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Management of Brassica Aphid Brevicoryne Brassicae Linnaeus in Canola Crop in Peshawar

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Abstract
This study aimed to assess the effectiveness of chemical insecticides against canola aphids during the winter of 2019 at The University of Agriculture Peshawar. Treatments including Cypermethrin @ 3ml/lit, Indoxacarb @ 0.5 ml/lit, Bifenthrin @ 2.5 ml/lit, lambda-cyhalothrin @ 1.5-2 ml/lit and a control (tap water) were applied four times monthly at 7-day intervals. Aphid population data were recorded, with the highest infestation (3.1 Aphids leaf^{-1}) observed during the 2nd week of November. Results indicated that lambda-cyhalothrin resulted in the lowest mean infestation (3.74±0.36), followed by bifenthrin (3.95±0.32), indoxacarb (4.35±0.28) and cypermethrin (4.55±0.28). Furthermore, the maximum yield (16.00±0.49 ha^{-1}) was obtained from lambda- cyhalothrin-treated plots, while the minimum yield (7.17±0.43 ha^{-1}) was recorded in the control group. The highest mortality rate of 100% was achieved by lambda-cyhalothrin and cypermethrin after 72 hours of testing. Based on these findings, further investigations into the potential side effects of synthetic insecticides are recommended to better understand their impact on the ecosystem.

INTRODUCTION

Canola is a winter oilseed crop which is scientifically known as Brassica napus and belongs to family Brassicaceae. (Kandil and Gad, 2012., USDA, 2016). Canola is used in Pakistan as a minor oil crop. For the preparation of medicines and traditional remedies canola can be grown on barren and marginal land as well as in those areas having low soil fertility and rainfall. Canola has the ability to tolerate salt and that's why it is also known to be drought resistance (Flanders and Abdu, 1985., Shannon and Grieve 1999). Family Brassicaceae have 3000 species including 333 genera. (Warwick and Shahbazs, 2006). In Pakistan rapeseed and mustard are the important oil producing crops. (Khan *et al* 2004). Canola can be grown in different agroclimatic condition also tolerate both drought and stress condition. In Europe both Brassica napus and Brassica campestris are cultivated but in Canada mostly spring season cultivation occurs. Brassica napus mostly grown in China in spring season while in India and sub content Brassica junica is dominate and Brassica carinata is mostly grown in Ethiopia. (Prakash and, Hinata 1980). High amount of protein and free amino acid has been responsible for susceptibility to canola aphid while the ascorbic acids and glucosinolates. are have negative impact on pest population. (Malik, 1981, labana *et al,* 1983). Insect pest infestation in Pakistan almost up to 80 percent and sever infestation can lead to total destruction of the crop and due to their high attacked the crop become no viable for further germination. (Rustamani *et al.,* 1988). In Pakistan the total area under Canola cultivation was 243.000 hector with a total production 231,000 tons while in Khaybar Pakhtunkhwa the total area under canola cultivation was 17000 hectares with production of 8000 tons and the average yield was 493kg/h (Anon 2013-2014). Brassicaceae classified into i.e., B. napus B. carinata B. junicea and B. compestris. The annual production of canola 24.61 million metric tons has been recorded from 14 million hectares growing areas. Which fulfill 12% of the world-wide edible consumption. (Colton and Sykes 1992). Canola is the main component of our regular food, consumed as edible oil. Pakistan has become the third leading importer of cooking oil throughout the world. Due to the high number of requirements the current production of oil seed does not fulfill the world requirement. Aslam *et al.* 2002-2005. Canola attack and effected by majors and minor's insect pests i.e., Flea beetles, head caterpillar, butterflies and diamond back moth and as also effected by sucking insects like thrips, jassid, whitefly and aphids. By the infestation of the above insect pests the yield of the crop highly effected and can lead to yield losses. For the control and bitter market values, formers used different high toxicant pesticides against insect pests which are harmful to man animal and environment. (AVRCD, 2011). Different types of management practices i.e., cultural, physical, biological and chemical are mainly used for insect pests. Among this control measure the most efficient way is the use of synthetic insecticides. The use of chemical or synthetic insecticides is most common for the management of the insect pests but it has some limitations which include pest resistance and negative effect of the chemicals on the environment[1]. Aphids' population has been increasing for last few years and become a regular pest in Pakistan (Aheer *et al.,* 2008). The aphid population attained peak level in the mid-March, varied on test cultivars of wheat during the month of February-April and peak level of aphids was noted during third week of March, also observed peak aphid's population at milk stage i.e., during third week of March and began to decline at dough stage i.e. At the end of March. Aphid population increased exponentially from end of February to end of March and declined from end of March to beginning of April in case of crop planted at various dates (Aslam *et al.*, 2005). Aphid Caused 100 percent losses in grain production in Pakistan during 1987 where attack was very severe (Anon., 1987). It is found that five aphid's species damaging crop viz. Sitobionavenae (Fab), Schizaphis graminus (Roudoni), Rhopalos iphumrufiab dominalis (Sasaki), Rhopalo siphumpadi (L.) and Rhopalosi phummaidis (Fitch). Aphids caused direct damage by feeding deeply within the leaf whorl and inject a toxin in the plant which appears to destroy the chloroplast membrane and indirect damage by transmission of several plant viruses (Aheer *et al.,* 2006). aphids may become a problem in the future. Their numbers are presently kept low by using insecticides[2-6]. Integrated pest management (IPM) can play an important role in the control of wheat aphids in the future (Tradan and Mileboj, 1999). Biological control of pests by natural enemies is, therefore, an important eco-system service (Naylor and Erlich, 1997).

MATERIALS AND METHODS

Research Area: Research study was conducted for determining the efficacy of chemical for the management of canola aphid at NDF (new developmental farm) at The University of Agriculture Peshawar during year, 2019.

Field Layout: (RCBD) Randomized Complete Block Design was consisted of five treatments including control. Each treatment was replicated three times. Treatment size was kept 3m×10m. Total Plot size of the experiment was kept 18m ×30m. R-R and P-P distances were kept 30cm and 15cm, respectively. Synthetic chemical along with their recommended doses are the followings.

Table 1: Treatments Active-Ingredient

Treatments	Active-ingredient	Recommended Dose
T1	Lamda-cyhalothrin	3 ml/lit
T2	Cypermethrin	0.5ml/lit
T3	Control	2.5ml/lit

Canola Aphid (Lipaphis Erysimi Kalt.) (Aphididae., Homoptera): When aphid attacked the leaves and the shoot of canola the population densities of canola aphid were counted on the leaves and the shoots as well. And data was recorded from under side of the leaves. 50 randomly leaves were selected from 10 plants then 10 were also selected randomly from 3 different location within the plot and sub plots. Nymph and adult of aphids also be counted from the selected plants, the population on the shoots was counted by putting a white shed on the shoot[7-10]. The numbers of aphids present within the sheet were counted.

Collection of Aphids: Aphids were collected from the plants in a petri dish with the help of fine camel hair brush and transfer them into a bottle having alcohol were collected with the help of insect hand net and were placed in killing jar having ethyl acetate as killing agent. The collected specimens were then brought into the entomological research laboratory for further research.

Identification: The Collected samples were brought into the Department of Entomology, The University of Agriculture and Peshawar for proper identification. The collected specimens were identified with the help of existing laboratory collection and entomological keys.

Synthetic Insecticides: The chemical insecticides were kept from local market and spray solutions were prepared for foliar application according to their recommended doses with the help of electric balance and graduated cylinder.

Data Collection: Data will be recorded on day time at two-time intervals., i.e 10-12am and 3-5pm from the start of flowers up to the maturity of the crop. Five minutes will be the time for usual[11-15].

% Mortality: In order to study the population density of Aphid of canola crop will be recorded on weekly base four times in a month.

$$\textbf{\% Mortality} = \frac{\textbf{Pest population after treatment}}{\textbf{Pest population before treatment}} \times 100$$

Yield: Yield of the harvested crop will be recorded for each of the treatment separately and then the yield will be compared with the untreated control plot. Yield will be converted into kg/hac Kumar, 2014). By using the formula:

$$\textbf{Yield (kg ha-1)} = \frac{\textbf{Yield plot}^{-1}}{\textbf{Plot size}} \times 10000$$

Analysis: The recorded data since Sowing till harvesting of the crop will be analyzed by Statistics-8.1. mean will be separated at alpha 5% after the application of LSD[2].

RESULTS AND DISCUSSIONS

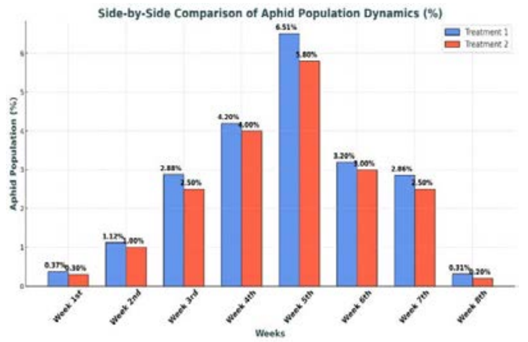

Fig. 1: Time Intervals (Weeks) and their Interaction on the Average Number of Aphid, Leaf^{-1} on Canola Crop

(Fig. 1) showed the effectiveness of interaction of the time interval×canola crop on average number of Aphids, Here the weather is too hot that is why the numbers are low[16-22]. The data regarding the overall mean number of Aphids, leaf^{-1} recorded on weekly intervals revealed that highest aphids' infestation leaf^{-1} were observed on 2nd week of November.

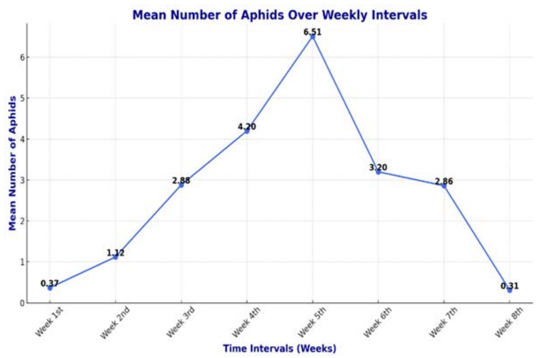

Fig. 2: Time Intervals (Weeks) and their Interaction on the Average Number of Aphids leaf^{-1} on Canola

The bar graph illustrates the mean number of aphids observed over eight weeks. Initially, the aphid population is extremely low, with only 0.03 aphids in the first week. There is a gradual increase over the next two weeks, reaching 0.45 by the third week. This trend continues, peaking significantly in the fifth week at 1.2 aphids. After this peak, the aphid population begins to decline, decreasing to 0.75 in the sixth week and further to 0.62 in the seventh week. By the eighth week, the aphid count drops sharply to 0.02, suggesting a substantial reduction or effective control measure taken[23,24]. This pattern indicates a cyclical growth and decline, which could be influenced by environmental factors or implemented pest control strategies.

Influence of Different Chemicals on Canola Yield (Kg ha^{-1}): Yield data recorded in kg ha-1 from different chemicals treated plots of canola aphid (Table 2) showed significant difference at P<0.05. The maximum yield (6.000.49 kg ha^{-1}) was recorded from plots treated with lambda-cyhalothrin followed by bifenthrin (5.330.29), cypermethrin (5.10.58), indoxacarb (4.860.58),). While the minimum (0.7.170.43 kg ha^{-1}) yield was recorded from control plots. Plots treated with synthetic pesticides did not differ significantly from each other., however, these were significantly better as compared to control plots.

Table 2: Influence of Different Chemicals on Canola Aphid Yield (kg ha ^{1})

S.No	Treatments	Yield (kg ha ^{1})
1	Lamda-cyhalothrin	5.16±0.58 a
2	Cypermethrin	4.86±0.58 a
3	Control	5.33±0.29 a

Means followed by different letter(s) are significantly different from one another at (P≤0.05), using LSD test. using LSD test.

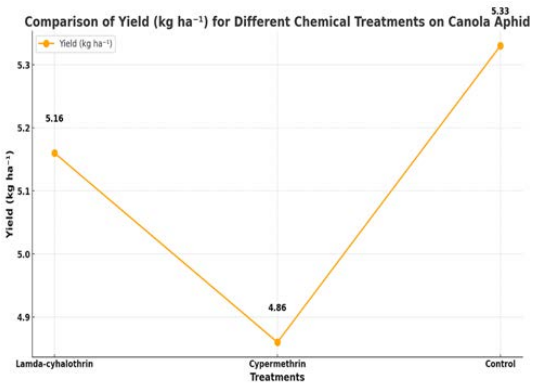

Fig. 3: Comparison of Yield Kg ha^{-1} for Different Chemical Treatment on Canola Aphid

Influence of Different Synthetic Insecticides on Mortality (%) of Canola Aphid: The results presented in (Table 2) demonstrate the influence of different chemical treatments on the yield of canola crops under aphid infestation[25,26]. Three treatments were compared: Lamda-cyhalothrin, Cypermethrin and an untreated control. The yield for Lamda-cyhalothrin was 5.16±0.58 kg ha^{-1}, while Cypermethrin yielded 4.86±0.58 kg ha^{-1}. Both chemical treatments received the same letter ('a'), indicating that there was no statistically significant difference in yield between these two treatments at P≤0.05. Interestingly, the untreated control recorded a yield of 5.33±0.29 kg ha^{-1}, which was also not significantly different from the chemical treatments, as shown by the same 'a' letter designation. This suggests that under the experimental conditions, the natural aphid pressure was either low or naturally controlled, resulting in minimal yield loss even without chemical intervention. Consequently, the data imply that the use of Lamda-cyhalothrin or Cypermethrin may not have provided a distinct advantage in this trial, highlighting the potential for integrated pest management approaches when aphid infestations are below economic thresholds.

Table 3: Influence of Different Synthetic Insecticides on Mortality (%) of Canola Aphid

Treatments	Doses	Mean % Mortality After 24 Hrs	Mean % Mortality After 48 Hrs	Mean % Mortality After 72 Hrs
Lamda-cyhalothrin	1.5-2 ml/liter	34.50 a	63.78 a	80.00 a
Cypermethrin	3 ml/liter	32.52 a	62.12 a	80.00 a
Control	Water	0.00 c	0.00 c	0.00 c
LSD		3.9075	4.4884	3.1566

Means followed by different letter(s) are significantly different from one another at (P≤0.05), using LSD test. The results in (Table 3) illustrate the effectiveness of two synthetic insecticides, Lamda-cyhalothrin and Cypermethrin, in controlling canola aphids, as measured by percentage mortality after 24, 48 and 72 hours. Both Lamda-cyhalothrin (1.5-2 ml/liter) and Cypermethrin (3 ml/liter) showed a similar trend in aphid mortality, starting with moderate efficacy after 24 hours (34.50% and 32.52% respectively) and significantly increasing after 48 hours (63.78% and 62.12% respectively)[27,28]. By 72 hours, both insecticides achieved a mortality rate of 80%, indicating their strong performance over time. The control treatment, which consisted of water, exhibited no aphid mortality across all observation periods (0.00%). The LSD (Least Significant Difference) values for 24, 48 and 72 hours were 3.9075, 4.4884 and 3.1566 respectively, confirming that the mortality rates for the insecticide treatments were statistically significantly different from the control group at P≤0.05. This indicates that both Lamda-cyhalothrin and Cypermethrin are highly effective against canola aphids when compared to untreated conditions, with no significant difference in performance between the two insecticides throughout the trial period. In the present study, various synthetic insecticides were evaluated for their effectiveness against the canola aphid (Brassica napus), a significant pest impacting canola crops globally. Canola aphid infestations contribute to substantial yield losses, with estimates suggesting over 50% loss attributed to insect pests. Previous research, such as that by Kumar (2010) in Himachal Pradesh, India, has highlighted the efficacy of synthetic insecticides like Deltamethrin, Quinalphos and Cypermethrin in managing canola aphid populations. Cypermethrin, a synthetic pyrethroid, is particularly noted for its stomach and contact mode of entry. It acts swiftly and is highly effective against sucking and chewing insects. Additionally, it can be absorbed by insect pests when they come into contact with dry residues, enhancing its efficiency in pest control (Kahramanoglu and Usanmaz, 2013). In the present study, the synthetic insecticides tested included lamda-cyhalothrin, bifenthrin, indoxacarb and cypermethrin. These insecticides were assessed for their ability to mitigate canola aphid infestations, aiming to provide insights into effective pest management strategies for canola crops. Detailed examination of their efficacy and mode of action against canola aphid populations would be outlined in the study's methodology and results sections.

Recommendation: In the present study, various synthetic insecticides were evaluated for their effectiveness against the canola aphid (Brassica napus), a significant pest impacting canola crops globally. Canola aphid infestations contribute to substantial yield losses, with estimates suggesting over 50% loss attributed to insect pests. Previous research, such as that by Kumar (2010) in Himachal Pradesh, India, has highlighted the efficacy of synthetic insecticides like Deltamethrin, Quinalphos and Cypermethrin in managing canola aphid populations. Cypermethrin, a synthetic pyrethroid, is particularly noted for its stomach and contact mode of entry. It acts swiftly and is highly effective against sucking and chewing insects. Additionally, it can be absorbed by insect pests when they come into contact with dry residues, enhancing its efficiency in pest control (Kahramanoglu and Usanmaz, 2013). In the present study, the synthetic insecticides tested included lambda-cyhalothrin, bifenthrin, indoxacarb and cypermethrin. These insecticides were assessed for their ability to mitigate canola aphid infestations, aiming to provide insights into effective pest management strategies for canola crops. The field study showed a significant difference in percent infestation of canola aphid across all treatments compared to the control. Lambda-cyhalothrin exhibited the lowest infestation (3.74±0.36), followed by bifenthrin, indoxacarb and cypermethrin. Control plots had the highest infestation (15.57±1.24). While synthetic chemicals didn't significantly differ, lambda-cyhalothrin was notably the most effective. This aligns with Khan *et al.* (2017) and Obeidat and Mazen (2002), who also found lambda-cyhalothrin to be highly effective against canola aphid. The study observed significant differences in yield (kg ha^{-1}) among treated plots. Lambda-cyhalothrin produced the highest yield (6.00±0.49 kg ha^{-1}), followed by bifenthrin, cypermethrin, and indoxacarb. Control plots had the lowest yield (0.7.17±0.43 kg ha^{-1}). These results are consistent with Ramachandra's (2007) findings, which also reported higher canola yield from insecticide-treated plots. After 24 hours, lambda-cyhalothrin and cypermethrin showed similar mortality rates. By 72 hours, both insecticides achieved the highest mortality (80%), while the control had 0% mortality. Synthetic insecticides significantly reduced infestation and increased yields compared to untreated plots, aligning with previous findings on their efficacy against similar pests.

CONCLUSION

synthetic insecticides significantly reduced canola aphid infestation and increased mortality rates, resulting in higher yields in treated plots compared to untreated controls. The study suggests exploring botanical insecticides due to their minimal environmental impact. Additionally, there is a need for further research into the side effects of synthetic insecticides. Educating farmers on Integrated Pest Management (IPM) practices is crucial for sustainable pest control. Close attention is recommended during the 2nd and 3rd week of October to manage sucking insect pests on canola crops, potentially reducing the need for insecticides and enhancing IPM practices.

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