Predator Prey Interaction on some Wheat Cultivars

S. Shahzad Ali[1,*], Sakhawat Ali[1], Syed Sohail Ahmed[1], Huma Rizwana[2], Shahnaz Naz[2], Falaknaz Meano[1], Paras[1], Sumbul[1] and Sher Ahmed[1]

[1]*Department of Entomology, Faculty of Crop Protection, Pakistan*

[2]*Department of Livestock Management Sindh Agriculture University, Tandojam, Pakistan*

Abstract: The present findings was aimed to determine the predator prey interaction on some wheat cultivars was laid out at Experimental Area of Entomology Section, Agriculture Research Institute, Tandojam during rabi wheat growing season of 2014. Five wheat varieties were sown in a complete randomized block design plot. The varieties are 1. NIA-Sunhari, 2. NIA-Amber, 3. NIA-Sundar, 4.Kiran 5.Kirman.The results indicated that maximum mean population of insect pest and predators were recorded on different varieties of wheat crop. The maximum mean Black aphid population was recorded on variety of NIA-Amber (3.36/leaf) and minimum on Kiran (2.79/leaf). The maximum mean numbers of green aphids were recorded on variety Kiran (5.26/leaf) and minimum mean population on variety NIA-Amber (3.59/leaf). The maximum American bollworm was recorded on variety of NIA-Sunhari, (0.51/leaf) and minimum population was recorded on variety NIA-Sundar (0.14/leaf). Its population was increase in the mid to end of season. The maximum Thrips population appeared on variety NIA-Amber (5.61/leaf) and lowest on NIA-Sunhari (2.79/leaf). The Thrips increased slowly at the start of the season and continued at mid to end of the season. Among predators, the maximum population of Brumus was recorded on variety NIA-Sunhari (0.81/plant) and lowest population observed on variety of NIA-Sundar (0.05/ plant). Similarly the lacewing was recorded on variety of NIA-Sunhari (0.25/plant) and its lowest population was on varieties of Khirman and Kiran (0.05/plant). Maximum 7- spotted beetles population was on variety NIA-Sunhari (0.64/plant) and the lowest population on Kiran (0.15/plant). While the maximum mean population of 11- spotted beetles was recorded on variety of NIA-Sunhari (0.52/plant) and the minimum population on Kiran (0.17/plant).

Keywords: Wheat cultivars, wheat pests, predators of wheat pests.

INTRODUCTION

Among the cereals, wheat ranks first in area and production in the world. It has played a very vital role in stabilizing the food grains production over the past few years. In Pakistan the wheat crop is being grown throughout the country on an area of about 8693 thousand hectares and 24.2 million tons production was achieved in 2012-13 [1]. Wheat being the staple diet is the most important crop and cultivated on the largest acreages in almost every part of the country. Several insects are known to be the pests of wheat in Pakistan. Among those aphids, thrips, beetles and bollworms cause sporadic problems and their presence depends upon favorable physical and environmental conditions [2]. Different biotic factors such as predators, parasitoids and different pathogens affect the pests of cereals. Also affecting them are the abiotic factors temperature, rainfall, humidity, wind and sunshine [3]. Due to indiscriminate use of pesticides have created resistance in many pest species including aphids and also increased pollution in the environment. Interest in the use of biological control against harmful pests has been increased in the recent years [4]. Biological control is major component of Integrated Pest Management (IPM) strategies. The aim of biological control is to reduce pest populations through natural enemies such as predators, parasitoids and pathogens. The successful natural enemies are those which have high reproduction rate, good searching ability for its host adaptability in different environmental conditions and synchronized with its host [5].

The aphidophagous coccinellid, *Hippodamia convergens* Guèrin-Mèneville, and the generalist *Nabis* spp. were the most abundant predators during the increasing phase of Russian wheat aphid population development, and *Coccinella septempuntata* L., and *H. sinuate* Mulsant were the most abundant predators during the declining phase of Russian wheat aphid population growth [6]. Farmers in general have left the army worm attacked field abandoned. In view of shortage of irrigation water flooding of affected wheat crop field may not be possible. Since the army worm invasion area harbour advanced stage army worm larvae, as well as pupal population in abundance, it is imperative to give through ploughing of the affected wheat crop fields, as well as grasses in the vicinity to expose the larvae and pupae to birds and other predators. Since ploughing/flooding may not ensure destruction of all hibernating army worm residual population, large scale emergence of moths during the month of March is apprehended. As wheat crop is also the major host of army worm it is warranted that the standing wheat crop in the upper Sindh region may be taken under regular pest's surveillance both at the

*Address correspondence to this author at the Department of Entomology, Faculty of Crop Protection, Pakistan;
E-mail: alisyedshahzad75@gmail.com

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provincial and the federal level for timely control of this menace. It would be proper to mention here that wheat crop at milky to grain formation stage has been found very much susceptible to army worm attack particularly, Inqalab variety of wheat which holds large acreage in the upper Sindh region [7]. The present research was conducted to study the interaction of predators on insect pests of wheat crop at Tandojam.

MATERIALS AND METHODS

The present research work on "Predator prey interaction on some wheat cultivars" was conducted in the experimental area of Entomological Research Field of Agricultural Research Institute, Tandojam during the year 2012. Five wheat varieties viz NIA- Sunhari, NIA-Amber, NIA- Sunder, Kiran and Khirman were sown on 26-11-2012. The design applied was RCBD factorial followed by five repeats. Net plot size was 5 x 5 meter. Data regarding interaction among the insect and predators population were recorded from 25 randomly selected plants from each plot by counting the insects and predators. The observations were recorded at morning hours (9.00 AM) the population of insect was examined carefully. The number of thrips (*Thrips tabaci*), green aphids (*Aphis gossypii)*, black aphids (*Pentalonia nigronervosa*), American bollworms (*Hellicoverpa armigera*) and insect predators, i.e Green lace wings (*Chrysoperla carnia*), 7 - spotted beetles (*Coccinella septempunctata*), 11 - spotted beetles (*Coccinella undecempunctata*), brumers (*Brumus suturalis*) and others was counted. The predator and insect pests were carefully counted with the help of magnifying glass as well as with naked eye. No pesticide was applied in the experimental area or around the side of experimental area. Population of predator and insect pests were observed separately and mean population was calculated weekly. However, abiotic factors like temperature, humidity and rainfall also obtained from Meteorological Centre Tandojam. Data was analyzed statistically to see the significant difference among populations. Finally the data were statistically analyzed to check the significance of treatments through analysis of variance and applying least significant difference test.

RESULTS

The data regarding Black aphids, Green aphids, Thrips, American bollworms, and Predators such as Brumers, Green lace wings, 7-spotted beetles and 11-spotted beetles population on various wheat varieties are presented in Tables **1-8** and their analysis of variance as appendices I-VIII.

Insect Pests

1. Black Aphid (Pentalonia nigronervosa)

The results on the mean per leaf population of Black Aphids on different wheat varieties are given in Table **1** and the analysis of variance as given in Appendices-I depicted that difference in Black Aphid population over

Table 1: Mean Population of Black Aphid (*Pentalonia nigronervosa*) on Different Varieties of Wheat

Dates	Varieties					
	NIA- Sunhari	NIA-Amber	NIA- Sunder	Kiran	Kirman	Mean
5/1/2009	1.92	1.49	1.54	0.86	1.22	1.40
12/1/2009	1.49	1.32	1.89	1.54	2.12	1.67
19/1/2009	1.71	1.76	2.42	1.23	2.41	1.90
26/1/2009	4.89	8.36	6.00	4.11	4.44	5.5
2/2/2009	9.67	7.43	7.94	13.21	8.23	9.29
9/2/2009	4.62	5.41	4.77	5.44	6.71	5.39
16/2/2009	4.00	5.22	4.48	5.11	5.33	4.82
23/02/2009	2.74	7.16	6.36	1.16	2.51	3.98
2/3/2009	1.66	1.25	0.54	0.62	0.33	0.88
9/03/2009	1.16	0.27	0.14	0.18	0.21	0.39
16/03/2009	0.77	0.30	0.15	0.06	0.05	0.26
23/03/2009	0.08	0.42	0.22	0.06	0.05	0.16
Mean	2.89	3.36	3.03	2.79	2.80	

$P < 0.05$.

varieties tested were statistically significant. It was observed from the table that Black Aphid population was higher (3.36/leaf) on variety NIA-Amber followed by NIA- Sunder (3.03/leaf), NIA- Sunhari (2.89/leaf) and (2.80/leaf) on Kirman. While the lowest Black aphid population (2.79/leaf) was found in variety Kiran and Kiran was resistant against Black Aphids as compared to rest of verities tested.

2. Green Aphid (Aphis gossypii)

The results on the mean per leaf population of green aphid on different wheat varieties are given in Table **2** and their analysis of variance differences in green aphid's population on different varieties were significant statistically. A perusal of data revealed that green aphid population was comparatively more (5.26/leaf) on variety Kiran followed by Khirman (5.09/leaf), NIA- Sunder (4.61/leaf) and NIA- Sunhari (3.76/leaf). However, the lowest green aphid population was observed (3.59/leaf) on NIA-Amber variety. This demonstrated that variety NIA-Amber was found to be resistant against green aphid population when compared with rest of varieties evaluated.

3. Thrip (Thrips tabaci)

The results on the mean per leaf population of thrip on different wheat varieties are given in Table **3** and their analysis of variance as appendixes-(III) reveals that the different in thrips population on different varieties were significant statistically. To perusal of data revealed that thrip population was comparatively more (5.61/leaf) on variety of NIA-Amber, followed by NIA- Sunder (4.32/leaf), Kirman (3.75/leaf) and Kiran (3.72/leaf). However, lowest population of thrip was observed (2.79/leaf) on NIA-Sunhari variety. This demonstrated that variety NIA-Sunhari was found to be resistant against thrip population, when compared with rest of the varieties evaluated.

4. American Boll Worm (Hellicoverpa armigera)

The details of data are given in Table **4** and their analysis of variance Appendices-IV.

The results indicated that the mean per leaf greater population of American bollworm was observed (0.51/leaf) on NIA- Sunhari variety followed by Kiran (0.23/leaf), Kirman (0.20/leaf) and NIA-Amber (0.16/leaf). However, lowest population of American boll worm (0.14/leaf) was observed in case of variety NIA- Sunder. This trend demonstrated that variety NIA-Sunder proved to be resistant against American boll worm while, NIA-Sunhari was susceptible against American bollworm attack.

Predators

5. Brumers (Brumus suturalis)

The results on the mean per plant population of Brumers on different wheat varieties are given in Table **5**. It was observed from the table that the brumer's

Table 2: Mean Population of Green Aphid (*Aphis gossypii*) on Different Varieties of Wheat

Dates	Varieties					
	NIA- Sunhari	NIA-Amber	NIA- Sunder	Kiran	Kirman	Mean
5/1/2009	0.4	0.63	0.38	0.04	0.62	0.41
12/1/2009	0.9	3.98	1.14	3.21	4.86	2.82
19/1/2009	3.38	7.21	5.2	10.14	6.98	6.58
26/1/2009	8.18	11.97	13.62	17.63	15.48	13.38
2/2/2009	12	0.2	11.26	11.74	11.76	9.39
9/2/2009	5.1	7.44	9.6	8.72	9.04	7.98
16/2/2009	9.89	6.01	7.14	6.45	5.4	6.98
23/02/2009	4.1	4.94	3.98	4.16	4.94	4.42
2/3/2009	0.25	0.24	1.52	0.52	1.03	0.71
9/03/2009	0.1	0.12	0.34	0.34	0.24	0.23
16/03/2009	0.32	0.1	0.81	0.04	0.63	0.38
23/03/2009	0.48	0.24	0.3	0.09	0.05	0.23
Mean	3.76	3.59	4.61	5.26	5.09	

$P < 0.05$.

Table 3: Mean Population of Thrip (*Thrips tabaci*) on Different Varieties of Wheat

Dates	Varieties					
	NIA- Sunhari	NIA-Amber	NIA- Sunder	Kiran	Kirman	Mean
5/1/2009	0.2	11.32	8.23	7.14	11.42	7.66
12/1/2009	5.82	12.01	7.65	5.46	5.61	7.31
19/1/2009	6.15	19.98	9.78	10.18	6.67	10.55
26/1/2009	7.23	8.36	12.12	9.26	12.12	9.82
2/2/2009	8.98	9.48	8.22	7.14	5.02	7.77
9/2/2009	2.6	3.61	4.04	3.64	2.74	3.33
16/2/2009	0.63	0.55	0.34	0.62	0.34	0.50
23/02/2009	1.12	0.94	0.54	0.46	0.41	0.69
2/3/2009	0.34	0.32	0.32	0.44	0.21	0.33
9/03/2009	0.11	0.25	0.22	0.18	0.22	0.20
16/03/2009	0.18	0.31	0.18	0.11	0.23	0.20
23/03/2009	0.1	0.14	0.24	0.02	0.05	0.11
Mean	2.79	5.61	4.32	3.72	3.75	

P < 0.05.

Table 4: Mean Population of American Bollworm (*Hellicoverpa armigera*) on Different Varieties of Wheat

Dates	Varieties					
	NIA- Sunhari	NIA-Amber	NIA- Sunder	Kiran	Kirman	Mean
5/1/2009	3.15	0.1	0.21	1.2	1.02	1.14
12/1/2009	0	0	0	0	0	0.00
19/1/2009	1.02	0	0	0	0.2	0.24
26/1/2009	0.22	0	0.2	0.2	0	0.12
2/2/2009	0	0.24	0	0	0	0.05
9/2/2009	0	0	0.18	0.18	0.18	0.11
16/2/2009	0.49	0.39	0.27	0.56	0.27	0.40
23/02/2009	0.52	0.67	0.46	0.38	0.37	0.48
2/3/2009	0.20	0.41	0.21	0.22	0.19	0.25
9/03/2009	0.37	0.12	0.12	0	0	0.12
16/03/2009	0.06	0	0	0	0.12	0.04
23/03/2009	0.04	0.04	0.06	0.04	0.04	0.04
Mean	0.51	0.16	0.14	0.23	0.20	

P < 0.05.

population was higher (0.18/ plant) on variety NIA-Sunhari followed by (0.08/plant) Kirman, (0.07/plant) NIA-Amber and Kiran (0.07/plant). While the lowest Brumers population (0.05/plant) was found in variety NIA-Sunder. These differences were statistically significant.

6. Lacewing (Chrysoperla carnia)

The results on the mean per plant population of lacewing on different wheat varieties are given Table **6**. The analysis of variance as given in Appendices VI. It was observed from the results that the lacewing population was maximum (0.25/plant) on variety of NIA-Sunhari followed by NIA-Amber (0.11/plant) and NIA-Sunder (0.10/plant), while the minimum population of lacewing (0.05/plant) was recorded in varieties Khirman and Kiran. The data were statistically significant.

7. 7-Spotted Beetle (Coccinella septempunctata)

The result on the mean per plant population of 7-spotted beetles on different wheat varieties are given

Table 5: Mean Population of Brumus (*Brumus suturalis*) on Different Varieties of Wheat

Dates	Varieties					
	NIA- Sunhari	NIA-Amber	NIA- Sunder	Kiran	Kirman	Mean
5/1/2009	1.0	0	0.02	0.2	0.03	0.25
12/1/2009	0.2	0.02	0	0	0.2	0.08
19/1/2009	0.05	0	0.02	0.02	0	0.02
26/1/2009	0.08	0.02	0.05	0	0.4	0.11
2/2/2009	0.06	0.2	0.04	0.08	0.04	0.08
9/2/2009	0.05	0.08	0.09	0.05	0.05	0.06
16/2/2009	0.13	0.16	0.08	0.08	0.04	0.10
23/02/2009	0.3	0.12	0.07	0.08	0.08	0.13
2/3/2009	0.09	0.12	0.04	0.2	0.04	0.10
9/03/2009	0.08	0.08	0.04	0.04	0.02	0.05
16/03/2009	0.05	0.04	0.08	0.04	0.02	0.05
23/03/2009	0.08	0.04	0.06	0.04	0.04	0.05
Mean	0.18	0.07	0.05	0.07	0.08	

$P < 0.05$.

Table 6: Mean Population of Green Lacewing (*Chrysoperla carnia*) on Different Varieties of Wheat

Dates	Varieties					
	NIA- Sunhari	NIA-Amber	NIA- Sunder	Kiran	Kirman	Mean
5/1/2009	1.20	0.22	0.2	0	0	0.32
12/1/2009	0.3	0.02	0.4	0.04	0	0.15
19/1/2009	0.06	0	0	0	0	0.01
26/1/2009	0.06	0.03	0.05	0.06	0	0.04
2/2/2009	0.16	0.04	0.04	0.09	0.08	0.08
9/2/2009	0.09	0.11	0.06	0.06	0	0.06
16/2/2009	0.09	0.4	0.14	0.11	0.16	0.18
23/02/2009	0.05	0.08	0.06	0.04	0.04	0.05
2/3/2009	0.8	0.12	0.04	0.02	0	0.20
9/03/2009	0.06	0.07	0.10	0.08	0.08	0.08
16/03/2009	0.06	0.05	0.04	0.03	0.16	0.07
23/03/2009	0.08	0.23	0.04	0.04	0.04	0.09
Mean	0.25	0.11	0.10	0.05	0.05	

$P < 0.05$.

Table **7**. The analysis of variances as given in appendices VII depicted that difference in 7-spotted beetles population over varieties tested were statistically significant. It was observed from the table that the 7-spotted beetles population was maximum in (0.64/plant) on variety NIA-Sunhari followed by (0.46/plant) NIA-Sunder, NIA-Amber (0.45/plant) and Kirman (0.19/plant). While, the minimum mean per plant population of 7- spotted beetles was (0.15/plant) of Kiran. The data were statistically significant.

8. 11-Spotted Beetle (Coccinella undecempunctata)

It was indicted that the mean per plant population of 11-Spotted beetle on different wheat varieties are given Table **8**. It was observed from the table that the 11-Spotted beetle population was maximum (0.52/plant)

Table 7: Mean Population of 7-Spotted Beetle (*Coccinella septempunctata*) on Different Varieties of Wheat

Dates	Varieties					
	NIA- Sunhari	NIA-Amber	NIA- Sunder	Kiran	Khirman	Mean
5/1/2009	1.22	1.09	1.11	0.4	0.6	0.88
12/1/2009	1.0	1.02	1.00	0.3	0.4	0.74
19/1/2009	1.8	0.4	0.6	0.4	0.5	0.74
26/1/2009	1.32	1.04	1.00	0.2	0.3	0.77
2/2/2009	0.42	0.24	0.20	0.04	0.02	0.18
9/2/2009	1.06	0.49	0.32	0.03	0.08	0.40
16/2/2009	0.18	0.17	0.14	0.02	0.04	0.11
23/02/2009	0.14	0.10	0.8	0.16	0.16	0.27
2/3/2009	0.28	0.32	0.22	0.18	0.12	0.22
9/03/2009	0.08	0.04	0.05	0.04	0.03	0.05
16/03/2009	0.06	0.04	0.06	0	0	0.03
23/03/2009	0.08	0.41	0.06	0.04	0.04	0.13
Mean	0.64	0.45	0.46	0.15	0.19	

P < 0.05.

on variety NIA-Sunhari followed by NIA-Amber (0.45/plant), NIA-Sunder (0.33/plant) and Kirman (0.22/plant). However, the minimum population of 11-Spotted beetle is the (0.17/plant) on variety of Kiran. The data was statistically significant.

Correlation of Predators with Insect Pests of Wheat

The correlation among the predators with insects pest of wheat are presented in Table **9** which showed that seven spotted beetle were non-significant positively association with black aphid (r = 0.281NS), green aphid (r = 0.235NS) and thrips (r = 0.171NS), 11-Spottedbeetle were non-significant correlated with black aphid (r = 0.231NS) green aphid (r = 0.147NS) and thrips (r = 0.181NS), lacewing were non-significant (r = 0.138NS) correlation with black aphid, green aphid (r = 0.274 NS), and thirps (r = 0.067NS) While Brumus were non-significant positive (r = 0.032NS) with black aphid, (r = 0.141NS) with green aphid and (r = 0.031) with thrips were calculated. However, American boll worm negative significantly correlated with predators, which is suggested that increased in predation

Table 8: Mean Population of 11-Spotted Beetle (*Coccinella undecempunctata*) *on* Different Varieties of Wheat

Dates	Varieties					
	NIA- Sunhari	NIA-Amber	NIA- Sunder	Kiran	Kirman	Mean
5/1/2009	1.00	1.09	0.77	0.5	0.5	0.77
12/1/2009	1.21	0.89	0.82	0.2	0.5	0.72
19/1/2009	0.92	0.3	0.20	0.6	0.7	0.54
26/1/2009	1.06	0.90	0.76	0.20	0.4	0.66
2/2/2009	0.52	0.21	0.10	0.05	0.04	0.18
9/2/2009	0.89	0.44	0.22	0.05	0.06	0.33
16/2/2009	0.14	0.15	0.11	0.04	0.02	0.09
23/02/2009	0.13	0.6	0.6	0.11	0.15	0.32
2/3/2009	0.26	0.41	0.20	0.14	0.14	0.23
9/03/2009	0.06	0.06	0.05	0.04	0.03	0.05
16/03/2009	0.04	0.06	0.04	0.03	0.02	0.04
23/03/2009	0.06	0.31	0.04	0.04	0.02	0.09
Mean	0.52	0.45	0.33	0.17	0.22	

P < 0.05.

Table 9: Correlation Coefficient (r) of Predators with Insect Pests on Different Wheat Varieties of Wheat Crop.

Predators V/S insect pests	Black aphid	Green aphid	American boll worm	Thrips
Seven spotted beetle	0.281NS	0.235NS	-0.538*	0.171NS
11-Spotted beetle	0.231NS	0.147NS	-0.548*	0.181NS
Lacewing	0.138NS	0.274 NS	-0.587*	0.067NS
Brumus	0.032NS	0.141NS	-2.573*	0.031

Table 10: Average Monthly Meteorological Data during Experimental Period January to March 2012-2013

Months	Temperature °C		Relative humidity %	
	Minimum	Maximum	Minimum	Maximum
January	12.55	21.86	58.15	86.45
February	13.65	28.52	50.04	85.77
March	18.82	34.25	39.00	82.28

Source: Regional Agromet Center Tandojam.

population on simultaneously boll worm population will be deceased.

DISCUSSION

Jansen [4] assessed short-term effects of six insecticides used to control aphids in wheat on plant-dwelling aphid predators. Products were applied to small plots of winter wheat in June or at the beginning of July and the densities of predators were estimated three days after treatment using a beating method. Insecticides were tested in 1994, 1995 and 1997 at a single dose, corresponding to their maximum recommended field rate in Belgium. Fluvalinate and esfenvalerate did not significantly reduce catches of syrphid larvae compared to the control but ladybirds were affected by these compounds. Pirimicarb was the only product tested that had no effect on ladybirds. However, syrphid larvae appeared sensitive to this product. Cyfluthrin, deltamethrin and phosalone reduced catches of both syrphids and ladybirds. Populations of lacewing larvae were unaffected by any of the insecticide treatments. Syrphid larvae were the most abundant aphid predator and *Episyrphus balteatus* the most common species. Ladybirds (*Coccinella septempunctata* and *Propylea quatuordecimpunctata*) were less numerous and only a few *Chrysoperla carnea* larvae were recorded. These results indicate that products that are less toxic to syrphid larvae, like esfenvalerate and fluvalinate, may be preferable to other compounds to control cereal aphids in wheat in spring and early summer. However, other criteria, such as the effectiveness of the different aphid-specific predators, cost, efficacy of the treatment and side effects on other aphid antagonists (including parasitic hymenoptera and polyphagous predators) must also be taken into consideration.

During the present studies the maximum population of Black aphid was observed (3.36/leaf) on variety NIA-Amber followed by NIA- Sunder (3.03/leaf), NIA-Sunhari (2.89/leaf) and (2.80/leaf) on Kirman. While, the lowest Black aphid population (2.79/leaf) was found in variety Kiran. Whereas, the maximum population of green aphid was comparatively more (5.26/leaf) on variety Kiran followed by Kirman (5.09/leaf), NIA-Sunder (4.61/leaf) and NIA- Sunhari (3.76/leaf). However, the lowest green aphid population was observed (3.59/leaf) on NIA-Amber variety. This demonstrated that variety NIA-Amber was found to be resistant against green aphid population when compared with rest of the varieties evaluated.

Malschi [8] studied on integrated control of thrips in wheat in Transylvania, Romania. One of the most important factors affecting pest development is mentioned, i.e. predation activity by *Chrysopidae, Nabidae, Araneae, Aeolothripidae, Carabidae, Staphylinidae, Coccinellidae, Malachiidae, Cantharidae, Syrphidae* and *Empididae*. Results are summarized of comparative trials on abundance and dynamics of thrips, and their predators in 2 crop systems of wheat in an open area and with agroforestry belts, as well as on the effects of some insecticides on the larvae control and wheat yield. Akhtar and Parveen

[9] surveyed that the aphid population on wheat fields in Lahore, Pakistan, as affected by temperature and humidity, from 9 January to 14 April of 1998. Two species of aphid's viz., *Schizaphis graminum* and *Rhopalosiphum padi* were recorded infesting wheat in the experimental field. Aphid density peaked on 26 February. During this time, pests started moving from the leaves to the ears. A decline in the aphid population was recorded on 11 March followed by an increased on 27 March. Tabulated data are presented on the mean values of temperature and relative humidity during the duration of the experiment.

CONCLUSIONS

It is concluded from the results that the population of insect pests and predators fluctuated with the passage of time in different varieties of wheat crop. However, the temperature and humidity were favourable to increase the reproduction of insect pests and predators on wheat crop.

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