from all the locations. Since no work has been carried out on population monitoring of the pest from District Kupwara, although little work on this aspect has been done from other districts of Kashmir *viz.,* Budgam and Srinagar by Ahmad *et al.* (2018a) and Dar *et al.* (2015) who also found peak population of *Leucinodesorbonalis* during 34 SW. The simple correlation studies between abiotic factors and adult moth catch of *Leucinodesorbonalis*at all the three locations had positive and significant correlation with minimum temperature, while as maximum temperature, rainfall, and relative humidity (evening) had positive and non-significant correlation, though relative humidity (morning) had negative and non-significant correlation during the present study. Shukla and Khatri (2010) reported both maximum and minimum temperature positively correlated with moth catch, though in present study only minimum temperature had positive and significant correlation with moth catch but with maximum temperature, it was non-significant but positively correlated. Nayak*et al.* (2014a) found moth catch to be significant and positively correlated with both maximum and minimum temperature and negatively correlated with relative humidity, whereas rainfall did not influence the trap catch significantly.

Multiple regression analysis between abiotic factors and pheromone trap catch revealed that both minimum temperature and relative humidity (evening) had major contribution in population build-up of the pest at all the six locations under investigation; followed by maximum temperature, though rainfall had least effect in moth population build up, whereas relative humidity (morning) had negligible effect on pest population fluctuation. The present results are in accordance with the findings of Nayak*et al.* (2014b) who concluded that both the temperature and relative humidity are the important factors and play maximum and significant role in adult population fluctuations of *Leucinodesorbonalis.*

Conclusion

Monitoring of *Leucinodesorbonalis*population through pheromone trap revealed the first adult male moth catch at all the three locations of District Kupwara from 24SW (3rd week of June) that remained up to 40 SW (1st week October) with peak population in 34 SW (last week of August).The simple correlation analysis revealed positive and significant association between moth catch and minimum temperature at all the locations under study, while positive and non-significant correlation with maximum temperature, rainfall and relative humidity (evening).Multiple regression analysis between pheromone trap catch and abiotic factors revealed that the minimum temperature and relative humidity (evening) had major contribution in pest population build up at almost all the locations.

References

Ahmad, M., Arif, M. I. and Ahmad, M. 2007. Occurrence of insecticide resistance in field populations of *Spodopteralitura*(Lepidoptera: Noctuidae) .*Pakistan Journal of Crop Protection***26**(6): 809-817

Ahmad, S. I., Pathania, S. S., Nehru, R. K. and Wani, A. R. 2018a. Population dynamics of Brinjal shoot and fruit borer,*Leucinodesorbonalis* (Lepidoptera: Pyralidae) in Kashmir. *Indian Journal of Entomology***80**(2):435-440

Chakraborti, S. and Sarkar, P. K. 2011.Management of *Leucinodesorbonalis*Guenee on eggplant during the rainy season in India.*Journal of Plant Protection Research* **51**(4): 325- 328

Choudhary B. 1970. Vegetables.National Book Trust, India, New Delhi. pp. 25-50

Dar, S. A., Padder, S. A., Wani, A. R., Mir, S. H. and Sofi, M. A. 2015. Evaluation of combined options for management of Brinjal shoot and fruit borer (*Leucinodesorbonalis*) in Kashmir.*Journal of Experimental Zoology***18**(1):359-365

Dutta, P., Singha, A. K., Das, P.andKalita, S. 2011. Management of brinjal fruit and shoot borer, *Leucinodesorbonalis*Guenee in agro-ecological condition of West Tripura. *Scholarly Journal of Agricultural Science* **1**(2): 16-19

Hackenberg D. Letter from David Hackenberg to American growers from March 14, 2007. Platform Imkerinnen Austria, 2007

Haseeb, M., Sharma, D. K. and Qamar, M. 2009. Estimation of the losses caused by shoot and fruit borer, *Leucinodesorbonalis*Guenee. (Lepidoptera: Pyralidae) in eggplant. Trends in Bioscience, **2**(1): 6869

Kouser, S. and Qaim, M. 2013. Valuing financial, health, and environmental benefits of *Bt*cotton in Pakistan. *Journal of Agricultural Economics***44**(3):323-335

Latif, M.A., Rahman, M. M. and Alam, M. Z. 2010. Efficacy of nine insecticides against shoot and fruit borer, *Leucinodesorbonalis*Guenee (Lepidoptera: Pyralidae) in eggplant. *Journal of Pest Science***83**(4): 391-397

Muriithi, W. B., Affognon, D. H., Diiro, M. G., Kingori, W. S., Tanga, M. C. and Nderitu, W. P.2016.Impact assessment of integrated pest management (IPM) strategy for

suppression of mango-infesting fruit flies in Kenya.*Crop Protection* 81:20-29

Nayak, U. S., Baral, K., Khuntia, A. and Rath, L. K. 2014a.Monitoring of brinjal shoot and fruit borer (*Leucinodesorbonalis*Guenee) through pheromone traps and the impact of abiotic factors on trap catch.*Journal of Crop andWeed* **10**(1): 143-146.

Nayak, U. S., Baral, K., Mandal, P. and Chatterjee, S. 2014b.Seasonal variation in the larval population of brinjal shoot and fruit borer *Leucinodesorbonalis*Guenee with respect to different ecological parameters. *International Journal of Bio-resource and Stress Management* **5**(3): 409-412.

Patil, B. V., Nandihalli, B. S., Hugar, P. and Somashekar, 1992. Influence of weather parameters on pheromone trap catches of cotton bollworms. *Karnataka Journal of Agriculture Sciences*. Bangalore pp. 125

Raju, S. V. S., Bar, U. K., Shanker, U. and Kumar, S. 2007. Scenario of infestation and management of eggplant shoot and fruit borer, *Leucinodesorbonalis*in India. Resistant Pest Management News 16: 14-16

Saimandir J., Gopal, M. 2012. Evaluation of synthetic and natural insecticides for the management of insect pest control of eggplant (*Solanummelongena*L.) and Pesticide Residue Dissipation Pattern.*American Journal of Plant Science* **3**(2): 214-227

Shukla, A. and Khatri, S.K. 2010. Incidence and abundance of Brinjal shoot and fruit borer *Leucinodesorbonalis*Guenee. *The Bio Scan- An InternationalQuarterly Journal of Life Science* **5**(2): 305-308.

Table 1.Monitoring of adult moths of *Leucinodesorbonalis* in District Kupwara during *kharif* -2019.

SW*	Catch/week/trap		
	Langate	**Chowgal**	**Handwara**
24	0.33**	1.00	0.70
25	1.00	1.00	0.70
26	1.33	1.33	1.00
27	1.33	1.70	1.00
28	1.70	1.70	1.33
29	1.70	2.00	2.00
30	2.33	2.00	2.00
31	2.33	2.33	2.70
32	3.00	2.70	3.00
33	3.70	3.70	3.33
34	4.00	4.00	4.00
35	3.70	3.70	3.33
36	3.33	3.70	3.33
37	2.70	3.00	2.70
38	1.00	2.70	2.33
39	0.33	1.33	1.00
40	0.00	0.00	0.00

***SW=Standard week;**pooled mean of three fields traps.**

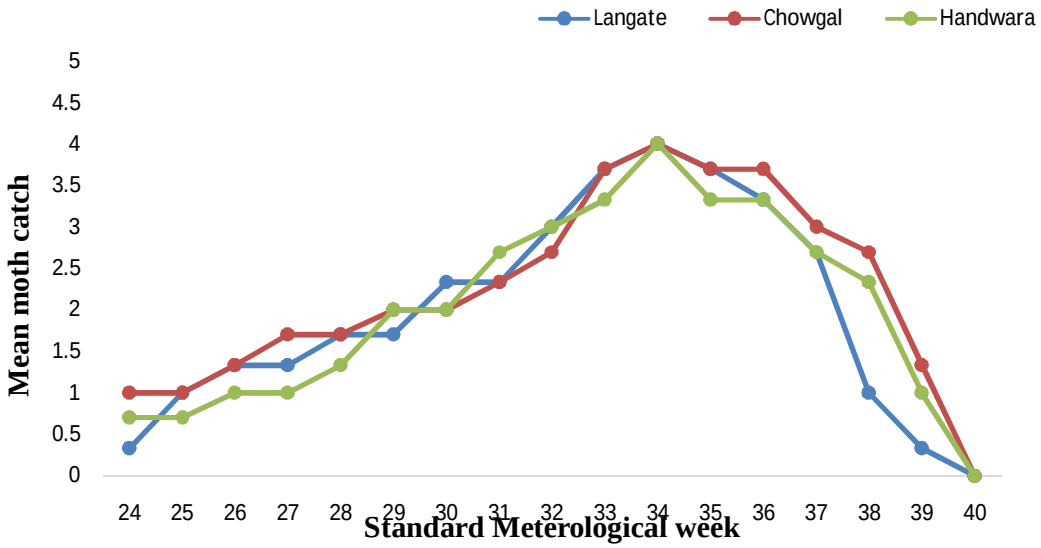

Fig 1. Adult moth catch of *Leucinodesorbonalis* at different locations of District Kupwaraduring *Kharif*, 2019.

Table 2. Correlation between moth catches vs. weather parameters in District Kupwara during 2019

Locations	Correlation coefficients* (r)				
	Max. temp (°C)	**Min.temp (°C)**	**R.f (mm)**	**RH% (morning)**	**RH% (evening)**
Langate	0.406 (0.08)	0.469* (0.03)	0.032 (0.89)	-0.149 (0.54)	0.434 (0.06)
Chowgal	0.401 (0.08)	0.461* (0.04)	0.058 (0.81)	-0.123 (0.61)	0.418 (0.07)
Handwara	0.410 (0.08)	0.462* (0.04)	0.035 (0.88)	-0.166 (0.49)	0.421 (0.07)

*Significant at $p \leq 0.05$; Max. Temp = Maximum temperature; Min.Temp = Minimum temperature; R.f = Rainfall; RH= Relative humidity.

Table 3.Regression of moth catches vs weather parameters in District Kupwara during 2019

Location	Coefficient of determination (R^2)	Prediction equation	% contribution				
			Max. Temp (°C)	Min. Temp (°C)	Rainfall (mm)	RH% (morning)	RH% (evening)
Langate	0.6532	$\mathbf{Y}$= -6.415+0.165$\mathbf{X_1}$+0.045$\mathbf{X_2}$+0.100$\mathbf{X_3}$ - 0.029$\mathbf{X_4}$+0.075$\mathbf{X_5}$	18.02	39.71	7.04	11.00	24.24
Chowgal	0.6754	$\mathbf{Y}$= -8.872+0.231$\mathbf{X_1}$+0.028$\mathbf{X_2}$+0.134$\mathbf{X_3}$ - 0.006$\mathbf{X_4}$+0.056$\mathbf{X_5}$	12.12	50.60	1.23	6.44	29.61
Handwara	0.5642	$\mathbf{Y}$= -7.108 +0.216$\mathbf{X_1}$+0.011$\mathbf{X_2}$+0.133$\mathbf{X_3}$ - 0.037$\mathbf{X_4}$+0.077$\mathbf{X_5}$	16.25	45.25	2.74	7.78	27.98

Y = Moth Catches; X1 = Maximum Temperature (°C); X2= Minimum Temperature (°C); X3 = Rainfall (mm); X4 = % Relative Humidity (Morning); X5 = % Relative Humidity (Evening)