Indian Journal of Entomology Online published Ref. No. e24478 DoI. No.: 10.55446/IJE.2024.1478

POPULATION DYNAMICS OF MUSTARD APHID AND ITS NATURAL ENEMIES

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ABSTRACT

Mustard aphid *Lipaphis erysimi* (Kaltenbach) appeared as a major pest in Jobner and its incidence is highly influenced by weather parameters and natural enemies. Therefore, a study was conducted to understand their population dynamics. The commencement of the aphid incidence was recorded in the fourth week of December (52th SMW) which gained a peak in the 6th SMW i.e., second week of February and declined thereafter and reached its lowest during 9th SMW i.e., first week of March. Among the natural predators *Coccinella septempunctata* (L) and *Xanthograma scutellarae* (F) were found predating on *L. erysimi* and showed significant positive relationship (r= 0.997* and r = 0.883*). The population of *X. scutellarae* showed a significant negative correlation (r=-0.658*) with minimum temperature.

Key words: *Brassica juncea*, *Lipaphis erysimi, Coccinella septempunctata, Xanthograma scutellarae*, yield loss, management, oilseed, biocontrol, weather parameters, biotic, abiotic

Insects such as aphids, painted bugs, mustard sawflies, leaf miners, cabbage leaf webbers, flea beetles, and diamondback moths are significant pests that pose a threat to mustard production in India. *Lipaphis erysimi* (Kaltenbach) has been identified as a major pest due to the economic losses it inflicts (Bakhetia and Sekhon, 1989). These pests can cause substantial damage to mustard crops and severly impact the overall yield. According to Bakhetia (1979), *L. erysimi* alone may result an estimated losses of 66.0 to 99.0% in *B. campestris* and 27.0 to 28.0% in *B. juncea*, with a 15.0% decline in oil content (Verma and Singh 1987; Rohilla et al., 1987; Singh and Sachan, 1994). Both the immature and adult stages of *L. erysimi* extract sap from damaged plant parts. Infested plants might curl, and if the infestation progresses far enough, plants may even wither and die. Plants affected by their infestation show wilting, yellowing, and stunting (Khan et al., 2015; Dhillon et al., 2022). Damage inflicted by *L. erysimi* resulted in a reduction of photosynthetic pigments throughout various plant components in the tested genotypes of *Brassica juncea* (Samal et al., 2022; Dhillon et al., 2018; Awasthi, 2002). It proliferates and spreads rapidly in favourable weather. Coccinellid predators, *Menochilus sexmaculatus* (F) and *Coccinella septempunctata* (L) contribute significantly in reducing this pest (Saharia, 1984; Kalra, 1988; Rana et al., 1995). Weather factors have a great impact on the incidence and peak activity of the *L. erysimi* as well as its natural enemies (Singh and Lal, 2012). This study was conducted to address the existing research gaps regarding the relationships between pest activity and various factors, including biotic and abiotic factors, at the field level.

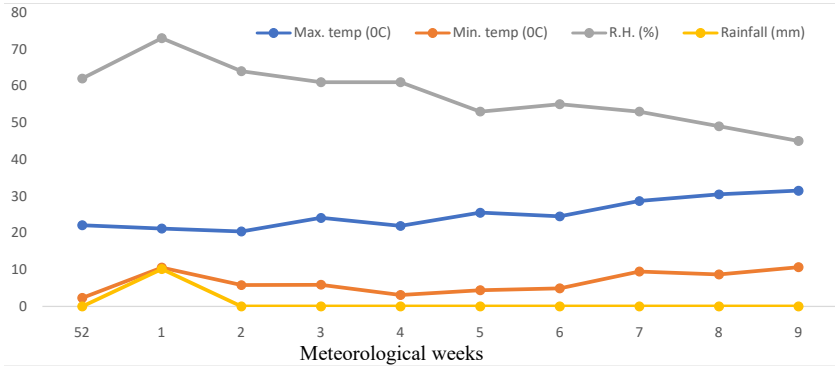
MATERIALS AND METHODS

Study was carried out on mustard during rabi 2020-2021 at the Agronomy Farm of SKN College of Agriculture, Jobner (26˚ 26' N, 78˚ 28' E, and 427 masl. Mustard variety Bio-902 was sown on 30th October, 2020 in five plots of 2× 2 m^2 size with a spacing of 30 cm (row to row) and 10 cm (plant to plant). Counts of *L. erysimi and C. septempunctata* and *Xanthograma scutellarae* (F) were recorded in each plot from five randomly selected and tagged plants at weekly intervals. Weather data was obtained from the meteorological observatory situated at the agronomy farm. Correlation of maximum and minimum temperature, relative humidity, and rainfall with incidence was done using OPSTAT.

RESULTS AND DISCUSSION

L. erysimi, natural enemies' population and weather variables, such as the temperature (maximum and minimum) and relative humidity were correlated (Fig. 1) by its two natural predators viz. *C. septempunctata* and *X. scutellarae*. The initial appearance of the *L. erysimi* (17.52/ 10 cm of terminal shoot) was recorded during the 52nd SMW, 2020 which gradually increased, and peaked in the 2nd week of February at 205.60 aphids/ 10 cm of terminal shoot (6th SMW). These observations agreed with those of earlier studies conducted by Jandial and Kumar (2007); Hugar et al., (2008); Venkateswarlu et al., (2011) and Sahoo (2013). There was an insignificant negative correlation of *L. erysimi* with temperature maximum (r= -0.303) and temperature minimum with maximum (r= -0.303) and minimum temperatures (r= -0.493) and insignificant positive correlation (r= 0.142) with average RH. The present findings were partially corroborating with Bale et al., (2002); Gour and Pareek (2003); Vekaria and Patel (2005); Jat et al., (2006) and Sahoo (2013).

The *C. septempunctata* population was first recorded in the 52nd SMW, 2020 with a density of 1.0 beetle/ five plants and it attained its highest point in 6th SMW, 2020 (9.60 beetles/ five plants) (Table 1). Subsequently, the population gradually declined (0.80 beetles/ five plants) in the first week of March. The *X. scutellarae* population (2.0 flies per five plants) also appeared during the 52nd SMW, and attained its peak (4.0 flies/ five plants) in 6th SMW. Thereafter, *X. scutellarae* population eventually declined to a very low level in the first week of March, with only 0.2 syrphid fly/ five plants. The population of natural predators viz. *C. septempunctata* and *X. scutellarae* population had significant positive correlation (r= 0.997 and r = 0.883) with the population of *L. erysimi*. The current



SMW	Date of observations	Aphid	Natural enemies	
			Xs	*Cs*
52	29.12.2020	17.52	2.0	1.0
1	05.01.2021	66.12	2.40	3.80
2	12.01.2021	122.28	2.80	6.20
3	19.01.2021	160.32	3.0	8.20
4	26.01.2021	180.64	3.20	8.80
5	02.02.2021	190.08	3.40	9.40
6	09.02.2021	205.60**	4.0**	9.60**
7	16.02.2021	102.40	1.40	4.80
8	23.02.2021	41.64	1.20	2.20
9	02.03.2021	1.44	0.20	0.80
	Maximum temperature	-0.303	-0.608	-0.319
	Minimum temperature	-0.493	-0.658*	-0.473
	Relative humidity	0.142	0.461	0.162
Correlation	*Coccinella septempunctata*	0.997*	-	-
	Xanthogramma scutellarae	0.883*	-	-

SMW-Standard Meteorological Week; *Significant at p= 0.05; **denotes peak incidence; Ap= Aphid/ 10 cm terminal shoot; Xs= Mean population of *Xanthogramma scutellarae*/ five plants; Cs= Mean population of *Coccinella septempunctata*/ five plants

Fig. 1. Seasonal incidence of *Lipaphis erysimi* on mustard (Rabi, 2020-21)

results supported by the previous findings of Kulkarni and Patel (2001); Hugar et al. (2008); Singh et al. (2011) and Dotasara et al., (2018) regarding the role of *C. septempunctata* and *X. scutellarae* as significant predators of *L. erysimi* population of *C. septempunctata* had insignificant negative correlation with maximum (r= -0.319) and minimum temperatures (r= -0.473) although, non-significant positive association (r= 0.162) with RH. The current results aligned with the findings of Gour (2001) and Tripathi et al. (2005) who testified that the maximum, minimum and mean temperatures manifested positive and highly significant relationships with *Ischiodon scutellaris* (F).

ACKNOWLEDGEMENTS

Acknowledge all the students as well as teacher at Department of Entomology, S.K.N. college of Agriculture for their assistance.

FINANCIAL SUPPORT

Financial support during M.Sc. and research, received from department itself as well as national talent scholarship (ICAR-NTS).

AUTHOR CONTRIBUTION STATEMENT

This research work was carried out in collaboration among all authors. Arvind conducted the experiment, collected and analysed data and prepared original draft of manuscript under the supervision and guidance of B L Jat, who also contributed in designing, conceptualization, reviewing, editing. Sunil, Mahender and Amarchand helped in data collection, its handling and analysing. Beside them, Mandeep Redhu helped analysis, reviewing and editing. All authors have read and approved the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

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(Manuscript Received: July, 2023; Revised: February, 2024;
Accepted: March, 2024; Online Published: April, 2024)
Online First in www.entosocindia.org and indianentomology.org Ref. No. e24478