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Resistance evaluation in homopterans against synthetic pyrethroids: A case study of cypermethrin against aphids in maize

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Abstract

In this experiment, aphids fed on maize were treated with synthetic pyrethroid, cypermethrin under field conditions in Faisalabad. Data was recorded on different dates after a specific time interval. Three replications in each treatment were used for this experiment and ten plants were sampled in each replication. Three different concentrations were used at low, recommended (standard) and high and were further compared with control variety. Mortality results showed, at low concentration there was less mortality of aphids. While on standard concentration medium mortality was observed. While at higher concentration there was high mortality as compared to control. These results can be helpful in precising the sprayed pesticides in the maize fields. These results can further be helpful in spraying pesticides to control aphids under field conditions.

Keywords: maize, cypermethrin, resistance evaluation

1. Introduction

Maize is mostly commonly cultivated crop of the world. But in that case Mexico is on fifth number for the cultivation of Maize ^[1]. In Pakistan after rice and wheat, maize is ranked at third position to a great extent display in Punjab and NWFP. In Punjab crop was increased in fall and spring period ^[2]. Maize has significant role as a food crop in the agricultural economy of any country in the world. The area of 9.60 lakh hectare is covered by maize in Karnataka. The hybrid varieties of maize have resistance against various insects of maize. In Iran maize is an economical essential crop and it is established on around 300,000 hectare yearly in worldwide. Some insect pests are found in Iran that spells the maize. In marketable fields of maize aphids is most commonly present as compare to another insect pest ^[3]. There were several causes for the low production of maize in Pakistan. The eruption of insect pest was main reason for low production of maize. The crop was damaged by various insect pests in different patterns ^[4]. The aphid of hybrid maize, *Rhopalosiphum maidis* have Asiatic origin because it was frequently present in Asia but now present in tropics and temperate region. The aphid's presence mostly occurs on seedling, leaves, inside the whorl, the cover inflorescence of plants and produce plentiful honeydew ^[5, 6, 7, 8]. When late growing season starts, the tassels appeared and aphid was ruptured in maize fields. There are many pesticide applications for the control of aphids, employed in maize area. These pesticide applications have detrimental effects. For example, human health is badly affected by environmental and agro ecosystem contamination and give warning to financial issues. There are dissimilar insect species develop resistance against these hazardous chemical compound ^[9, 10, 11, 12] As a useful food crop and more than 90 insect species attack on Maize crop ^[13]. When aphid of maize shifts in summer from heater zones to cooler areas for their survival because they does not persist winters in North America and give occasional discharges of this species ^[14]. The biotic factors (e.g. Host quality, crowding, and natural enemies) as well as abiotic factors (e.g., temperature and rainfall) affects the population of corn leaf aphid ^[15]. Aphid attack can result in retarded plant growth which cannot be observed immediately with onset of aphids attack. Due to aphid sucking, chlorotic spots may appear close to the feeding regions. Toxins have systemic effects inserted by aphids and in perennials transmit to the next season ^[16]. The aphids are fall in category of sucking insect. The examination of infected maize leaves showing two separate response levels, with the most important transcriptional and metabolic variations happening in

the first few hours after the beginning of aphid attack ^[17].

In our studies we used cypermethrin against aphids and we observed the population dynamics of aphids at different concentrations of cypermethrin. The population dynamics were further compared to control maize hybrid.

2. Materials and Methods

The experiment was directed at fields of new Yongwala, at University of Agriculture, Faisalabad. The randomized complete block design (RCBD) was applied on four varieties of maize having three replications.

2.1 Maize Sowing and field preparation

The land was prepared by considering certain aspects carefully; the experimental land was ploughed up by cross-wise disc plough. The seedbed was ready by using cross-wise cultivator followed by rotavator and after soaking dose, the land came in condition. The clod crusher was used to completely crush the clods monitored by planking. Manual hand method was used for sowing of experimental crops. All the four varieties were sown in three replicates and channels and bunds was prepared to help the irrigation procedure and more monitoring of the crop against any pest issues. The Randomized Complete Block Design (RCBD) was applied with three replications. The area of plot was 1 acre and area of one replication is 40 sq feet and row to row distance 2.5 ft and plant to plant distance of 20 cm. The first two irrigations were applied frequently after 20 days of seed emergence and thinning was carried out to maintain the required plant to plant spacing. Throughout the growing period of crop the normal agronomic practices was performed around the experimental area.

2.2 Field sampling method and spray of insecticides

The aphid's population was recorded on hybrid maize varieties. Moreover, variety with higher infestation was being known to be under higher insect attack. For recording data, ten plants selected randomly, from each replication. Aphid population (both adults & nymphs) was recorded from leaves. The data was recorded after seven day interval. Manual spray method adopted. Knap sack sprayer machine was used for spray. The 10 plants was selected randomly from each replication of every variety and applied different concentration of low, medium and high. After spray the data on aphid population was collected from corn leaves. These plants were tagged to avoid repetition.

2.3 Insecticide concentration

Three concentrations of insecticides i.e. low, medium, high were used under field conditions. The insecticides were sprayed on 10 plants of each treatment. The replication of each treatment was randomly selected and tagged. We prepared three concentrations of insecticides. For high concentration, 3ml of insecticide was added in 1000 ml of water. For standard concentration of insecticide, was added 2 ml cypermethrin and 1000 ml of water. While for low concentration of insecticides was 1 ml of insecticide was added in 1000 ml water.

2.4 Data analysis

Analysis of variance of all the collected data was being computed using the appropriate statistical software. Two way Anova applied under field condition and Tuckey,s HSD test applied under laboratory condition.

3. Results

From figure 1 it was found that there was no significant difference of control from the different concentration i.e. low, standard and high. As $df=3$, $f=2.81954$, $p=0.057831$. Figure 2 showed that there was no significant difference of control from the different concentration i.e. high, standard and low. As $df=3$, $f=1.181952$, $p=0.33508$. This was shown in figure 3 it was found that there is a significant difference of control from the different concentration i.e. low, standard and high. As $df=3$, $f=1644.168$, $p=0.249803$.

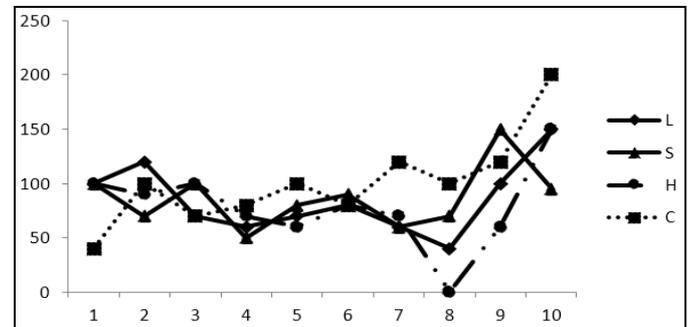


Fig 1: First time data recorded after spray of cypermethrin in three different concentrations i.e. low, standard and high, against aphids.

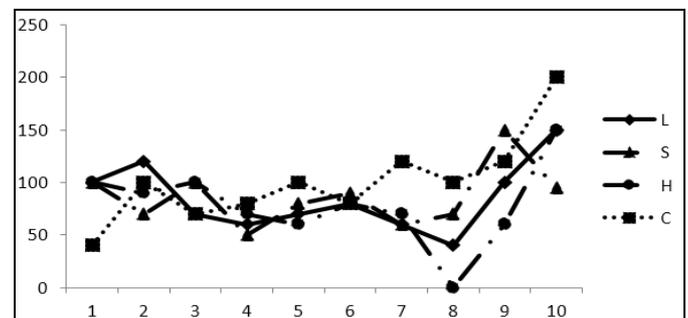


Fig 2: Second time data observed after the spray of cypermethrin in three different concentration i.e. low, high and standard.

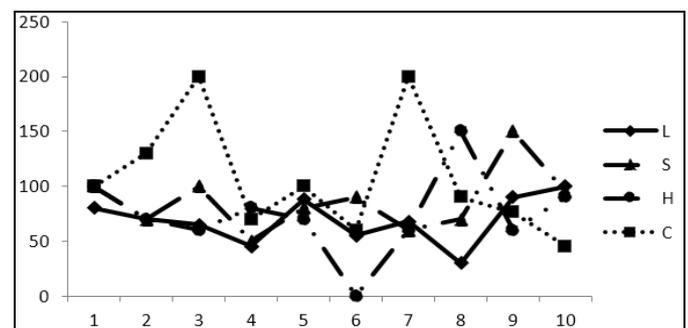


Fig 3: Third time data taken after spray of cypermethrin in three different concentrations i.e. low, standard and high.

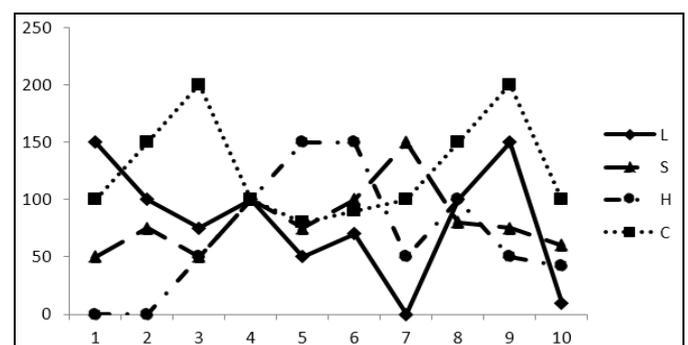


Fig 4: Forth time data observed after spray of cypermethrin in three different concentrations i.e low, standard and high.

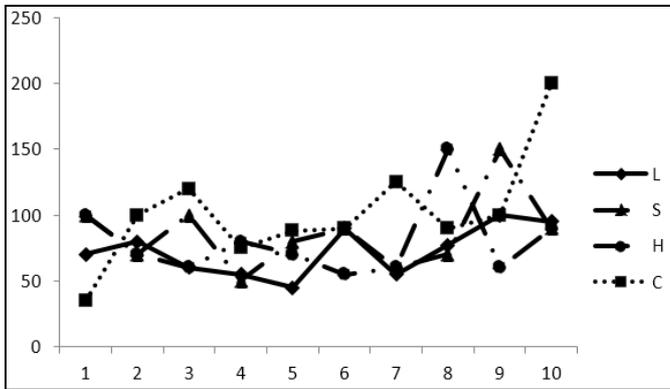


Fig 5: Fifth time data observed after spray of cypermethrin in three different concentrations i.e. low, standard and high.

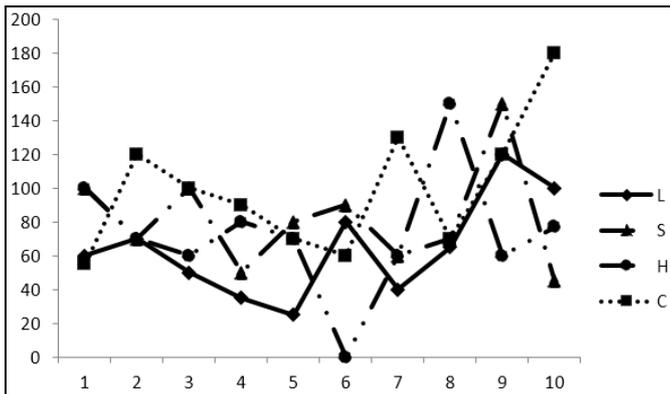


Fig 6: Sixth time data observed after spray of cypermethrin in three different concentrations i.e. low, standard and high.

It is shown in figure 4 that there was a significant difference of control from the different concentration i.e. low, standard and high. As $df = 3$, $f = 2872.492$ and $p = 0.153412$. This was indicated in figure 5 that there was a significant difference of control from the different concentration i.e. low, standard and high. As $df = 3$, $f = 79194$, $p = 0.172494$. From figure 6 it was observed that there was a significant difference of control from the different concentration i.e. low, standard and high. As $df = 3$, $f = 1.923081$, $p = 0.149653$.

4. Discussion

In this study we observed the efficacy of cypermethrin insecticides against aphids of maize. Three concentrations of cypermethrin were used i.e. standard, high and low. We found that high concentration of insecticides gave a better outcome because population dynamics of aphids was low. In case of standard concentration of cypermethrin the population dynamics of aphid was medium. When we used low concentration of cypermethrin insecticides the population dynamics of aphids was high. In case of control variety the population dynamics was high because in this case no insecticides was applied.

Khinchi and Kumawat studied the relative efficacy of 11 insecticides against the *Rhopalosiphum maidis aphid* (Fitch). The result showed that dimethoate emulsion was the most efficient which was followed by imidacloprid, thia methoxam, acephate solution. Whereas, Vertimec, spinosad and diflubenzuron had intermediate effectiveness. Our results are also in accordance with result of them. We also noted that imidacloprid is effective against control of corn leaf aphid [19]. Ali *et al.* checked the effect of some insecticides in reducing the population of *Rhopalosiphum maidison* sorghum varieties. The result showed that the most efficient compound were

spinosad and nicotinoid as compared to chlorpyrifos and cypermethrin in controlling corn leaf aphids. In our study the cypermethrin was most efficient for corn leaf aphid control [20]. Pons and Albajes worked on control of maize pest with treatment of insecticide. The result showed that density of aphid was reduced by the treatment of insecticide. In our research the effect of insecticide was also significant against pesticide control [21].

Our research was in accordance to other studies in which it was found that the performance of corn leaf aphids was affected by the use of pesticides [9, 10, 11, 12]. We also found insecticides gave effective control against aphids.

5. Conclusion

As a conclusion it can be suggested that cypermethrin at its higher concentration showed higher mortality. At standard concentration it showed moderate mortality. Which explicitly revealed that if insects pests would have been provided with high dose under field conditions will be less to develop resistance against pesticides in the future.

6. Acknowledgement

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7. References

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