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Population Dynamics of Thrips Infesting *Bt* Cotton in Relation to Weather Factors

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Abstract

Population dynamics of thrips, *Thrips tabaci* Lindemann and their correlation with weather factors were investigated during 2017 to 2019 at ICAR-Central Institute for Cotton Research, Tamil Nadu. The incidence of thrips was recorded from the 39th SMW (Standard Meteorological Week) and peaked at 43rd SMW with the range of 0.7 to 14.7 thrips leaf^{-1} in 1st season (*Kharif* 2017-18). At the second season (*Summer* 2018), thrips incidence occurred at the 10th SMW and thrips population peaked in the 14th SMW and varied between 1.5 and 15.8 thrips leaf^{-1}. Thrips incidence started during the 39th SMW during the third season (*Kharif* 2018–19). The thrips population peaked in the 42nd SMW, ranging from 1.4 to 11.2 thrips leaf^{-1}. After reaching its peak, thrips population was constantly decreased. Correlation matrix revealed that thrips population correlated positively with minimum temperature, maximum temperature and relative humidity although there was a negative association with rainfall. These findings will be useful for evolving appropriate management practices for thrips.

Keywords: Cotton, Population dynamics, Thrips, Weather factors

Introduction

The important commercial crop cotton (*Gossypium* spp.) is susceptible to a number of insect pests and is grown in a variety of agro climatic situations around the world. The problem of the bollworm complex was successfully addressed in India by the introduction of transgenic Bt cotton, which also reduced the usage of insecticides that likely caused severe sucking pest outbreaks and significant production losses in both traditional and Bt cotton (Zala *et al.,* 2014). Thrips, *Thrips tabaci* Lindemann is one of the major insect infesting cotton among the different sap feeding insect pests, and responsible for considerable yield loss in cotton. The development and seasonal incidence of thrips were found to have positive associations with weather conditions (Soni and Dhakad, 2016). Studies on the role of various abiotic factors are of prime importance as they have a profound impact on the survival, development and population build-up of insect pests. Studies on population dynamics of thrips helps in developing effective management strategies in cotton agro ecosystem. Thus, the current investigation on cotton thrips population dynamics was carried out in *Kharif* and *Summer* seasons of 2017 to 2019 to fulfill the objectives.

Materials and Methods

A field trial was conducted under irrigated condition at farm of Central Institute for Cotton Research, Regional Station, Coimbatore, Tamil Nadu during the *Kharif* season (August to February) of 2017-18 and 2018-19 and *Summer* season (2018). MECH 162 Bt hybrid was used in the study. Experiment assessed in a Randomized Block Design with four replications. The observations on population of cotton thrips were taken from ten randomly selected plants per replication on three leaves, one each from top, middle and bottom. Weekly observations were made starting after one month. To study the impact of different abiotic factors (*i.e.*, Maximum Temperature (T °C), Minimum Temperature (T

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°C), Morning and Evening Relative Humidity (%) and Rainfall (mm) on pest incidence, a simple correlation between pest population and weather parameters was worked out.

Results and Discussion

In the present investigation, during the *Kharif* season of 2017-18, it was observed that the incidence of thrips was commenced from 3rd week of October *i.e.,* 43rd Standard Meteorological Week (SMW) and continued till second week of February (7th SMW) which ranged from 0.7 to 14.7 (thrips leaf^{-1}). At 43rd SMW, maximum population of 14.7 thrips leaf^{1} was recorded. In subsequent weeks, the incidence was decreased and reached to 0.7 thrips leaf^{-1} during 7th SMW. Starting from germination of the crop, pest showed continuous increasing trend and after reaching its first peak, thrips were continuously decreased.

During the *Summer* season of 2018, the infestation of thrips was started from second week of March (10th SMW) and showed its peak (15.7 thrips leaf^{-1}) during first week of April (14th SMW). After this week, non-significant populations were recorded.

In *Kharif* season of 2018-19, the thrips population commenced at last week of September (39th SMW). The thrips population ranged from 1.2 to 11.2 thrips leaf^{-1}. A maximum population of 11.2 thrips leaf^{-1} was recorded in the second week of October (42nd SMW), while a minimum population of 1.2 thrips leaf^{-1} was recorded in the last week of January (4th SMW). The population of *T. tabaci* was fluctuated during the crop period during all the three seasons (Table 1).

Table 1: Population of thrips during different seasons

Kharif			*Summer*	
Standard Meteorological Week	No. of thrips leaf^{-1}		Standard Meteorological Week	No. of thrips leaf^{-1}
	2017-18	2018-19		2018
39	10.4	10.40	10	12.5
40	11.3	8.90	11	10.6
41	12.5	10.30	12	13.2
42	13.2	11.20	13	12.8
43	14.7	9.40	14	15.7
44	12.8	10.60	15	11.5
45	10.7	9.20	16	12.4
46	11.6	8.10	17	13.5
47	10.2	7.80	18	11.3
48	9.5	6.50	19	10.8
49	8.7	6.10	20	12.9
50	9.1	5.30	21	9.8
51	7.6	2.30	22	8.6
52	5.8	3.80	23	8.1
1	4.6	2.20	24	6.2
2	4.1	1.90	25	5.7
3	2.8	1.50	26	8.4
4	2	1.20	27	5.2
5	1.4	1.30	28	3.8
6	1.9	1.50	29	2.7
7	0.7	1.40	30	1.5

The pooled analysis of both the years (2017-18 and 2018-19), of *Kharif* season, peak incidence of thrips was observed during the standard week of 42 and 44. The occurrence of thrips started from the month of September and attains its peak during the month of October and declines after that (Figure 1).

The results of Babu and Meghwal (2014), reported that the highest thrips population was observed between the 39 and 41 SMW, are nearly in accordance to that of our current study. According to Bhute *et al*. (2012), thrips were active from the 32nd to the 52nd SMW and peaked at the 40th SMW. The present findings are varying with different reports. This might be due to location and weather parameters.

The data showed in the table 2 revealed that during 2017-18, thrips population and minimum temperature and relative humidity showed a significant positive correlation (r = 0.728* and 0.661*). Investigated the correlation between thrips population and environmental parameter during 2018

Table 2: Correlation of weather factors and thrips population

Year	Minimum Temperature	Maximum Temperature	Relative Humidity (Morning)	Relative Humidity (Evening)	Rainfall
2017-18	0.036	0.728*	-0.147	0.661*	-0.470
2018	0.584	0.795*	0.581**	0.827**	0.694
2018-19	-0.164*	0.591*	0.564**	0.756*	-0.454

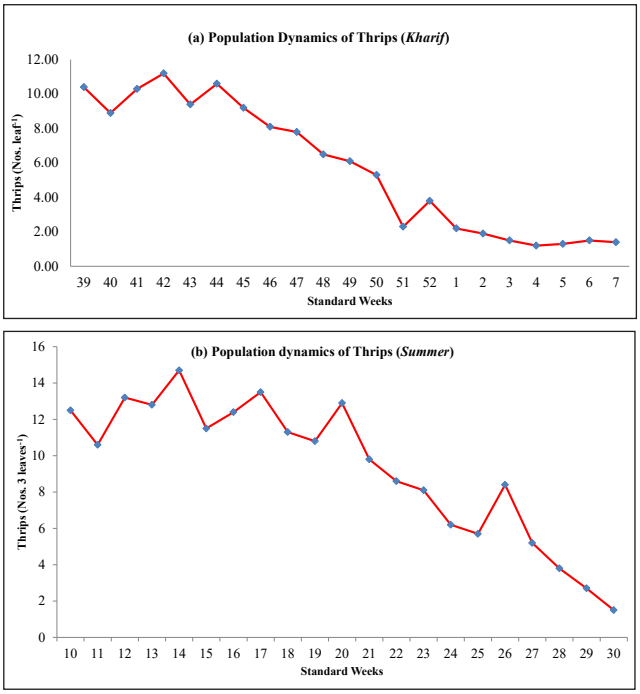

Figure 1: Mean population dynamics of thrips during *Kharif* and *Summer*

(*Summer*) revealed that the thrips population significantly correlated positively with both the maximum temperature and relative humidity. On the other hand non-significant positive correlation found between thrips population with maximum temperature and rainfall. During 2018-19 *Kharif*, population and minimum temperature had a significant negative correlation (r = -164*). Population correlation with maximum temperature, morning relative humidity, and evening relative humidity were r = 0.591*, 0.564** and 0.756*, respectively. This suggests that thrips population activity increases with high temperatures and high relative humidity and decreases with rainfall.

These results are consistent with Selvaraj and Adiroubane (2012) observation that temperature and relative humidity were positively correlated with thrips population. The current results supported Gupta *et al*. (1997), who found a positive correlation between temperature and relative humidity and the population of thrips. Khan *et al*. (2008) reported the findings that weather factors such mean air temperature, relative humidity, and rainfall had a significant impact on the occurrence of thrips. They revealed that temperature and relative humidity played a significant and positive role for thrips population development. Akram *et al*. (2013) reported positive association between thrips population and maximum and minimum temperature. Asif *et al.* (2020) revealed that population of thrips correlated positively with minimum temperature, maximum temperature. There was a significant positive correlation between thrips and morning relative humidity, rainfall and evening relative humidity (Patel, 2020).

Conclusion

The seasonal activity and population dynamics of thrips in cotton were determined by climatic conditions. The information gathered in the current study will be useful for developing effective pest management techniques.

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