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Research Article

Population dynamics of mustard aphid, *Lipaphis erysimi* (Kalt) in relation to biotic factors

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ABSTRACT

A field experiment was conducted during Rabi 2019-2020 at Research Farm of Agricultural Research Sub Station Nagaur (Agriculture University, Jodhpur) to know the pest incidence in mustard variety 'BIO 902'. The incidence of aphid 3.65 aphids per plant started in the first week of January (1st SMW) continued thereafter for a long period and reached to maximum 128.80 aphids per plant in the third week of February (7th SMW). The incidence of ladybird beetles appeared in the second week of January and reached its peak 9.95 coccinellids/plant in the third week of February (7th SMW). The correlation coefficient of *L. erysimi* with ladybird beetle population had a positive significant correlation (r= 0.979).

Keywords: Mustard aphid, *Lipaphis erysimi*, population dynamics, biotic factors, ladybird beetles, coccinellids

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INTRODUCTION

Mustard, *Brassica juncea* (L.) Czern and Coss is an important Crucifer oilseed crops grown in *rabi* season as oilseed, condiment and medicinal crops all over the globe. From the nutritional point of view, mustard contains edible oil (38 to 46%), erucic acid (38 to 57%), linolenic acid (4.7 to 13%) and oleic acid (27%) which are of high nutritive value required for the human body (Downey, 1983). The seeds and oil of mustard have a peculiar pungency, thus suitable for making condiments and for the preparation of pickles, curries and vegetables. It is widely used for making soap, varnishes, paints, hair oils, medicines, softening of leather and lubricants etc. (Patel, 2005). Apart from this the tender green leaves and stems are also used for making vegetables.

This crop accounts for nearly one-third of the oil produced in India, making it the country's key edible oilseed crop, mainly grown in the states of Rajasthan, Madhya Pradesh, Haryana, Uttar Pradesh, West Bengal, Gujarat, Jharkhand and Assam as a cold weather crop. The total area under the crop in India is about 6.86 million hectares with a production of 9.12 million tonnes. In Rajasthan, it occupies an area of 3.08 million hectares with an annual production of 4.20 million tonnes (Anonymous, 2021). Since it is cultivated mainly in the rain-fed and resource-scarce regions of the country, their contribution to the livelihood security of the small and marginal farmers in these regions is also very important.

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There are so many biotic and abiotic factors which are responsible for the low production of mustard in this region. Out of these, Insect-pests are one of the major limiting factors for higher production of mustard. Bakhetia & Sekhon (1989) listed 38 species of insect pests on rapeseed and mustard crops in India. Among these, the mustard aphid, *Lipaphis erysimi* (Kalt.); mustard sawfly, *Athalia lugens proxima* (Klug.); painted bug, *Bagrada hilaris* (Burm.) and the leaf miner, *Phytomyza horticola* (Goureau) are the major ones. Mustard aphid, *L. erysimi* was reported to be a regular and major insect pest in Rajasthan and other parts of the country, causing 35.4 to 73.3 per cent yield loss, 30.09 per cent seed weight loss and 2.75 per cent oil loss (Bakhetia & Sekhon, 1989; Singh & Premchand, 1995; Sharma & Kashyap, 1998). *L. erysimi* belongs to the family Aphididae of the order Hemiptera and suborder Homoptera. Both the nymph and adult stages of this pest cause quantitative and qualitative losses in the mustard crop by sucking the cell sap from leaves, petioles, tender stems, inflorescence and pods. Due to its fast multiplication within a few days, aphid covers the entire crop, particularly in cloudy weather. As a result of continuous sucking by large aphid numbers cause yellowing, curling and subsequent drying of leaves, which ultimately leads to the formation of weak siliqua (pod) and undersized seeds. The pest also secretes the honeydew, which provides a suitable medium for the development of sooty mould, which ultimately hampers the process of photosynthesis (Atwal & Dhaliwal, 2015).

It is well known that population dynamics of insect pests depend upon climatic conditions, crop growth stage and incidence of its natural enemies at a particular time. The interaction between pest activity and biotic factors helps in deriving predicative models that in turn forecast the pest incidence. Coccinellid predators, *Coccinella septempunctata* L. and *Menochilus sexmaculatus* Fab. play a significant role in the reduction of the aphid population. Therefore, present studies were undertaken to know the population dynamics of mustard aphid in relation to its biotic factors.

MATERIALS AND METHODS

A field experiment was conducted during *rabi* 2019-2020 at Research Farm of Agricultural Research Sub Station Nagaur (Agriculture University, Jodhpur) to know the pest incidence in mustard variety 'BIO 902'. The experiment was laid out in four plots, having sizes 3.0 x 3.0 metres with row-to-row and plant-to-plant distances were 30 and 10 cm, respectively. The crop was sown on October 23, 2019. Half of the recommended dose of nitrogenous fertilizer and a full dose of phosphatic and potassic fertilizer was applied at the time of the last ploughing and the rest of the nitrogenous fertilizer was applied through top dressing at the time of flowering. The experimental plots were kept free from weeds by manual weeding and hoeing. All the agronomic management practices were followed from time to time as per the package and practices booklet of the region. Observations on the aphid population were recorded soon after the appearance of the aphids. The population of aphids was recorded on five randomly selected and tagged plants per plot. Initially, the population of aphids was recorded on the whole plant as a single unit but later on, the aphids were counted per 10 cm long top portion of central twig per plant causing the least possible disturbances as per technique described by Mathur & Singh (1986) & Pradhan et al. (1960). The population of different natural enemies were recorded on the whole plant simultaneously with the population of aphids at weekly intervals. A simple correlation was worked out between the mean population of aphids and their natural enemies.

RESULTS AND DISCUSSION

During the present research, aphid was recorded as a major pest infesting mustard crop at different stages of plant growth (Plate 1). The data presented in Table 1 and Figure 1 showed that infestation of

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Plate 1: Damage of *L. erysimi* on pod and inflorescence of mustard

Table 1: Populations of mustard aphid, *L. erysimi* and ladybird beetle

Meteorological Week	Aphid population per plant*	Ladybird population per plant*
1	3.65	0.00
2	17.45	0.40
3	33.80	1.20
4	55.55	2.75
5	80.05	4.40
6	116.30	7.75
7	128.80	9.95
8	74.85	5.30
9	27.15	1.75
10	4.30	0.65
The correlation coefficient of *L. erysimi* with Ladybird population		0.979**

* Mean of five plants/plot; ** Significant at 1% level

L. erysimi during *rabi*, 2019-20 commenced in the first week of January (1st SMW) continued thereafter for a long period and disappeared in the second week of March (10th SMW) before the crop matured. Initially, the population was recorded to be 3.65 aphids per plant (1st SMW) which increased gradually and reached to maximum 128.80 aphids per plant in the third week of February (7th SMW). A gradual decline in the population of aphids was recorded thereafter. The present investigation gets support from the findings of Pradhan et al. (2020) who observed that *L. erysimi* remain active from the last week of December to 9th SMW. The results of Dotasara et al. (2022) also confirm the present findings who reported that aphid *L. erysimi* incidence began in the 1st standard meteorological week of January during 2017 and 2018, reaching a peak in the 5th SMW in 2017 and in the 4th SMW in 2018. These results were also at par with the results of Singh & Lal (2012) who reported that the appearance of the

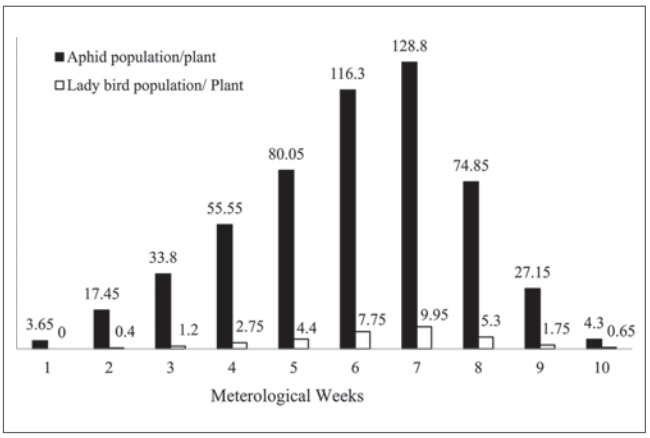


Figure 1: Populations of *L. erysimi* and lady bird beetles



Plate 2: Lady bird beetle (Grub, pupa and adult)

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mustard aphid population started in the 2nd week of January and reached its peak in the 8th standard week.

The predatory species of ladybird beetles, *viz*., *Coccinella septem punctata* Linn. and *Menochilus sexmaculatus* (Fabr.) have been found preying aphid, *L. erysimi* on the mustard crop. Out of these, *C. septempunctata* was reported to be the dominant one (Plate 2). The incidence of ladybird beetles (both beetles and grubs) appeared in the second week of January (0.40 coccinellids/plants) i.e. 2nd SMW and reached its peak 9.95 coccinellids/plant in the third week of February (7th SMW). Thereafter, the population started declining and disappeared in third week of March. The correlation coefficient of *L. erysimi* with ladybird beetle population had a positive significant correlation (r= 0.979). The results showed that ladybird beetle population had significantly controlled the population of aphids in natural conditions in crop ecosystems. The present findings corroborate with the earlier findings of Dotasara et al. (2022); Lal et al. (2018); Singh et al. (2017); Varshney et al. (2017) and Singh & Lokeshwari (2010) who reported that coccinellid predator revealed a significant positive correlation with aphid.

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