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Varietal Differences in the Population Trend of *Lipaphis Erysimi* Kalt in Canola

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Abstract

The present study was conducted to investigate the varietal differences in the population trend of *Lipaphis erysimi* kalt. in canola field at the Agriculture Research Institute Tarnab, Peshawar, during 2022. Five canola varieties, namely Raya, NARC, Champion, Zahoor, and Rokhana, were evaluated to determine their susceptibility to aphid infestation. Data on aphid population were recorded weekly from January to April 2023. Significant differences were observed among the tested varieties regarding aphid infestation levels. The lowest mean aphid population per leaf (5.23) was recorded on the NARC variety, indicating comparatively higher resistance, whereas the highest mean population (7.53 aphids leaf^{-1}) was observed on the Raya variety, suggesting greater susceptibility to aphid attack. Aphid populations remained low during the early growth stages of the crop and increased progressively with time, reaching a peak during the first week of March. The maximum aphid population (31.62 aphids leaf^{-1}) was recorded on the Raya variety, while the overall highest weekly mean population across all varieties was observed during the first week of March (26.36 aphids leaf^{-1}). Thereafter, the aphid population declined gradually toward crop maturity. The results indicate that canola varieties differ significantly in their response to *L. erysimi* infestation, with NARC showing the greatest tolerance and Raya the highest susceptibility. These findings provide valuable information for selecting suitable canola varieties and developing integrated pest management strategies for sustainable canola production.

Keywords: *Lipaphis Erysimi*, Canola, Population Dynamics, Varietal Resistance, Aphid Infestation, Integrated Pest Management.

Introduction

Canola (*Brassica napus L*) is most important oilseed crop after soybean and belongs to the family Brassicaceae (Miri et al., 2017). Canola oil is widely utilized throughout the world, particularly in Canada, Europe, and Japan (Knodel et al., 2008). In Pakistan, edible oil production remains insufficient to meet national requirements, making the country one of the major importers of edible oils. During 2017–18, canola was cultivated on approximately 241,792 hectares, producing 219,458 tons with an average yield of 898 kg ha^{-1}. During this period, the cultivated area increased by 108%, while production increased by 13% (G.O.P., 2018). Canola production in Pakistan is affected by various biotic and abiotic factors, among which insect pests and diseases are major constraints to crop productivity. The most important insect pests associated with canola include the canola aphid, *Lipaphis erysimi* (Kalt.), cabbage caterpillar, *Pieris brassicae* (Linn.), and leaf miner, *Phytomyza horticola* (Saljoqi et al., 2006). Among these, *L. erysimi* is recognized as one of the important insect pests of *B. napus* (Aslam and Razaq, 2007). Both nymphs and adults feed by sucking plant sap from various plant parts, including leaves, inflorescences, tender stems, and pods, thereby causing considerable economic damage. Heavy aphid infestation results in yellowing and curling of leaves and adversely affects plant development, leading to poorly developed pods and smaller seeds. Furthermore, aphids excrete honeydew, which promotes the development of sooty mold on plant surfaces (Bakhetia et al., 1989). Under severe infestation, effective pest management becomes essential to prevent substantial yield losses. Various management approaches, including biological, chemical, physical, and cultural control, have been employed for the management of canola aphids. Among these approaches, biological control is particularly important because several natural enemies, including lacewings, hoverflies, *Diaeretiella*, and ladybird beetles, contribute to the suppression of aphid populations (Saljoqi et al., 2011). Previous studies have reported variable responses of different canola varieties to aphid infestation, indicating differences in resistance and susceptibility among host plants. Several morphological and biochemical characteristics of canola plants have been associated with resistance to aphids (Afzal et al., 2009). These characteristics include smaller and hardier inflorescences, darker leaves, non-waxy plant surfaces, and higher concentrations of flavonoids, total and reducing sugars, nitrogen, and phosphorus, which may influence host plant resistance to aphid infestation (Bhowmik, 2003). When other management approaches fail to suppress aphid populations, chemical control may be used as a final measure to reduce pest populations below the economic threshold level while minimizing adverse effects on beneficial organisms. Insecticides are widely used because of their relatively low cost, effectiveness, and stability, particularly when aphid populations reach economically damaging levels. The economic threshold level for canola aphid has been reported as 10–15 aphids per leaf and 26–30 aphids per plant (Aslam et al., 2007). However, insecticide applications should be carefully managed to avoid unnecessary applications and minimize impacts on natural enemies. Based on the above-mentioned facts, the present study was conducted to investigate the population dynamics of *Lipaphis erysimi* (Kalt.) and its associated

natural enemies on selected canola varieties. The study further aimed to determine the anti-xenosis response of different canola varieties against *L. erysimi* and to evaluate the effectiveness of selected insecticides and biopesticides for the management of canola aphid.

Material and Methods

The research was conducted at the Agriculture Research Institute, Tarnab, Peshawar, during 2022 to investigate the population dynamics of *Lipaphis erysimi* on different canola varieties. The experimental field was prepared using a cultivator and rotavator. During field preparation, a row-to-row spacing of 60 cm and a plant-to-plant spacing of 20 cm were maintained. Each experimental row was 10 m in length. Canola was sown using the hand-drill method at a standard seed rate of 10 kg ha^{-1}. Standard agronomic practices were followed throughout the crop-growing period to ensure uniform crop establishment and development. Five canola varieties, namely Raya, NARC, Champion, Zahoor, and Rokhana, were evaluated in a randomized complete block design (RCBD).

Assessment of Aphid Population

The population of *L. erysimi* was monitored weekly throughout the crop-growing period. Three randomly selected plants were inspected, and aphid populations were recorded from the upper, middle, and lower leaves of each selected plant using a magnifying glass, following the method described by Nazeer et al. (2013). Aphid populations were counted weekly from the first appearance of aphid colonization until crop maturity.

For additional assessment of aphid abundance, a 15-cm-long, pencil-thick stick was used to gently shake the upper 10 cm of the inflorescence of each selected plant six times. The dislodged aphids were collected on a white sheet placed beneath the inflorescence and subsequently counted following the method of Razaq et al. (2012).

Statistical Analysis

The collected data were subjected to analysis of variance (ANOVA), and treatment means were compared using the least significant difference (LSD) test at the appropriate level of significance. Statistical analyses were performed using Statistix 8.1 software.

Results and Discussion

Population Trend of *Lipaphis erysimi* on Different Canola Varieties

Table 1 presents the population trend of the canola aphid, *Lipaphis erysimi* (Kalt.), on different canola varieties. Significant differences were observed among the tested varieties. The highest mean aphid population was recorded on Raya (7.53 aphids $leaf^{-1}$), followed by Zahoor and Champion, with mean populations of 6.54 and 6.07 aphids $leaf^{-1}$, respectively. In contrast, the lowest mean aphid population was recorded on the NARC variety (5.23 aphids $leaf^{-1}$), indicating comparatively lower susceptibility to aphid infestation. A significant effect of time interval on aphid population was also observed. The lowest mean population (1.00 aphid $leaf^{-1}$) was recorded at the end of January. Thereafter, the aphid population increased progressively and reached its

highest mean population (26.36 aphids leaf^{-1}) during the first week of March. Following this peak, the population gradually declined and became very low by mid-April. The interaction between canola varieties and time intervals also showed significant differences. The highest aphid population (31.62 aphids leaf^{-1}) was recorded during the seventh week on the Raya variety, followed by the seventh-week populations on Zahoor and Rokhana, with 27.44 and 25.66 aphids leaf^{-1}, respectively. The lowest populations were recorded during the twelfth week on Zahoor and NARC, with 0.20 and 0.27 aphids leaf^{-1}, respectively. The present findings demonstrate that Raya was the most susceptible variety to *L. erysimi* infestation among the tested varieties, whereas NARC showed comparatively greater resistance. Weibull and Melin (2003) reported that aphid infestation can cause substantial yield losses in Brassica crops. The higher aphid population recorded on Raya in the present study is consistent with the findings of Ahmad et al. (2013), who reported significantly higher aphid infestation on Raya compared with other Brassica varieties.

The observed seasonal population pattern is also in agreement with previous studies. Saljoqi et al. (2011) reported that aphid populations reached their peak during the first week of March and subsequently declined. Similarly, Sarwar (2013) observed the highest infestation from the second week of February to the second week of March, followed by a decline in population during April. Rana (2006) also reported that aphid populations increased progressively and reached a peak during the third week of March, after which a decline was observed. Akhtar et al. (2010) further noted that aphid populations remained relatively low at the beginning and end of the cropping season. Temperature may also influence the seasonal development and multiplication of aphids. Adult aphids were initially observed at approximately 20°C during the early infestation period. Prasad and Phadke (1984) reported that temperatures ranging from 20–30°C are favorable for aphid multiplication. Similarly, Singh and Sharma (2002) observed an increase in aphid infestation with increasing temperature, which supports the population trend observed in the present study. Overall, the results indicate that aphid infestation was strongly influenced by both canola variety and time of crop development, with the highest population occurring during the first week of March.

Table 1: Population trend of Aphid *L. erysimi* Kalt. leaf $^{-1}$ on different varieties of canola during 2023

Varieties	Time Interval (Weeks- Year 2023)												
	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12	Total
	23-Jan	30-Jan	06-Feb	13-Feb	20-Feb	27-Feb	06-Mar	13-Mar	20-Mar	27-Mar	03-Apr	10-Apr	Mean
Rokhana	0.66 ^{R}	1.56 ^{Q}	2.46^{OP}	2.26^{P}	2.97 ^{O}	10.98 ^{I}	25.66 ^{C}	14.38 ^{G}	4.16 ^{M}	3.12 ^{O}	1.96 ^{PQ}	0.55 ^{RS}	5.88 c
NARC	1.58 ^{Q}	1.60 ^{Q}	2.32^{P}	2.13^{P}	3.17 ^{NO}	8.77 ^{J}	21.44 ^{D}	13.78^{GH}	3.22 ^{NO}	3.38 ^{NO}	1.20 ^{Q}	0.27 ^{RS}	5.23 d
Champion	1.10 ^{QR}	1.16 ^{QR}	2.44^{OP}	3.02 ^{O}	3.50 ^{NO}	10.71 ^{I}	25.64 ^{C}	14.34 ^{G}	5.08 ^{L}	3.46 ^{NO}	1.97^{PQ}	0.50 ^{RS}	6.07 c
Zahoor	0.73 ^{R}	2.22^{P}	2.90 ^{O}	2.47 ^{OP}	3.63 ^{N}	12.10 ^{H}	27.44 ^{B}	15.62 ^{F}	5.30 ^{L}	3.48 ^{NO}	2.39^{P}	0.20 ^{S}	6.54 b
Raya	0.92 ^{R}	1.38 ^{Q}	2.07^{PQ}	3.59 ^{N}	6.17 ^{K}	13.90 ^{G}	31.62^{A}	17.42 ^{E}	5.41^{L}	4.49 ^{M}	3.03 ^{O}	0.43 ^{RS}	7.53 a
Mean	1.00 k	1.58 j	2.44 h	2.69 g	3.89 e	11.29 c	26.36 a	15.10 b	4.63 d	3.58 f	2.11 i	0.39 l	

LSD Value for the time intervals (Weeks)= 0.0667

LSD value for Varieties= 0.0430

LSD Value for Interaction of time intervals (Weeks) x Varieties= 0.5191

Conclusion and Recommendations

NARC showed the lowest aphid population, while Raya was the most susceptible variety. Aphid populations peaked during the first week of March and declined thereafter. These findings indicate that varietal selection and timely monitoring can help reduce *L. erysimi* infestation. Integrated pest management (IPM) practices should be encouraged, combining resistant or tolerant varieties with biological, cultural, and chemical control methods where necessary. Conservation of natural enemies such as ladybird beetles, lacewings, hoverflies, and parasitoids should be encouraged because they can contribute to the natural suppression of aphid populations.

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