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INFLUENCE OF WEATHER FACTORS ON POPULATION DYNAMICS OF WHITEFLY, *BEMISIA TABACI* (GENNADIUS) IN FCV TOBACCO

V.VENKATESWARLU, B. SAILAJA JAYASEKHARAN, U. SREEDHAR, S. BHASKAR NAIK AND M. SHESHU MADHAV

ICAR- Central Tobacco Research Institute, Rajahmundry-533 105, Andhra Pradesh, India

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The study on population dynamics of whiteflies in FCV tobacco was conducted at ICAR-CTRI, Black soil research farm, Rajahmundry during *Rabi* 2018-19 and 2019-20. The population dynamics of whitefly was ascertained on tobacco under prevailing weather conditions. Correlation and regression analysis of pest population was conducted with prevailing weather factors. Coefficient of determination R^2 was found with a range of 4.00 to 41.56 and population of whitefly was found to be influenced up to 80 per cent by the simple and multiple regression models. Simple linear regression model revealed that morning relative humidity (RH_I) had a higher impact on incidence of whitefly. In the multiple linear regression models, the impact of weather factors on the whitefly population during 2018-19 was 64.28 percent and it was 17.95 per cent during 2019-20. It can be concluded that the prevailing weather factors influences whitefly population.

INTRODUCTION

Tobacco (*Nicotiana tabacum*) is one of the most popular and widely grown commercial crops of tropical and sub-tropical areas of the world. Green leaf is the economic product used for commercial purpose after flue curing.

In India tobacco is cultivated in about 0.45 million hectares with annual production of 761 million kg. It is cultivated in an area of 3.24 million hectares producing about 5886 million kg. China is the major producer of tobacco, followed by India and then Brazil (FAOSTAT, 2022).

One of the major constraints for attaining higher yields in solanaceous crops is the damage caused by sucking insect pests and viral diseases. Major sucking pests, which cause maximum crop yield losses in tobacco, are whiteflies and aphids. Whitefly is the key destructive pest in all the tobacco growing areas of the world accounting to yield losses of up to 20-40% in India. (Rao and Chari, 1992).

The cotton whitefly, *Bemisia tabaci* (Gennadius) (Hemiptera: Aleyrodidae) is an important sucking pest of tobacco, cotton, tomato, brinjal and okra. It was first observed in the early 1930s in India, which causes heavy losses during certain years (Janu and Dahiya, 2017). Whiteflies cause damage usually by three ways: (a) Direct feeding leads to decrease in the vigor and vitality of the plants (b) As a vector it transmits the leaf curl virus causing significant yield losses especially in the early stages of crop growth and (c) Honeydew excreted by the whiteflies promotes growth of sooty mold which interferes with photosynthesis reducing the quality and market value of leaf. There has been a considerable change in the scenario of whitefly infestation in Southern India due to increase in area under vegetable crops and other commercial crops. The cotton whitefly acts as vector for *Leaf curl virus* (LCV) which results in stunted plant growth coupled with twisted and puckered leaves, thereby drastic reduction of yield of tobacco. There is a need to develop an effective pest management program suitable to each agro ecological region, where abiotic factors, play major role in the multiplication and abundance of insect pests. Keeping this in view, an experiment was conducted to study the population dynamics of whiteflies of tobacco and their relationship with weather factors. This will help to develop efficient IPM strategies for whiteflies in tobacco.

Keywords: FCV Tobacco, Correlation, Regression, Abiotic factors, Whitefly

The cotton whitefly, *Bemisia tabaci* is one of the major pests causing extensive damage in Virginia tobacco (Rao *et al.*, 1992).

MATERIALS AND METHODS

Seasonal incidence of whitefly in tobacco crop (FCV variety *Siri*) was carried out at BSR Farm, Katheru of ICAR-CTRI, Rajahmundry during *Rabi* season of 2018-19 and 2019-20. Recommended agronomic practices were followed throughout the season and crop protection measures against sucking pests were not taken up in the respective plots during the crop seasons. The whitefly population was recorded from ten plants/ plot at weekly intervals from the planting till the harvest. Data on weather factors like maximum temperature (T_{Max}), minimum temperature (T_{Min}), morning relative humidity (RH_I) and evening relative humidity (RH_{II}) were collected from the meteorological observatory at the farm. Two season's weather data was subjected to correlation and regression analysis to know the relationship between whitefly incidence and weather parameters.

RESULTS AND DISCUSSION

The incidence of whiteflies was observed during 2nd and 4th standard weeks of 2018-19 and 2019-20 respectively and the population of whiteflies reached a peak of 16.2 per plant during 9th standard week during 2018-19, while acquired its peak incidence of 10.8 per plant in 10th standard week during 2019-20. On the whole crop season, the population of whiteflies was very low during initial periods of crop growth and gradually increased as crop stage advanced.

The results showed in Table 1 revealed that maximum temperature (r = 0.412), minimum temperature (r = 0.636), morning relative humidity (r = 0.501) and evening relative humidity (r = 0.644) had significant positive influence on whiteflies during 2018-19. Whiteflies had significant positive relation with maximum temperature (r = 0.420) and minimum temperature (r = 0.323), whereas morning relative humidity (r = -0.100) and evening relative humidity (r = -0.201) had significant negative influence during 2019-20.

The fluctuation in the whitefly population due to weather factors was studied and the partial regression coefficients of pest population on weather parameters were computed taking the whitefly population as the dependent variable and all weather factors (maximum and minimum temperature, morning and evening relative humidity) as independent variables. Correlation studies revealed that all factors showed non-significant correlation with whitefly population.

The present findings are in conformity with the findings of Biswas and Patel (2015) who reported that the peak period for whitefly incidence was 6th SMW (1st week of February) and persisted

Table 1: Correlation of whiteflies with weather parameters during 2018-19 and 2019-20

	T max	*T min*	*RH_I*	*RH_{II}*	*Whiteflies*
T max	1				
T min	0.794	1			
RH_I	0.270	0.391	1		
RH_{II}	-0.031	0.287	0.544	1	
Whiteflies	0.412*	0.636*	0.501*	0.644*	1
	T max	*T min*	*RH_I*	*RH_{II}*	*Whiteflies*
T max	1				
T min	0.748	1			
RH_I	-0.135	0.029	1		
RH_{II}	-0.550	-0.326	0.054	1	
Whiteflies	0.420*	0.323*	-0.100*	-0.201*	1

up to 11th SMW (2nd week of March). Sirothiya *et al.* (2011) observed that the whitefly infestation increased from last week of January with an average population of 2.4/ plant and the population gradually increased up to 2nd week of February with 12.8 whiteflies/ plant. The highest population incidence (13.8/ plant) was observed during the 4th week of March. Present findings are in accordance with those of Kumar *et al.* (2019) and Chavan *et al.* (2013) who corroborated that whitefly population commenced three weeks after transplanting and reached peak during 2nd week of March. Whitefly population dynamics reports of Chaudhuri *et al.* (2001) and Lin *et al.* (2007) also support the results of the present study.

Reddy and Kumar (2004) recorded highest whitefly population during November and December. Mandloi *et al.* (2015) reported that *B. tabaci* was an important sucking pest of tomato for the entire duration of crop growing period. However Meena and Bairwa (2014) reported that the initial incidence of *B. tabaci* was observed on tomato crop from seven days after transplanting i.e. 10th standard week till maturity of the crop with a decline at 15th standard week.

Selvaraj and Ramesh (2012) reported that whitefly population showed a positive correlation with maximum and minimum temperature, and negative association with evening relative humidity. The present findings are corroborated by Khan *et al.* (2006) that minimum temperature & relative humidity showed significant positive correlation with whitefly population. The present findings also in accordance with Berragini *et al.* (2015) that there was a significant positive correlation of whitefly population with morning and evening relative humidity during *rabi* season.

During 2018-19, simple regression analysis (Table 2) showed that evening relative humidity exerted 41.00 per cent influence on the whitefly population variation, followed by minimum temperature (40.45 per cent). Similarly, in 2019-20, by evening relative humidity (4 per cent), maximum temperature (17 per cent), and minimum temperature (10 per cent). The cumulative influence of all the weather factors on the whitefly population was up to 64.28 percent during the 2018-19 and up to 17.95 percent during 2019-20. The influence of weather factors on population of whiteflies in tobacco were shown in the Table 3. The results revealed that only morning relative humidity was the most important factor which contributed 41.56 percent and maximum temperature contributed 17.56 per cent during 2018-19 and 2019-20.

Table 2: Simple regression models of individual weather factors with whitefly population dynamics

Year	Regression Equation	R^2
2018-19	Y= -21.44+0.784 Tmax	0.17
	Y= -19.56 +1.185 T min	0.40
	Y= -48.19+0.574 RH_I	0.25
	Y=-34.75+0.584 RH_{II}	0.41
2019-20	Y= -33.65 +1.140 Tmax	0.17
	Y= -14.95 +0.84 T min	0.10
	Y= -13.28-0.127 RH_I	0.10
	Y=-29.30- 0.378 RH_{II}	0.04

Table 3: Multiple regression models of cumulative weather factors on whitefly population dynamics

Year	Regression Equation	R^2
2018-19	Y= -52.89+0.22+0.701+0.058+0.462	0.64
2019-20	Y= -33.83+1.117+0.69-0.055+0.059	0.17

The results are in conformity with Rao *et al.* (1992) who reported that the minimum temperature exerted influence of 11.3 per cent on whitefly population. The cumulative influence of all the weather factors was up to 60.26 per cent on the whitefly population variation. Thus, various meteorological parameters had a profound influence on the incidence and population buildup of whiteflies in tobacco and have a greater role in pest forecasting.

Latif *et al.* (2009) recorded the whitefly incidence on brinjal plant during the 51st standard week with peak population of 7.90 whiteflies/plant. Hilje *et al.* (1993) reported that whitefly, *Bemisia tabaci* was first noticed on green chilli crop at 26 days after transplanting and it was observed till the maturity. *Bemisia tabaci* mostly prefers chilli crop as a host for reproduction.

In their findings, Berragini *et al.* (2015) remarked that whitefly population started increasing from 1st standard week and reached its peak during 11th standard week (8.90 adult whiteflies/ plant) in mungbean. Mane and Kulkarni (2011) reported that temperature, relative humidity and number of rainy days showed positive correlation with whitefly population in brinjal. The present results are similar to the findings of Khalid *et al.* (2009). The correlation study between whiteflies, mean temperature and relative humidity were positive and non-significant (Farman *et al.*, 2004).

The present results on the population fluctuation of whitefly, *Bemisia tabaci* in tobacco are in agreement with Arnal (2009) who reported that whitefly population gradually increased with environmental temperature and humidity in cultivated crop and then declined with increasing age of the crop (Latif & Akhtar, 2013). The present results are also in conformity with the findings of other workers (Acharya & Singh, 2007 and Chaudhary & Gaur, 2009).

Naik *et al.* (2009) reported that there was no significant increase in whitefly population with abiotic factors in Brinjal and that the peak period for whitefly incidence was 3rd week of February. In their study, wind velocity, morning and evening vapour pressure showed a significant positive correlation with whitefly population and other abiotic factors were non-significant.

It is concluded that monitoring of pests is a key step in Integrated Pest Management programme. The population dynamics of whiteflies in tobacco during the two consecutive season's revealed significance of weather factors in population buildup. Cultivation of susceptible plant varieties and change in cropping systems also has profound impact on pest abundance. Hence whitefly seasonal incidence information helps in planning, monitoring and implementation of effective strategies for timely management of whiteflies.

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