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Impact of abiotic factors on population fluctuation of aphid (Hemiptera: Aphididae) on the different wheat varieties from Larkana district

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Abstract
Investigations were conducted on the effects of abiotic factors such as temperature, humidity and rainfall on population dynamics of aphid on five different wheat varieties such as TD-1, Benazir, TJ-83, QS-4 and NIA Amber at Abbasi farm and Qauid-e-Awam Agriculture Research Institute Larkana Sindh, Pakistan, during 2017 and 2018. The aphid population starts to appear in the first week of January (0.3 aphids/leaf), the aphid count was low in January because of cold but gradually it starts to increase and reached its peak in mid March (mean aphid 54.9 per ten leaves/ear) during 2017 and (mean aphid 44.6 per ten leaves/ear) during 2018. Correlation analysis of aphid population with abiotic components shows that the temperature had a positive effect (r= 0.261), during 2017 and (r= 0.253), during 2018, while the relative humidity played a negative role (r= -0.125) and (r= -0.164), during2017 and 2018, respectively. The cloudness was negative (r= -0.270), during 2017 and positive (r= 0.202), during 2018. Similarly, rainfall had a negative effect (r= -0.282) and (r= -0.035), during 2017 and 2018, respectively. The wind speed showed positive correlation during years, 2017 and 2018 (r= 0.956) and (r= 0.267), respectively.
This study suggests that the early sowing of wheat showed the least aphid infestation. The study of the environmental factors and their effects on aphid population is also important for effective pest management.

Keywords: aphid, population, abiotic factors, larkana

Introduction
Wheat (*Triticum aestivum*) is the most important crop of country [11]. In Pakistan, wheat was grown on an area of 8330 thousand hectares with an annual production of 21109 thousand tones and having an average yield of 2537 Kg / ha- (Anonymous, 2005). Wheat is considered as staple food for more than 35% of the world population [9], but some insects pest are responsible for low yield of wheat [10]. Aphid or plant lice are amongst the most widely recognized polyphagous insect pest [5]. Aphids severely damage the wheat crop in Pakistan [13-7] and causing 35-40% yield losses directly [12]. The aphid, due to their sucking propensities devitalizes the plant tissues leading to yield reduction and their presence reduces the quality of crop [15]. The relationship of change in environmental factors and their effects on aphid population may not only help to anticipate the pest losses to the crop but also help to avoid them through some well-timed pest control measures [1]. The proper implementation of management of crop pest depends on knowledge of abiotic factors and pest population that build up in the area.
This study deals with aphid population, density on five wheat varieties grown under Larkana agro-ecological conditions with correlation of abiotic factors such as temperature, relative humidity, rainfall, cloudness and wind speed which build up the effects on aphid population.

Material and Methods
This study was carried out from January to April, 2017 and 2018, at two stations, Abbasi farm (St.1) and Qauid-e-Awam Agriculture Research Institute (St.2), District Larkana. Five different wheat varieties such as TD-1, Benazir, TJ-83, QS-4 and NIAamber were selected to investigate the effect of abiotic factors on aphid population. The crops were sown during mid of November by tillage method. The observation on aphid population was carried out from January to April 2017 and 2018. The aphid population data were recorded by selecting 10

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plants, fortnightly. The aphids were collected by aspirator, camel's hair-brush, net sweeping and by jerking the plant leaf in polythene bags and jars. Weather data; i.e., temperature, relative humidity, rainfall, cloudness and wind speed were collected from the National Agromet Centre, Larkana, the Pakistan Meteorological Department. The data of aphid population were analyzed through correlation coefficient with abiotic factors.

Results and Discussions
It was observed that the attack of aphids (*Rhopalosiphum padi* and *Schizaphis graminum*) on wheat varieties, started from January and gradually increased and reached at its peak in March, then gradually declined up to maturity of crop during years, 2017 and 2018. This study is also supported by the findings of many other workers [2-8-17] and found that the highest aphid population was during the month of March. The highest aphid population (Fig: 1) was found in February and March 2017 (22.8 per ten leaves in February /74.1 per ten ear in March), and during 2018, the highest aphid population (Fig: 2.) was also found in February and March (21.9 per ten leaves in February /69 per ten ear in March), on over all cultivars the mean number of aphid population was 54.9 and 44.6 per ten leaves /ear respectively. The cultivar NIAamber had lowest mean number of aphid, during 2017 (0.1 per ten leaves in January /5.6 per ten ear in April), in the same way, the lowest mean number of aphid on NIAamber, during 2018 was recorded (0.1 per ten leaves in January /3.3 per ten ear in February), which proves its resistance against aphid in comparison with all other cultivars.
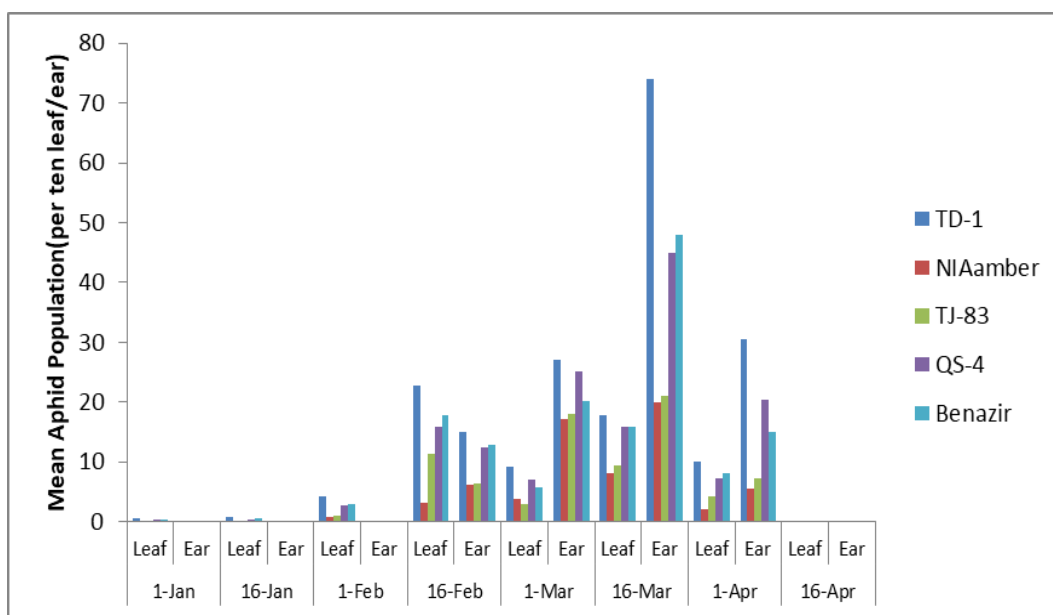

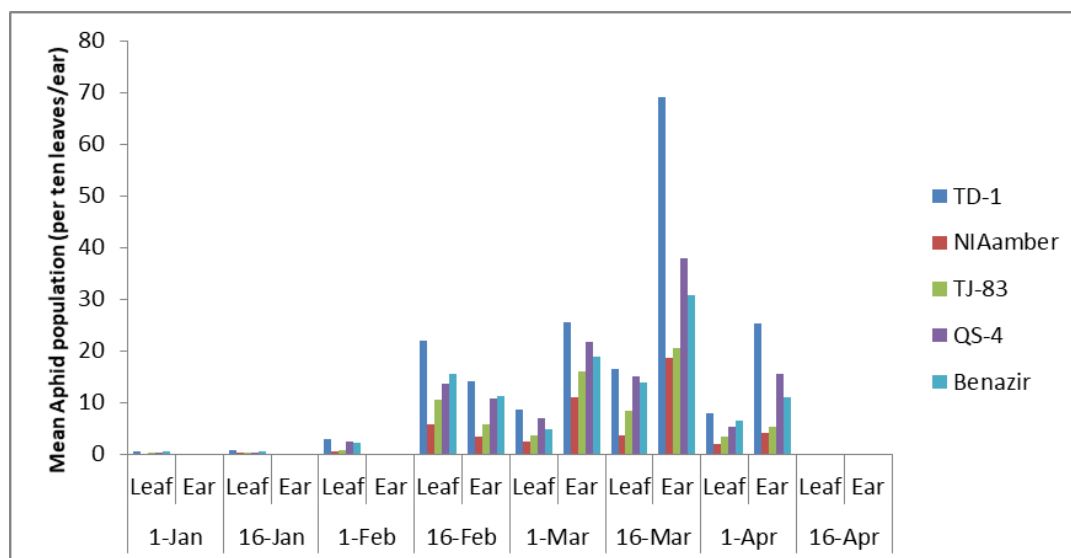**Fig 1:** Mean Aphid Population per ten leaves / ear, during 2017.

Fig 2: Mean Aphid Population per ten leaves / ear, during 2018.

The data of the various abiotic factors (Table. 1) for the two year periods (2017 and 2018) are given for an estimation of the correlation with aphid population. The correlation of aphid population with maximum temperature (Table: 2), during 2017 and 2018 (r = 0.261 and r = 0.253, respectively) showed positive effect [14], the minimum and maximum temperature had a positive role in causing fluctuation (Fig: 3) in the aphid population [2, 3], where as correlation of relative humidity during 2017-18 (r = -0.125 and r = -0.164) with aphid population exerted negative role. The related humidity

showed a negative correlation with aphid population [17]. The high rainfall during January to mid-February is favorable [16], but our study during 2017-18, showed negatively correlation of rainfall (r= -0.282 and r= -0.035, respectively) with aphid population.

Table 1: Mean aphid population per ten leaves / ear on five different varieties of wheat and meteorological data during 2017-2018.

Date of Sampling	Temperature (c°) max	Temperature (c°) min	Relative Humidity %	Cloudness (Octas)	Rainfall (mm)	Wind speed Km/hour	Aphid population (per ten leaves/ear) Leaves	Ear	Total
				2017					
January									
01-01-2017	19	7	62	1.4	0	1.9	0.3	0	0.3
16-01-2017	20	7.2	57.2	2.5	5	3	0.4	0	0.4
February									
01-02-2017	24	8.5	46.3	1.4	0	3.5	2.4	0	2.4
16-02-2017	27	10.6	53.6	2.5	0	5.1	15.6	10.5	26.1
March									
01-03-2017	32.6	15	41.3	1	1	5.2	5.7	21.5	27.2
16-03-2017	34	17	45	0.9	0	8.5	13.3	41.6	54.9
April									
01-04-2017	42.8	22	31	0.5	0	4.5	7.5	10.5	18
16-04-2017	45	24.1	29	1.1	0	3.8	0	0	0
				2018					
January									
01-01-2018	22.5	6	50	0	0	2	0.3	0	0.3
16-01-2018	24	8.5	53	0.4	0	3.3	0.4	0	0.4
February									
01-02-2018	26	10.5	56	0.6	0	2.3	1.7	0	1.7
16-02-2018	22.5	12	41	1.8	0	3.7	13.4	9.1	22.5
March									
01-03-2018	31	17.5	54	1.2	0	4.1	5.2	18.4	23.6
16-03-2018	32.5	18.5	42	0.3	0	4.3	11.4	33.2	44.6
April									
01-04-2018	40.5	21	32	0.8	0	6.6	7	13.5	20.5
16-04-2018	38.5	22.5	28	1	9	6.2	0	0	0

Table 2: Correlation coefficients between aphid population and abiotic factors in wheat

Year	Temperature (°c)	Relative humidity (%)	Cloudness (OCTAS)	Rainfall (mm)	Wind speed Km/hrs.
2017	0.261	-0.125	-0.27	-0.282	0.956
2018	0.253	-0.164	0.202	-0.035	0.267
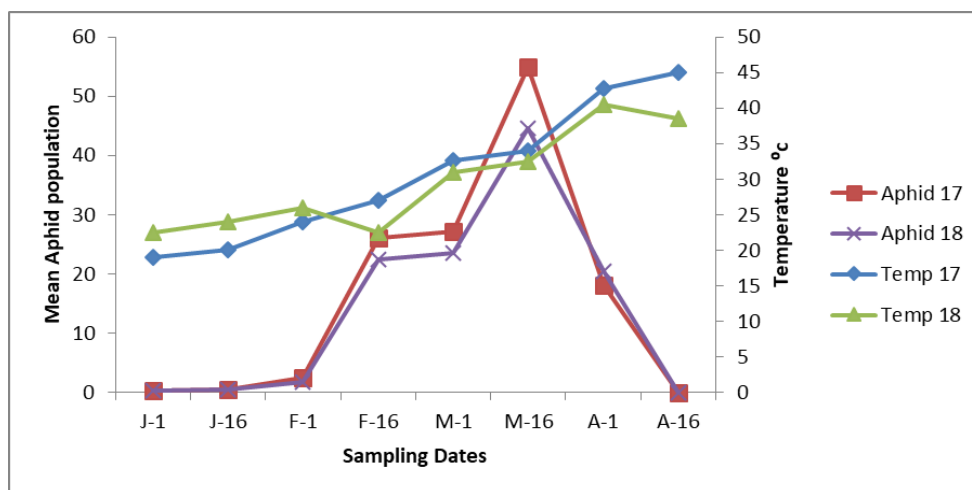
Fig 3: Aphid population in relation to temperature during 2017 and 2018.

The effect of rainfall was found to be not significant on the population of aphids [7]. The correlation of cloudness with aphid population during 2017-18 were found as r= -0.270 and r= 0.202, respectively. It shows negative correlation in 2017 and positive in 2018, whereas, the correlation of aphid population with wind speed revealed a positive (r= 0.956 and r= 0.267, respectively), during 2017-8. The wind speed played a positive role in fluctuating aphid density. The abiotic factors affected the population build-up of wheat aphids [6].

Conclusion
This study proves that early sowing of wheat is important for controlling aphids population. The peak aphid population was recorded during the beginning of the second week of March in

both years 2017 and 2018. Aphid population were largely dependent on temperature but was not positive correlated with relative humidity and rainfall, many workers also recorded [14] negative influence of rainfall on aphid population.

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