

Studies on Seasonal Prevalence of Major Insect Pests of Mustard and Botanical-Based Management of Mustard Aphid (*Lipaphis erysimi*) Under Field Conditions

Sapna Devi

Sri Sai University

Ankita Vats

ankitavats2003@gmail.com

Sri Sai University

Ankita Dhiman

Sri Sai University

Payal Thakur

Sri Sai University

Shalini Sugha

Sri Sai University

Priyanka Rana

Sri Sai University

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Studies on Seasonal Prevalence of Major Insect Pests of Mustard and Botanical-Based Management of Mustard Aphid (*Lipaphis erysimi*) Under Field Conditions.

Sapna Devi, Ankita vats*, Ankita Dhiman, Payal Thakur, Shalini Sugha, Priyanka Rana

Department of Zoology, Sri Sai University, Palampur 176081, Kangra, Himachal Pradesh, India

(Corresponding author: Ankita Vats*ankitavats2003@gmail.com)

Abstract

Mustard (*Brassica juncea*) is an important oilseed crop in India, valued for its oil, beneficial and economic significance. However, its productivity is badly affected by several insect pests, among which mustard aphids (*Lipaphis erysimi*) is the most deleterious, causing severe damage by sucking sap from tender plant parts, which result in inhibited growth, poor pod formation, and reduced oil content. Other pests such as painted bug, mustard saw fly, cabbage butterfly, leaf webber and flea beetle also affected the crop at different growth stages. The present study was conducted during the rabi season to evaluate the seasonal abundance of major insect pests, their correlation with abiotic factors, and the efficacy of different botanical treatments against mustard aphids. The results revealed the aphids population initiated in the second week of January and reached peak population (190.2 aphids/10 cm central shoot) during March. A significant positive correlation was observed between aphids population and relative humidity ($r=0.68$), while temperature showed a negative correlation ($r=0.55$). Among different botanical tested, Jeevamrit (5%) proved most effective, recording the lowest aphids population (9.32 aphids/plant) and highest reduction control (76.16 %). NSKE (3%) also showed good efficacy with 71.33% reduction in aphids population. Minimum infestation and better crop protection were observed in treatments involving neem-based products. Thus, eco friendly approaches such as botanical pesticides and Integrated pest management (IPM) strategies can effectively manage mustard pests while reducing environmental hazards and preserving natural enemies.

Keywords : Mustard, Aphids, Neem oil, NSKE, IPM, Abiotic factors

INTRODUCTION

Mustard (*Brassica juncea*) commonly known as Indian or brown mustard, is an important oil seed crop belonging to family Brassicaceae. The crop has played significant role in the agriculture economy of India and other parts of world for centuries due to its oil, medicinal and culinary value. The centre of origin of mustard is considered to be China and northeastern India, from where it is believed to have spread Westwards through the Punjab region upto Afghanistan (Mandal *et al.*, 2018). Brassica crops are among the earliest domesticated plants cultivated for herbs and oilseed purposes across Asia, North Africa and Europe (Smith *et al.*, 2020). India is the third – largest producer of rapeseed- mustard, contributing about 13% of global production, though productivity remains lower than the world average (Singh *et al.*, 2025). The crop is widely grown in rain – fed areas due to its adaptability and short duration and contributes significantly to edible oil production in India (Singh *et al.*, 2025).

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producer of rapeseed-mustard, contributing about 13% of global production, though productivity remains lower than the world average (Singh *et al.*, 2025). The crop is widely grown in rain-fed areas due to its adaptability and short duration and contributes significantly to edible oil production in India (Singh *et al.*, 2025). Mustard seeds contain 37- 49 % oil and are widely used for cooking, pickling and traditional medicine, while oil cake serves as cattle feed and organic manure (Singh, 2012). Despite its importance, productivity is affected by several insect pests. More than 43 insect species attack rapeseed – mustard in India, among which Mustard aphid (*Lipaphis erysimi*), Painted bug (*Bagrada hilaris*), Mustard sawfly (*Athalia lugens proxima*), cabbage butterfly (*Pieris brassicae*) and Flea beetle (*Phyllotreta cruciferae*) are major pests causing significant losses (Singh, 2009; Sarangdevot *et al.*, 2006).

Mustard aphid (*Lipaphis erysimi*) is the most destructive pest. Both nymphs and adults suck plant sap, causing yellowing, stunted growth and reduced yield. Honeydew secretion encourages sooty mould growth, further affecting photosynthesis (Khan *et al.*, 2015). Yield losses due to aphids may range from 9–96% with reduction in oil content (Singh *et al.*, 2005; Shylesha *et al.*, 2006). Pest incidence is influenced by temperature and humidity, with cool and humid conditions favouring rapid multiplication.

Chemical insecticides are commonly used for pest control but indiscriminate use leads to resistance, environment pollution and destruction of natural enemies such as parasitoids and predators (Nagar *et al.*, 2012; Singh, 2001). Therefore, Integrated Pest Management approaches including resistant varieties, biological control agents, botanicals and judicious pesticide use are recommended for sustainable pest management (Singh *et al.*, 2014).

MATERIAL AND METHODS

The present investigation entitled “Studies on several prevalence of major pests of mustard and botanical based management of mustard aphids (*Lipaphis erysimi*) under field conditions” was carried out during Rabi season 2025-26 in a local village of Palampur, Himachal Pradesh.

Climatic condition and geographical location

Kangra valley lies between 31.21°N to 32.59°N latitude and 75.47°E to 77.45°E longitude, at an altitude ranging from 500 to 1500 m above mean sea level. The climate of Himachal Pradesh is primarily subtropical. The average temperature during sowing time (October–November) was about 25°C, whereas during harvesting season (February–March) it ranged from 15–20°C. The area received approximately 375.5 mm rainfall which is suitable for Rabi crops.

Plan of Experiments

The experimental trials were conducted under field conditions. The mustard variety THPM-1 (Trombay Him Palam), commonly cultivated in Himachal Pradesh, was used for the study. Required inputs such as seeds, fertilizers and plant based products were arranged before sowing.

Field Preparation and Crop Establishment

The field was prepared by one deep ploughing followed by two cross harrowings to obtain fine tilth. All weeds and crop residues were removed manually. The field was divided into plots of 2 m × 2 m with row spacing of 0.5 m. Irrigation and drainage channels were provided for proper water management.

Fertilizer application

Recommended fertilizer dose of 80 kg N, 40 kg P₂O₅ and 40 kg K₂O per hectare was applied through urea, single super phosphate and muriate of potash, respectively. Half nitrogen along with full phosphorus and potassium were applied as basal dose. Remaining nitrogen was applied in two equal splits after first irrigation and at flowering stage.

Crop Management

Thinning was carried out 15 days after sowing to maintain proper spacing. One hand weeding was done to remove weeds. Two irrigations were applied at 30 and 60 days after sowing. Intercultural operations such as hoeing and weeding were performed after each irrigation.

Insect pest and natural enemies of mustard

The mustard crop was divided into plots (2 m × 2 m). Observations were recorded on major insect pests such as mustard leaf miner, cabbage webber, mustard aphid, diamondback moth, painted bug and mustard sawfly. Predator population including syrphid fly, coccinellid beetles and spiders were also recorded on plant basis.

Layout plan

Crop – Mustard

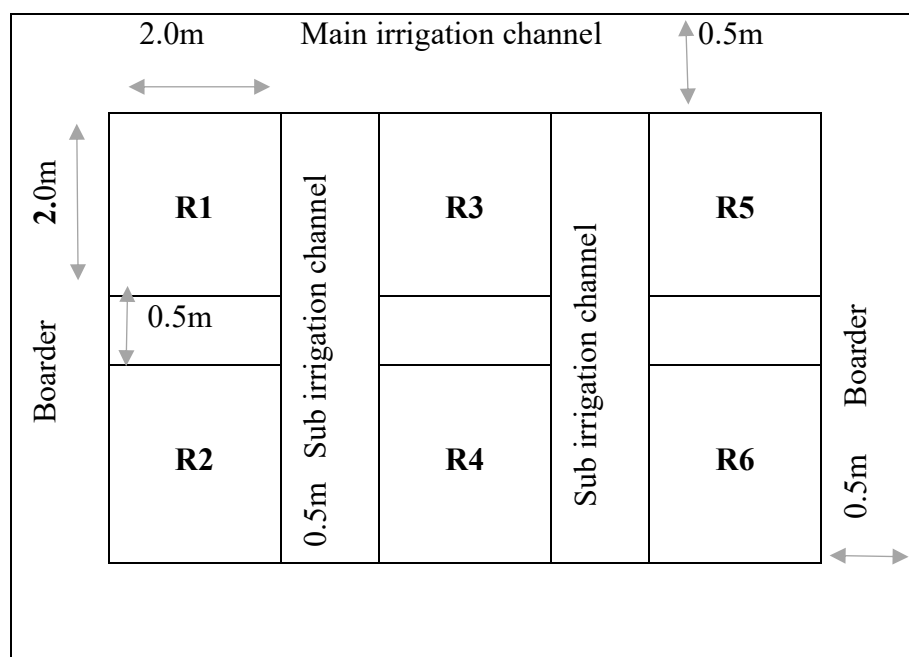
Variety – THPM-1 (Trombay Him Palam)

Design – Randomized Block Design (RBD)

Plot area – 2 m × 2 m

Replication – 6

Sowing date – 9 November 2025



Layout plan of experimental field layout to check the insect /pest or predator of mustard (*Brassica juncea*) crop

Treatments:

T1 – Neem oil 5%

T2 – NSKE 3%

T3 – *Carica papaya* extract 3%

T4 – Cow urine extract 5%

T5 – Jeevamrit 5%

T6 – Control (untreated)

Preparation of biopesticides

1. Neem Oil Spray

Neem oil solution was prepared by mixing 5 ml of neem oil with 100 ml of water. A few drops of liquid soap were added to enhance the adhesion of the oil to plant surfaces. The mixture was poured into a spray bottle and shaken thoroughly to ensure proper emulsification. The solution was sprayed evenly over the entire plant, including the soil, stems, and both sides of the leaves. Application was carried out in the early morning or late evening to avoid damage from direct sunlight. The treatment was repeated every 7–14 days, or as needed, to manage pest infestations.

2. Neem Seed Kernel Extract (NSKE)

Neem Seed Kernel Extract (NSKE) is an indigenous biopesticide prepared from neem (*Azadirachta indica*) seeds. For preparation, 4 kg of crushed neem seeds were boiled in an approximately equal volume of water. The mixture was heated until the volume was reduced to half, ensuring maximum extraction of bioactive compounds. After cooling, 2 litres of well-fermented cow urine were added and mixed thoroughly. The solution was then filtered and diluted with water at a ratio of 1:15 to 1:20 before application.

3. Carica papaya Leaf Extract

Fresh, mature leaves of papaya (*Carica papaya*) were collected and air-dried. The dried leaves were ground into a fine powder. For aqueous extraction, the powder was soaked in water to prepare a sprayable solution. The extract was then filtered and used for application on plants.

4. Cow Urine Extract

Five litres of pure cow urine were collected from domesticated cows and diluted with an equal amount (5 litres) of water. The solution was mixed thoroughly and applied as a spray in the experimental field during the evening hours.

5. Jeevamrit

Jeevamrit was prepared by taking 5 litres of clean water in a sanitized container. To this, 2.5 kg of fresh cow dung and 1 litre of cow urine (preferably from indigenous cows) were added. Subsequently, 500 g of jaggery, 500 g of chickpea flour, and a handful of soil collected from

the field bund were mixed into the solution. The mixture was stirred thoroughly and allowed to ferment under shaded conditions for 7 days. During fermentation, it was stirred twice daily to promote microbial activity. After fermentation, the solution was filtered using a muslin cloth and stored in a clean, airtight container for further use.

Pre-treatment and Post-treatment Observations

Observations on aphid population were recorded before treatment and at 1, 4, 8 and 12 days after spraying. Ten plants were selected randomly per plot. Economic threshold level was considered as 50 aphids per 10 cm central twig. Percent population reduction was calculated using Henderson-Tilton formula and data were statistically analysed.

Data were analyzed using Randomized Block Design (RBD) and treatment means were compared using Critical Difference (CD) at 5% level of significance.

RESULTS AND DISCUSSION

Abundance of Insect Pests in Rapeseed–Mustard (Rabi 2025–26)

Field observations revealed three major pests: mustard sawfly (*Athalia lugens proxima*), mustard aphid (*Lipaphis erysimi*), and painted bug (*Bagrada hilaris*), along with some minor pests. Their incidence varied with crop stage and weather conditions. Mustard sawfly: Appeared early (48th SW–2nd SW), with an initial population of 0.66 grubs/plant, peaking at 2.16 grubs/plant in the 1st SW, and disappearing by the 3rd SW. Mustard aphid: Observed from 51st to 12th SW, with population ranging from 0.66 to 190.2 aphids/10 cm twig. Peak occurred in the 10th SW under cool and humid conditions. Painted bug: Appeared late (9th–12th SW), with population ranging from 0.34 to 1.45 bugs/plant, peaking in the 12th SW. Other pests: Grasshoppers, caterpillars, etc., occurred from 2nd–10th SW, with populations ranging from 0.30 to 2.34 insects/plant, peaking during mid-season. Overall, sawfly dominated early crop stages, aphids persisted longer with peak during reproductive stage, while painted bug infestation occurred at later stages.

Presence of Natural Enemies

Natural enemy populations were observed throughout the crop season and showed close association with aphid abundance. The population of *Coccinella* spp. ranged from 0.42 to 3.35 grubs per plant, reaching its maximum during the 9th Standard Week when aphid population was also high (118.60 aphids per 10 cm twig).

Similarly, syrphid fly larvae were recorded from the 1st to 8th Standard Week and attained a peak population of 3.56 grubs per plant during the 6th Standard Week. Spider population varied from 0.33 to 2.83 spiders per plant, with the highest population observed during the 8th Standard Week. These observations indicate that predator populations increased with increasing pest density and contributed significantly towards natural biological control. Similar findings were reported by Gupta (1997) and Hakim *et al.* (2016), who observed a positive relationship between mustard aphid populations and their natural enemies.

Table-1. Occurrence of mustard insect pest population along with weather parameters during Rabi season ,2025-26

	Insect -pest				Predators				Temperature		Rainfall (mm)	RH (%)
	Saw fly Grubs/plant	Mustard Aphid (Aphid/ 10cm central twig/plant)	Painted Bug (Bugs/plant)	Other	<i>Coccinella</i> spp. (Grub/plant)	Syrphid fly (Grub/plant)	Spider	Other	Max.	Min.		
45	0	0	0	0	0	0	0	0	25.2	12.2	0	74
46	0	0	0	0	0	0	0	0	23.3	11.4	0	70
47	0	0	0	0	0	0	0	0	23.4	7.5	1.5	45
48	0.66	0	0	0	0	0	0	0	20.5	6.5	2.0	70
49	0.83	0	0	0	0	0	0	0	19.5	5.3	0	75
50	1.5	0	0	0	0	0	0.3	0	19.2	4.3	3.0	65.7
51	1.67	1.5	0	0	0	0	0	0	18.3	4.8	2.0	68.2
52	1.33	1.83	0	0	0	0	0	0	18	5.9	0	72.3
1	2.16	1.5	0	0	0.42	0.23	0.33	0.33	17.3	6.4	0	75.2
2	1.5	0.66	0	0.30	0.67	0.33	1.5	1	17.35	5.52	0	70.3
3	0	1	0	0	0.66	0	1	0.66	16.3	6.7	0	65.3
4	0	1.66	0	0.64	0	1.62	0	1	18.1	5.33	4.8	70
5	0	2	0	1	1.16	2	0.66	0	17.5	4.56	1.3	82
6	0	2.16	0	2.34	1	3.56	0.66	0.66	18.1	5.23	7.3	68.3
7	0	2.16	0	2	1.66	2.43	1	1.83	18.2	6.4	0	80
8	0	0.83	0	1.61	0.66	1.5	2.83	2.5	17.8	8.2	7.3	75
9	0	118.6	0.34	1.30	3.35	0	1	1	18.8	9.6	0	68.2
10	0	190.2	0	0.60	0.5	0	2.16	1.33	17.6	11.2	6.4	78.4
11	0	48.66	0.23	0	2.21	0	1.16	0	20.2	12.6	0	85.3
12	0	2.61	1.45	0	1.33	0	0	0	21.8	14.42	2.7	69.4

The seasonal occurrence of mustard sawfly along with weather parameters is presented in Fig. 1.

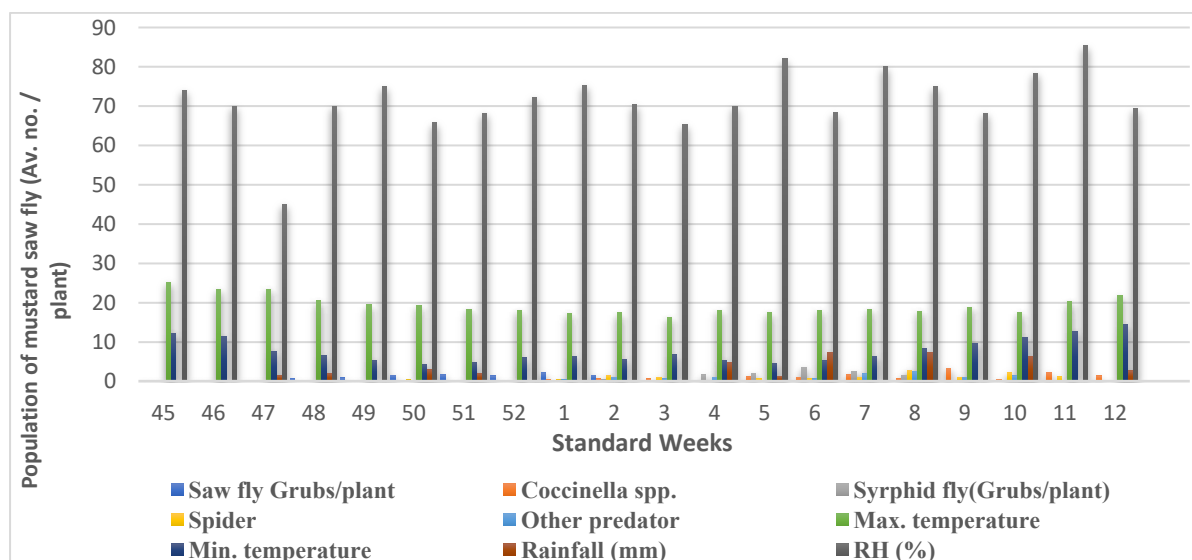


Fig.1 Occurrence of Mustard Sawfly (*Athalia lugens proxima*) on mustard along with biotic and weather parameters during Rabi season ,2025-26

Population dynamics of mustard aphid under field conditions are illustrated in Fig. 2.

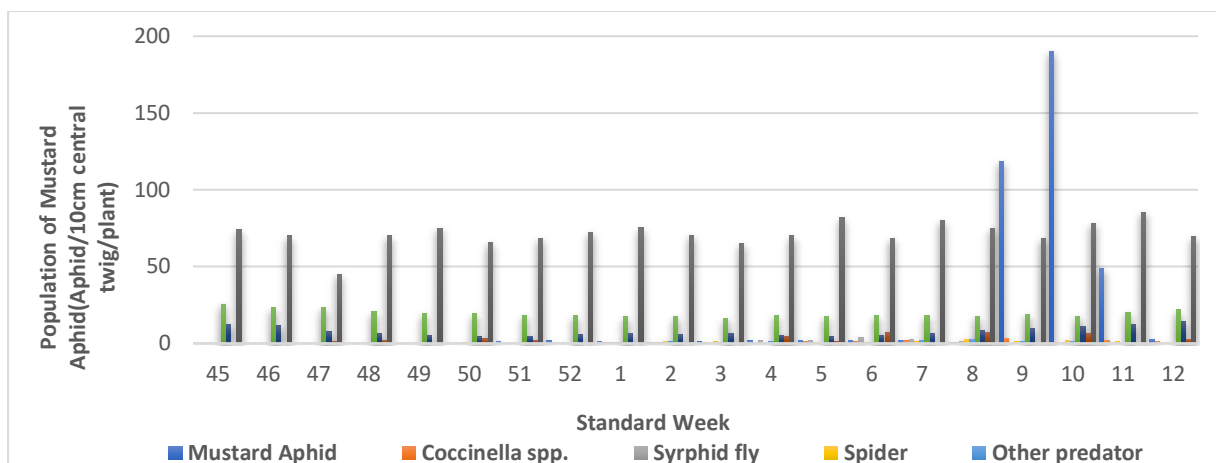


Fig.2 Occurrence of mustard Aphid(*Lipaphis erysimi*) on mustard along with biotic and weather parameters during Rabi season,2025-26

Seasonal incidence of painted bug in mustard crop is shown in Fig. 3.

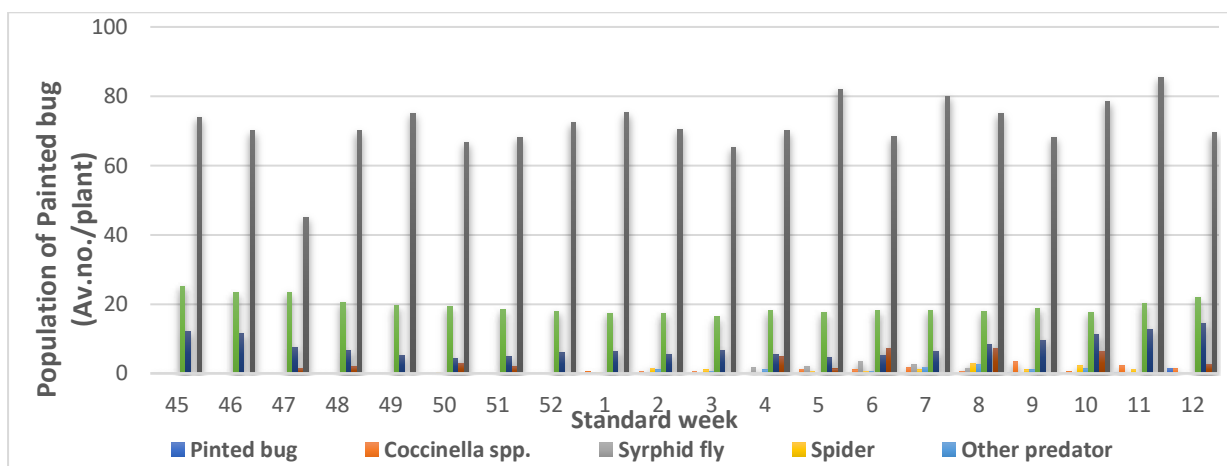


Fig.3 Occurrence of Painted bug (*Bagrada hilaris*) on mustard along with biotic and weather parameters during Rabi season,2025-26

Occurrence of other insect pests during the crop season is presented in Fig. 4.

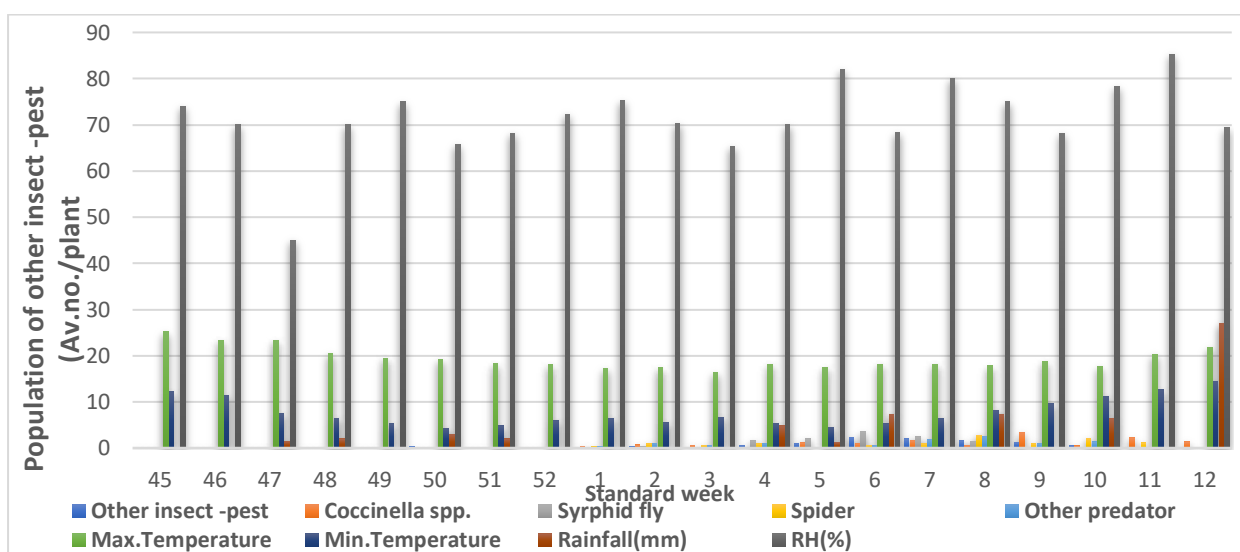


Fig.4 Occurrence of other insect-pest on mustard along with biotic and weather parameters during Rabi season,2025-26

Correlation of Insect Pest Incidence with Biotic and Abiotic Factors

Correlation analysis indicated that pest incidence was significantly influenced by both biotic and abiotic factors. Mustard sawfly exhibited a significant negative correlation with maximum temperature ($r = -0.495^*$), indicating that increasing temperature reduced its population. Painted bug showed a significant positive correlation with maximum temperature ($r = 0.596$), suggesting favourable development under relatively warmer conditions.

Mustard aphid showed positive correlation with *Coccinella* spp. ($r = 0.427$) and spiders ($r = 0.478^*$), indicating increased predator activity with increasing aphid density. Relative humidity ($r = 0.217$) and rainfall ($r = 0.226$) also exhibited positive associations with aphid population. Similar observations were reported by Jat et al. (2006), Gour and Pareek (2013) and Bapari et al. (2007), who concluded that weather parameters significantly affect population dynamics of mustard pests.

Table- 2. correlation coefficients of the insect -pest population with biotic (predators)and abiotic factors during rabi season 2025-26

S. No.	Insects	Biotic factors (Predators)				Abiotic factor			
		<i>Coccinella</i> spp.	Syrphid fly	Spider	others	Temperature		Rainfall (mm)	RH (%)
						Min.	Max.		
1	Mustard sawfly	-0.371	-0.319	-0.237	-0.273	-0.302	-0.495*	-0.261	-0.034
2	Mustard aphid	0.427	-0.203	0.478*	0.279	-0.164	0.389	0.226	0.217
3	Painted bug	0.389	-0.180	-0.132	-0.154	0.242	0.596**	0.003	-0.015
4	Others	0.470*	0.868**	0.487*	0.693**	-0.364	-0.189	0.497*	0.215

All botanical treatments significantly reduced aphid population compared with the untreated control. Before spraying, aphid populations ranged from 53.66 to 54.66 aphids per 10 cm central twig, indicating uniform infestation across treatments.

Among the botanicals tested, Jeevamrit @ 5% proved most effective and reduced aphid population from 54.00 aphids before spraying to only 9.32 aphids at 12 DAS, recording 76.16% reduction. This was followed by *Carica papaya* leaf extract @ 3%, which reduced aphid population to 10.66 aphids at 12 DAS with 73.00% reduction, and NSKE @ 3%, which reduced the population to 13.00 aphids with 71.33% reduction.

In contrast, aphid population in untreated control increased continuously from 54.66 aphids before spraying to 309.32 aphids per 10 cm twig at 12 DAS. The superior performance of Jeevamrit and papaya leaf extract may be due to the presence of bioactive compounds and microbial metabolites that adversely affect aphid survival and reproduction. Similar findings were reported by Mandal (2019), Dubey and Mishra (2007) and Isman (2006).

Table-3 .Effectiveness of Botanicals and Chemical insecticides against mustard aphid during Rabi 2025-2026

Treat. No.	Treatments	Conc.(%)	No. of spray	The population of mustard aphid (A.V. No./10 cm central twig /plant)				
				Pre-treatment	Post -treatment			
				1 DBS	1 DAS	4DAS	8 DAS	12DAS
T1	Neem oil	5%	1	54.00 (7.44)	36.32 (6.20)	30.65 (5.73)	29.00 (5.51)	15.32 (4.9)
T2	NSKE	3%	1	53.66 (7.41)	33.32 (5.93)	28.31 (5.53)	23.66 (5.01)	13.00 (3.93)
T3	<i>Carica papaya</i> extract	3%	1	53.66 (7.41)	33.66 (5.91)	27.65 (5.47)	19.00 (4.63)	10.66 (3.88)
T4	Cow urine extract	5%	1	54.32 (7.46)	35.65 (6.15)	29.31 (5.62)	25.00 (5.13)	14.66 (4.01)
T5	Jeevamrit	5%	1	54.00 (7.43)	32.31 (5.88)	27.00 (5.41)	19.66 (4.59)	9.32 (3.57)
T6	Control	(untreated)	1	54.66 (7.43)	60.38 (7.80)	76.65 (8.82)	208.32 (14.48)	309.32 (17.60)
		SEm±		-	(0.61)	(0.43)	(0.77)	(0.56)
		C.D.(0.5)		-	(0.34)	(0.23)	(0.23)	(0.24)
		CV			(10.58)	(7.35)	(7.78)	(7.63)

*Pre-treatment : 1 Day before spray (DBS)

**Post -treatment : Day after spray (DAS)

Figures in the parentheses are X+ 0.5 transformed values

Effectiveness of different botanical treatments against mustard aphid is presented in Fig. 5.

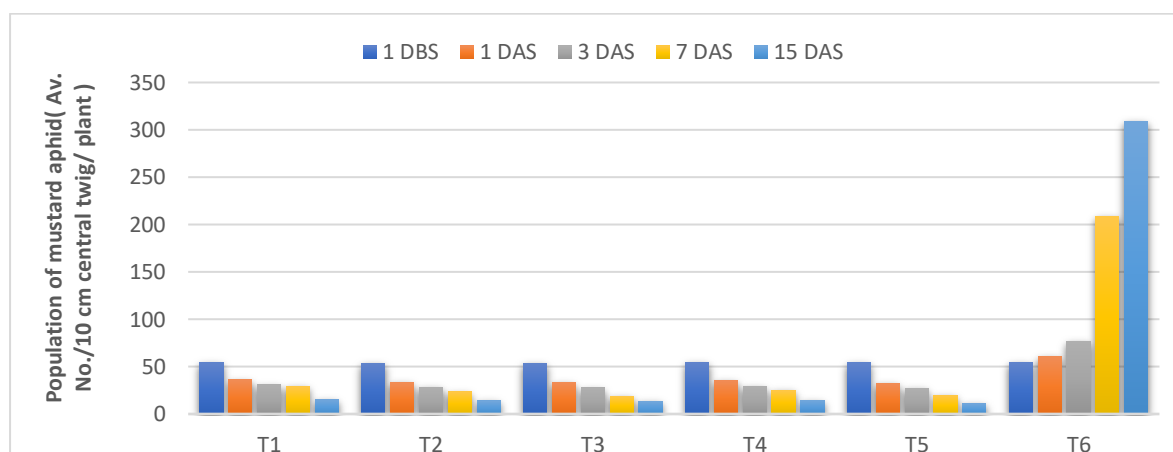


Fig -5. Effectiveness of botanical and chemical insecticides against mustard aphid during Rabi 2025-26

Table -4. Effectiveness of treatments based on reduction (%) in the population of mustard aphid during Rabi 2025-26

Treat. No.	Treatments	Conc.(%)	Reduction(%)			
			1 DAS	4 DAS	8 DAS	12 DAS
T1	Neem oil	5%	31.83 (34.32)	40.33 (39.05)	45.16 (45.16)	70.66 (70.66)
T2	NSKE	3%	34.16 (35.75)	43.16 (41.05)	52 (52)	71.33 (71.33)
T3	Carica papaya extract	3%	35.16 (36.35)	44.66 (41.92)	60.33 (60.33)	73
T4	Cow urine extract	3%	32.16 (34.53)	45.33 (42.30)	50.83 (50.83)	70.66
T5	Jeevamrit	5%	36.16 (36.95)	45.66 (42.49)	61.16 (61.16)	76.16
T6	Control	(Untreated)	0.00	0.00	0.00	0.00
	SEm±	-	(0.36)	(0.25)	(0.38)	(0.35)
	C.D.(0.5)	-	(1.08)	(0.73)	(1.12)	(1.05)
	C.V(%)	-	(3.04)	(1.78)	(2.1)	(1.45)

Figures within parentheses are angular transformed values

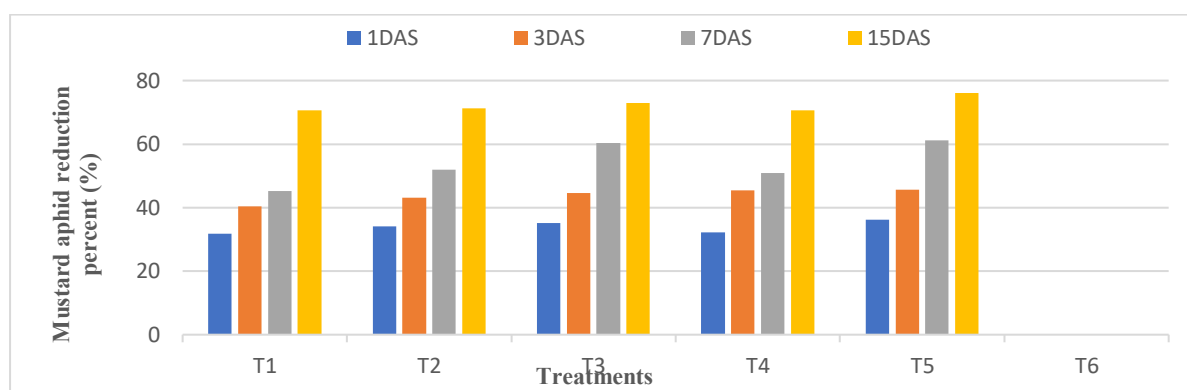


Fig .6 Effectiveness of treatments based on reduction (%) in the population of mustard aphid during Rabi 2025-26

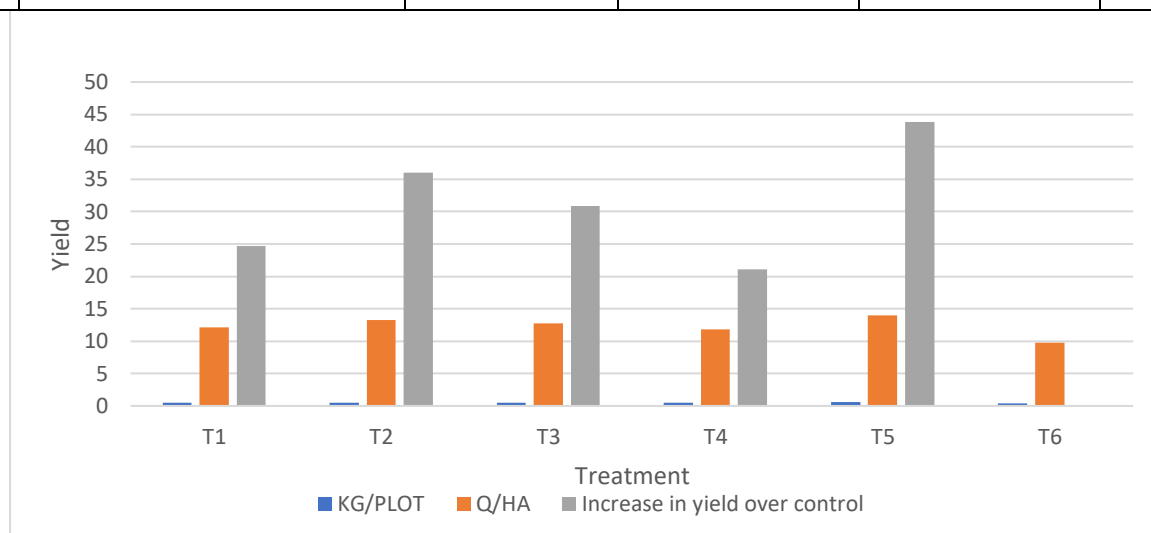
Effect of treatments on seed yield

The effect of different botanical treatments on seed yield and increase over control is presented in Table 7.

The effectiveness of treatments was evaluated through both pest reduction (percent mortality) and seed yield. All botanical treatments significantly outperformed the control, achieving 70.66–76.16% pest reduction at 15 DAS (with values in parentheses indicating angular-transformed data) and seed yields of 11.1–14.01 q/ha versus 9.74 q/ha in the untreated control.

Table -5. Effect of botanicals and chemical insecticides on seed yield of mustard during Rabi season 2025-26

Treat No.	Treatment	Conc.(%)	Yield		Increase in yield over control (%)
			Kg/plot	Q/ha	
T1	Neem oil	5%	0.49	12.15	24.74
T2	NSKE	3%	0.53	13.25	36.04
T3	<i>Cacica papaya extract</i>	3%	0.51	12.75	30.90
T4	Cow urine extract	3%	0.47	11.79	21.05
T5	Jeevamrit	5%	0.56	14.01	43.84
T6	Control (water spray)	(Untreated)	0.39	9.74	-
	SEm±		0.03	0.29	-
	C.D. (0.5)		0.12	0.88	-
	C.V.(%)		4.2	4.2	-



The effect of botanical treatments on mustard seed yield is shown in Fig. 7.

Fig.7 Effect of botanical and chemical insecticides on seed yield of mustard during Rabi season 2025-26

Among all botanical treatments, Jeevamrit @ 5% recorded the highest seed yield (14.01 q/ha) and maximum increase over control (43.84%), followed by NSKE @ 3% (13.25 q/ha) and Carica papaya extract @ 3% (12.75 q/ha)

Cost benefit ratio :

The highest cost–benefit ratio was recorded in cow urine extract and *Carica papaya* extract (0.03%) with 1:2. This was followed by NSKE (0.03%) (1:32.5), Jeevamrit 5% (1:14.29), and Neem oil 5% (1:8.88). Overall, *Carica papaya* extract and cow urine treatment showed the best economic returns among all treatments.

The effect of different botanicals treatments on seed yield and increase over control is presented in table 6.

Table 6. Economic of cost benefit ratio of the botanical treatment during Rabi 2025-26

S.No.	Treatments	Dose(%)	Quality of chemicals required Kg or lit	Cost of required chemicals (Rs)	Yield (q)	Saved yield over control (q)	Value of saved yield (Rs.)	Cost benefit ratio(C:B)
1	Neem oil	5%	9 lit	169	12.15	2.41	3977	1:23:53
2	NSKE	3%	9 lit	100	13.25	3.51	5792	1.57:92
3	<i>Carica papaya extract</i>	3%	9 lit	0	12.75	3.01	4967	1:2*
4	Cow urine extract	3%	9 lit	0	11.79	2.05	3382	1:2*
5	Jeevamrit	5%	9 lit	97	14.01	4.27	7046	1.72:64
6	Control(water spray)	Untreated	-	-	2.83	-	-	-

Author Contribution

Dr. Sapna Devi, Major Advisor, provided overall guidance and supervision throughout the research work. She contributed to the planning and execution of the study, data analysis, interpretation of results, and critical review of the manuscript. Her valuable suggestions and continuous support greatly improved the quality of the research. The final manuscript was reviewed and approved.

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CONCLUSION

The present study on rapeseed–mustard crop during the Rabi season revealed the occurrence of several insect pests, among which mustard aphid (*Lipaphis erysimi*) was identified as the most dominant and economically important pest. The aphid population appeared from the 51st Standard Week and reached its peak (190.20 aphids per 10 cm central twig per plant) during the 10th Standard Week under favourable environmental conditions. Other pests such as mustard sawfly (*Athalia lugens proxima*) (0.66–2.16 grubs per plant) and painted bug (*Bagrada hilaris*) (0.34–1.45 bugs per plant) were recorded at specific crop stages and caused comparatively less damage. Natural enemies including ladybird beetles (*Coccinella* spp.) (0.42–3.35 grubs per plant), syrphid flies (0.33–3.56 grubs per plant), and spiders (0.33–2.83 per plant) were observed during the crop season. Their population trends coincided with aphid incidence, indicating their significant role in natural pest regulation. Correlation studies

suggested that pest populations were influenced by abiotic factors such as temperature, relative humidity, rainfall, and sunshine hours, with varying degrees of association. Field evaluation of botanical treatments against mustard aphid indicated that all treatments were effective in reducing aphid population compared to the untreated control, where the population increased over time. Pre-treatment population ranged from 54.00 to 54.66 aphids per 10 cm central twig per plant. Among the treatments, Jeevamrit @ 5% was found to be the most effective, followed by Carica papaya extract @ 3%, NSKE @ 3%, cow urine extract @ 5%, and neem oil @ 5%, showing significant reduction in aphid population at 1, 3, 7, and 15 days after spraying. Overall, the study concludes that mustard aphid is the key pest of rapeseed–mustard, and its effective management can be achieved through an integrated approach involving regular pest monitoring, conservation of natural enemies, and application of eco-friendly botanical treatments. Among the botanicals tested, Jeevamrit @ 5% proved most promising and can be recommended as a sustainable component of integrated pest management (IPM) for enhancing crop productivity and environmental safety.

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