www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; SP-12(12): 702-705

www.thepharmajournal.com
Received: 12-09-2023
Accepted: 29-11-2023

Jony Kunar
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

BK Singh
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Chanchal Singh
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Akhilesh Kumar Singh
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Mukesh Mishra
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Rakesh Pandey
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Corresponding Author:
BK Singh
Banda University of Agriculture and Technology, Banda, Uttar Pradesh, India

Effect of weather variables on infestation of linseed bud fly, *Dasyneura lini* (Branes) in Bundelkhand region

Jony Kunar, BK Singh, Chanchal Singh, Akhilesh Kumar Singh, Mukesh Mishra and Rakesh Pandey

Abstract
A field experiment was carried out at Banda University of Agriculture and Technology, Banda, Uttar Pradesh during two consecutive cropping seasons of *Rabi*, 2021-22 and 2022-23 to find out the effect of weather variables on infestation of linseed bud fly, *Dasyneura lini* (Branes) in Bundelkhand region. The infestation of linseed bud fly was observed from 5th standard week (SW) to 13th SW of both the years. The maximum infestation (42.42 & 31.72) was recorded at dough stage of the crop growth during both the cropping seasons. The maximum and minimum temperatures were found more encouraging for this insect during this period. However, morning and evening relative humidity had negative association with infestation of linseed bud fly.

Keywords: Bud fly, Bundelkhand, infestation, linseed, weather

Introduction
Linseed, *Linum usitatissimum* (L.) is an important oilseed crop which belongs to the family: Linaceae. It is an important industrial and fiber producing crop. This crop is grown either for oil or fiber. Its grain is rich in oil (41%), protein (20%), dietary fiber (28%), moisture (7.7%) and ashes (3.3%). Around the globe, linseed crop occupies an area of 22.70 lakh ha yielding out 22.39 lakh ton having an average productivity of 986 kg/ha. In India, it is cultivated in an area of 3.29 lakh ha with production and productivity being 1.46 lakh ton and 484 kg/ha, respectively. India ranks second in terms of area after Canada, which contributes about 14.89% and 6.56% to world area and production, respectively. Linseed crop is attacked by a number of insect pests at various stages of its growth. Among which linseed bud fly, *Dasyneura lini* (Barnes) causing 88% grain yield losses and it is considered as a key pest of this crop (Mukherji *et al*., 1999) [5]. The infested buds become hollow and unproductive. Studies on pest succession of any crop are essential as it provide information on the status of various insect pests and also helps in identifying the most critical stage of the crop. This information would help in developing an efficient management module for linseed bud fly, *Dasyneura lini* (Barnes) attacking at various growth stages of the crop. Keeping above facts in mind, the present experiment on effect of weather variables on infestation of linseed bud fly, *Dasyneura lini* (Branes) in Bundelkhand region was therefore undertaken with objective to record the infestation of bud fly and its association with weather variables in agro-ecosystem of linseed.

Materials and Methods
The experiment was laid out at Banda University of Agriculture and Technology, Banda, Uttar Pradesh during cropping season of *Rabi*, 2021-22 and 2022-23. The linseed var. BUAT-Alsi-3 was sown in 4th week of November with plot size of 15 m^2 (10 rows of 5 meter length) having crop spacing of 30×10 cm and replicated thrice during both the years. The recommended agronomic practices except plant protection measures were followed. The seasonal incidence of linseed bud fly was recorded at weekly interval on 5 randomly selected plants from each plot. The incidence of bud fly was estimated by making count on the basis of number of infested bud per plant and total number of healthy bud. The percent bud infestation was calculated by using formula.

$$\text{Percent bud fly Infestation} = \frac{\text{Number of infested bud}}{\text{Total number of buds}} \times 100$$

The observations on infestation of linseed bud fly and fluctuations in weather variables were recorded at weekly interval. The infestation of linseed bud fly were averaged and subjected to analysis of simple correlation and regression coefficients by considering infestation of bud fly as dependent factor and temperature, humidity, wind velocity and rainfall as independent factors of linseed agro-ecosystem.

$$\text{Correlation coefficient (r)} = \frac{\Sigma(X-\overline{X})(Y-\overline{Y})}{\sqrt{\Sigma(X-\overline{X})^2\,\Sigma(Y-\overline{Y})^2}}$$

$$\text{Regression coefficient (byx)} = \frac{\Sigma(X-\overline{X})(Y-\overline{Y})}{\sqrt{\Sigma(X-\overline{X})^2}}$$

The regression equations were derived by using following formula as suggested by Panse and Sukhatme (1985) [6].

$$\text{Regressios equation} \rightarrow (Y-\overline{Y}) = \text{byx}(X-\overline{X})$$

Where,
$X \rightarrow$ Independent variables (weather variables),
$\overline{X} \rightarrow$ Mean of independent variables,
$Y \rightarrow$ Dependent variables (insect populations),
$\overline{Y} \rightarrow$ Mean of dependent variables and
BYX → Regression coefficient of Y on X

Results and Discussion

The infestation of linseed bud fly was recorded in agro-ecosystem of linseed var. BUAT-Alsi-3 during the cropping seasons of *Rabi*, 2021-22 and 2022-23. The correlation and regression co-efficient were calculated to find out the associations of linseed bud fly infestation (dependent factor) with weather variables (independent factor). The summary of observations on infestation of linseed bud fly and weather data with respect to the standard week during *Rabi*, 2021-22 and 2022-23 is cited in table 1 & 2, respectively. The incidence of bud fly was first recorded on the crop with the formation of buds during 5th standard week with 3.25 & 2.21 percent bud infestation. It remained continue throughout the cropping period. The infestation of insect increased gradually with highest infestation at 13th standard week with 42.42 & 31.72 percent bud damage during *Rabi*, 2021-22 & 2022-23, respectively. The intensity of infestation was initially one to two larvae per bud in last week of January (Table-1&2). According to Singh *et al*., 1998 [3], maximum numbers of larvae (16-25 larvae/bud) were recorded during last week of February and middle of March. The maximum bud infestation was observed as 11.82 and 10.22% during last week of February to mid-March by Malik *et al*., 1998 [3].

The correlation and regression coefficients of bud fly infestation with weather variables revealed that incidence of insect had significant positive correlation with maximum (0.862 & 0.885) and minimum (0.912 & 0.915) temperature during both the cropping seasons (Table-3). This result is found to be in close association with the result obtained by Singh *et al*. (2013) [8], Ekka *et al*. (2017) [1] and Sahoo (2016) [7]. However, morning (-0.845) and evening (0.837) relative humidity showed significant negative association with occurrence of this insect during *Rabi*, 2021-22 only. Remaining associations were found non-significant either during *Rabi*, 2021-22 or 2022-23 or both (Table-3). This result is supported by Mishra and Shamshad (2007), Singh *et al*. (2013) [8] and Sahoo (2016) [7]. This might be because of the rate development of pests would enable a more rapid response to a change in temperature (Karuppaiah and Sujayanad, 2012) [2].

The influences of maximum & minimum temperature, morning & evening relative humidity, wind velocity and rainfall on population buildup of linseed bud fly were driven out through step down regression analysis. It was perceived that the combined influence of weather variables had more influence on infestation of bud fly with R^2=0.0896 & 0.961 than the single weather variable with R^2 value was only 0.742 & 0.782 during cropping season of *Rabi*, 2021-22 & 2022-23 respectively. The combined effect of temperature (Maximum & Minimum) and relative humidity (Morning & Evening) with R^2 value of 0.863 & 0.935 and when relative humidity was deleted the R^2 value comes down to 0.850 & 0.923. This shows that maximum temperature have comparatively more influences on bud fly infestation with R^2 value of 0.742 & 0.782 during both the cropping seasons respectively (Table-4). Similar observations were also reported by Sahoo (2016) [7].

Table 1: Effect of weather on infestation of bud fly in agro-ecosystem of linseed during- *Rabi*- 2021-22

SW	Bud fly infestation (%)	Temperature (ºC)		Relative Humidity (%)		Wind Velocity (Km/Hr)	Rainfall (mm)
		Maximum	Minimum	Morning	Evening		
4	0.00	20.6	8.7	80.86	46.86	3.43	0.04
5	3.25	24.6	10.1	76.43	38.00	0.29	0.0
6	5.73	25.1	10.7	77.29	39.86	1.43	0.0
7	15.17	28.0	12.3	69.43	28.57	0.86	0.0
8	34.05	29.6	14.6	61.00	32.71	2.00	0.0
9	36.03	28.1	16.6	68.29	30.00	1.71	0.0
10	37.05	33.0	17.4	61.14	26.29	2.71	0.0
11	38.04	38.1	22.0	60.00	27.86	3.00	0.0
12	40.03	38.9	22.7	41.14	17.29	4.57	0.0
13	42.42	42.0	23.9	40.00	12.14	4.14	0.0

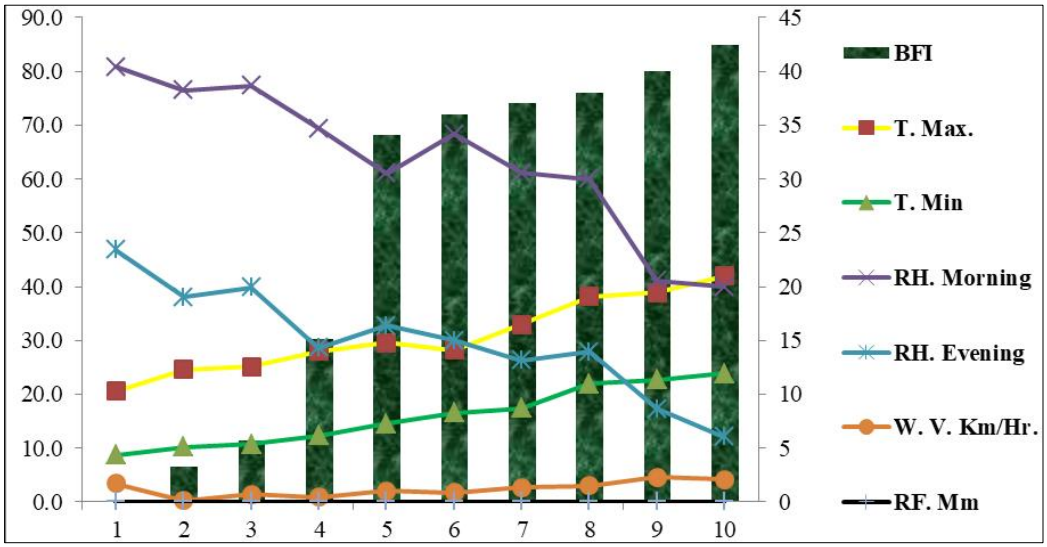

Fig 1: Linseed bud fly infestation vs. weather variables during *Rabi*-2021-22.

Table 2: Effect of weather on infestation of bud fly in agro-ecosystem of linseed during *Rabi*- 2022-23

SW	Bud fly infestation %	Temperature ºC		Relative Humidity (%)		Wind Velocity (Km./Hr.)	Rainfall (mm)
		Maximum	Minimum	Morning	Evening		
1	0.00	24.4	14.9	85.6	67.6	3.3	88.0
2	2.21	23.0	14.9	73.0	36.0	4.3	0.0
3	4.31	27.7	13.3	60.6	29.3	3.7	0.0
4	9.38	28.0	13.9	72.4	35.6	1.4	0.0
5	12.71	32.0	17.3	57.1	27.4	2.0	0.0
6	23.81	32.9	18.3	57.3	31.3	2.9	0.0
7	24.50	31.0	18.1	65.9	34.4	1.7	14.0
8	25.84	30.9	20.9	66.4	45.0	1.7	0.0
9	27.51	32.3	21.1	62.7	36.1	2.9	7.0
10	31.72	33.4	20.9	56.4	38.3	3.9	0.0

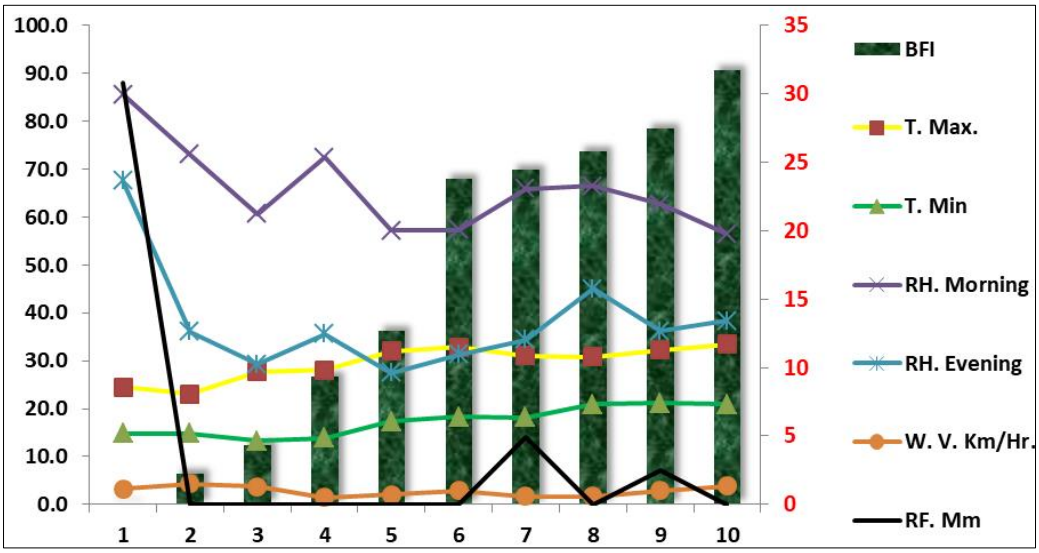

Fig 2: Linseed bud fly infestation vs weather variables during *Rabi*-2022-23.

Table 3: Correlation and Regression coefficients of infestation of bud fly with weather variables

Weather Variables	Correlation Coefficient			Regression Coefficient		
	2021-22	2022-23	Pooled	2021-22	2022-23	pooled
Max. Temp.	0.862**	0.885**	0.957**	-2.95*	3.823	-0.673
Min. Temp.	0.912**	0.915**	0.942**	5.65*	1.482	3.294
Morning RH	-0.845**	-0.630	-0.259	-0.74*	1.135	-0.515
Evening RH	-0.837**	-0.885**	-0.710*	0.319*	-0.096	-0.492
Wind Velocity	0.546	-0.259	0.252	-3.096	3.028	-6.098
Rainfall	-0.519	-0.422	0.450	-124.115	-0.175	0.413

*Significant at 1 percent level, **Significant at 5 percent level

Table 4: Regression equations appraising the influence of weather variables on infestation of bud fly in agro-ecosystem of linseed

Cropping Season	Multiple Regression Equation	R^2
2021-22	$Y=71.64-2.95X_1+5.65X_2-0.74X_3+0.31X_4-3.09X_5-124.11X_6$	0.896
	$Y= 74.48-2.89X_1+5.78X_2-0.82X_3+0.36X_4-4.35X_5$	0.895
	$Y=40.60-2.31X_1+4.69X_2-0.08X_3-0.45X_4$	0.863
	$Y=31.79-1.89X_1+4.56X_2-0.28X_3$	0.856
	$Y=-2.64-1.48X_1+4.63X_2$	0.850
	$Y=-39.48+2.09X_1$	0.742
2022-23	$Y=-199.95+3.82X_1+1.48X_2+1.13X_3-0.09X_4+3.02X_5-0.17X_6$	0.961
	$Y=-146+2.66X_1+2.34X_2+0.80X_3-0.40X_4+1.77X_5$	0.941
	$Y=-93.14+1.70X_1+2.52X_2+0.37X_3-0.24X_4$	0.935
	$Y=-69.78+1.53X_1+2.22X_2+0.03X_3$	0.923
	$Y=-65.91+1.45X_1+2.25X_2$	0.923
	$Y=-68.53+2.86X_1$	0.782

Note: X_1= Maximum temperature (°C); X= minimum temperature (°C); X_3= morning RH (%); X_4= evening RH (%); X_5= wind velocity (Km/h) andX_6= Rainfall (mm).

Conclusion

The multiplication of linseed bud fly was most suited during February and March, which prefers almost all living organism available over here. The study on association of bud fly infestation with weather variables revealed significant values in most of the cases as temperatures and relatives humidity. From the step wise regression equation it may be concluded that combined effect of weather factors had more influence on insect infestation. None of the weather factor alone had much more influence on them except maximum temperature.

Acknowledgement

Thanks to Banda University of Agriculture and Technology, Banda, Uttar Pradesh to provide facilities in terms of administrative and financial during experimentation at farm.

Reference

1. Ekka RK, Meena RS, Laichattiwar MS. Seasonal incidence of linseed bud fly, *Dasyneura lini* Branes in linseed ecosystem. Agriculture Update. 2017;12:1328-1331.
2. Karuppaiah V, Sujayanad GK. Impact of climate change on population dynamics of insect pests. World Journal of Agricultural Science. 2012;8(3):240-246.
3. Malik YP, Singh B, Pandey ND, Singh SV. Infestation dynamics of linseed bud fly *Dasyneura lini* Barnes in relation to weather factors under irrigated conditions in central Uttar Pradesh. Ann. Plant Protec. Sci. 1998;6(1):80-83.
4. Mishra MK, Shamshad A. Seasonal and varietal incidence of insect-pests of linseed. Indian J Entomol. 2007;69(3):288-292.
5. Mukharji KG, Dubey OP, Upadhyaya R. Insect pests of linseed, IPM system in Agriculture Oilseed crops. 1999;5:250-263.
6. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. ICAR Pub., New Delhi; c1985.
7. Sahoo SK. Effect of climatic variability on population dynamics of insect pests and natural enemies in linseed (*Linum usitatissimum* L.). Internet J Bio-resource & Stress Mgmt. 2016;7(2):247-251.
8. Singh S, Ali S, Kumar S. Population dynamics of insect-pests of linseed. Ann. Plant Protec. Sci. 2013;21(2):426-427.
9. Singh DR, Srivastava KM, Mathur YK. Population dynamics of linseed Bud fly (*D. lini*) on linseed crop. Ann. Plant Protec. Sci. 1998;6(1):75-79.