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ORIGINAL ARTICLE

Seasonal dynamics of mustard aphid, *Lipaphis erysimi* Kalt and their natural enemies in relation to meteorological parameters on mustard under Gurugram conditions

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ABSTRACT
Field observations were recorded during rabi seasons of 2024–25 and 2025–26 for seasonal incidence of mustard aphid, Lipaphis erysimi Kalt. and their natural enemies on Indian mustard under Gurugram conditions. Aphids started to appear in 52nd standard meteorological week (SMW) and steadily increased to a maximum of 138.4 aphids/10 cm apical twig in 6th SMW. Amongst natural enemies, the most common were coccinellids and syrphid larvae. Their numbers were positively correlated with aphid build-up. Aphid population was positively correlated with coccinellids (r = 0.942) and syrphids (r = 0.891). Weather analysis showed that the aphid population was negatively correlated with the maximum temperature (r = -0.487), minimum temperature (r = -0.523) and sunshine hours (r = -0.361), whereas relative humidity was positively correlated (r = 0.418). The flowering stage, especially 5th-7th SMWs, was the most vulnerable time for aphid outbreak in the Gurugram region, stated the study.
Keywords: *Indian mustard, Brassica juncea, mustard aphid, Lipaphis erysimi, associated insect pests, natural enemies, population dynamics, Gurugram*

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INTRODUCTION

Indian mustard (*Brassica juncea* L. Czern. & Coss.) is an important rabi oilseed crop of northern India and an important source of edible oil. In Haryana and other adjoining areas, its productivity is often constrained by insect-pests damaging the crop from seedling stage to maturity. Repeated application of insecticides is costly and may interfere with natural regulation in the crop ecosystem [4]. Knowledge of pest incidence under field conditions still remains important for the development of timely and ecologically sound management practices.

Mustard aphid, *Lipaphis erysimi* (Kaltenbach) is a key sucking pest of the crop from pest complex. Colonies develop on tender shoots, buds and inflorescences and the feeding causes curling, yellowing and poor development of siliquae. Aphid numbers can increase rapidly under cool winter weather, and significant loss may occur if the infestation coincides with flowering and pod initiation [3, 4].

Besides the aphid, the mustard fields also harbor a number of other insect pests like flea beetle, mustard sawfly, painted bug and leaf webber. At the same time, aphid colonies attract a complex of natural enemies, including coccinellids, syrphid larvae and lacewings. Studying these organisms together gives a more realistic picture of the mustard agroecosystem than considering aphids alone, especially when the goal is to identify the period of greatest risk and the scope for natural biological suppression [4, 5].

Previous studies have indicated that the aphid appearance and peak activity are influenced by locality, sowing environment, crop stage and prevailing weather. In most of the cases in north India, incidence starts by the end of December or beginning of January, increases during flowering and decreases towards maturity of the crop. But, local information is still required, since the timing and intensity of infestation

can be different in different agro-ecological conditions and such variation affects the timing of monitoring and management [1, 2, 7].

Natural enemies usually respond to aphid build-up in the field, but their greatest abundance is usually after aphid colonies are well established. Thus, simultaneous observation of pest and beneficial population is required to understand whether the natural enemies are merely reacting to the prey density or are likely to contribute meaningfully to the suppression under local conditions [1, 6, 7].

With this in view, the present investigation was undertaken to study the seasonal incidence of mustard aphid and major natural enemies on Indian mustard under Gurugram conditions and to relate their population fluctuations with the prevailing weather parameters.

MATERIAL AND METHODS

Field experiment

The field experiment was conducted during rabi seasons of 2024–25 and 2025–26 at the research farm of the Department of Entomology, School of Agricultural Sciences, G. D. Goenka University, Sohna, Gurugram, Haryana, India. The present study was designed to record the seasonal population dynamics of mustard aphid and natural enemies under unsprayed field conditions.

Indian mustard cv. NRCHB-101 was sown in a plot of 3 × 10 m size with 30 cm row-to-row and 10 cm plant-to-plant spacing. The crop was grown following the recommended agronomic practices for the region but no plant protection measures were carried out to monitor the natural infestation and activity of natural enemies during the season.

Data collection

Observations were recorded at weekly intervals from the first appearance of pests until crop maturity. Twenty plants were selected at random and tagged for repeated observation. Aphid population was recorded as the number of nymphs and adults on a 10 cm apical twig from each tagged plant, and the weekly mean number of aphids per 10 cm twig was calculated.

Coccinellids were recorded as larvae and adults per 20 plants, and syrphid larvae and lacewings were counted separately.

Meteorological observations

Weekly data on maximum temperature, minimum temperature, relative humidity, rainfall and sunshine hours were obtained from the nearest meteorological observatory serving the experimental area and aligned with the corresponding week-wise pest observations for correlation analysis.

Statistical analysis

Week-wise mean populations were compiled for both seasons and pooled for interpretation. Statistical analyses were performed in R software version 4.2.1. Pearson's correlation coefficients were calculated to examine the relationship of aphid population with natural enemies and weather parameters, and the pooled weekly data were used to prepare the seasonal trend figures.

RESULTS AND DISCUSSION

Mustard Aphid, *Lipaphis erysimi* (Kaltenbach)

Aphid incidence attained peak of 138.4 aphids per 10 cm apical twig during the 6th SMW. The population declined 4.2 aphids per 10 cm twig during 11th SMW (Table 1). The aphid population exhibited a significant negative correlation with maximum temperature (r = -0.487), minimum temperature (r = -0.523) and sunshine hours (r = -0.361), a significant positive correlation with relative humidity (r = 0.418) and a non-significant positive correlation with rainfall (r = 0.126) (Table 2). Maximum population was recorded when the maximum temperature ranged between 26.1 and 27.0 °C, minimum temperature between 11.3 and 12.8 °C and relative humidity between 78 and 81 percent. The outcome is consistent with the findings of [7], who reported a similar build-up of aphid population under the influence of meteorological parameters, and [1], who recorded peak aphid activity during the corresponding period in northern India. A negative association of aphid population with temperature and a positive association with relative humidity were also reported by [2, 6].

Table 1: Pooled weekly population of mustard aphid and natural enemies 2024–25 and 2025–26

SMW	Aphid / 10 cm twig	Coccinellids / 20 plants	Syrphids / 20 plants
50	0.0	0.0	0.0
51	0.0	0.0	0.0
52	1.6	0.0	0.0
1	4.8	0.4	0.0
2	12.4	1.1	0.2
3	28.6	2.4	0.6
4	54.2	4.0	1.0
5	92.8	5.9	1.6
6	138.4	6.8	2.2
7	121.6	7.2	2.6
8	88.5	5.6	2.1
9	49.7	3.2	1.3
10	18.3	1.4	0.5
11	4.2	0.4	0.1

Table 2: Correlation coefficients (r) between aphid population and weather parameters

Weather parameter	Correlation coefficient (r)	Significance
Maximum temperature	-0.487	P < 0.05
Minimum temperature	-0.523	P < 0.05
Relative humidity	0.418	P < 0.05
Rainfall	0.126	NS
Sunshine hours	-0.361	P < 0.05

Seasonal abundance of natural enemies

Coccinellids were first observed during the 1st SMW at 0.4 individuals per 20 plants, and their population increased steadily to reach a maximum of 7.2 individuals per 20 plants during the 7th SMW (Table 1). Syrphid larvae recorded peak populations of 2.6 and per 20 plants in the 7th SMW. Similar responses of coccinellid and syrphid predators to aphid build-up on mustard have been reported by [6, 7].

Relationship between mustard aphid and natural enemies

The aphid population exhibited positive correlation with coccinellids (r = 0.942) and syrphid larvae (r = 0.891) (Table 3). The results are in line with the findings of [1, 7], who reported significant positive correlations between aphid population and its coccinellid predators on mustard.

Table 3: Correlation coefficients (r) between aphid population and natural enemies

Variable 1	Variable 2	Correlation coefficient (r)	Significance
Aphid population	Coccinellid population	0.942	P < 0.01
Aphid population	Syrphid population	0.891	P < 0.01

Table 4: Pooled weekly weather parameters during the crop season

SMW	Max temp (°C)	Min temp (°C)	RH (%)	Rainfall (mm)	Sunshine (h)
50	24.1	8.4	58	0.0	8.2
51	23.2	7.8	61	0.0	7.6
52	22.0	6.9	65	0.0	7.0
1	20.8	5.8	68	1.2	6.4
2	21.5	6.2	71	0.0	5.9
3	23.0	7.5	73	0.0	5.6
4	24.7	9.4	76	2.4	5.2
5	26.1	11.3	78	0.0	5.0
6	27.0	12.8	81	0.0	4.8
7	28.2	14.4	79	0.6	5.1
8	29.4	16.1	74	0.0	5.8
9	31.0	18.5	69	0.0	6.4
10	33.5	20.6	63	0.0	7.0
11	35.6	22.4	58	0.0	7.5

CONCLUSION

Under Gurugram conditions, mustard aphid was the dominant insect pest of Indian mustard during the reproductive stage, with peak infestation during the 6th SMW. Populations of coccinellids and syrphid larvae, increased with aphid abundance and peaked shortly after the aphid maximum. Aphid incidence was favored by comparatively cool and humid weather. The results indicate that flowering is the most critical period for aphid surveillance and that conservation of natural enemies should form an integral part of mustard pest management.

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