Research Article

Response of Different Wheat Cultivars Towards Wheat Aphids, (*Rhopalosiphum padi* L.) and their Associated Natural Enemies

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Abstract | The current study on population trends of wheat aphid, *Rhopalosiphum padi* (L.) and its associated natural enemies on different wheat cultivars was carried out at Agriculture Research Institute (ARI) Tarnab, Peshawar Khyber Pakhtunkhwa (KP)-Pakistan during *rabi* season 2018-2019. Fourteen wheat cultivars i.e Wadaan-17,Paseene-17,Khaista-17,Ghaneemat,KT-2017,Pakhtunkhaw-15,PS-15,NIFA-Insaf-15,NIFA-Aman-15, Pakistan-13, PS-13, Shahkaar-13, PS-5, NIFA-lalma were planted in Randomized Complete Block design (RCBD) having three (3) replications. Data regarding the population trends of *R. padi* and its associated natural enemies were recorded on weekly basis. The result showed significant differences among different wheat cultivars with respect to the time interval for most of the parameters. Aphid's population was at its peak during the 3rd week of February but later on, the aphid's population decreased as the population of its natural enemies increased. Based on mean populations of aphid leaf^{-1}, cultivar Pakhtunkhwa-15 recorded the maximum mean number of aphids (5.48 leaf^{-1}), while PS-13 recorded the minimum mean number of aphids (4.09) leaf^{-1}. Data regarding the natural enemies showed that Khaista-17 had a maximum population of Ladybird beetle adults (1.00 plant^{-1}), and Paseene-17 had a maximum population of syrphid fly larvae (0.84 plant^{-1}), and Pukhtunkhwa-15 had maximum lacewings larvae (0.81 plant^{-1}). Overall results revealed that PS-13 showed relatively greater resistance to aphid population with maximum wheat yield (3412.5 kg ha^{-1}) as compared to other wheat cultivars.

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Introduction

Wheat (*Triticum aestivum* L.) is one of the most important cereal crops belonging to the family Gramineae,which contains a high amount of nutrients and dietary fibers. It provides a large number of edible items such as bread, chapatti, macaroni, pasta, and rolls (Bhanu *et al*., 2018). It is one of the significant cereal crops used by 36% population of the world (Ahmad *et al*., 2016). Globally, wheat was cultivated under area of 215.90 million hectares with average production of 3.57 tons per hectare during 2020. The

top wheat-producing countries are Ukraine, Egypt, Lebanon, China, India, Russia, USA, Canada and Pakistan with annual production of 134, 107, 85, 49, 35, 25, and 26 million metric tons, respectively (FAO, 2020). In Pakistan, wheat was grown on an area of 9.1 million hectare with the production of 2.7 tons per hectare, while in KP wheat was grown on area of 0.75 million hectare with the production of 1.9 tons per hectare (Pakistan Bureau of Statistics, 2021).

Several insect pests attack on wheat crop both in field and during storage, but aphids cause significant damages to the wheat crop in Pakistan. Aphid causes direct yield losses ranging from 30 to 40 % by sucking plant sap and indirectly acts as a vector of many fungal and viral diseases (Brault and Reinbold, 2007). Among the different wheat aphids species, the wheat aphid, *Rhopalosiphum padi* (L.) (Homoptera; Aphididae) is one of the most serious pests of wheat worldwide, causing yield losses up to 15% at blossoming stage (Khan *et al*., 2006). It not only acts as a vector of wheat yellow dwarf virus (BYDV), but also causes direct injury to the plants by injecting the chemical present in their saliva and sucking of sap and indirectly through the excess production of honeydew, damaging the whole crops (Brault and Reinbold, 2007).

Different control methods including cultural, mechanical, chemicals and biological methods have been used against aphids in wheat to reduce the yield losses. Among these, biological control is a safest, stable and more economical method than the rest (Arshad *et al*., 2016). The aphid populations can be suppressed significantly by its natural enemies below economic threshold level. Biological control agents such as coccinellid beetles, syrphid flies, spiders and lacewings are considered to be responsible for killing the wheat aphids. Among the biological control agents, parasitoids are the most important one. The aphid parasitoid larvae are internal feeders of tissues and adults are free-living (Sherin *et al*., 2017). Host plant resistance also plays an important role against insect pests. Due to the extensive losses of the wheat crop, it is always desirable to evolve resistance host against aphids infestation as different genotypes have a different level of Phyto-toxins. Thus, the current study was designed to study the population trend of aphids and their associated natural enemies in different wheat cultivars.

Materials and Methods

The present experiment was carried out at Agriculture Research Institute (ARI) Tarnab, Peshawar- Khyber Pakhtunkhwa Pakistan during the cropping season 2018-2019. All the wheat cultivars were planted in Randomized Complete Block design (RCBD) having three (3) replications. Fourteen different wheat cultivars were sown during 2nd week of November using standard agronomic practices and balanced fertilizers application approved for wheat sowing. Each cultivar was sown on a separate plot with an area of 2.4 m^2 having two rows per plot with a row-to-row distance of 30 cm and row length of two meters. Data on the population trend of aphids and their associated natural enemies were started soon after the appearance of the aphids in wheat crop and continued till the harvest of the crop. The data were recorded by counting the numbers of aphid population and its associated natural enemies on randomly selected three plants from each treatment. Three tillers were randomly selected from both rows of each treatment and the numbers of aphid leaf^{-1} of the infested tillers were counted. The data were recorded at the weekly basis from the initial stage of infestation till the harvesting of the crop.

The yield data was calculated from each cultivar with the help of electric balance. Average yield per hectare was calculated by following formula:

$$Yield\ kg\ per\ ha = \frac{Total\ yield\ (kg)}{Area\ harvested\ (m)} \times 10000$$

All the recorded data were analyzed statistically through STATISTIX (8.1) software. Then means of all cultivars were separated by using LSD test with the significance level at 5% ($P \leq 0.05$).

Results and Discussion

Number of aphids leaf^{-1}

The numbers of aphid per leaf showed highly significant difference ($P \leq 0.01$) among the tested genotypes presented in (Table 1). The results indicated that the mean values for numbers of aphids per leaf among the tested cultivars ranged from 4.09 to 5.48 respectively. In cultivar Pakhtunkhwa-15, the maximum mean number of aphids leaf^{-1} was recorded (5.48), this was followed by Pakistan-13 (5.05) and NIFA-lalma (4.98) (Table 1). While the minimum

mean number of aphids leaf^{-1} was recorded (4.09) in PS-13. Analysis of variance for numbers of aphid/leaf showed highly significant differences ($P \leq 0.01$) among the recorded weeks. The interaction between time intervals and cultivars for the aphid population showed in (Table 1). A minimum number of aphids leaf^{-1} was observed (0.01) in the 3rd week of January in PS-5, followed by Pakistan-13 with 0.17 aphids leaf^{-1} during 3rd week of February, while the maximum number of aphids leaf^{-1} was recorded (11.40) in Shahkaar-13 during 3rd week of February (Table 1). These findings are similar to Aheer *et al.* (2008), who also reported maximum aphid populations during 3rd week of February. Similarly, Aslam *et al.* (2004) reported a peak aphid's population during 1st week of February. In tested cultivars, the maximum mean number of aphid infestation was recorded on cultivar Pakhtunkhwa-15 as compared with other tested genotypes across all the weeks. These findings confirm the investigations of Zeb *et al.* (2011) who studied the aphid populations across different wheat lines.

Number of ladybird beetle plant^{-1}

Table 2 analysis of variance for a mean number of ladybird beetles (larvae and adults) plant^{-1} showed non-significant differences among the planted cultivars. A mean number of ladybird beetles ranged from 0.37 to 1.00 plant^{-1} in all the studied cultivars. The results further showed that the mean minimum number of ladybird beetles plant^{-1} was recorded (0.37) in cultivar PS-15, followed by cultivar Wadaan-17 (0.46) and cultivar PS-15 (0.59). The cultivar that showed maximum numbers of ladybird beetles plant^{-1} was (1.00) on Khaista-17. The interaction between weeks and cultivars for a mean number of ladybird beetles was found non-significant ($P \geq 0.01$). The results regarding weekly mean number of ladybird beetles showed that the minimum mean number of ladybird beetles (0.06 plant^{-1}) was recorded during the 3rd week of January followed by the 4th week of January (0.46) and 1st week of February (0.57). While maximum mean number of ladybird beetles (0.97 plant^{-1}) was observed in the 3rd week of March. Same results were also reported by Khan *et al.* (2011), who determined the influence of five wheat cultivars against aphid and their coccinellid predators. They reported maximum mean numbers of coccinellid spp plant^{-1} during the 3rd week of March compared to other recorded weeks.

Number of syrphid fly larvae plant^{-1}

Data in Table 3 indicates that the mean number of syrphid fly larvae plant^{-1} ranged from 0.25 to 0.84 among the tested cultivars against wheat aphid. In cultivar PS-13, the minimum population of syrphid fly larvae (0.25 plant^{-1}) was recorded, followed by NIFA-Insaf-15 with syrphid fly larvae (0.32 plant^{-1}) while the maximum population of syrphid

Table 1: *Mean number of Aphids leaf^{-1} recorded on different wheat cultivars during 2019.*

Cultivars	January			February			March				Means
	3rd week	4th week	1st week	2nd week	3rd week	4th week	1st week	2nd week	3rd week	4th week	
Wadaan-17	1.39f-p	2.83s-f	4.00j-u	7.00o-y	11.0a-d	9.00f-l	5.10z-k	4.00j-t	2.00x-m	1.00j-p	4.73 bcd
Paseene-17	0.93k-p	2.22w-l	4.71c-n	6.72q-y	9.78c-h	7.89k-s	7.77k-u	3.21o-b	2.06x-m	1.17i-p	4.64 be
Khaista-17	1.00j-p	3.22n-a	3.71k-w	3.28n-a	8.28i-p	7.78k-t	6.77q-y	3.77j-v	2.00x-m	1.17i-p	4.23 ef
Ghaneemat	1.54d-o	2.22w-l	4.43g-r	6.28u-b	9.56d-i	6.83p-y	5.83y-g	4.87b-l	1.83z-n	0.72m-p	4.41 c-f
KT-2017	1.25g-p	2.44v-j	2.44v-j	5.61y-i	11.2abc	9.44e-j	5.93x-f	3.10q-c	2.93s-e	1.94x-n	4.62 be
Pakhtunkhaw-15	1.67c-n	4.61d-o	6.10v-d	7.50m-w	10.4a-f	8.89g-m	7.89k-s	4.99a-k	1.87y-n	0.94k-p	5.48 a
PS-15	0.50nop	3.11p-c	4.60e-p	5.60y-i	9.89c-h	7.83k-t	6.38t-a	5.21z-j	2.89s-e	1.11i-p	4.71 bcd
NIFA-Insaf-15	0.89l-p	1.83z-n	4.32h-s	7.94k-r	8.44h-o	7.56l-v	5.93x-f	3.43k-w	1.22h-p	1.17i-p	4.27 def
NIFA-Aman-15	1.33f-p	2.50u-i	3.99j-u	6.44s-a	10.9a-e	9.11f-k	7.38n-x	2.93s-e	1.06i-p	0.61m-p	4.62 be
Pakistan-13	0.17op	3.33l-x	4.82b-m	6.78q-y	11.9a	8.72g-n	6.38ta	4.27i-s	2.31v-l	1.83z-n	5.05 ab
PS-13	1.72b-n	2.67t-h	4.16i-t	6.17v-c	8.78g-n	6.06w-e	4.27i-s	4.66d-o	2.39v-k	1.44e-p	4.09 e
Shahkaar-13	1.56d-o	3.67k-w	4.10j-t	7.83k-t	11.4ab	9.17f-k	5.88y-g	3.32n-z	1.33g-p	1.56d-o	4.98 b
PS-5	0.01p	3.28n-z	5.77y-h	6.50r-z	11.1abc	8.00j-q	9.60d-i	2.99r-d	1.00j-p	0.11o-p	4.83 bc
NIFA-Lalma	1.78a-n	2.22w-l	4.71c-n	7.39n-x	10.0b-g	9.02f-k	6.49r-z	4.49f-q	2.72t-g	1.02i-p	4.98 b
Means	1.24 h	2.86 f	4.41 d	6.50 c	10.2 a	8.23 b	6.54 c	3.94 e	1.97 g	1.28 h	

Mean followed by different letters are significantly different from each other at 5% level of significance using LSD test ($P<0.05$). $LSD_{(0.05)}$ for Cultivars = 0.47; $LSD_{(0.05)}$ for Weeks = 0.41; $LSD_{(0.05)}$ for Cultivars x Weeks = 1.50

Table 2: *Mean number of Lady bird beetle (larvae and adults) plants^{-1} recorded on different wheat cultivars during 2019.*

Cultivars	January		February				March				Means
	3rd week	4th week	1st week	2nd week	3rd week	4th week	1st week	2nd week	3rd week	4th week	
Wadaan-17	0.00	0.02	0.15	0.50	0.76	0.80	0.70	0.60	0.50	0.35	0.46 cd
Paseene-17	0.01	0.05	0.10	1.17	0.93	0.79	0.75	1.01	0.89	1.22	0.69 a-d
Khaista-17	0.00	0.00	1.26	0.71	1.17	0.64	1.20	1.35	1.41	1.26	1.00 a
Ghaneemat	0.00	0.03	0.86	0.84	0.95	0.66	1.41	1.17	0.86	0.86	0.84 abc
KT-2017	0.06	0.80	0.90	1.46	1.29	1.07	1.00	0.96	0.89	1.04	0.94 ab
Pakhtunkhaw-15	0.00	0.40	0.64	0.66	0.72	1.41	0.59	0.42	1.04	1.27	0.72 a-d
PS-15	0.05	0.00	0.70	0.80	0.49	0.50	0.60	0.70	0.84	0.72	0.59 bcd
NIFA-Insaf-15	0.00	0.87	1.00	1.32	0.79	0.95	1.23	0.90	1.34	0.72	0.92 ab
NIFA-Aman-15	0.00	0.20	0.40	0.66	0.70	0.80	0.90	1.00	0.78	0.60	0.60 a-d
Pakistan-13	0.00	0.00	0.29	1.00	1.19	0.85	0.67	1.28	0.79	1.36	0.74 a-d
PS-13	0.05	0.00	0.00	0.00	0.65	0.75	0.85	0.60	0.50	0.30	0.37 d
Shahkaar-13	0.08	0.60	0.71	0.67	0.58	0.28	0.48	0.82	1.36	0.62	0.75 a-d
PS-5	0.00	0.55	0.57	1.13	0.71	1.49	1.01	0.71	1.32	0.97	0.85 abc
NIFA-Lalma	0.17	0.10	0.30	0.70	1.05	1.00	0.76	0.86	1.00	1.07	0.68 a-d
Means	0.06 d	0.46 c	0.57 bc	0.83 ab	0.86 ab	0.93 a	0.86 ab	0.88 ab	0.97 a	0.89 ab	

Mean followed by different letters are significantly different from each other at 5% level of significance using LSD test (P<0.05). $LSD_{(0.05)}$ for cultivars = ns; $LSD_{(0.05)}$ for Weeks = 0.34; $LSD_{(0.05)}$ for cultivars x Weeks = ns

Table 3: *Mean number of Syrphid fly larvae plants^{-1} recorded on different wheat cultivars during 2019.*

Cultivars	January		February				March				Means
	3rd week	4th week	1st week	2nd week	3rd week	4th week	1st week	2nd week	3rd week	4th week	
Wadaan-17	0.00g	0.41j-f	0.15a-g	0.30p-g	0.64c-t	0.51f-b	0.56e-i	0.11d-g	0.64c-t	0.79c-k	0.41cd
Paseene-17	0.00g	0.21w-g	0.68c-p	0.75c-n	2.00a	1.50b	1.00b	0.80c-m	0.79c-i	0.69c-o	0.84a
Khaista-17	0.00g	0.26s-g	0.43i-f	0.19x-g	0.44i-f	0.88c-g	0.69c-o	0.54f-b	0.57e-i	0.68c-q	0.47c
Ghaneemat	0.40k-f	0.29p-g	0.75c-n	0.95cde	1.00c	1.50b	0.90c-f	0.80c-m	0.78c-m	0.67c-q	0.80a
KT-2017	0.00g	0.15b-g	0.48h-d	0.57e-i	0.41i-f	0.62c-v	0.47h-e	0.53f-b	0.64c-t	0.39m-g	0.43cd
Pakhtunkhaw-15	0.31p-g	0.10e-g	0.58e-w	0.78c-l	0.85c-h	1.00b	0.90c-f	0.75c-n	0.50g-c	0.27r-g	0.60c
PS-15	0.21w-g	0.00g	0.61d-v	0.44i-f	0.51f-b	0.41j-f	0.58e-w	0.44i-f	0.52f-b	0.37n-g	0.41cd
NIFA-Insaf-15	0.00g	0.00g	0.63c-u	0.39l-f	0.34o-g	0.36n-g	0.46h-e	0.36n-g	0.45i-e	0.24u-g	0.32d
NIFA-Aman-15	0.12c-g	0.00g	0.51f-b	0.26s-g	0.39m-g	0.29p-g	0.61d-v	0.20w-g	0.67c-q	0.75c-n	0.38cd
Pakistan-13	0.34o-g	0.38n-g	0.55f-z	0.60d-v	0.80c-m	0.98cd	1.00c	0.90c-f	0.85c-h	0.75c-n	0.72b
PS-13	0.00g	0.09fg	0.17z-g	0.20w-g	0.40k-f	0.50g-c	0.45i-e	0.35o-g	0.25t-g	0.10e-g	0.25f
Shahkaar-13	0.27r-g	0.24u-g	0.66c-r	0.50g-c	0.67c-q	0.58e-w	0.15a-g	0.46h-e	0.15a-g	0.33o-g	0.40de
PS-5	0.05fg	0.30p-g	0.45i-e	0.55f-z	0.65c-s	0.47h-e	0.37n-g	0.29q-g	0.19x-g	0.08fg	0.34ef
NIFA-lalma	0.12c-g	0.29p-g	0.60d-v	0.70c-o	0.75c-n	0.85c-h	0.55f-z	0.40k-f	0.50g-c	0.23v-g	0.50cd
Means	0.13d	0.19d	0.52bc	0.51c	0.70a	0.75a	0.62ab	0.50c	0.54bc	0.45c	

Mean followed by different letters are significantly different from each other at 5% level of significance using LSD test (P<0.05). $LSD_{(0.05)}$ for Cultivars = 0.13; $LSD_{(0.05)}$ for Weeks = 0.11; $LSD_{(0.05)}$ for Cultivars x Weeks = 0.40.

fly larvae plant^{-1} was recorded (0.84) in cultivar Paseene-17. Highly significant differences ($P \leq 0.01$) among weeks were observed for a mean number of syrphid fly larvae plant^{-1}. The number of syrphid fly plant^{-1} ranged from 0.13 to 0.75 among weeks. The minimum mean value (0.13) for syrphid fly plant^{-1} was recorded during 3rd week of January, followed by the 4th week of January (0.19). While maximum mean value (0.75) for syrphid fly larvae plant^{-1} was recorded during the 4th week of February, followed by 3rd week

of February (0.70 plant^{-1}). These findings were also investigated by Khan *et al.* (2011) and Ali *et al.* (2015) who reported highest syrphid population in 3rd week of February while determining the density of aphids and its natural predators under the effect of ten local wheat cultivars. Arshad *et al.* (2016) also reported a maximum population of *syrphid* spp. in the 2nd week of March while studying aphids' natural enemies in different wheat genotypes.

Number of lacewings larvae plant^{-1}

Mean number of lacewings larvae plant^{-1} ranged between 0.20 to 0.81 plant^{-1} (Table 4) In cultivar, PS-13 minimum population of lacewing larvae was observed (0.20 plant^{-1}), followed by NIFA Aman-15 (0.31 plant^{-1}) and NIFA-Insaf-15 (0.32 plant^{-1}). While maximum mean value (0.81 plant^{-1}) of lacewing larvae was shown by Pakhtunkhwa-15, followed by KT-2017 (0.68 plant^{-1}) and Khaista-17 (0.65 plant^{-1}). The lowest mean number of lacewing larvae plant^{-1} (0.08) was recorded in the 3rd week of January, followed by the 4th week of January (0.14 plant^{-1}). Similarly, the highest mean number of lacewings larvae plant^{-1} was recorded (0.78) in the 2nd week of February. The overall mean for numbers of lacewing larvae plant^{-1} ranged between 0.00 and 2.07. The results showed that during 3rd week of January, the minimum population of lacewing larvae were recorded in cultivars Wadaan-17, Paseene-17, NIFA Aman-15 and Shahkaar-13. Similarly, maximum mean number of lacewings larvae plant^{-1} (2.07) was observed for Ghaneemat during the 2nd week of February, followed by Pakhtunkwa-15 (2.00 plant^{-1}). Our results confirm the findings of Saleem *et al.* (2009) who studied population trend of aphids and its associated natural enemies on winter wheat and reported an initial population of lacewings during 1st week of march and reach to its peak during 2nd week of April.

Yield (kg ha^{-1})

Results in Table 5 shows that the yield ranged from 2844.89 to 3412.55 kg ha^{-1}. In cultivar NIFA-Insaf-15 minimum yield of 2844.89kg/ha was recorded, followed by NIFA-Aman-15 (2944.89 kg ha^{-1}) and PS-5 (2947.16 kg ha^{-1}). Similarly, maximum mean value (3412.55 kg ha^{-1}) for yield was recorded in cultivar PS-13, followed by KT-2017 with 3242.4 kg ha^{-1}and Wadaan-17 with 3322.65 kg ha^{-1}respectively. These findings are similar to those of Zeb *et al.* (2011) and Ali *et al.* (2015) work who reported an inversely relationship between wheat yield and aphids population. The results further revealed that cultivar PS-13 showed comparatively more resistance towards aphid's population with maximum wheat yield (3412.5 kg hac^{-1}) as compared to other wheat genotypes/cultivars and hence can be used in IPM of wheat aphids in wheat crop.

Table 4: *Mean number of Lacewings larvae plants^{-1} recorded on different wheat cultivars during 2019.*

Cultivars	January		February				March				Means
	3rd week	4th week	1st week	2nd week	3rd week	4th week	1st week	2nd week	3rd week	4th week	
Wadaan-17	0.00j	0.03j	0.49m-c	0.62f-u	0.41q-h	0.62f-u	0.54j-z	0.72c-q	0.65f-u	0.45o-f	0.45bc
Paseene-17	0.00j	0.02j	0.60g-w	0.70c-r	0.80c-m	0.65f-u	0.07j	0.70c-r	0.26x-j	0.52l-b	0.43c
Khaista-17	0.15f-j	0.07j	0.72c-q	0.88c-h	0.98cde	0.85c-j	0.87c-i	0.78c-n	0.67e-t	0.57h-x	0.65ab
Ghaneemat	0.03j	0.06j	0.21b-j	2.07a	0.90c-f	0.43q-f	0.44p-f	0.38s-i	0.71c-r	0.56i-i	0.58bc
KT-2017	0.04j	0.23z-j	0.93cf	0.99cd	1.00c	1.50b	0.89c-g	0.62f-u	0.42q-f	0.20c-j	0.68ab
Pakhtunkhaw-15	0.20c-j	0.45o-f	0.99cd	2.00a	0.50l-c	1.00c	0.99cd	1.00c	0.50l-c	0.48n-d	0.81a
PS-15	0.01j	0.28w-j	0.47n-d	0.64f-u	0.15f-j	0.35u-i	0.48n-d	0.55j-y	0.29w-j	0.46n-d	0.37cd
NIFA-Insaf-15	0.13hij	0.02j	0.55j-y	0.36t-i	0.35u-i	0.36t-i	0.23z-j	0.50l-c	0.17d-j	0.52l-c	0.32d
NIFA-Aman-15	0.00j	0.01j	0.30w-j	0.10hij	0.42q-f	0.76c-o	0.22a-j	0.43q-f	0.40r-h	0.50m-c	0.31d
Pakistan-13	0.45o-f	0.07j	0.63f-u	0.81c-l	0.23z-j	0.37s-i	0.23z-j	0.42q-g	0.45o-f	0.30w-j	0.40c
PS-13	0.01j	0.00j	0.29w-j	0.35u-i	0.41q-h	0.40r-h	0.22a-j	0.10h-j	0.26x-j	0.00j	0.20f
Shahkaar-13	0.00j	0.41q-g	0.11hij	0.29w-j	0.48n-d	0.64f-u	0.73c-q	0.53k-a	0.60g-w	0.78c-n	0.46bc
PS-5	0.05j	0.00j	0.21b-j	0.40r-h	0.42q-f	0.20b-j	0.71c-r	0.65f-u	0.70c-r	0.49m-c	0.38c
NIFA-Lalma	0.04j	0.25	0.45o-f	0.64f-u	0.90c-f	0.90c-f	0.62f-u	0.50l-c	0.49m-c	0.35u-i	0.51b
Means	0.08f	0.14e	0.50c	0.78a	0.57bc	0.65b	0.52c	0.56bc	0.47cd	0.44d	

Mean followed by different letters are significantly different from each other at 5% level of significance using LSD test (P<0.05). $LSD_{(0.05)}$ for Cultivars = 0.10; $LSD_{(0.05)}$ for Weeks = 0.08; $LSD_{(0.05)}$ for Cultivars x Weeks = 0.31.

Table 5: *Mean yield of different wheat cultivars during 2019 (kg ha^{-1}).*

Cultivars	Yield (kg ha^{-1})
Wadaan-17	3322.6ab
Paseene-17	3018.3cde
Khaista-17	3168.9abc
Ghaneemat	3288.2abc
KT-2017	3342.4ab
Pakhtunkhaw-15	3011.2cde
PS-15	3000.8def
NIFA-Insaf-15	2844.9f
NIFA-Aman-15	2945.0ef
Pakistan-13	3266.1abc
PS-13	3412.5a
Shahkaar-13	3145.6abc
PS-5	2947.2ef
NIFA-lalma	3099.4bcd

Mean followed by different letters are significantly different from each other at 5% level of significance using LSD test (P<0.05). LSD (0.05) for Cultivars =277.43

Novelty Statement

The study reports the population trend of aphids and their associated natural enemies in different kinds of wheat cultivars. Among the tested genotypes, PS-13 resulted in less aphid infestation and maximum wheat yield (3412.5 kg ha^{-1}). Therefore, the aphids tolerant cultivar PS-13 is recommended to be grown in order to reduce yield losses caused by aphids in the wheat crop.

Author's Contribution

Muhammad Tayyab: Conducted the research trial and compiled the data.
Muhammad Salim: Wrote the article.
Ahmad ur Rahman Saljoqi: Supervised the whole research.

Conflict of interest
The authors have declared no conflict of interest.

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