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POPULATION DYNAMICS OF APHID (*APHIS GOSSYPII* GLOVER) IN RELATION TO WEATHER FACTORS IN *BT AND* NON *BT* COTTON IN MALWA REGION

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ABTRACT

The present study was conducted at College of Agriculture, Indore, in Kharif season of 2011 to record the trend of occurrence and the effect of abiotic factors on aphid (Aphis gossypii Glover) multiplication in Bt cotton and their corresponding non Bt cotton in Malwa region. The occurrence of aphid started with 1.05 and 0.38 aphid / leaf in 34 MSW ending 20 August, i.e. after six week of sowing and it remained throughout the crop growth, both in Bt and non Bt cotton. The peak population was recorded 18.4 and14.7 aphids / leaf in 3rd MSW in Bt and non Bt cotton, respectively. The significant negative correlation was observed with maximum temperature, minimum temperature and morning humidity to aphid population. Regression equation also indicated significant negative impact of maximum temperature, minimum temperature and morning humidity on aphid population.

Key words: Aphid, correlation, cotton, population dynamics, weather factors.

INTRODUCTION

Cotton (*Gossypium spp*.) is most extensively cultivated commercial cash crop and is important of all fiber crops of the world. In Madhya Pradesh cotton is cultivated in 7.06 million ha with production of 17.70 million bales and productivity of 426.20 kg ha-[1]. (Anonymous, 2012). The cotton aphid (*Aphis gossypii* Glover), is one of the most limiting factor in achieving higher productivity of cotton. Aphid (both nymph and adult) suck sap from underside of the leaves causes direct damage to reduce the yield and indirect damage by lint contamination with honey dew and associate fungi. It reduces seed cotton yield, varies from 25.9 to 48.9% (Rao *et al*. 1989). The prevalence and build up of aphid population on cotton, is mostly governed by weather parameters like temperature, relative humidity, rainfall, sunshine hours, wind velocity and rainy days. Furthermore, the weather parameters vary greatly from place to place and season to season. Thus, the knowledge of the influence of weather parameters on aphid population will help to develop a forecasting system. This will also be helpful in decision making system and timely application of suitable insecticides for effective insect pest management in cotton agro-ecosystem. Therefore, the present investigation was undertaken to study the relationship between the population dynamics of aphid in *Bt* & non *Bt* cotton and the weather parameters in Malwa region.

MATERIALS AND METHODS

The experiments were conducted at farm of College of Agriculture, Indore, (M.P.) during *kharif* season of 2011, using cotton variety TULSI-171 (BGII *Bt* and non *Bt*). The crop was sown on 10 July 2011 in the plots measuring 540×520 cm having row to row and plant to plant distance of 60×45 cm. respectively. All the recommended agronomical practices were followed time to time to raise the crop successfully as per package of practices prescribed for the region. The data on the population of cotton aphid were recorded at weekly intervals, taking two leaves each from top, middle and bottom from five randomly selected plants of each plot. The weather factors i.e. maximum and minimum temperature (^{0}C), humidity (%), rainfall (mm), wind velocity (km/h) and rainy days in different meteorological standard weeks (MSW) during the crop season of 2011–12, were recorded and their relationship with aphid population was worked out by using simple correlation and regression.

RESULTS AND DISCUSSION

Population dynamics of aphid (*Aphis gossypii* Glover)

The aphid infestation started with 1.05 aphids / leaf and 0.38 aphid / leaf in 34 MSW ending 20 August *i.e.* after six week of sowing and it remained throughout the crop growth period in both *Bt* and non *Bt* cotton, when the weather factors *i.e*. maximum temperature, minimum temperature, humidity, rainfall wind velocity and rainy days were 27^{0}c, 21.8^{0}c, 90%, 6.6 mm, 7.7km/h and 1 days respectively (Table 1, Figure 1). The present studies are corroborated with Soujanya *et al*, (2010) as they observed the initial incidence of aphid on 34th standard week (4th week of August) with same trend of seasonal occurrence of aphid and other sucking pests on *Bt*, stacked *Bt* and

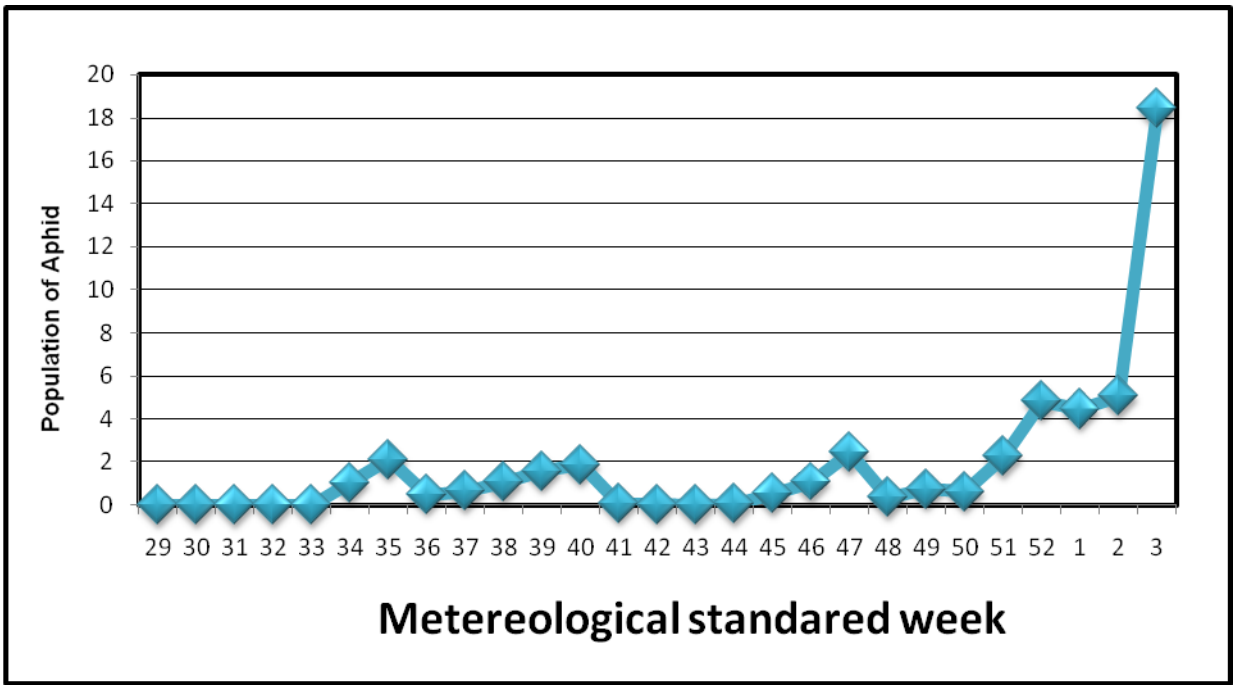

Fig. 1: Population dynamics of aphid in *Bt* cotton

Table 1: Population dynamics of aphid in *Bt* cotton and their corresponding to Non *Bt* cotton

Month	Std. week	Std. week ending	aphid population		Weather parameters					
					Temperature (^{0}c)		Humidity (%)	Rainfall (mm)	Wind (km/h)	Rainy days
			Bt	non Bt	max	min				
July	29	Jul-16	0.00	0.00	32.4	24.5	87.0	18.6	10.0	1.0
	30	Jul-23	0.00	0.00	27.0	22.1	93.1	349.1	11.7	4.0
	31	Jul-30	0.00	0.00	27.1	22.5	88.1	26.0	10.1	3.0
Aug	32	Aug-06	0.00	0.00	26.1	22.5	90.0	173.4	9.6	4.0
	33	Aug-13	0.00	0.00	25.0	21.3	93.0	39.6	8.3	3.0
	34	Aug-20	1.05	0.38	27.0	21.0	90.0	6.6	7.7	1.0
	35	Aug-27	2.11	2.15	28.2	22.0	91.7	22.6	3.9	4.0
Sep	36	Sep-03	0.50	0.28	28.0	22.0	89.0	128.4	3.9	3.0
	37	Sep-10	0.66	0.28	28.2	21.0	92.0	36.7	5.7	3.0
	38	Sep-17	1.07	0.38	29.8	21.0	90.8	0.0	4.0	0.0
	39	Sep-24	1.58	0.46	30.0	20.2	84.2	3.8	3.0	1.0
Oct	40	Oct-01	1.88	0.45	32.2	20.9	85.0	0.0	2.6	0.0
	41	Oct-08	0.08	0.05	32.6	18.0	82.8	0.0	1.6	0.0
	42	Oct-15	0.03	0.00	32.7	16.2	85.7	0.0	1.6	0.0
	43	Oct-22	0.00	0.00	31.2	15.0	89.2	0.0	1.7	0.0
	44	Oct-29	0.05	0.00	29.5	10.8	82.6	0.0	2.8	0.0
Nov	45	Nov-05	0.53	0.62	28.8	9.2	84.2	0.0	1.8	0.0
	46	Nov-12	1.08	0.50	28.7	9.0	81.7	0.0	1.7	0.0
	47	Nov-19	2.45	3.20	28.2	81	80.8	0.0	2.2	0.0
	48	Nov-26	0.35	0.95	29.3	10.0	81.2	0.0	2.1	0.0
Dec	49	Dec-03	0.75	0.41	29.4	10.3	79.4	0.0	2.1	0.0
	50	Dec-10	0.63	0.36	28.9	9.5	78.8	0.0	20.0	0.0
	51	Dec-17	2.25	4.15	25.5	7.8	75.2	0.0	2.1	0.0
	52	Dec-24	4.84	4.61	24.6	6.3	75.8	0.0	2.1	0.0
	1	Dec-31	4.45	5.28	23.7	5.1	77.0	0.0	2.7	0.0
Jan	2	Jan-07	5.06	4.18	23.4	3.2	77.0	0.0	2.3	0.0
	3	Jan-14	18.40	14.70	24.8	5.5	76.0	0.0	3.5	0.0

non *Bt* cotton hybrids. In the present finding, the peak population was recorded 18.4 and 14.7 aphids / leaf in 3 MSW in both *Bt* and non *Bt* cotton, respectively which are contradictory with Tomar, (2010) who observed aphid population for the first time in 28th standard week, which remained active up to 1st standard week having its peak density (18.15/leaf) in 37th standard week .The present findings are also contradictory with Gupta *et al.*, (1997) as they recorded the peak population of aphid during the last week of July to mid-August (24.8-30.1^{0}C and >87% R.H.). The contradiction in the findings of these researchers might be due to variation in meteorological conditions. The aphid population was recorded more in *Bt* cotton (18.4 aphids / leaf) than non *Bt* cotton (14.7 aphids / leaf). Similarly Soujanya *et al*, (2010) observed slightly higher infestation of aphid and other sucking insect pest on *Bt* cotton compared to non *Bt* cotton.

Correlation between aphid population and weather factors

The significant negative correlation (Table 2) was found between aphid population and maximum temperature (r = -0.217*) (r = -0.546*) minimum temperature (Bt r = -0.236*) (non Bt r = -0.577*) and morning humidity (r = -0.258*) (r = -0.588*) in *Bt* and non *Bt* cotton. The findings of Singh and Paul (2009) are in close conformity as they observed the significant negative correlation between aphid population and minimum temperature and mean % relative humidity. Further Shanthi *et al.* (2009) reported significant negative influence of temperature on the population buildup of *Aphis gossypii*. Similarly Jalali *et al.* (2000) recorded significantly negative correlation between maximum temperature, relative humidity % and aphid population and non significant negative correlation between aphid population and minimum temperature which is in partial agreement with present investigation. The findings of Soujanya *et al.* (2010) are in close association as they observed that all the weather factors except maximum temperature, showed significant negative correlation. The findings of Tomar (2010) are contradictory with present study who observed that maximum and minimum temperature and relative humidity showed positive correlation with aphid population. The variation in findings may be due climatic changes.

Table 2: Correlation coefficient on aphid population with abiotic factors in *Bt* and non *Bt* cotton

S. No.	Weather parameters	Aphid	
1	Temperature (c)	*Bt*	non *Bt*
	Max	-0.466*	-0.546*
	Min	-0.486*	-0.577*
2	Humidity (%)		
	Morning	-0.508*	-0.588*
3	Rainfall (mm)	-0.187	-0.197
4	Wind velocity (k/h)	-0.193	-0.226
5	Rainy days	-0.246	-0.265

***** *Significant at 5% level*

Regression between aphid populations and weather factors

The regression revealed (Table 3) that among the various weather factors, maximum temperature, minimum temperature and morning humidity were found to be most influencing factors which causes 23, 21 and 25% variation in Bt and 29, 33 and 34% variation in aphid population in non *Bt* cotton. The regression equation further indicated that among the various weather factors, maximum temperature (Bt y = -0.630x+19.65)(non Bt y = -0.628x+19.35), minimum temperature (Bt y = -0.254x+5.677)(non Bt y = -0.256x+5.474) and morning humidity (Bt y = -0.320x+28.89)(non Bt y = -0.315x+28.23) (table 3) has negative impact on the population of aphid which showed that one unit increase in maximum temperature, minimum temperature and morning humidity there was 19.65, 5.67 and 28.89, and 19.35, 5.474 and 28.23 unit decrease in aphid population, respectively in *Bt* and non *Bt* cotton. Excluding these factors, other factors *i.e*. rainfall, wind velocity and rainy days did not exhibited any significant effect on the population of aphid in both cotton crops.

Table 3: Aphid populations in relation to weather factors in *Bt* and non *Bt* cotton

Weather parameters	*Bt*		Non *Bt*	
	R^2 value	Re. Equation.	R^2 value	Re. Equation
Temperature (c)				
Max	$R^2 = 0.217$	y = -0.630x + 19.65	$R^2 = 0.298$	y = -0.628x+ 19.35
Min	$R^2 = 0.236$	y = -0.254x + 5.677	$R^2 = 0.333$	y = -0.256x + 5.474
		Humidity (%)		
Morning	$R^2 = 0.258$	y = -0.320x + 28.89	$R^2 = 0.345$	y = -0.315x + 28.23
Rainfall (mm)	$R^2 = 0.035$	y = -0.009x + 2.113	$R^2 = 0.038$	y = -0.008x + 1.848
Wind velocity (k/h)	$R^2 = 0.037$	y = -0.223x + 2.779	$R^2 = 0.051$	y = -0.222x + 2.537
Rainy days	$R^2 = 0.060$	y = -0.587x + 2.434	$R^2 = 0.070$	y = -0.538x + 2.147

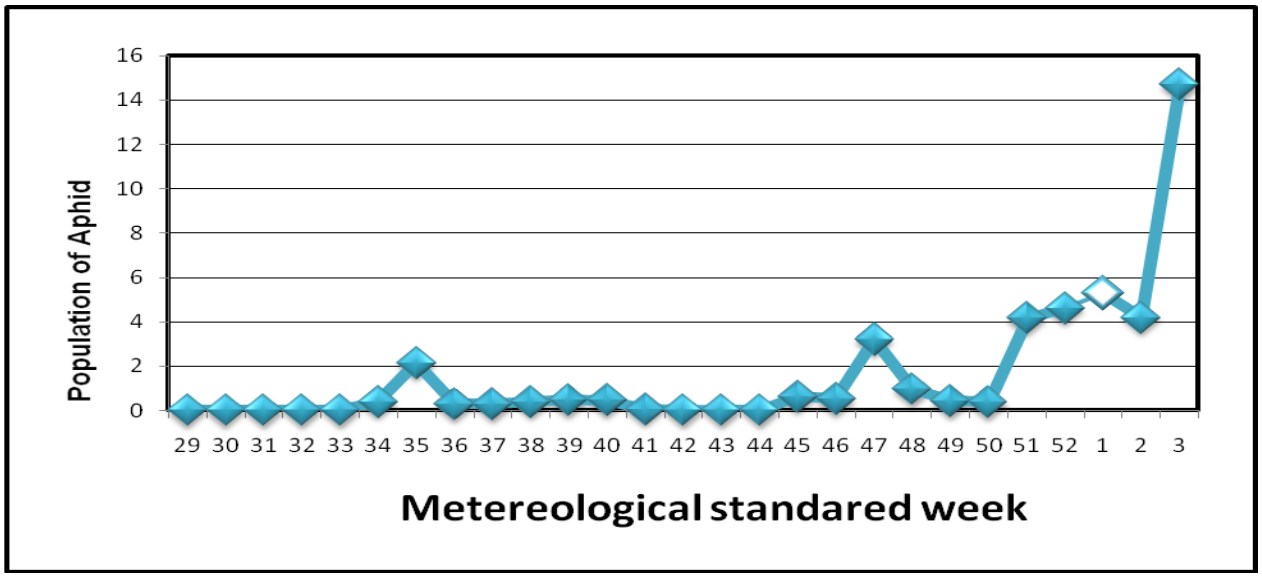

Fig. 2: Population dynamics of Aphid in non *Bt* cotton.

The present investigations is in partial agreement with Selvaraj *et al.* (2010) as they reported that the among the various abiotic factors evening relative humidity, sunshine hours and wind velocity were found to be most influencing factors, which contributed (R^2=0.8430) 80% variation in aphid population and also reported that the significant negative impact of evening relative humidity, sunshine hours and wind velocity on the population of aphid *i. e.* one unit increase in evening relative humidity, sunshine hours and wind velocity there will be 0.99, 0.29 and 1.53 unit decrease in aphid population. The contradiction in present investigation with findings of various workers might be due to variation in climatic conditions and date of sowing as reported by Shanthi *et al.* (2009). It may be concluded from the study that the climatic factors determine the seasonal activity and population dynamics of aphid (*Aphis gossypii* Glover) in *Bt* cotton and their corresponding non *Bt* cotton. The information generated in present study would be helpful in developing efficient pest management strategies against aphid in *Bt* and non *Bt* cotton crops for increasing production and profit, besides safety to the environment.

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