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Effect of Lambda Cyhalothrin and Imidacloprid on the population density of aphid attacking strawberry

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Abstract
The study was conducted to investigate the impact of Lambda Cyhalothrin and Imidacloprid on aphids in strawberry fields located in district Gujrat, Punjab, Pakistan. The experiment was laid down in RCBD design with three replications. The spray was carried out once and observations regarding pest infestation were recorded at an interval of seven days for four consecutive weeks. The results depicted that aphid population significantly reduced after the spray of Cyhalothrin and Imidacloprid (1ml l^{-1}). Maximum mean values of aphid population per leaf were found to be 27.9 before spraying Cyhalothrin whereas mean values of aphid population per leaf in case of Imidacloprid was 25.9. The population decreased significantly in first three weeks, however, it showed increasing trend in the fourth week. Minimum mean values of aphid population were found to be 6.6 after 14 days of spraying Cyhalothrin while minimum mean values after Imidacloprid spray was set up to be 11.4. The study demonstrated that both chemicals are effective in lowering aphid density in strawberry; however Lambda Cyhalothrin yielded better results as compared to Imidacloprid. The study emphasizes on the use of these chemicals to suppress aphid population under threshold levels and also recommends concentration and number of sprays to enhance the profitability of the crop and ensuring quality. The study asserts that pest status of aphid need to be assessed and management strategies worked out accordingly at larger scale.

Keywords: strawberry aphids, chemical control, imidacloprid and cyhalothrin.

1. Introduction
Strawberry (*Fragaria ananassa*) is a member of family Rosaceae and it belongs to genus Fragaria. Strawberry is becoming much popular worldwide due to its nutritional value and palatability. The cultivation of strawberry can be through in variety of regions and climates like from tropical to Arctic. The strawberry is cultivated worldwide with average production of about 366, 889 tons annually [1].

The climatic conditions of Pakistan are much suitable for the production of strawberry. Strawberry culture was initiated in Pakistan in 1986 in NARC, Islamabad. The estimated per acre income of this crop is about Rs.1, 00,000 per season [2]. The varieties that are being grown in Pakistan are Chandelier, Corona and Stuff. Strawberry is not cultivated as a minor or major crop in Pakistan but its demand has been increasing and more area under cultivation is being observed in various districts of Punjab province. The potential of the crop to give more earning opportunities to the farmers has led to changes in the farming preferences in wheat dominating farming systems especially in rainfed areas where farmers can utilize other irrigation sources.

The strawberry crop has shown better adaptability in the Gujranwala division with better economic returns to the farmers. There is dire need of crop assessment with respect to crop production and crop protection. Production technology of strawberry may attract insect pests and disease prevalence in these areas thus serving as potential threat to other crops grown in the area [3]. Overall yield of the crop is affected by the incidence of pest and disease attack resulting in economic loss to the farmers [4]. Major pests of strawberry are nematodes, insects, mites and mollusks. Aphids have been reported as major pests of strawberry causing significant loss in the yield [5]. Some of the aphid species that feed on strawberry include *Aphis gossypii, Aphis fabae, Myzus persicae, Macrosiphum euphorbiae* and *Chaetosiphon fragaefolii* [6]. Aphids damage the strawberry crops by direct feeding and through viral transmission [7]. In addition aphids secrete honey dew that forms a black sooty mold on the subject reducing the crop yield by lowering the photosynthetic activity [6]. The study was conducted to evaluate the imidacloprid and lambda cyhalothrin against aphids attacking strawberry. Imidacloprid is a systemic insecticide which acts on Nicotinic Acetylcholine Receptors of target pests when

enters the pest through ingestion or direct contact [8]. Lambda Cyhalothrin is a synthetic chemical correspondent of naturally occurring insecticide pyrethrin. It is used in agriculture and for domestic purposes as well [9].

The farmers growing strawberry need better yield with improved quality of strawberry to market and benefit from the popularity of strawberry. To have greater economic advantage as compared to other crops grown for profitability in the competitive environment, it is mandatory, to work out better production technology of the crop. Thus, maximization of crop yields by improving production technology and insect pest management are key features to be extensively studied to evaluate the crop in new but potential area is highly desirable. The study was undertaken to find out the effect of different concentrations of Lambda Cyhalothrin and Imidacloprid on aphid populations attacking strawberry.

2. Materials and methods

2.1. Area of study

The aphid population densities were studied in the strawberry field in village Langrial (district Gujrat, Pakistan) that is located at 32º 50' 0'' North, 74º 2' 0'' East.

2.2. Field under study

The study was carried out on a farmer's field. The Strawberry saplings were planted on 14th November, 2013. Average temperature in Gujrat during November, 2013 was 18 °C. The agronomic practices were carried out as suggested by Cedola and Greco [7].

2.3. Experimental Design

The experiment was laid down in RCBD Design with three replications. A plant-plant distance was maintained at 20 cm whereas row-row distance was 45 cm.

2.4. Application of chemicals

Imidacloprid (1ml l^{-1}) and Cyhalothrin (1ml l^{-1}) were sprayed on the crops with the help of knapsack sprayer before the onset of fruit.

2.5. Sampling

Sampling was carried out from 16th December, 2013 to 15th January, 2014. Field was divided into twelve blocks with three replications each. Sampling was conducted from five different locations within the blocks. Three plants were selected randomly from each location of subplots for sampling. Two leaves from each plant were sampled. The aphid population was counted. Sampling was carried out for the first time before spray then after 1 day, 7 days, 14 days, and 21 days.

2.6. Data Analysis

The data was subjected to statistical analysis. Means were drawn from the data. Data was analyzed in RCBD design. Data was used to analyze the effect of chemicals on the aphid population.

3. Results and discussion

3.1. Mean of aphid populations in comparison with chemicals

The mean value of aphid population for Imidacloprid was 16.3 while it was seen to be less for Cyhalothrin i.e. 14.0. The data presented in Table 01 clearly demonstrated that on comparing mean values of aphid population, Cyhalothrin provided better control as compared to Imidacloprid.

3.2. Mean of aphid population in comparison with days after chemical spray

The highest mean value of aphid number was observed in control. Greatest mean value of aphids before the spray was 26.9. The mean of aphid population after 1st, 7th and 14th day of sprays showed a declining trend (Table 1). After day 1 the aphid population was found to be 18.1 while after day 7 the number of aphids decreased to be at 12.2. After day 14 the population further reduced to 9.0. Population of aphids was increased after day 21 Mean value of aphid population after day 21 was. 9.8. Days 21 and 14 gave almost similar numbers that were not different significantly.

Table 1: Mean Aphid Population per Plant Comparison Test of Aphid for Days

Days	Number of Aphids (Mean ± S.E)
Pre spray	26.9 ± 0.6 a
1	18.1 ± 0.6 b
7	12.2 ± 0.6 c
14	9.0 ± 0.6 d
21	9.8 ± 0.6 d

Means showing same letters in a column are not significantly different, α = 0.05.

3.3. Mean of aphid population in comparison with chemicals and days

Mean values of aphids in the strawberry field treated with Imidacloprid and lambda Cyhalothrin were statistically analyzed. The data shows that maximum mean aphid number before spraying Cyhalothrin was 27.9. The minimum value after spray at day 14 was 25.9. After spraying Cyhalothrin the mean values of aphids were noticed to be 17.9, 10.9, 6.6 and 6.9 after days 1, 2, 7 and 21 respectively. A decreasing trend was seen as the spray proceeded up to day 14. The population of aphids was increased after day 21. In case of Imidacloprid, the aphid population was at greater numbers of 25.9 before spray treatment. After application of Imidacloprid, the mean values of aphids were seemed to be representing a declining pattern of 18.4, 13.4, 11.4 after days 1, 7 and 14 while at day 21 the population increased and mean of aphid population was 12.5.

Table 2: Mean number of aphids per leaf on various days after spraying Imidacloprid and Cyhalothrin in comparison with chemicals and days.

Chemicals	Mean Aphid Number (Mean ± SE) on different days after spray				
	Pre spray	1	7	14	21
Lambda Cyhalothrin	27.9 ± 0.8 a	17.9 ± 0.8 b	10.9 ± 0.8 d	6.6 ± 0.8 e	6.9 ± 0.8 e
Imidacloprid	25.9 ± 0.8 a	18.4 ± 0.8 b	13.4 ± 0.8 c	11.4 ± 0.8 cd	12.5 ± 0.8 cd

Mean showing same letters in a column / row are not significantly different α = 0.05.

The chemical control of pest populations of various aphid species have been carried out extensively throughout the world. The chemical pesticides provide quick control of pest population and keep pest populations under threshold levels

when judiciously used. The aphids attacking strawberry plantations reduce production significantly in addition to lowering of quality of fruit. Cyhalothrin and Imidacloprid were being used for the control of pests in order to keep the population of insects below economic injury level. The results obtained from these two chemicals were effective in control of number of aphids. Cyhalothrin proved to be more effective as compared to Imidacloprid as the mean of aphid population in Imidacloprid was greater than mean aphid population in Cyhalothrin. In addition the population rise in Imidacloprid was greater than Cyhalothrin after spray application. Cyhalothrin provided much efficient result in control of aphids. The results were in accordance with Fountain [10] who reported control of potato aphid on strawberry. Cyhalothrin suppressed the number of aphids in field. The results obtained from the application of Cyhalothrin were contrary to Kidd *et al*. [11] who came across a strange incidence of application of cyhalothrin on field population of cotton aphid. As the insecticide was applied, the aphid population increased in number. The reason for this reverse response was said to be unknown. Cyhalothrin was selected against aphids attacking strawberry because of its effectiveness against aphids and less hazardous action against natural enemies of aphids. It was cleared from Whalen *et al*. [12] who reported out the use of Cyhalothrin against soybean aphids. It controlled the aphid number and was ineffective for the field earthworms. Imidacloprid was also proved to be useful in the control of aphids. The results were similar to Joshi and Sharma [13], the use of Imidacloprid was evaluated as an insecticide. It was found to be much effective and gave out positive results.

Ohnesorg *et al*. [14] evaluated the effects of three insecticides on Soya-bean Aphids. Aphid number was at maximum on untreated crops while results obtained showed greater efficiency of Lambda-Cyhalothrin towards aphid treatment as compared to Imidacloprid treatment, that gave a result between cyhalothrin treated and untreated crops. Our results also showed an increased efficacy of Cyhalothrin as compared to Imidacloprid. Mandal *et al*. [15], reported their work in which the efficacy of different pesticides for the management of mustard aphid on rapeseed was assessed. Imidacloprid was found to be much effective and was efficient up to 90.46% while highest cost return ratio was obtained from Imidacloprid followed by Lambda-Cyhalothrin. Our findings clearly showed that Cyhalothrin proved as better choice in controlling aphid populations. Berry *et al*. [16] evaluated different insecticides including Lambda Cyhalothrin and Imidacloprid against potato psyllid. Lambda Cyhalothrin proved to be efficient to a greater extent as compared to Imidacloprid.

4. Conclusion

The present study demonstrates that chemical control proves to be an effective strategy against pests like aphids. Two pesticides; Cyhalothrin and Imidacloprid were studied as means to control the population of aphids on strawberry plantation. Both chemicals yielded significant results. The study suggested that, Cyhalothrin proved to be better chemical control agent for aphids than Imidacloprid when sprayed on strawberry plants prior to fruit bearing @ 1ml l-1. The spray suppressed the aphid population efficiently for three weeks. After three weeks the aphid population slightly increased. From above study, Cyhalothrin is recommended as a better and efficient pesticide for control of aphids on strawberry plantation. Furthermore, various concentrations of these chemicals may also be applied for enhanced control/management of these pests.

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