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INFLUENCE OF CULTIVARS ON POPULATION DYNAMICS OF BRINJAL SHOOT AND FRUIT BORER *LEUCINODES ORBONALIS*

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ABSTRACT

Shoot and fruit borer *Leucinodes orbonalis* Guenée (Lepidoptera: Crambidae) is the key pest of brinjal. The present study on its population dynamics in relation to brinjal cultivars revealed significant variation in fruit damage (6.73% to 60.26%). The least damage was observed on Eeranagere (23.02%) and maximum on Mullubadane (27.92%). The infestation varied at different growth stages; least (<22.00%) between 8-11th and 35-38th standard meteorological weeks (SMW) in rabi and kharif seasons, respectively. The maximum damage (35.14%) was observed at 50th SMW during rabi 2017 and 43rd and 44th SMW (~35.60%) during kharif 2018; the least damage was in rabi (24.83%) compared to kharif (26.39%). The wind velocity and maximum temperature had a significant negative relation with fruit damage during the rabi season; but in kharif morning relative humidity and minimum temperature had a significant negative association.

Key words: *Leucinodes orbonalis*, brinjal, cultivars, Eeranagere, Mullubadane, population dynamics, seasons, correlation coefficient, wind velocity, temperature, relative humidity

Brinjal is the second important solanaceous vegetable after tomato (FAO, 2017) and India is the largest producer of it in entire South Asia (Anonymous, 2017). The brinjal is attacked by 53 insect pests, and among these, the most destructive and regular pest is the shoot and fruit borer *Leucinodes orbonalis* Guenée (Biswas et al., 1992; Bhadauria et al., 1999). Its damage results in wilting of the shoot and withering of leaves (Haseeb, et al., 2009; Mishra et al., 2014); and causes severe yield loss to the extent up to 90% (Kodandaram et al., 2017; Prodhan et al., 2018), with severity being in the autumn season (Atwal, 1976). The pest distribution and abundance vary with weather factors determining the population density (Indirakumar et al., 2016; Kassi et al., 2019). Without observing the level of incidence farmers use mixture of conventional insecticides to manage the *L. orbonalis*, that leads to resistance development against many insecticide (Chatterjee and Roy, 2004, Sharma et al., 2004; Mishra Dash, 2007; Kariyanna et al., 2019; 2020a; 2020b). Hence the ecofriendly approach is to adopt resistant cultivars along with other strategies (Lit, 2009), but no proper resistant varieties are available for the shoot and fruit borer (Srinivasan, 2008; Yousafi et al., 2013). This study evaluates seven commonly grown brinjal cultivars against *L. orbonalis* under the changing weather conditions.

MATERIALS AND METHODS

The field trial was conducted for two seasons from September-2017 to March-2018 (rabi) and July to November-2018 (kharif), at the research farm of ICAR-National Bureau of Agricultural Insect Resources, Yelahanka, Bengaluru (13°03″N,77°34″E, 924 masl). Seven cultivars viz., Gourav and Lalitha (hybrids in Karnataka), Manjarigota (improved cultivar from UAS, Dharwad), Mullubadane, Madhugiri Mulla, Eeranagere and Mattugulla (local cultivars of Karnataka) were raised by adopting the randomized complete block design (RCBD) tool. The plot size was 4x 5 m with 60x 60 cm spacing under unprotected condition, replicated thrice using RCBD design. The first crop was taken during rabi (2017-18) and the second one in the subsequent kharif (2018). Observation on fruit damage was recorded from the 9th week after the transplantation and continued till 22nd week. Fruits (both damaged and healthy) were harvested at weekly interval and the % fruit damage (based on bore holes and fecal pellets) observed. The weekly data of the weather parameters viz., maximum and minimum temperature, morning and afternoon RH, wind velocity, sunshine hours, total rainfall were obtained from the Department of Agrometeorology, University of Agricultural Sciences, Bengaluru. The data on damage were subjected to angular transformation before ANOVA (Snedecor and

Cochran, 1956; Sokal and Rohlf. 1995); and means separated by CD values (Sokal and Rholf, 1981) using SAS software (SAS Institute Inc., 2015). The influence of weather parameters on damage was analysed through Karl Pearson's correlation analysis and step-down correlation and coefficient of determination using the IBM-SPSS 24.0 Software Package (IBM-CROP, 2016).

RESULTS AND DISCUSSION

During rabi 2017-18, the fruit damage by *L. orbonalis* on the evaluated cultivars varied from 21.76 to 27.8%, with the least being in Madhugiri Mulla; during kharif, 2018, Eeranagere was the least damaged (22.43%). Such variations in cultivers was also reported by Javed et al. (2017). During rabi, the least damage (20.13%) was observed at 11th standard meteorological week (SMW) and it was on par with 9th (20.37%) and 8th (20.51%) SMW; while the maximum of 35.14% was observed in the 50th SMW. During kharif maximum damage (~35.60%) occurred during 43rd and 44th SMW (Fig. 1). These observations on the peak infestation in October is known (Oomen and Kumar, 2004; Jat et al., 2002); also from October to December (Shukla and Khatri, 2010; Kumar and Sing, 2012). During rabi, incidence revealed a decreasing trend with increase in temperature, and decreased rainfall irrespective of cultivars; while during kharif, it was due to decrease in temperature and increased rainfall.

During rabi, the wind and temperature influenced the incidence more. In cultivars Manjarigota, Mattugulla and Mullubadane, the incidence was observed to show significant negative correlation with the wind velocity (r= -0.69, -0.57 and -0.63, respectively); while, Gourav (r= -0.56) and Lalitha (r= -0.62) registered a significant negative relation with maximum temperature. The multiple regression revealed that weather factors influenced 33-58% of the fruit damage (Table 1). Earlier work (Kumar et al., 2004; Mannan et al., 2015; Kassi et al., 2019) observed that the weather parameters influenced the dynamics of *L. orbonalis*. During kharif, morning RH and minimum temperature exhibited a negative effect on damage in all the cultivars; it was significant in Eeranagere (r= -0.71) and Mattugulla (r= -0.74) with morning RH. Multiple regression revealed that, the weather factors contributed to 48-88% of *L. orbonalis* fruit damage (Table 1); during rabi, wind velocity showed a significant negative correlation in most of the cultivars (r= -0.55−-0.69), also with maximum temperature (r= -0.41−-0.62). But, no such relations were observed in case of Eeranagere and Madhugiri Mulla (Table 1). Similar trends with rainfall, wind velocity, maximum and minimum temperature are known (Singh et al., 2011; Anjali et al., 2012; Indirakumar et al., 2016). Rainfall had no significant effect, as observed by Kassi et al. (2019) and contrary to the observations of others (Naik et al. 2011; Singh et al. 2009; Shukla and Khatri, 2010).

The cultivar Eeranagere was the best with least fruit damage (23.02%). Likewise, Pusa Purple Long-74 and Navkiran and accessions like EG058, BL009, and hybrid Turbo were found superior (Mathur et al., 2012; Srinivasan, 2008). The fruit damage was more in Mullubadane (27.92%) followed by Mattugulla (27.50%) and the results are in line with the varieties like Krishna and Kanahya (Choudhary et al., 2018); also Ft Long and FI Round hybrids (Tapa et al., 2009). Among the two seasons, the rabi-winter had lesser fruit damage (24.83%) compared to kharif (26.39%). In the kharif, the crop was found more vulnerable (Malshe et al., 2016).

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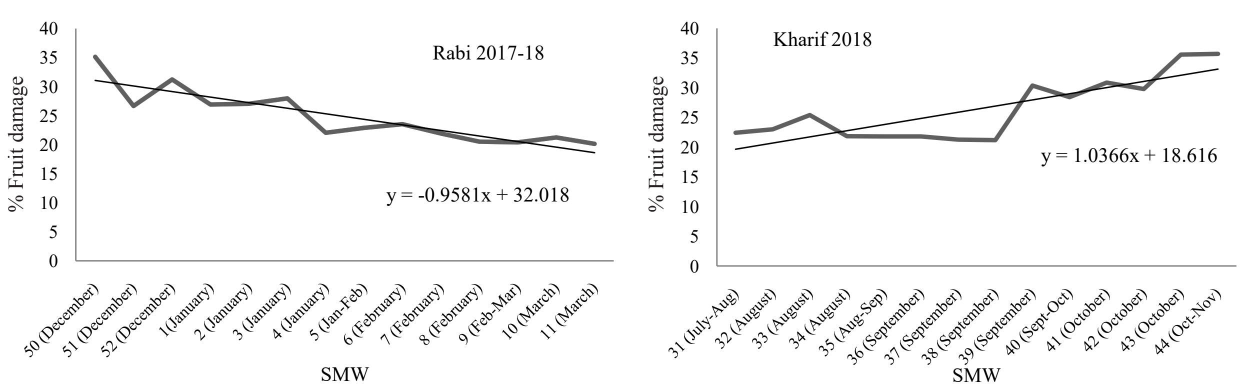

Fig. 1. Fruit damage by *L. orbonalis* in cultivars over standard meteorological weeks

Table 1. Correlation coefficients- *L. orbonalis* fruit damage vs. weather factors on cultivars of brinjal

Season		Rabi 2017-18							Kharif 2018-19						
Sl. No.	Factors	Eeranagere	Madhugiri Mulla	Manjari-gota	Mattu-gulla	Mullu-badane	Gourav	Lalitha	Eeranagere	Madhugiri Mulla	Manjari-gota	Mattu-gulla	Mullu-badane	Gourav	Lalitha
1	Minimum Temperature	-0.2	-0.22	-0.06	-0.21	-0.20	-0.15	-0.16	-0.55*	-0.70**	-0.18	-0.79**	-0.81**	-0.70**	-0.07
2	Maximum Temperature	-0.38	-0.25	-0.42	-0.41	-0.58*	-0.56*	-0.62**	0.32	0.29	0.11	*0.50*	0.26	0.23	0.18
3	RH morning	0.11	-0.11	0.24	0.33	0.37	0.33	0.38	-0.71**	-0.63*	-0.37	-0.74**	-0.65*	-0.56*	-0.34
4	RH afternoon	0.3	0.31	0.3	0.28	0.43	0.43	0.51	-0.055	-0.11	-0.15	-0.21	-0.064	0.06	0.08
5	Wind velocity	-0.43	-0.07	-0.69**	-0.57*	-0.63*	-0.55*	-0.41	-0.16	-0.12	-0.23	-0.22	0.001	-0.2	-0.4
6	Rainfall	-0.31	-0.23	-0.2	0.24	-0.29	-0.21	-0.25	-0.26	-0.29	0.21	-0.28	-0.41	-0.22	-0.03
7	Sunshine	-0.23	-0.8	-0.49	-0.34	-0.47	-0.4	0.36	0.53*	0.52	0.28	0.71**	0.49	0.47	0.34
8	R^2	0.33	0.38	0.58	0.42	0.58	0.44	0.57	0.84	0.83	0.48	0.84	0.88	0.85	0.77
9	Regression equation	y= -0.6892x+ 21.607	y= -0.2807x+ 16.191	y= -1.0718x+ 30.105	y= -0.2951x+ 21.351	y= -1.674x+ 31.445	y= -2.0306x+ 33.374	y= -3.681x+ 48.105	y= -0.8215x+ 8.8414	y= -1.8795x+ 7.3042	y= 0.7103x+ 14.199	y= 2.317x+ 7.0326	y= -1.8271x+ 13.235	y= 1.504x+ 7.1275	y= -1.526x+ 6.774

*Significant at p=0.05; **Significant at p=0.01

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