ISSN Print: 2664-6064
ISSN Online: 2664-6072
NAAS Rating: 4.69
IJAN 2025; 7(6): 09-13
www.agriculturejournal.net
Received: 14-04-2025
Accepted: 17-05-2025

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Population trends of Mustard sawfly (Athalia lugens proxima) and their association with weather parameters in Indian

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DOI: https://www.doi.org/10.33545/26646064.2025.v7.i6a.227

Abstract
Indian mustard (*Brassica juncea*) is a key Rabi oilseed crop in India, extensively grown across 6.07 million hectares during the 2022-23 season, with Uttar Pradesh contributing significantly. However, pest infestations, especially by the mustard sawfly (*Athalia lugens proxima*), pose serious threats to crop yield. A two-year field study (2022-23 and 2023-24) conducted at CSA University, Kanpur, monitored sawfly population dynamics on the 'Varuna' mustard variety under unsprayed conditions. The pest appeared in early crop stages and peaked during the 51st-52nd Standard Meteorological Week (SMW), with earlier and more severe infestation observed in the second year. Correlation analysis showed non-significant relationships between sawfly incidence and weather parameters (Temperature, rainfall, and humidity), while biotic factors had weak negative associations. The study concludes that climatic factors moderately affect pest incidence, but crop stage and microclimate also play important roles. These insights support the development of effective pest forecasting and eco-friendly management strategies.

Keywords: Indian mustard, *Brassica juncea*, Rabi oilseed crop, Pest infestation, Mustard sawfly

Introduction
Indian mustard (*Brassica juncea*) emerged as the predominant Rabi oilseed crop in India during the 2022-23 growing season. It was cultivated over an extensive area of 6.07 million hectares, producing a significant output of 7.92 million tonnes, with an average productivity of 1,304 kg/ha (Anonymous, 2023). In Uttar Pradesh, the crop covered 0.95 million hectares, yielding 2.45 million tonnes, though the productivity in this state stood at 1,155 kg/ha, which was lower than in Gujarat. Gujarat recorded the highest productivity of 1,363 kg/ha from 0.22 million hectares, contributing 0.30 million tonnes to the national total. Within Uttar Pradesh, Mathura district led in terms of area, production, and productivity, with 0.053 million hectares under cultivation, producing 0.077 million tonnes, and an impressive productivity of 1,453 kg/ha. On a global scale, Indian mustard occupied a total of 36.68 million hectares in 2022-23, yielding 70.42 million tonnes with an average productivity of 1,920 kg/ha (Anonymous, 2023).

Despite its economic significance, Indian mustard is highly susceptible to pest infestations, with over 43 insect species documented to attack the crop in India. Among these, approximately a dozen are considered major pests (Singh *et al*., 2006) [12]. Some of the most destructive pests include the mustard aphid (*Lipaphis erysimi*), mustard sawfly (*Athalia lugens proxima*), leaf miner (*Bagrada hilaris*), pea leaf miner (*Chromatomyia horticola*), cabbage butterfly (*Pieris brassicae*), and Bihar hairy caterpillar (*Spilarctia oblique*). Of particular concern is the pea leaf miner (*Chromatomyia horticola*), a significant pest that thrives in the warmer months, particularly from September to November and March to April, under moderate temperatures ranging between 20-40 °C and low humidity levels (61-80%). This pest poses a serious threat to mustard crops, especially during its larval stage, when it initiates damage by feeding on the leaf tissue. The larva creates feeding trails known as "mines" on the leaves, which are visible as white or grey patches of varying shapes, ranging from small, linear tunnels to larger, irregular chambers (Mahendran and Agnihotri, 2013) [5].

In severe infestations, nearly 86-93% of the leaves may be covered with these mines, leading to extensive damage (Atwal *et al*., 1969; Singh and Saravanan, 2008) [1, 11]. The consequences of such feeding activity are not only cosmetic but also physiological. The damage impairs the plant's ability to perform essential functions like transpiration and photosynthesis, leading to a significant reduction in yield. In extreme cases, this pest infestation can cause substantial losses in harvestable output, severely impacting both the quality and quantity of mustard production (Moanrao and Choudhary, 2016) [7].

Materials and Methods

The field experiment was conducted over two consecutive *Rabi* seasons, 2022-2023 and 2023-2024, commencing on November 20th each year. The location for this study was the Students' Instructional Farm (SIF) of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. The primary objective of the research was to examine the population dynamics of the mustard sawfly (*Athalia lugens proxima*) on the mustard variety "Varuna." This variety was chosen due to its regional importance and susceptibility to pest infestation, making it an ideal candidate for understanding pest trends under natural field conditions. For this purpose, mustard crops were cultivated in relatively large plots, each measuring 10 x 10 meters. Standard agronomic practices such as timely sowing, appropriate spacing, irrigation, and nutrient management were strictly followed to ensure uniform crop growth and development. Importantly, no insecticides or pesticides were applied during the course of the study, allowing for the natural occurrence and progression of the leaf miner population. This unsprayed condition was critical to accurately capturing the interaction between pest populations and environmental factors without the confounding influence of chemical controls.

To monitor pest activity, weekly observations were carried out by randomly selecting ten plants from each plot. From these plants, the number of mustard sawfly present was recorded systematically. This sampling technique provided a reliable estimate of the average population in each plot on a weekly basis. These averages were then compiled and statistically analyzed to detect trends and fluctuations in the pest population over time. In parallel, environmental data were also collected weekly to examine potential correlations with pest population changes. The data included maximum and minimum temperatures, relative humidity, and rainfall—all recorded by the Department of Agronomy at the College of Agriculture, Chandra Shekhar Azad University. These parameters are known to significantly influence insect development, reproduction, and survival, and thus were essential for understanding the ecological context of the mustard sawfly population.

To establish a relationship between climatic conditions and pest incidence, a simple correlation analysis was conducted. This analysis was performed using the methodology described by Panse and Sukhatme (1985) [8], a well-established statistical approach in agricultural research. By applying this method, the researchers were able to quantitatively assess the degree of association between fluctuations in leaf miner numbers and variations in weather parameters. The study's findings are expected to contribute to the understanding of how environmental factors influence mustard leaf miner populations, which in turn can help in developing eco-friendly pest management strategies. The insights gained may be valuable for forecasting pest outbreaks and for making informed decisions about the timing of control measures in mustard cultivation, particularly in regions with similar climatic conditions to Kanpur.

Result and Discussion

The seasonal incidence of *Athalia lugens proxima* (Mustard sawfly) was closely monitored during two consecutive cropping seasons (2022-23 and 2023-24) to understand its population dynamics and relationship with prevailing abiotic and biotic factors.

During the 2022-23 cropping season, the activity of mustard sawfly commenced in the 49th Standard Meteorological Week (SMW) and persisted until the 2nd SMW, corresponding with the early vegetative phase of the mustard crop. The initial population was recorded at 0.51 grubs per plant, which gradually increased to a peak of 1.21 grubs per plant in the 52nd SMW. Following this peak, a declining trend was observed, with the population disappearing by the 3rd SMW (Table 1 and Fig 1). This pattern aligns with earlier reports that mustard sawfly prefers cooler temperatures and early crop stages for oviposition and larval development (Sharma *et al*., 2011; Singh & Yadav, 2015) [10, 13].

In the 2023-24 cropping season, sawfly activity started a week earlier, in the 48th SMW, with a relatively higher initial population of 0.67 grubs per plant. The population peaked at 2.21 grubs per plant during the 51st SMW, showing a higher magnitude of infestation compared to the previous year. The pest population declined thereafter and was not observed beyond the 3rd SMW (Table 2 and Fig 2). This year-to-year variation in incidence may be influenced by changes in environmental conditions such as early onset of favorable temperature and humidity or differences in host plant phenology (Kumar *et al*., 2016) [4].

Correlation analysis between mustard sawfly population and biotic factors revealed a negative correlation in both years, though the results were statistically non-significant. This may indicate inconsistent effects of natural enemies such as parasitoids or predators on sawfly populations, as also noted in earlier studies (Chandel & Verma, 2006) [2].

Regarding abiotic factors, the correlation coefficients indicated a non-significant negative correlation between mustard sawfly incidence and temperature and rainfall, while a non-significant positive correlation was observed with relative humidity. These observations suggest that slightly cooler and more humid conditions might favor the development of the pest, but not to a statistically significant level (Gupta *et al*., 2013; Meena *et al*., 2018) [3, 6]. Rainfall events may have a washing effect on sawfly eggs and larvae, thus reducing population density. However, fluctuating microclimatic conditions within the crop canopy might buffer some of these broader climatic effects.

The findings from both years suggest that mustard sawfly infestation is closely linked to the early growth stages of the crop and influenced moderately by weather parameters. The lack of statistically significant correlations emphasizes the complex interaction of multiple factors affecting sawfly population dynamics. Similar trends have been documented in other studies on insect-pest incidence in mustard and other cruciferous crops (Patel *et al*., 2019) [9].

Correlation coefficients of the Mustard sawfly with abiotic factors during *Rabi* 2022-23 and 2023-24.

	Temp. Max.	Temp. Min.	Relative humidity	Rainfall
2022-23	-0.226^{NS}	-0.343^{NS}	0.268^{NS}	-0.137^{NS}
2023-24	-0.173^{NS}	-0.276^{NS}	0.231^{NS}	-0.089^{NS}

Table 1: Occurrence of major insect pest of Mustard population along with weather parameters during *Rabi*, 2022-23.

Standard week	Date	Mustard saw fly (grub/plant)	Temperature (°C)		Relative humidity (%)	Rain Fall (mm)
			Max.	Min.		
46	14 Nov- 20 Nov	0	27.8	12.7	60	0
47	21 Nov- 27 Nov	0	26.3	11.3	62	0
48	28 Nov- 4 Dec	0	24.3	12.3	70	0
49	5 Dec- 11 Dec	0.51	23.1	12.8	68	0
50	12 Dec- 18 Dec	1.6	23.7	8.3	64.5	0
51	19 Dec- 25 Dec	1.21	22.4	7.1	75	0
52	26 Dec- 1 Jan	1.1	19.1	8.1	75.5	0
1	2 Jan- 8 Jan	0.67	15.3	10.2	82	0
2	9 Jan -15 Jan	0.33	15.2	6.1	81.5	0
3	16 Jan- 22 Jan	0	11.5	5.3	69.5	0
4	23 Jan- 29 Jan	0	16.3	5.1	81.5	18.2
5	30 Jan- 5 Feb	0	22.1	9	75	1
6	6 Feb- 12 Feb	0	20.1	9.3	70.5	0
7	13 Feb- 19 Feb	0	25.3	10.1	66.5	0
8	20 Feb- 26 Feb	0	25.1	11.6	69.5	0
9	27 Feb- 5 Mar	0	24.1	13.5	72.5	0
10	6 Mar - 12 Mar	0	24.6	13.3	68.5	0
11	13 Mar -19 Mar	0	30.1	12.3	40	0
12	20 Mar - 26 mar	0	30.3	13.3	37	0
13	27 Mar - 3 Apr	0	34.8	19.8	31	0

Table 2: Occurrence of major insect pest of Mustard population along with weather parameters during *Rabi*, 2023-24.

Standard week	Date	Mustard saw fly (grubs / plant)	Temperature (°C)		Relative humidity (%)	Rain Fall (mm)
			Max.	Min.		
46	14 Nov-20 Nov	0	27.5	12.8	62	0
47	21 Nov-27 Nov	0	26.8	11.4	41	0
48	28 Nov- 4 Dec	0.67	25.2	12.7	61	0
49	5 Dec- 11 Dec	1.51	24.2	13.2	46	11.8
50	12 Dec-18 Dec	2.6	24.6	8.4	46	0
51	19 Dec-25 Dec	2.21	23.8	7	61	0
52	26 Dec- 1 Jan	2.16	20.3	8.3	69	0
1	2 Jan- 8 Jan	1.04	16.8	10	81	11.2
2	9 Jan -15 Jan	0.33	16.4	6.2	72	0
3	16 Jan- 22 Jan	0	12.5	5.3	77	0
4	23 Jan- 29 Jan	0	17.4	5.1	63	0
5	30 Jan- 5 Feb	0	23.1	9	55	0
6	6 Feb- 12 Feb	0	21.1	9.3	54	26.8
7	13 Feb- 19 Feb	0	26	10.1	48	0
8	20 Feb- 26 Feb	0	26.6	11.6	45	0.6
9	27 Feb- 5 Mar	0	25.5	13.5	51	32.2
10	6 Mar - 12 Mar	0	25.7	13.3	40	0
11	13 Mar -19 Mar	0	30	13	40	0
12	20 Mar - 26 mar	0	30.8	14	37	11.6
13	27 Mar - 3 Apr	0	35.8	20	31	39.2

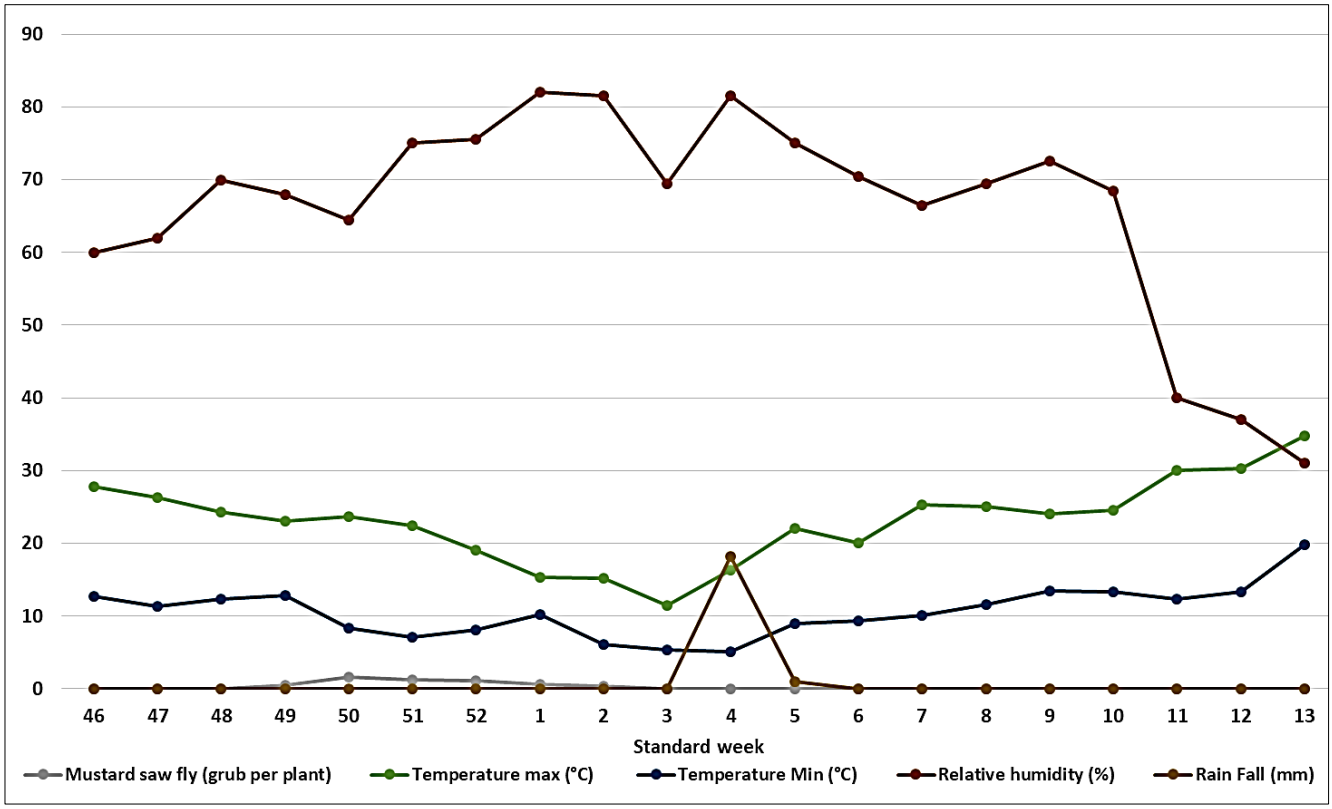

Fig 1: Occurrence of Mustard sawfly along with weather parameters during *Rabi*, 2022-23

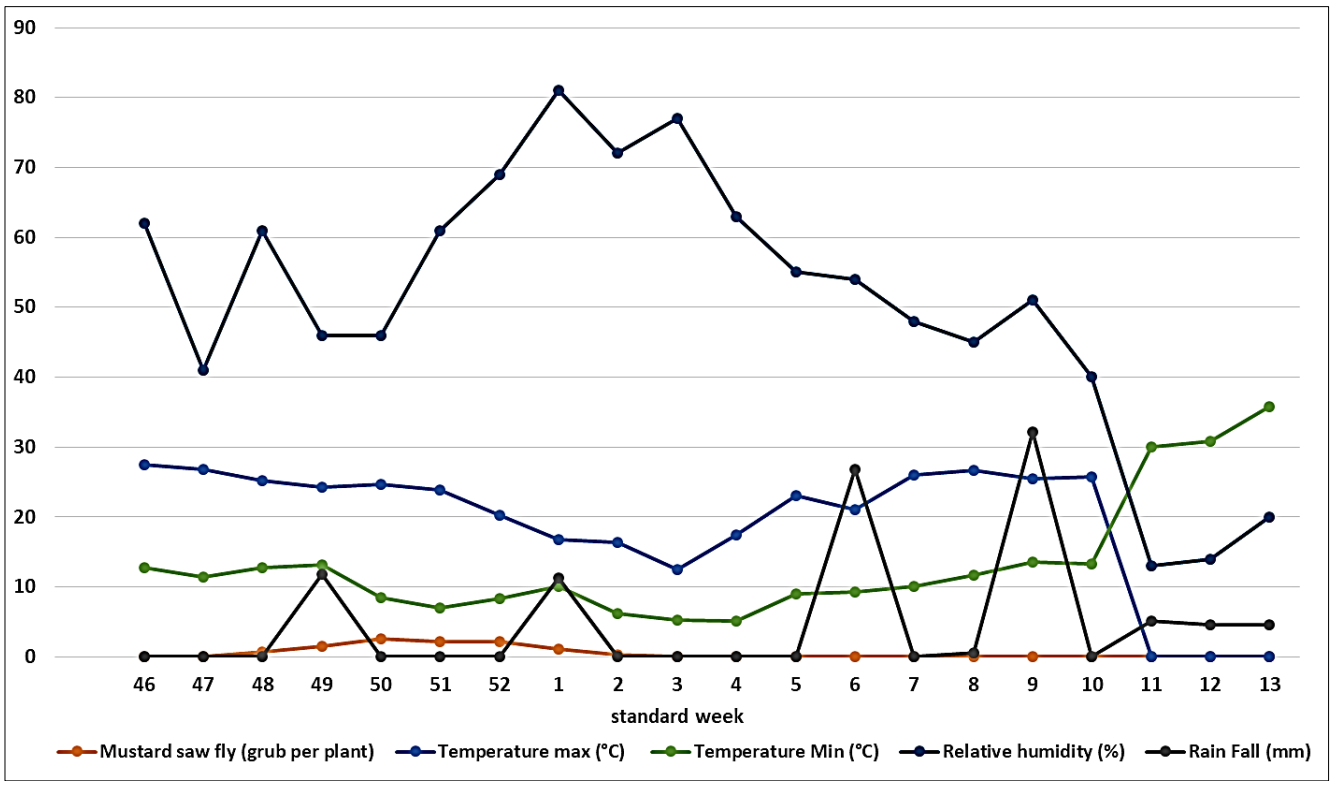

Fig 2: Occurrence of Mustard saw fly along with weather parameters during *Rabi*, 2023-24

Conclusion

The present study highlights the seasonal fluctuation and ecological interactions of *Athalia lugens proxima* on Indian mustard under field conditions in Kanpur. The pest consistently appeared during the early vegetative phase of the crop and peaked in late December, with variations observed between the two cropping seasons. Although the correlation analysis with abiotic factors such as temperature, rainfall, and humidity revealed non-significant trends, the data indicated that cooler and moderately humid conditions slightly favored pest buildup. Biotic factors also exhibited weak but negative associations, suggesting a limited role of natural enemies under the study conditions. The findings emphasize that mustard sawfly infestation is governed by a combination of climatic factors and crop stage, and cannot be attributed to a single environmental variable. These

insights are crucial for optimizing pest monitoring and timing of interventions. Such knowledge forms the foundation for developing sustainable and eco-friendly pest management strategies tailored to regional agro-climatic conditions.

References

1. Atwal AS, Chaudhary J, Ramzan M. Studies on the bionomics and control of pea leaf miner, *Phytomyza atricornis* Meigen (Agromyzidae: Diptera). Punjab Agric Univ J Res. 1969;6:163-169.
2. Chandel RS, Verma KS. Population dynamics of insect pests of rapeseed-mustard and their natural enemies. Indian J Entomol. 2006;68(3):241-245.
3. Gupta R, Tiwari RK, Pandey KP. Population fluctuation of mustard sawfly (*Athalia lugens proxima*) in relation to weather parameters. Ann Plant Prot Sci. 2013;21(1):152-154.
4. Kumar S, Singh R, Arya MC. Influence of abiotic factors on mustard pests under field conditions. J Oilseed Brassica. 2016;7(2):130-134.
5. Mahendran B, Agnihotri M. Natural parasitism of agromyzid leaf miner, *Chromatomyia horticola* (Goureau) (Diptera: Agromyzidae) on field pea. Middle East J Sci Res. 2013;13:952-955.
6. Meena RL, Singh G, Hooda KS. Seasonal incidence of major insect pests and their natural enemies on mustard crop. J Agrometeorol. 2018;20(3):258-261.
7. Moanaro, Choudhary JS. Influence of weather parameters on population dynamics of thrips and mites on summer season cowpea in Eastern Plateau and Hill region of India. J Agric Meteorol. 2016;18(2):296-299.
8. Panse VG, Sukhatme PV. Statistical Methods for Agricultural Workers. New Delhi: ICAR; 1985. p. 381.
9. Patel JJ, Patel GM, Bhut JB. Seasonal occurrence of insect pests of mustard (*Brassica juncea* L.) and their natural enemies in North Gujarat. Int. J Curr Microbiol Appl Sci. 2019;8(3):1575-1581.
10. Sharma RK, Singh J, Kaushik HD. Monitoring of insect pests in rapeseed-mustard agro-ecosystem. Indian J Entomol. 2011;73(4):332-326.
11. Singh H, Saravanan L. Seasonal incidence and management of pea leaf miner *Phytomyza horticola* Goureau infesting pea. Int J Plant Prot. 2008;1:33-37.
12. Singh AP, Singh PP, Singh YP. Pest complex of Indian mustard, *Brassica juncea*, in eastern Rajasthan. Indian J Entomol. 2006;68(2):148-149.
13. Singh H, Yadav SR. Incidence and seasonal abundance of mustard sawfly in relation to weather parameters. Bioscan. 2015;10(1):231-234.