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Effect of weather parameters on incidence of whitefly, *Bemisia tabaci* (Gennadius) on tomato

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Abstract
Field trial was conducted to ascertain the population dynamics of *B. tabaci* on tomato crop variety Avinash 2 at Vegetable Research Farm of Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur), Bihar during *Rabi* season of 2016-17. Population count of the *B. tabaci* was made at five days interval from starting from 30 days after transplanting. Peak population (42.4 per three leaves) of whitefly was observed on 70th day after transplanting. Temperature (max. and min.) and sunshine (hrs) had a negative significant correlation, while morning and evening relative humidity had a positive significant correlation but wind speed had non- significant positive correlation. The correlation coefficient (r) was computed for max. temperature (-0.481), min. temperature (-0.483), morning relative humidity (0.514), evening relative humidity (0.483), wind speed (0.007) and sunshine hrs (-0.641), respectively. The weather parameters were found to contribute around 55.70 per cent impact on population of *Bemisia tabaci* when acted together ($R^2 = 0.5570$).

Keywords: tomato, whitefly, population

1. Introduction
Tomato, *Solanum lycopersicum* is an important and remunerative vegetable crop grown as commercial and kitchen garden in India. In India, tomato is grown across the length and breadth of the country [2]. In 2015-16 total area under cultivation is 7.74 lakh ha with annual production 188 lakh tonnes and productivity 24 tonnes per ha [20]. Both biotic and abiotic factors are responsible for low yield of tomato. The whitefly, *Bemisia tabaci* is one of the most economically important pests of tomato in many tropical and sub-tropical regions [4]. In warmer region, it is serious pest in open field vegetable production but crop grown under protected cultivation (polyhouse) are equally suffering from whitefly. In addition, it has recently become a serious pest of protected Horticulture in temperate regions [18]. Whitefly, *Bemisia tabaci* causes significant damage to crops through phloem feeding, induction of phytotoxic disorders, excretion of honeydew and most importantly, transmission of plant viruses [6, 7]. It can transmit more than 15 viruses that cause almost 40 plant diseases [16]. Among the viral diseases, tomato leaf curl virus (TLCV) has emerged as the most important geminiviral disease [10]. Weather parameters like temperature, reltive humidity, sunshine and rainfall were played limiting factors for the buildup of whitefly population [14]. On tomato crop contribution of maximum temperature, minimum temperature and relative humidity was 83 to 91, 75 to 85 and 78 to 85, respectively in whitefly population development [21]. On brinjal incidence of whitefly started from November (7.27 whitefly per three leaves) and reached to peak level (25.73 whitefly per three leaves) during January and both maximum and minimum temperature has highly negative influence on whitefly population [9]. Whitefly population has significant negative correlation with maximum and minimum temperature while positive correlation with relative humidity and rainfall [11]. Whitefly population was significantly and positively correlated with temperature [12]. The insect showed a negative correlation for wind speed [15] and positive for sunshine hrs [19]. The experiment was conducted to study the population dynamics of whitefly, *Bemisia tabaci* on tomato during crop season in relation to abiotic factors.

2. Materials and Methods
The present field experiment was conducted at Vegetable Research Farm of Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur), Bihar during *Rabi* season of 2016-17. Tomato variety 'Avinash - 2' seedling (25 days old) of 8-10 cm in length were transplanted

from nursery to the main field and crop was grown without application of any insecticide either in soil or as seed treatment. This was done to allow natural population of whitefly on crop. Meteorological observations with regard to ambient (maximum and minimum) temperature (ºC), per cent relative humidity (at 07 00 and 14 00 hrs), wind speed (km per hr) and sunshine hours prevailing at Vegetable Research Farm during the crop season i.e. October 2016 to January 2017 (*Rabi*) were recorded on daily basis in the observatory of the Department of Meteorology, DRPCAU Pusa. The observations on the population of whitefly were recorded at five days interval starting from thirty days after transplanting. The number of whitefly was counted on five randomly selected plants by observing three leaves (upper, middle and lower), randomly during early morning hours in each plot when it remains on leaves with the help of a hand lens of 10X magnification. Simultaneously, weather parameters viz; temperature, humidity, wind speed and sunshine hours were recorded during the entire period of experiment.Correlation of insect population with temperature (maximum and minimum), relative humidity, rainfall, wind speed and sunshine hours was worked out to find out relationship, if any, exits between them.

Results and Discussion

It was evident from the data presented in Table 1. that the whitefly population was present on the crop throughout the cropping period. Whitefly was initially observed on the crop 30 days after transplanting with population density of 1.4 per three leaves and increased with the advancement of crop growth and reached upto 41.6 per three leaves on 65th day after transplanting and the peak population (42.4 per three leaves) was observed on 70th day. After that population decreased continuously and lowest population (17 per three leaves) was observed at the end of cropping period. The present findings on the population fluctuation of whitefly, *Bemisia tabaci* on tomato are in agreement with the result that whitefly were present throughout the growing period in the tomato field [3]. It also found that population of whitefly gradually increased with environmental temperature and humidity upto a certain age of cultivated crop and then declined with increasing age of the crop [13]. The present results are also in conformity with the findings of other workers [1, 5]. The correlation analysis between weather parameters and the mean number of whitefly has been summarised in Table 2. The data revealed that all the weather parameters except wind speed highly influenced the

Table 1: Population dynamics of whitefly, *Bemisia tabaci* on tomato during crop season in relation to abiotic factors

Date of Observation	Temperature (ºC)		Relative Humidity (%)		Wind speed (km h^{-1})	Sunshine (hrs)	Population/3 leaves
	Max.	Min.	07 00 hrs	14 00 hrs			
28/10/2016	32.40	20.50	81.00	52.00	1.90	9.00	1.40
02/11/2016	32.00	19.60	85.00	41.00	2.30	9.10	3.40
07/11/2016	30.50	19.20	89.00	34.00	1.90	6.70	8.00
12/11/2016	31.10	17.00	77.00	42.00	1.30	8.00	14.80
17/11/2016	29.00	14.10	81.00	32.00	2.00	7.80	29.60
22/11/2016	28.00	13.80	87.00	54.00	1.70	5.70	33.80
27/11/2016	26.00	13.40	97.00	57.00	1.40	0.00	37.40
02/12/2016	28.00	15.50	88.00	56.00	1.00	2.10	41.60
07/12/2016	23.50	10.40	95.00	74.00	2.60	3.30	42.40
12/12/2016	16.80	10.50	93.00	70.00	3.40	0.00	37.20
17/12/2016	21.80	10.50	92.00	65.00	2.30	3.60	34.60
22/12/2016	23.80	10.06	90.00	54.00	1.40	0.00	30.40
27/12/2016	23.50	16.00	95.00	73.00	3.90	0.00	28.20
01/01/2017	19.50	12.20	93.00	75.00	3.20	1.10	25.00
06/01/2017	17.50	9.00	95.00	78.00	3.20	0.00	22.80
11/01/2017	23.50	10.00	90.00	53.00	2.60	1.80	18.20
16/01/2017	21.50	5.00	91.00	55.00	2.40	7.30	17.00

Whitefly population. The correlation coefficient (r) was computed as -0.481, -0.483, 0.514, 0.483, 0.007, -0.641 for max. temperature, min. temperature, morning relative humidity, evening relative humidity, wind speed and sunshine hours, respectively. The weather parameters were found to contribute around 55.70 per cent impact on population of *Bemisia tabaci* when acted together (R^2 = 0.5570).This finding is in partial agreement with the results that whitefly population has significant negative correlation with maximum and minimum temperature while positive correlation with relative humidity [11]. It was reported that negative correlation with both maximum and minimum temperature and wind speed while positive correlation with mean relative humidity [15]. It was aslo reported that a negative correlation between whitefly population and maximum (-0.375) and minimum temperatures (-0.552), sunshine hrs (-0.255) and relative humidity (-0.148) [17]. The present results are more or less in conformity with the findings of other workers [9, 12]. It was also reported that maximum temperature had a significantly positive effect and evening relative humidity had a significantly negative effect on whitefly population [8]. correlation, while morning and evening relative humidity had a positive correlation but wind speed had non – significant positive correlation.

Table 2: Correlation coefficient and regression equation between weather parameters (X) and mean number of *Bemisia tabaci* per three leaves (Y)

Weather parameters	Correlation coefficient (r)	Regression coefficient (b)
X_1 - Maximum Temperature (ºC)	-0.481 *	0.637
X_2 - Minimum Temperature (ºC)	-0.483 *	-1.061
X_3 - Relative Humidity 07 00 hrs (%)	0.514*	0.036
X_4 - Relative Humidity 14 00 hrs (%)	0.483*	0.291
X_5 -Wind Speed (km h^{-1})	0.007	-5.458
X_6 - Sunshine Hour (hrs)	-0.641**	-1.954

4. Conclusion

Population of whitefly, *Bemisia tabaci* with temperature (max. and min.) and sunshine (hrs) had a negative significant correlation, while morning and evening relative humidity had a positive correlation but wind speed had non – significant positive correlation.

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6. References

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