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STUDIES ON POPULATION OF WHEAT APHIDS ON WHEAT CROP IN NEW CAMPUS AREA, LAHORE

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Abstract: Aphid population on wheat crop was studied during the growing season of crop at New Campus, Lahore. Two species of aphids were recorded on wheat crop. These were *Schizaphis graminum* and *Rhopalosiphum padi*. The aphid density per leaf varied from January 9, 1998 to April 14, 1998 and was maximum on February 26, 1998. At the end of February, aphids started shifting to the ears. Maximum aphid population per ear (48.0) was recorded on March 27, 1998.

Key words: Aphids, wheat crop, Lahore.

INTRODUCTION

Polyploid bread wheat, *Triticum aestivum*, is an important economic food crop. Productivity of wheat is reduced by abiotic and biotic stress factors. Among the abiotic stress factors both physical (temperature, wind, rainfall, drought) and chemical (salinity, pollution, pesticides) factors can affect quantity and quality of crop yield. Among the biotic stress factors, insects play significant role in yield reduction.

Aphids or the plant lice are serious pests of crops. They damage the crops by sucking cell sap due to which plant becomes weak and ultimately bears less fruit. They also damage plants by throwing honey dew on the leaves, which initiates the development of sooty mould that ultimately affects the photosynthesis. Most of them are vectors of plant pathogens, which cause some fatal diseases.

In Pakistan, Nasir and Yousaf (1995) reported five aphid species on wheat (*Triticum aestivum*), during an extensive survey carried out throughout the Punjab Province. These are:

1. *Rhopalosiphum maidis* (Fitch).
2. *Rhopalosiphum padi* (L.).
3. *Schizaphis graminum* (Rondani).
4. *Diuraphis noxia* Mordvilko.
5. *Sitobion miscanthi* (Takahashi).

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Hashmi et al. (1983) found four species of aphid damaging the wheat crop viz., 1. *Sitobion avenae* (F.). 2. *Schizaphis graminum* (Rond.), 3. *Rhopalosiphum rufiabdominalis* (Saski) and *Rhopalosiphum maidis* (Fitch.).

The green bug, *Schizaphis graminum* (Rondani), was first reported as an agronomic pest in the United States on wheat in 1882 (Leonard, 1968; Webster and Phillips, 1912). It has a host range of at least 60 plant species including wheat, barley, sorghum and corn (Kindler *et al.*, 1984; Michels *et al.*, 1987; Walgenbach *et al.*, 1988). Polyphagous nature of green bug contributes to its pest status on small grains and grain sorghum. Green bugs feed exclusively on the aerial parts of the plant but cause biomass reductions with shoot and root systems (Daniels, 1965; Burton *et al.*, 1985; Burton, 1986), which is ultimately expressed as reductions in yield. The bird cherry-oat aphid, *Rhopalosiphum padi* (L.) is another important pest of wheat crop in Pakistan.

Anon (1987) reported 100% loss in grain production due to aphids outbreak. Fifty and seventy-six percent loss in grain weight per year in winter and spring wheat, respectively was reported by Kuroli *et al.* (1987).

As a favourable physical environment is a necessary requirement for pest insects to move in and flourish, a thorough understanding of the exact relationship between the pest insects of the crop and its macroenvironments may help the forecasting of their pest incidences, which may, ultimately lead to very well timed plant protection operations. Based on these considerations aphid population and its relation with environmental factors in wheat fields in Lahore is described.

MATERIALS AND METHODS

Sampling of aphid population

A. Plot

A plot of 100 m x 100 m was selected near Punjab University, New Campus, Lahore. From this plot on each observation, three subplots of 2 m x 2 m were selected for total number of plants and percentage of infested plants.

B. Sampling procedure

Observations on the study site were carried out from January 9, 1998 to April 14, 1998, which is a wheat crop season. Observations were taken fortnightly. At each observation three subplots (2 m x 2 m) were selected at random to count healthy and infested plants. Aphid population was counted by taking ten leaves at random from a quadrat of $4m^2$. This data was transformed as number of aphids per leaf.

When ears started appearing aphids started shifting to the ears. Consequently, three ears at random were selected from each subplot to count aphid population per ear.

C. Environmental data

Temperature and humidity data for Lahore were procured from the Meteorological Office, Lahore, which is gratefully acknowledged.

RESULTS

Aphid population

Two species of aphids were found infesting wheat plants in New Campus area during the period January 9, 1998 to April 14, 1998, the wheat crop season. These were *Schizaphis graminum* and *Rhopalosiphum padi*.

On January 9, 1998, only *S. graminum* was recorded on wheat plants. Table I indicates total number of plants and number of plants infested with aphids, in three selected plots. Infested plants in plot No.1, 2 and 3 were 2.9, 2.6 and 2.8%, respectively. The mean value of infested plants was 2.76%. Number of aphids per leaf in plot No.1, 2 and 3 were 0.3, 0.4 and 0.3, respectively. Mean value of aphids per leaf was 0.33.

On January 22, 1998 (the date on which second observation was made) population of aphids showed some increase. Infested plants in plot No.1, 2 and 3 were 5, 1.5 and 2.1%, respectively. Mean value of infested plants was 2.86%. Number of aphids per leaf also increased, 0.50 per leaf.

On February 12, 1998, aphid population further increased (Table II). The second species of aphids *R. padi* also started infesting wheat plants. Infested plants in plot No.1, 2 and 3 were 10.5, 13.8 and 11.5%, respectively. Mean value of infested plants was 11.9%. Number of aphids per leaf in plot No.1, 2 and 3 was 2.9, 3.6 and 2.4, respectively. Mean value of aphids per leaf was 2.96.

On February 26, 1998, there was tremendous increase in the aphid population (Table I). The magnitude of plant infestation was 100%. Number of aphids per leaf in plot No.1, 2 and 3 was 17.2, 21.3 and 23.2, respectively. Mean value of aphids per leaf was 20.56.

At this stage of growth, ears started appearing and aphids started moving from leaves to ears. Number of aphids per ear in plot No.1, 2 and 3 was 10.3, 7.9 and 7.0, respectively. Mean value of aphids per ear was 8.4.

On March 11, 1998, there was a decline in aphid population (Table II). Number of aphids per leaf decreased whereas the number of aphids per ear showed some increase.

Infested plants in plot No.1, 2 and 3 were 96.2, 95.9 and 98.3%, respectively. Mean value of infested plants was 96.8. Number of aphids per leaf in plot No.1, 2 and 3 was 5.8, 4.7 and 3.0, respectively. Mean value of aphids per leaf was 4.5. Number of aphids per ear in plot No.1, 2 and 3 was 20.3, 17.0 and 15.3, respectively. Mean value of aphid per ear was 17.5.

Table I: Aphid population wheat plants

Observation	Total No. of plants	No. of infested plants	Percent infested plants	No. of aphids per leaf			No. of aphids per ear		
				S. graminum	*R. padi*	Total	*S. graminum*	*R. padi*	Total
January 9, 1998									
Plot No.1	690	20	2.9	0.3	-	0.3	-	-	-
Plot No.II	570	15	2.6	0.4	-	0.4	-	-	-
Plot No.III	650	18	2.8	0.3	-	0.3	-	-	-
Mean	637	18	2.76	0.33	-	0.33	-	-	-
January 22, 1998									
Plot No.1	600	30	5	0.6	-	0.6	-	-	-
Plot No.II	650	10	1.5	0.4	-	0.4	-	-	-
Plot No.III	580	12	2.1	0.5	-	0.5	-	-	-
Mean	610	17	2.86	0.5	-	0.5	-	-	-
February 12, 1998									
Plot No.1	570	60	10.5	2.4	0.5	2.9	-	-	-
Plot No.II	450	62	13.8	3.0	0.6	3.6	-	-	-
Plot No.III	520	60	11.5	2.0	0.4	2.4	-	-	-
Mean	480	61	11.9	2.46	0.5	2.96	-	-	-
March 11, 1998									
Plot No.1	520	500	96.2	2.7	3.1	5.8	10	10.3	20.3
Plot No.II	485	465	95.9	2.1	2.6	4.7	8	9	17.0
Plot No.III	600	590	98.3	1.2	1.8	3.0	7	8.3	15.3
Mean	535	518	96.8	2.0	2.5	4.5	8.3	9.2	17.5
March 27, 1998									
Plot No.1	450	450	100	7	8.7	15.7	18	22	40
Plot No.II	520	520	100	6.1	7.7	13.8	19.6	26	45.6
Plot No.III	490	490	100	7	8.4	15.4	18.6	22	40.6
Mean	487	487	100	6.7	8.2	14.9	18.6	23.3	42.0

On March 27, 1998, the aphid population again showed some increase (Table II). The magnitude of plant infestation was 100%. Number of aphids per leaf in plot No.1, 2 and 3 was 15.7, 13.8 and 15.4, respectively. Mean value of aphid per leaf was 14.9. Number of aphids per ear in plot No.1, 2 and 3 was 40.0, 45.6 and 40.6, respectively.

Mean value of aphids per ear was 42. On April 14, 1998, no aphid was found on wheat plants.

Figure 1 compares total number of aphids per leaf and per ear. Maximum population of aphids on leaves (20.56 per leaf) was recorded on February 26, 1998, whereas on ears it was recorded (42.0 per ear) on March 27, 1998.

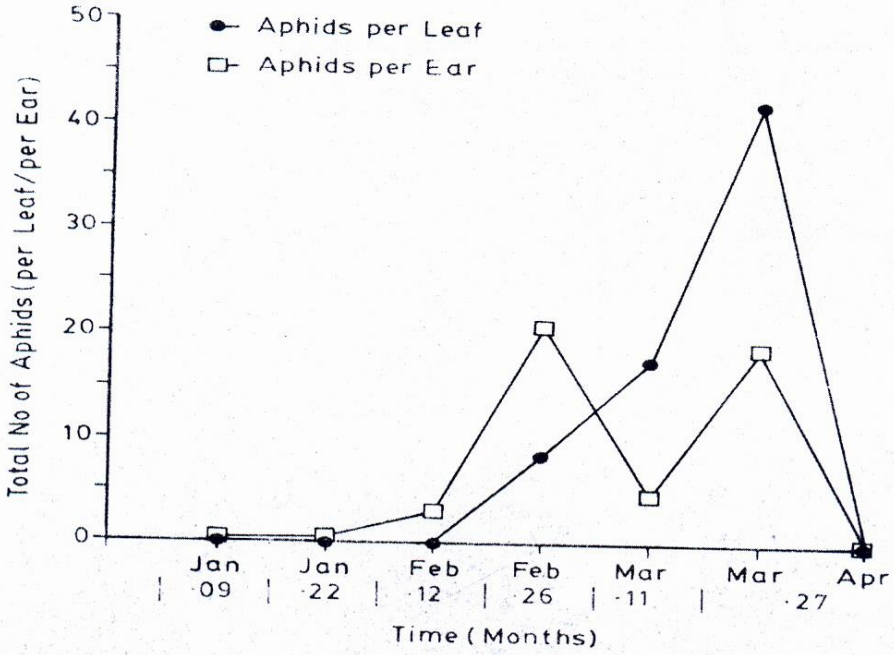

Fig. Aphid population (number per leaf and per ear) on wheat in different months

Table II shows a multiple comparison of the population dynamics of the aphids (per leaf, per ear) along with different physical factors of the environment from January 9, 1998 to March 27, 1998. Aphid population per leaf showed significant differences ($P<0.05$) during February 26, 1998, March 11, 1998 and March 27, 1998. Similarly, aphid population per ear was significantly ($P<0.05$) different on the above mentioned dates.

Table II: A multiple comparison of mean values of different physical factors of the environment, tested against mean population (per leaf, per ear) of wheat aphids.

Date of sampling	Aphids per leaf	Aphids per ear	Max. temp. (°C)	Min. temp. (°C)	Temp. fluctu-ations (°C)	Mean temp. (°C)	Soil temp. (°C)	Relative humidity (%)
9-1-98	0.33[a]	-	20.6	10	10.6	15.3	14	61.5
22-1-98	0.5[a]	-	19.4	6.2	13.2	12.6	19	51.5
12-2-98	2.96[b]	-	25.2	12.5	12.7	18.85	24	63
26-2-98	20.56[c]	8.4a	17.3	8.6	8.7	12.95	19	66
11-3-98	4.56[b]	17.5b	26	12	14	19	18	67.5
27-3-98	14.96[d]	42.0c	32	15	17	23.5	18.5	51.5

Any two means not having a common superscript are significantly different at 5% level of probability.

A comparison of the different physical factors of the environment with the aphid population (per leaf, per ear) revealed non-significant correlation between aphid population (per leaf, per ear) and different physical factors of the environment.

DISCUSSION

Wheat crop in Pakistan is one of the most important crops and plays very important role in the economy of Pakistan. This crop is attacked relatively by a few pests as compared to other crops such as cotton.

Wheat crop in the New Campus area was found to harbour two species of aphids *i.e.*, *Schizaphis graminum* and *Rhopalosiphum padi*. Amongst these *S. graminum* is a polyphagous aphid on more than 70 graminaceous hosts (Michels *et al.*, 1987). Studies on certain aspects of the biology of green bug have been reported by McCauley *et al.* (1990) on corn and grain sorghum from USA and by Hamid (1987) in Pakistan. Laboratory studies on life table of green bug on different wheat varieties were conducted by Buriro *et al.* (1996). Survivorship and fecundity curves of green bug on 3 varieties (Kohinoor, Mehran-89 and Sarsabz) of wheat were not similar. The mortality rate was high initially on all the varieties. This could be due to age of leaves as green bug prefers mature leaves for its development (Rabe *et al.*, 1989).

Starks and Merkle (1977) reported that some wheat cultivars with pubescence may have slight resistance to the green bug, but the pubescence probably does not cause the resistance. However, the research of Roberts and Foster (1983) provided evidence that dense leaf pubescence in wheat confers resistance to another grain aphid, *R. padi*. Webster *et al.* (1994) reported that leaf surface pubescence is of questionable value in a greenbug plant resistance program.

Miles (1990) reviewed Aphidoidea insect studies and suggested that the specific responses of plants (*e.g.*., chlorosis and necrosis) to aphid feeding were caused mainly by the feedings made on mesophyll or cortical parenchyma through removal or destruction of cell contents including chloroplasts in plant tissues.

Todds *et al.* (1997) determined the effects of feeding by *R. padi* and *Sitobion avenae* on plant vigor and grain yield during the reproductive growth stages of spring wheat. They reported that aphid feeding may influence yields early in the growth stages but later the effect fades away rapidly. As the plant development proceeds beyond the flowering stage, the deleterious effects of aphid feeding can no longer negatively influence any of the major components of grain yield except average seed weight.

Aheer *et al.* (1994) carried out studies to determine the role of temperature, relative humidity, rainfall and wind velocity in fluctuating aphid density on wheat during 1988-91. They reported that fluctuation in pest population varied in different years. Maximum aphid population was trapped in March. Present studies have shown maximum aphid population per leaf in February at New Campus area, Lahore. As the aphids started shifting to ears by the end of February, maximum aphid population per ear was recorded by the end of March.

Aheer *et al.* (1994) have also reported that wind velocity played a positive and significant role in fluctuating aphid density during 1990-91 (r=0.798). All other factors for the years individually had no significant correlation with aphid density. Wahla *et al.* (1996) reported that the changes in temperature fluctuation, were positively correlated to the population dynamics of sucking pest insects of cotton whereas minimum temperature and relative humidity negatively correlated to it. Present studies indicate no correlation between aphid population and the climatic factors.

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