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Population distribution and species richness of canola aphids and their natural enemies in different areas of Punjab, Pakistan

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Abstract

Present study was conducted to determine the population trends and species richness of aphids and natural enemies at four locations of Punjab i.e. Faisalabad, Bahawalpur, Dera Ghazi Khan and Khanpur during 2014 and 2015. Three species of aphids i.e. *Brevicoryne brassicae*, *Myzus persicae* and *Lipaphis erysimi* were reported in studied locations. *Brevicoryne brassicae* population (38-152) was higher than that of *Myzus persicae* (0-77) and *Lipaphis erysimi* (19-41). Among various locations, maximum aphids population was observed in Khanpur (150-157) followed by Bahawalpur (77-80) Faisalabad (48-56) and D.G. Khan (38-42). *Brevicoryne brassicae* and *Lipaphis erysimi* were recorded from all locations while specie *Myzus persicae* was only recorded at Faisalabad. Maximum natural enemy population recorded was of ladybird beetle (1.6-2.6), followed by Green lacewing (0.7-1.6) and Syrphid fly (0.8-1.0). Species richness showed that *Brevicoryne brassicae* and *Lipaphis erysimi* were recorded from D.G. Khan and Bahawalpur, while *Brevicoryne brassicae*, *Myzus persicae* and *Lipaphis erysimi* were recorded from Khanpur and Faisalabad localities.

Keywords: Population distribution, canola, aphids, natural enemies

1. Introduction

Canola (*Brassica napus*) is one of prominent oilseed crop sown in Pakistan. This plant has good agricultural and food nourishment properties, such as resistance to drought, cold and salinity stresses and low level of cholesterol.^[1-2] It is 2nd important source of edible oil after cotton in Pakistan.^[3] Its Seeds are rich source of oil (44 – 46%) which is low in erucic acid (<2%) and glucosinulates (<30 µmole/g of defatted meal).^[4] Canola crop is subject to attack by various insects pests. Among these insect pests, the aphids are considered as major pest which has worldwide distribution.^[5] An aphid forms large colonies on leaves, stems and inflorescence. This leads to causes severe distortion of leaves and stunted growth, this pest also serves as vector of several diseases.^[6-7] reported that aphid infested plants showed growth and development inhibition

Occurrence and severity of aphid infestation have been recorded to be inconsistent during different crop seasons.^[8] Different scientists recorded different times of initiation of aphid attack on canola. Different species of aphids have been reported in canola growing areas of Punjab Pakistan. In general it has been reported that aphids infestation begins from November and continues till March. In the beginning winged aphids appear on the crop plants which subsequently produces nymphs and apterous forms appears in the field. Aphids' density gradually increases from November to April.^[9]

Population studies of insect are one of important part of pest management strategy. A little work has been reported on aphid distribution of canola in Punjab Pakistan. Keeping in view the importance of population fluctuation aphids and their natural enemies, current studies were planned with aim to determine the population trends and species composition of canola aphids and their natural enemies in different areas of Punjab. This information may help us in developing integrated pest management strategy against aphids in canola growing regions of Pakistan.

2. Materials and Methods

A thorough survey was conducted to determine population trends and species compositions of aphids and their natural enemies on the canola crop in Punjab, Pakistan. Different canola growing areas of Punjab i.e. Faisalabad, Bahawalpur, Khanpur and D.G. Khan were selected for this study. Population data were recorded from canola fields irrespective of variety grown at two weeks intervals during 2014 and 2015. Data collection was started when aphids first appeared and continued until crop maturity. This was eight weeks in duration. To estimate population size, aphids on top 10 cm inflorescence of a canola plant were counted. Five samples were taken per plot with three replicates. Aphid species were identified in the field using a hand lens. The data was subjected to ANOVA technique to determine whether any variation in aphid populations and its associated natural enemies (green lace wing, coccinellids and syrphid fly) exists in canola growing areas and observation weeks of the months. For significant results, means of population for aphid and its associated natural enemies were compared by LSD test. Mstat-C Package was used for all these statistical analysis.

3. Results

3.1 Population distribution of *Brevicoryne brassicae* on canola crop during 2014 and 2015 in various Districts of Punjab

The population distribution of cabbage aphid (*B. brassicae*) on canola during 2014 and 2015 at various localities in Punjab is presented in Fig. 1 and 2, respectively. It was observed that the highest aphid density was recorded at Bahawalpur during 2nd fortnight of February (171 aphids per 10 cm inflorescence), followed by Khanpur during 1st fortnight of March (152 aphids per 10 cm of inflorescence) followed by D.G.Khan during 2nd fortnight of February with aphid population of 123.9 per 10 cm inflorescence. In 2nd year (2015, figure 2) of study same results were obtained, maximum aphid population appeared in Bahawalpur (86.4 per 10 cm inflorescence) followed by the Khanpur (70 per 10 cm inflorescence) followed by D.G. Khan (56.3 per 10 cm inflorescence) irrespective of dates of observations. While during the different dates of observations, the maximum aphids population was recorded at the end of February and minimum population was recorded in mid January.

3.2 Population distribution of *Myzus persicae* on canola during 2014 and 2015 in various Districts of Punjab

The data pertaining to population distribution of *M. persicae* on canola during 2014 and 2015 in Punjab is presented in Fig 3 and 4. During 2014 the highest aphid numbers (53.7 aphids per 10 cm inflorescence) were observed in Faisalabad followed by Khanpur (11.6 aphids per 10 inflorescence) during 1st fortnight of March (fig, 3). During the 2nd year of study, same trend was observed, Faisalabad showed highest density during whole period of experimentation (fig, 3). Aphid population started from 2nd week of January, increased gradually and reached maximum in 2nd week of March.

3.3 Population distribution of *Lipaphis erysimi* on canola crop during 2014 and 2015 in various Districts of Punjab

Data regarding the population of *L. erysimi* in various districts of Punjab during 2014 and 2015 is given in Fig. 5 and 6, respectively. The results revealed significance differences among the dates of observation. There was significant variation in aphid population among the various locations sampled in Punjab. It was noted that aphids population started

on January 30 and increased up to March 15. In 2015 (fig 6), aphid population started on January 15 with almost equal population of 0.5, 0.6, 0.4 and 0.7 aphids per 10 cm inflorescence in D.G. Khan, Bahawalpur, Khanpur and Faisalabad, respectively population increases gradually and reached in peak on 1st two week period of March in Bahawalpur.

3.4 Population fluctuation of Ladybird beetle during 2014 and 2015 in various Districts of Punjab

The results regarding of dates of observation and sampled localities (presented in Fig. 7, 8.) Showed that the ladybird beetle population was highest in Faisalabad on March 15 (2.06 aphids per plant followed by Bahawalpur and D.G.Khan on the same date of observation. The ladybird beetle population was lowest in Khanpur (0.333 per plant) on 1st two week period of January followed by D.G.Khan which has almost equal population.

3.5 Population fluctuation of Green lacewing during 2014 and 2015 in various Districts of Punjab

Population fluctuation of green lacewing presented in Fig. 9,10. Maximum population of green lacewing was found in Faisalabad locality (0.73) during the 15th of February. Followed by D.G.Khan (0.6), Bahawalpur (0.5) and Khanpur (0.4) Minimum population of green lacewing was recorded during 15th January it increases with passage of time and reached maximum level at 15th February then show decline in all locations studied.

3.6 Population fluctuation of syrphid flies during 2014 and 2015 in various districts of Punjab

Population fluctuation of syrphid flies presented in Fig. 11, 12. Results revealed that syrphid flies population ranges from 0.2 to 1.3, the highest population was observed in Faisalabad (1.4 flies per plant) on 2nd two week period of February followed by that was recorded in D.G.Khan locality (1.3 flies per plant). Minimum population was recorded during 15th of January it showed increase with the passage of time and reach maximum during the 15th march in all four locations.

3.7 Species richness and Population indices of aphids (*Brevicoryne brassicae*, *Myzus persicae* and *Lipaphis erysimi*) and natural enemies during 2014 and 2015 in various districts of Punjab

The results pertaining to species richness and population indices are presented in Table 1 and 2. The results indicated that there was more population of *Brevicoryne brassicae* in Bahawalpur (0.71-0.86) followed by D.G.Khan (0.77-0.79), Khanpur(0.67-0.73) and Faisalabad (0.45-.49). It was found that two species of aphids i.e. *Brevicoryne brassicae* and *Lipaphis erysimi* were recorded at D.G. Khan and Bahawalpur while three species i.e. *Brevicoryne brassicae*, *Myzus persicae* and *Lipaphis erysimi* were recorded at Khanpur and Faisalabad localities. The population of natural enemies was almost similar at all four locations. However, the species richness of natural enemies of canola aphids indicated that green lacewing, syrphid flies and ladybird beetle were found in all four locations studied.

4. Discussion

Aphids are serious pest of canola which causes severe damage to crop. [10] Its incidence and severity has been found inconsistent during the crop season. [8] The present study was conducted to determine the population trends and species

composition of aphids infesting canola in four localities of Punjab, Pakistan during 2014 and 2015. It was observed that cabbage aphids (*Brevicoryne brassicae*) and mustard aphids (*Lipaphis erysimi*) were present in all four locations selected for study, while green peach aphid (*Myzus persicae*) was observed only in two locations i.e. Faisalabad and Khanpur. Aslam (2005)^[11] reported *Brevicoryne brassicae* and *Lipaphis erysimi* as important pest of canola in southern Punjab, Province of Pakistan. It means that these two species, *Brevicoryne brassicae* and *Lipaphis erysimi* were found in locations i.e. D.G. Khan and Bahawalpur. Similar information has been reported by Marghub *et al.* (2009)^[12], who reported that two species of aphid (*Brevicoryne brassicae*, *Lipaphis erysimi*) were present in southern Punjab. The results of present studies also revealed that the population of *Brevicoryne brassicae* was higher in all four locations as compared with other two species of aphids infesting canola. However, a population of *Brevicoryne brassicae* was found highest in Bahawalpur locality on March 1st during both years of studies. These results are in confirmatory with those of^[12] who also reported the maximum population of *Brevicoryne brassicae* at Bahawalpur. *Myzus persicae* was only observed in Faisalabad and Khanpur and was not found in D.G. Khan and Bahawalpur, The aphid species *Lipaphis erysimi* was found in all four districts during both years of studies, it was highest in Bahawalpur followed by Khanpur and D.G. Khan. From the results it was noted that the highest populations appeared on last week of February and 2nd week of March in all four districts studied. Aphid's population appeared in the 2nd week of January (approximately three months after sowing) and increased gradually up to March 15 before declining. These are results in conformity with^[13, 14, 11] who reported maximum population in 1st week of March during 1995 and 3rd week of February during 1997.

A number of natural enemies principally ladybird beetles, *Coccinella septempunctata* (L.) (Coleoptera: Coccinellidae), Syrphid flies, *Episyrphus balteatus* (Diptera: Syrphidae), lacewings, *Chrysoperla carnea* (Stephens) (Neuroptera: Chrysopidae) have been found feeding on aphids.^[15] Most of them are general predators, roving freely among green peach

aphids. In some cases, the natural enemies are influenced by the host plant, crop cultural practices and environmental conditions.^[16] Our results indicate that green lacewing population appeared on 1st two week period of January, it increased gradually and reached maximum in 1st two week period of March when canola crop season was approximately going to end and crop get matured.^[17] also documented very late appearance of green lace wing abundantly in the season.^[17] The adult hover flies feed on nectar and pollens of the flowers, while the larvae on aphids in canola crop that's why its population sustains in the canola cropping system.^[17] Our results also reveal that the population of syrphid fly remained in record from February to March.^[18] reported that *C. septempunctata* is an important predator of *Myzus persicae*, with a wide distribution in Pakistan.

Among the various natural enemies, a maximum population was recorded for coccinellid followed by green lacewings and syrphid flies. These findings are similar to those of^[19], who reported *C. septempunctata* as the dominant predator species feeding on *M. persicae*. *C. septempunctata* was first recorded during 4th week of February with a mean number of 2.3 lady beetle/ plant.

5. Conclusion

This study leads to conclusion that three aphid species attacked on canola crop in Punjab followed by three natural enemies. As the population of pest increases the natural enemies population increases abruptly. So natural enemies play significant role in reducing the aphid population. This information may help us in developing the integrated pest management strategy against aphids

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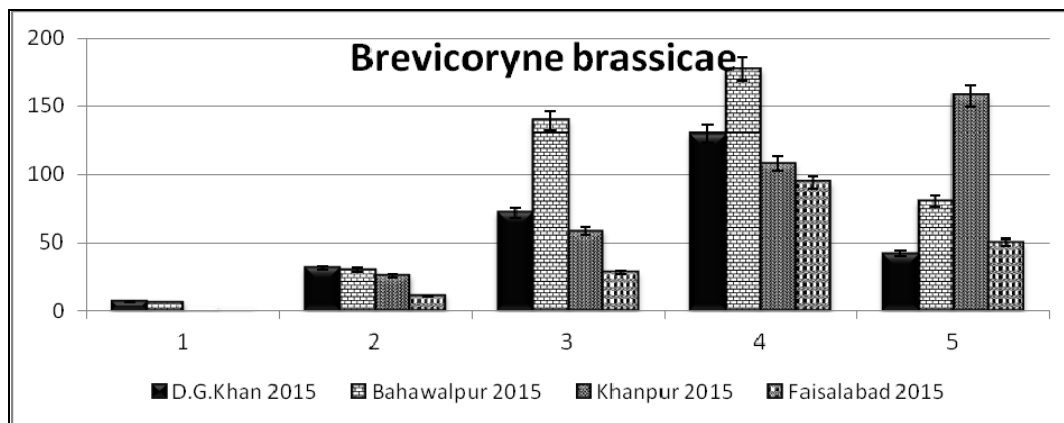


Fig 1: Population distribution of cabbage aphid on canola crop in various areas of Punjab, Pakistan during 2014.

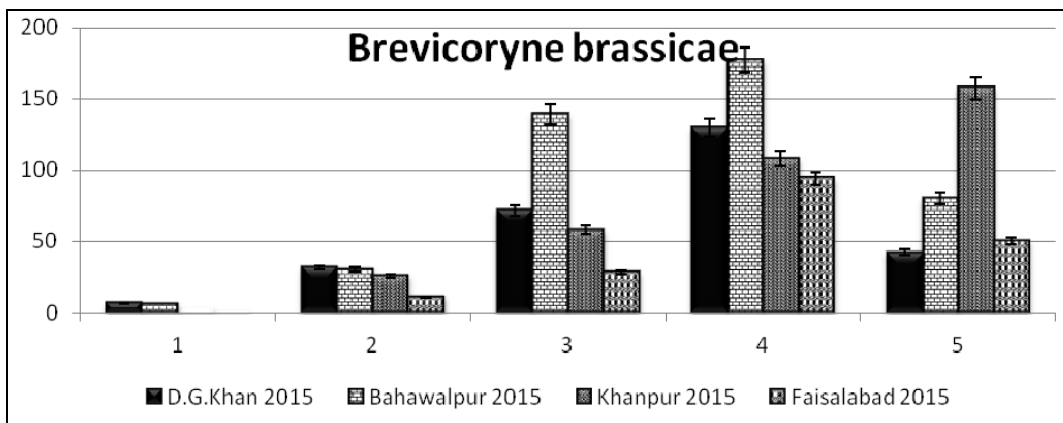


Fig 2: Population distribution of cabbage aphid on canola crop in various areas of Punjab, Pakistan during 2015.

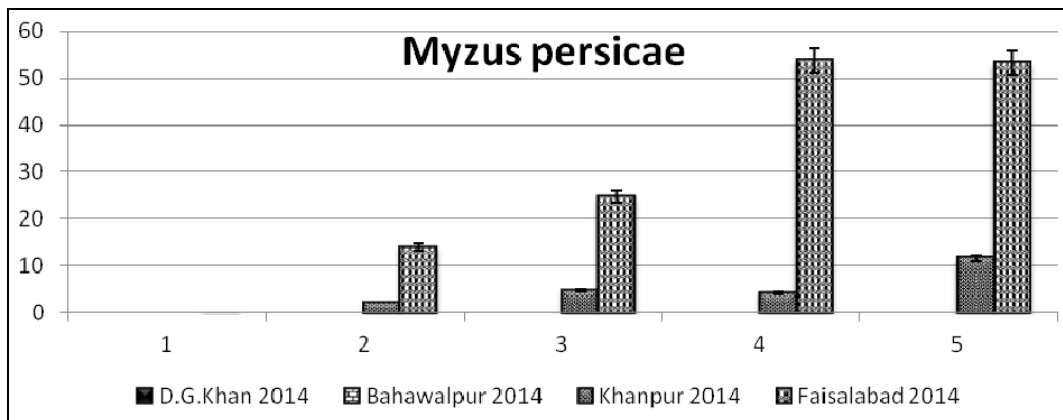


Fig 3: Population distribution of Green Peach Aphid on canola crop in various areas of Punjab, Pakistan during 2014.

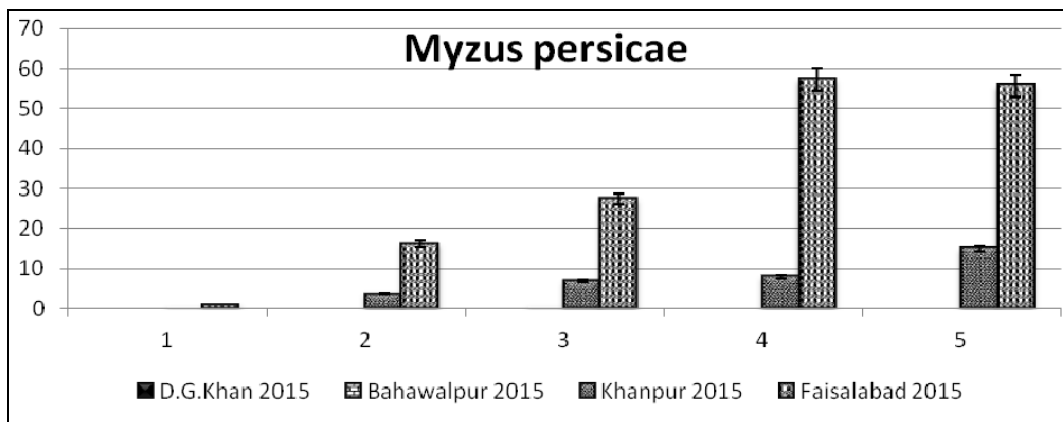


Fig 4: Population distribution of Green Peach Aphid on canola crop in various areas of Punjab, Pakistan during 2015.

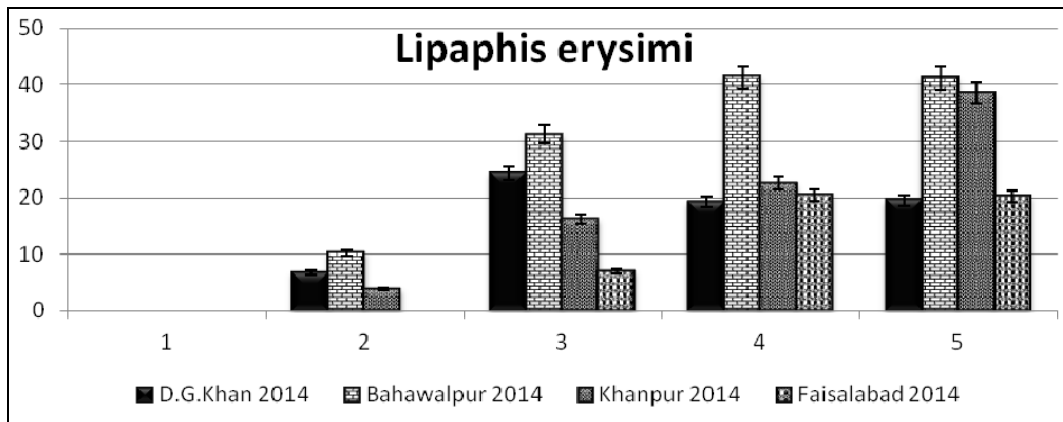


Fig 5: Population distribution of Turnip Aphid on canola crop in various areas of Punjab, Pakistan during 2014.

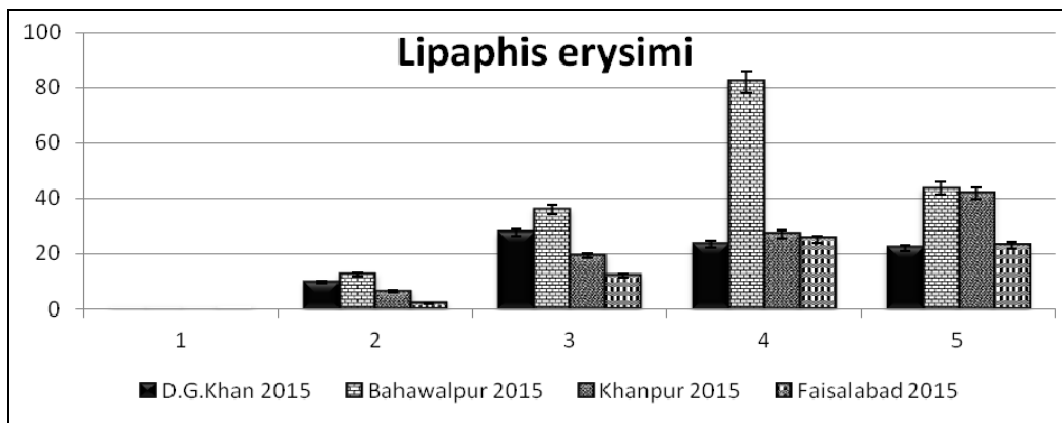


Fig 6: Population distribution of Turnip Aphid on canola crop in various areas of Punjab, Pakistan during 2015.

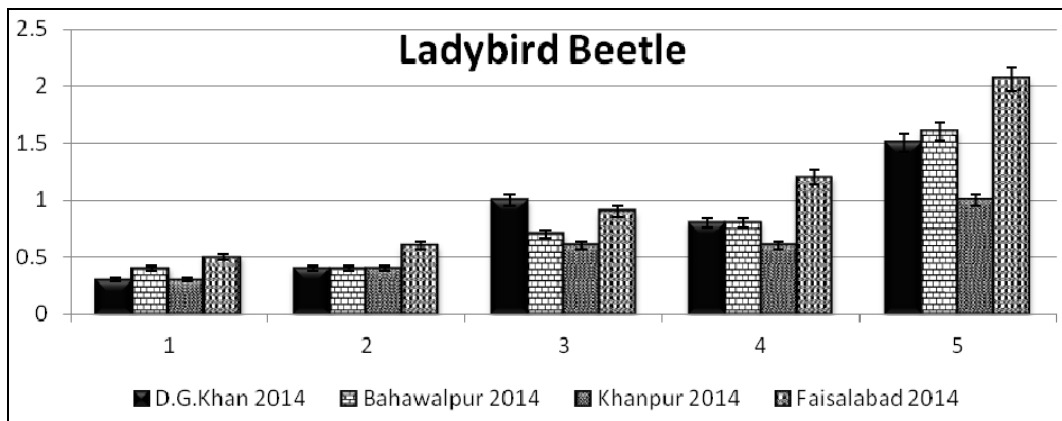


Fig 7: Population distribution of Ladybird beetle on canola crop in various areas of Punjab, Pakistan during 2014.

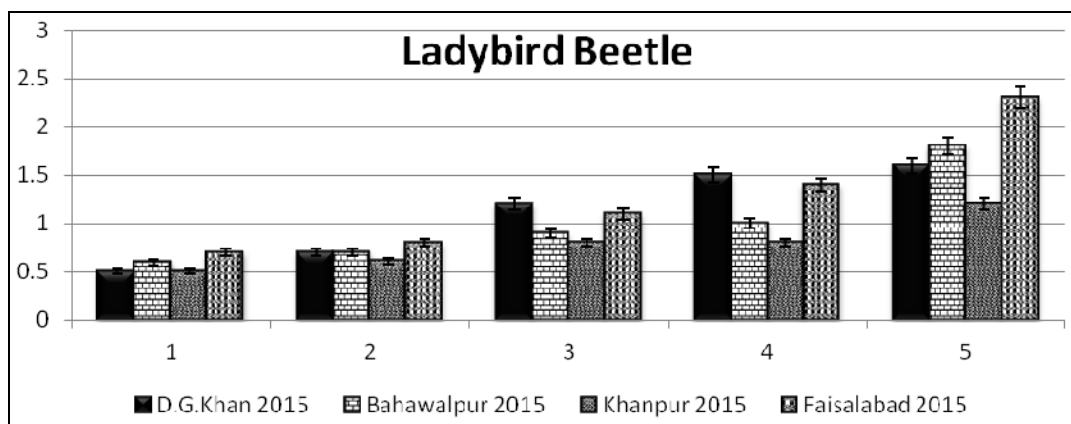


Fig 8: Population distribution of Ladybird beetle on canola crop in various areas of Punjab, Pakistan during 2015.

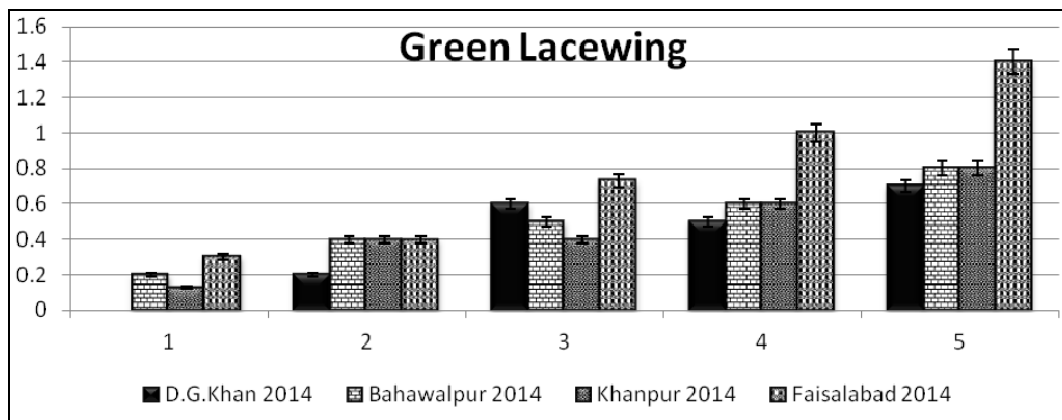


Fig 9: Population distribution of Green Lacewing on canola crop in various areas of Punjab, Pakistan during 2014.

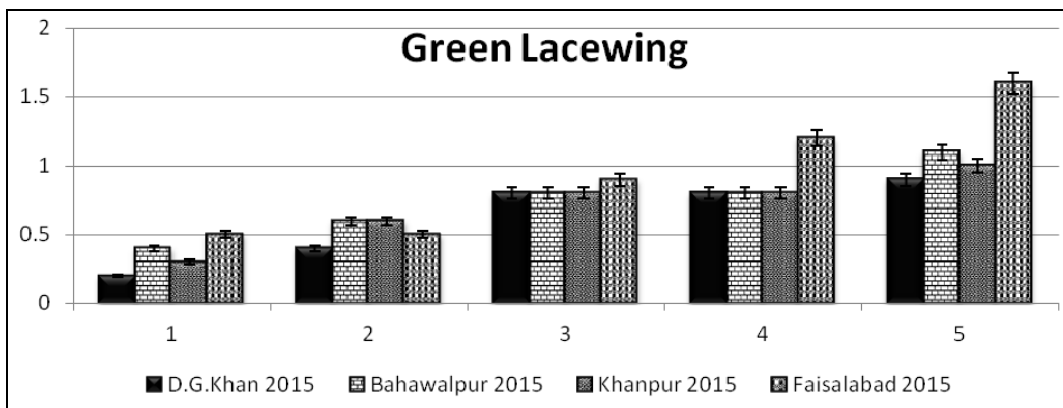


Fig 10: Population distribution of Green Lacewing on canola crop in various areas of Punjab, Pakistan during 2015.

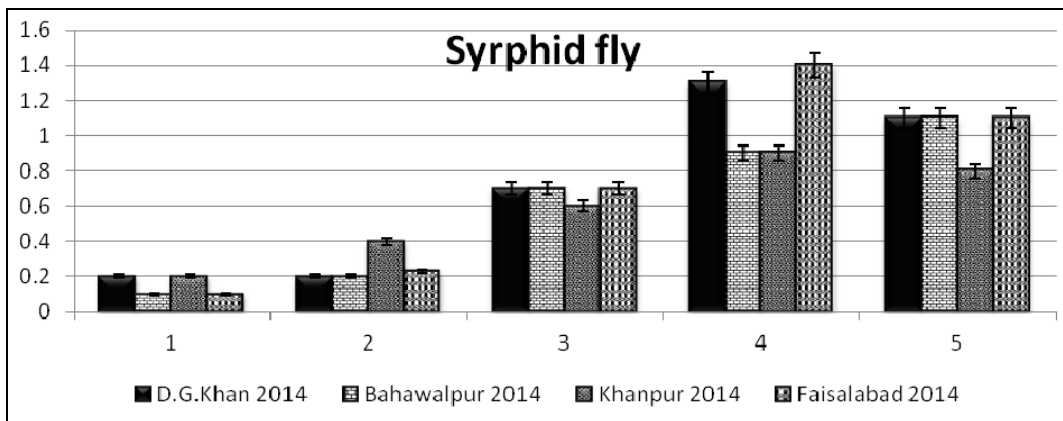


Fig 11: Population distribution of Syrphid Fly on canola crop in various areas of Punjab, Pakistan during 2014.

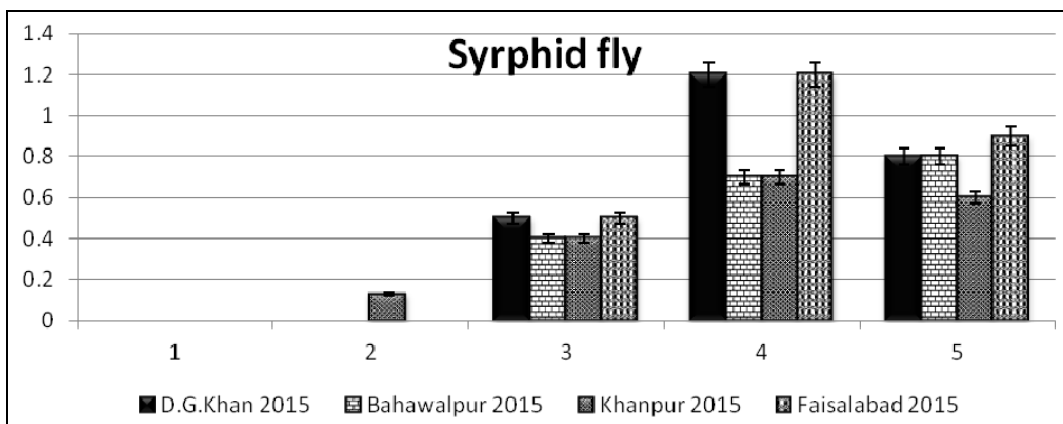


Fig 12: Population distribution of Syrphid Fly on canola crop in various areas of Punjab, Pakistan during 2015.

Table 1: species richness of aphids on canola crop in various areas of Punjab

| | cabbage aphid | | green peach aphid | | mustard aphid | | species richness | |
|------------|---------------|------|-------------------|------|---------------|------|------------------|------|
| | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 |
| DGKhan | 0.79 | 0.77 | 0 | 0 | 0.21 | 0.23 | 2 | 2 |
| Bhawalpur | 0.86 | 0.71 | 0 | 0 | 0.13 | 0.29 | 2 | 2 |
| Khan pur | 0.67 | 0.73 | 0.16 | 0.06 | 0.16 | 0.20 | 3 | 3 |
| Faisalabad | 0.49 | 0.45 | 0.42 | 0.39 | 0.08 | 0.16 | 3 | 3 |

Table 2: species richness of natural enemies on canola crop in various areas of Punjab

| | <i>Chrysoperla carnea</i> | | coccinellid | | Hoverfly | | Species richness | |
|------------|---------------------------|------|-------------|------|----------|------|------------------|------|
| | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 | 2014 | 2015 |
| DGKhan | 0.24 | 0.29 | 0.42 | 0.49 | 0.35 | 0.22 | 3 | 3 |
| Bhawalpur | 0.27 | 0.26 | 0.41 | 0.34 | 0.32 | 0.4 | 3 | 3 |
| Khan pur | 0.29 | 0.39 | 0.35 | 0.42 | 0.35 | 0.19 | 3 | 3 |
| Faisalabad | 0.31 | 0.35 | 0.41 | 0.46 | 0.28 | 0.19 | 3 | 3 |

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