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EVALUATING THE TOXICOLOGICAL IMPACT OF CYPERMETHRIN, INDOXACARB, BIFENTHRIN, AND LAMBDA-CYHALOTHRIN ON *BREVICORYNE BRASSICAE* (L.)

***[1]Fawad Khan, [2]Prof. Mahnoor Pervez, [3]Prof. Dr. Imtiaz Ali Khan, [4]Samina Yasmin, [5]Prof. Dr. Farhanda Manzoor, [6]Inam Ullah and [7]Sana Shahid**

[1]Medical Entomologist, Department of Health, Khyber Pakhtunkhwa Department of Entomology, Abdul Wali Khan University, Mardan.
[2]Lahore College for Women University, Lahore.
[3]The University of Agriculture, Peshawar.
[4]Hazara University, Mansehra, KPK.
[5]Minhaj University Lahore.
[6]Abdul Wali Khan University, Mardan.
[7]Quaid E Azam University Islamabad Pakistan.

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***Corresponding author:**
***Fawad Khan**
Medical Entomologist, Department of Health, Khyber Pakhtunkhwa Department of Entomology, Abdul Wali Khan University, Mardan.
medicalentomologist94@gmail.com

ABSTRACT
The purpose of this study was to evaluate how well chemical pesticides work against canola aphids during the winter of 2019 at The University of Agriculture Peshawar. The treatments that were included are Indoxacarb @ 0.5 ml/lit, Cypermethrin @ 3ml/lit, lambda-cyhalothrin @ 1.5-2 ml/lit, Bifenthrin @ 2.5 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 the lowest mean infestation was caused by lambda- cyhalothrin (3.74±0.36), which was followed by bifenthrin (3.95±0.32), then indoxacarb (4.35±0.28), and then the cypermethrin (4.55±0.28). Additionally, lambda-cyhalothrin-treated plots had the highest yield of (16.00±0.49 ha^{-1}), whereas the control group produced the lowest yield of (7.17±0.43 ha^{-1}). Hundred percent was the highest mortality rate attained by lambda-cyhalothrin and cypermethrin after 72 hours of testing. These results suggest that further research be done on the possible adverse effects of synthetic pesticides in order to have a better understanding of how they affect the environment.

KEYWORDS: The purpose of this study was to evaluate how well chemical pesticides work against canola aphids during the winter of 2019 at The University of Agriculture Peshawar.

INTRODUCTION

Canola is a winter oilseed crop which is scientifically known as *Brassica napus* and belongs to the 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 can 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 conditions and tolerate both drought and stressful conditions. 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. 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 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, canola was grown on 17,000 hectares, yielding an average of 493 kg/h and 8000 tons of output (Anon 2013-2014). Brassicaceae classified into i.e., *B. napus B. carinata B. junicea* and *B. compestris.* The annual production of canola 24.61million metric tons has been recorded from 14 million hectares growing areas. Which fulfills 12% of the world-wide edible consumption. (Colton and Sykes 1992 2). 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 attacks 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. Invasion of these pests effects the yield of the crop adversely 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).

Insect pests are primarily managed using a variety of techniques, including biological, physical, cultural, and chemical methods. The most effective of these control methods is the use of synthetic pesticides. The most popular method of controlling insect pests is the use of chemical or synthetic pesticides; nevertheless, this approach has many drawbacks, such as pest resistance and the adverse environmental effects of the chemicals (Durmusoglu *et al.,* 2015).

In Pakistan, the number of aphids has been rising over the past few years, making them a common annoyance (Aheer *et al.,* 2008). The aphid population peaked in the middle of March and varied depending on the test cultivars of wheat from February to April. The third week of March was associated with the highest aphid population, which was also seen during the milk stage, or the third week of March and started to fall toward the end of March, or the dough stage. When crops were planted at different times, the aphid population grew exponentially from the end of February to the end of March and decreased from the end of March to the beginning of April (Aslam *et al.,* 2005).

Aphid. caused a 100% loss in Pakistan's grain production in 1987, when the attack was particularly harsh (Anon., 1987). Rhopalos iphumrufiab dominalis (Sasaki), Rhopalo siphumpadi (L.), Schizaphis graminus (Roudoni), Sitobionavenae (Fab), and Rhopalosi phummaidis (Fitch) are the five aphid species that have been reported to cause crop damage. Indirect damage was induced by a number of plant viruses, whereas direct damage was caused by aphids feeding deep within the leaf whorl and injecting a toxin into the plant that seems to disrupt the chloroplast membrane (Aheer *et al.,* 2006). Aphids can eventually become an issue in the future. Insecticides are currently used to keep their populations down. Future wheat aphid control can be done greatly from Integrated pest management (IPM) (Tradan and Mileboj, 1999Therefore, one of the key eco-system services is the biological control of pests by natural enemies (Naylor and Erlich, 1997).

MATERIALS AND METHODS

Research Area

In 2019, research studies were carried out at The University of Agriculture Peshawar's NDF (new developmental farm) to ascertain the effectiveness of chemicals for managing canola aphids.

Field layout

Five treatments, including control, were included in the Randomized Complete Block Design (RCBD). Three duplicates of each treatment were made. 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. The following are synthetic chemicals and the suggested dosages for each.

Treatments

Actions	Active component	Recommended Dosage
T 1	Cypermethrin	3 ml / lit
T 2	Indoxacarb	0.5 ml / lit
T 3	Bifenthrin	2.5 ml / lit
T 4	Lambda-cyhalothrin	1.5-2 ml / lit
T 5	---------	---------

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 aphids also be counted from the selected plants, the population on the shoots was counted by putting a white shed on the shoot. The numbers of aphids present within the sheet were counted.

Collection of Aphids

Using a fine camel toothbrush, aphids were collected from the plants in a petri dish. They were gathered using an insect net and put in a killing jar with ethyl acetate as the death agent before being transferred into an alcohol-filled bottle. For additional study, the gathered specimens were then taken to the entomological research lab.

Identification

For accurate identification, the collected samples were taken to the University of Agriculture, Peshawar in The Department of Entomology. With the aid of entomological keys and the current laboratory collection, the obtained specimens were identified.

Synthetic Insecticides

Using an electric balance and graduated cylinder, the chemical pesticides were stored from the local market and spray solutions were made for foliar application in accordance with the indicated dosages.

Collection of Data

On day time, data will be recorded at two-time intervals; i.e 10am to 12am and 3pm to5pm from the start of flowers up to the maturity of the crop. Five minutes will be the time for usual.

% Mortality

Four times a month, on a weekly basis, the Aphid population density of the canola crop will be monitored.

$$\% \text{ Mortalilty} = \frac{\text{Pests population after treatment}}{\text{Pest population before treatment}} \times 100$$

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). The formula used is

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

Evaluation

Following the application of LSD, the mean will be separated at alpha 5% based on the recorded data from the time of crop sowing to harvest (Gomez and Gomez, 1982).

OUTCOMES AND DISSCUSSIONS

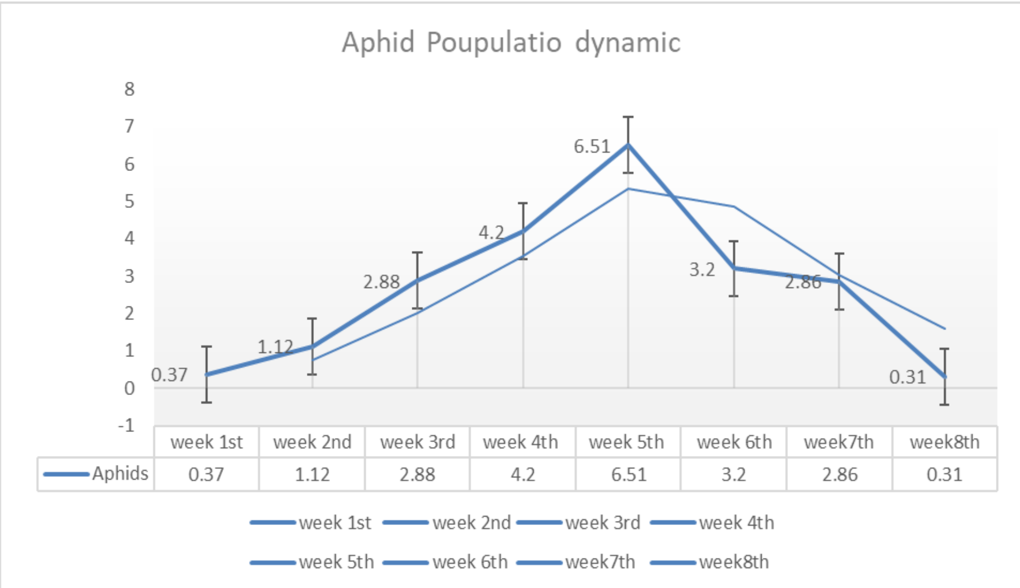

Fig-1: The average number of Aphids per leaf on canola crops as a function of time intervals (weeks).

Fig-1 demonstrated how well the time interval and canola crop interact to affect the average amount of aphids. In this case, the low numbers are caused by the very hot weather. The second week of November saw the highest aphid infestation per leaf, according to statistics on the total mean number of aphids and per leaf documented at weekly intervals.

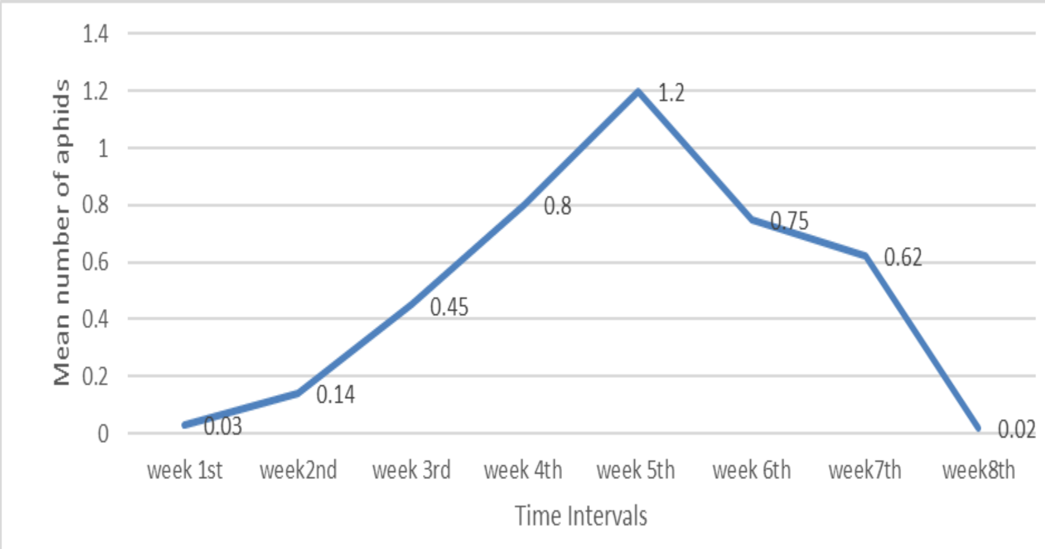

Fig-2: The impact of time intervals (weeks) on the average number of aphids per leaf on canola. The bar graph illustrates the mean number of aphids observed over eight weeks. Initially, the aphid population is extremely low, with only 0.03 aphids in the first week. There is a gradual increase over the 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. This pattern indicates a cyclical growth and decline, which could be influenced by environmental factors or implemented pest control strategies.

4.2 Various Chemicals' Effects on Canola Yield (kg per ha)

The yield data, expressed in kilograms per hectare, from canola aphid plots treated with various insecticides (Table 4.2) demonstrated a significant difference at P <0.05. Plots treated with lambda-cyhalothrin produced the highest yield (6.00±0.49 kg per ha), which was followed up by bifenthrin (5.33±0.29), then cypermethrin (5.1±0.58), and then indoxacarb (4.86±0.58). The control plots yielded the lowest yield (0.7.17±0.43 kg per ha). Synthetic pesticide-treated plots were noticeably superior to control plots, although they did not differ substantially from one another.

Table 4.2 Influence of Different Chemicals on canola aphid Yield (kg ha^{-1})

SN	Treatments	Yield kg ha^{-1}
1	Cypermethr Lambda cylothrine	5.16 ± 0.58 a
2	Indoxacarb	4.86± 0.58 a
3	Bifenthrin	5.33± 0.29 a
4	Lambda-cyhalothrin	6.00± 0.49 a
8	Control	0.7.17± 0.43 c
	LSD	1.2369

According to the LSD test, means that are separated by distinct letter (s) differ substantially from one another at (P≤0.05).

4.4 Impact of several synthetic pesticides on Canola Aphid Mortality (%)

The results indicated that the mean percent mortality of larvae after 24, 48, and 72 hours of exposure to various synthetic insecticides differed significantly at (P < 0.05).

Lambda-cyhalothrin and cypermethrin were shown to be significantly different after 24 hours, while non-significant changes were noted between them.

Larvae exposed to lambda-cyhalothrin had the highest mortality rate (34.50%), followed by cypermethrin (32.52%).

The control group had the lowest mean percent mortality rate (0.00%).

After 48 hours, the mean percent mortality rose for every therapy (control excluded). Lambda-cyhalothrin had the highest mean percent mortality, 63.78, which is statistically comparable to cypermethrin's 82.12; the control plot had the lowest mortality, 0.00. Following 72 hours, the lowest mean percent mortality was 0.00 and the greatest was not statistically different for lambda-cyhalothrin and cypermethrin (80.00).

Table No 4.4. impact of various synthetic insecticides on Mortality (%) of canola aphid.

Therapies	Dosage	The Mean Mortality % after		
		24hr	48hr	72 hr
Lamda-cyhalothrin	1.5–2milliliters per litre	34.50 a	63.78 a	80.00 a
Cypermethrin	3 milliliters per litre	32.52 a	62.12 a	80.00 a
Control	H_2O	0.00 c	0.00 c	0.00 c
Lysergic acid diethylamide		3.9075	4.4884	3.1566

Average that is followed by different letter (s) are significantly different from one another at ($P \leq 0.05$), using LSD test**.**

DISUSSION

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 meet 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.

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.

RECOMMENDATION AND CONCLUSION

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. Furthermore, insect pests can absorb it when they come into touch with dried residues, increasing its effectiveness as a pesticide (Kahramanoglu and Usanmaz, 2013). The synthetic insecticides that were evaluated in this study were cypermethrin, indoxacarb, bifenthrin, and lambda-cyhalothrin. These insecticides were assessed for their ability to mitigate canola aphid infestations, aiming to provide insights into effective pest management strategies for canola crops.

In comparison to the control, the field investigation revealed a considerable variation in the percentage of canola aphid infestation across all treatments. The lowest level of infestation was shown by lambda-cyhalothrin (3.74±0.36), which was 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 per ha) among treated plots. Lambda-cyhalothrin produced the highest yield (6.00±0.49 kg per ha), followed by bifenthrin, cypermethrin, and indoxacarb. Control plots had the lowest yield (0.7.17±0.43 kg per ha). These outcomes align with the findings of Ramachandra (2007), 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.

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