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Population Dynamics of Thrips, *Thrips tabaci* Lindemann in American Cotton (*Gossypium hirsutum*)

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A B S T R A C T

The population dynamics of thrips, *Thrips tabaci* Lindemann along with their correlation with abiotic factors were studied during 2014 and 2015 at the Cotton Research Area, CCS Haryana Agricultural University, Hisar. During the 1st season, the incidence of thrips was recorded from the 27th SMW (standard meteorological week) onwards and reached to its peak at 33rd SMW with the range of 12.89 to 58.27 thrips/leaf. The maximum and minimum mean thrips population was recorded in RCH 314 BGII (16.13thrips/leaf) and H 1226 (3.52thrips/leaf) genotype, respectively. During the 2nd season the incidence of thrips was commenced at 25th SMW. The peak of the thrips population reached in 31st SMW and it ranged from 14.68 to 36.85 thrips/leaf. The minimum mean thrips population of 4.64 nymphs/leaf was recorded in the H 1226 genotype whereas RCH 314 BGII had the maximum mean thrips population of 13.02 nymphs/leaf. Correlation studies revealed that during 1st season all the weather parameters were non-significantly correlated with the thrips population whereas, during 2nd season maximum temperature correlated significantly negative with thrips population while minimum temperature, morning and evening relative humidity correlated significantly positive.

Introduction

Cotton is important commercial crop grown under diverse agro-climatic conditions around the world and vulnerable to attacked from several insect pests. In India with the introduction and successful implementation of transgenic *Bt* cotton not only solved the problem of bollworm complex but also cut down the number of insecticidal spray which probably leads sever incidence of sucking pest and occupied major pest status and cause considerable damage in traditional and *Bt* cotton in India at present (Zala *et al.*, 2014). Sap feeders have been reported to cause loss in yield to the extent of 8.45 q/ha in *hirsutum* cotton (Radhika *et al.*, 2006). Among the various sap feeding insect pests, thrips, *Thrips tabaci* Lindemann is major factor limiting profitable cultivation of cotton. A common sign of a heavy thrips infestation is the distorted leaves that have turned brownish around the edges and cup upward. Thrips also found on underside of the leaves damaging them by piercing the epidermis of the tissues and sucking the sap oozing out of wounds (Sanjta and Chauhan, 2015). As a result, leaves became slivery due to formation of white patches or streaks which finally caused scarring and distortion of leaves (Patel and

Patel, 2014). Different weather factors found to have positive association with thrips population (Soni and Dhakad, 2016) for their development and seasonal incidence. The knowledge about incidence of pest during cropping season and its possible dynamics helps in designing pest management strategies hence present study on population dynamics of cotton thrips was undertaken during *Kharif* seasons of 2014 and 2015 to fulfil objectives.

Materials and Methods

The field experiment were conducted during Kharif 2014 and 2015 at Cotton Research field area, CCS Haryana Agricultural University, Hisar in unprotected with three replicated. The plot having 5 rows of 5 m each for each treatment. The seeds of 23 genotypes were sown at 2 seeds/hill on 18th May, 2014 and 16th May, 2015 by hand dibbling method. Gap filling was done within 5-7 days after emergence of the crop and thinning was done at 15 days after emergence of the crop, keeping one healthy seedling/hill.

The observations on population of thrips (nymph and adult) were recorded at weekly interval from 23rd to 41st SMW on three leaves (each from top, middle and bottom) at five randomly selected plants from each replication (Zala *et al.,* 2014). The data pertaining to seasonal incidence of thrips of cotton crop were compared with various environmental factors. The relation between weather parameters and thrips of cotton was studied and simple correlation was worked out.

Results and Discussion

Population dynamics of *Thrips tabaci* on cotton during *Kharif* 2014

The population of thrips commenced at 27th SMW (Fig. 1). At 27th SMW, maximum thrips population was recorded on RCH 314 BGII (14.33 thrips/leaf) and it were statistically on par with KCH 14 K 59 BGII (8.89 thrips/leaf), Western Niroga 151 BGII (11.44 thrips/leaf), GBCH 85 BGII (11.44 thrips/leaf) and S 07 H 878 BGII (12.67 thrips/leaf). Minimum thrips population were recorded on RCH 653 BGII and VICH 310 BT II (1.67 thrips/leaf) and it were statistically on par with HHH 223 (2.22 thrips/leaf), H 1226 (2.22 thrips/leaf), PRCH 333 BGII (2.22 thrips/leaf), KSCH 210 BGII (2.56 thrips/leaf), Bioseed 6588 BGII (3.22 thrips/leaf), PCH 876 BT (3.33 thrips/leaf), SP 7007 BGII (3.44 thrips/leaf), SP 7010 (3.44 thrips/leaf), PCH 877 BGII (3.67 thrips/leaf) and SP 7171 BGII (4.67 thrips/leaf). Standard meteorological week 27th onwards, increasing trend in thrips population were observed and reached to its peak at 33rd SMW (Fig. 1) with the range of 12.89 to 58.27 thrips/leaf. Genotype RCH 314 BGII were recorded with maximum population of 58.27 thrips/leaf and it were statistically on par with Western Niroga 151 BGII (49.84 thrips/leaf) and S 07 H 878 BGII (51.49 thrips/leaf) while minimum were 12.89 thrips/leaf on genotype H 1226 and it were statistically on par with HHH 223 (14.00 thrips/leaf), RCH 653 BGII (16.16 thrips/leaf), PCH 876 BT (17.43 thrips/leaf), SP 7010 (18.00 thrips/leaf) and PRCH 333 BGII (18.57 thrips/leaf). After 33rd SMW, population started declining till 41st SMW. At 41st SMW, maximum population of 1.44 thrips/leaf were observed on RCH 314 BGII and it were statistically on par with Western Niroga 151 BGII (1.23 thrips/leaf) and S 07 H 878 BGII (1.27 thrips/leaf). Minimum population of thrips were observed on H 1226 (0.32 thrips/leaf) and it were statistically on par with HHH 223 (0.34 thrips/leaf), RCH 653 BGII (0.40 thrips/leaf), PCH 876 BT (0.43 thrips/leaf), SP 7010 (0.44 thrips/leaf), PRCH 333 BGII (0.46 thrips/leaf) and PCH 877 BGII (0.47 thrips/leaf). Mean population

of thrips were recorded on different genotypes of cotton and it ranged from 3.52 to 16.13 thrips/leaf (Table 1). Maximum population was recorded on RCH 314 BGII (16.13 thrips/leaf) while, minimum was on H 1226 (3.52 thrips/leaf) and it was statistically on par with HHH 223 (3.77thrips/leaf).

Population dynamics of *T. tabaci* on cotton during *Kharif* 2015

The thrips population commenced at 25th SMW is presented in figure 2. The significant difference among the thrips population was observed at 26th SMW and it ranged from 0.11 to 2.22 thrips/leaf. Maximum population was 2.22 thrips/leaf on S 07 H 878 BGII and it were statistically on par with RCH 314 BGII (1.22 thrips/leaf) and Western Niroga 151 BGII (1.33 thrips/leaf). Minimum population were 0.11 thrips/leaf on HHH 223, RCH 653 BGII, SP 7010, PRCH 333 BGII and PCH 406 BT and these were statistically on par with rest of the genotypes. Peak population reached in 31st SMW (Fig. 2) and it ranged from 14.68 to 36.85 thrips/leaf. Genotype RCH 314 BGII (36.85 thrips/leaf) was recorded with maximum population and it was statistically on par with S 07 H 878 BGII (33.78 thrips/leaf) while, minimum was on HHH 223 (14.68 thrips/leaf) and it were statistically on par with H 1226 (14.86 thrips/leaf), RCH 653 BGII (15.59 thrips/leaf), PRCH 333 BGII (16.44 thrips/leaf), SP 7010 (16.51 thrips/leaf) and PCH 876 BT (16.98 thrips/leaf). After 31st, the thrips population went to decline till 41st SMW.

At 41st, non-significant population were recorded among the different genotypes. Mean population of thrips were recorded on different genotypes of cotton and it ranged from 4.64 to 13.02 thrips/leaf (Table 1). Minimum population was recorded on H 1226 (4.64 thrips/leaf) and it was statistically on par with HHH 223 (4.71 thrips/leaf) while, Maximum were on RCH 314 BGII (13.02 thrips/leaf).

Population dynamics of *T. tabaci* on cotton during both seasons (2014 and 2015)

During pooled analysis of both the years (2014 and 2015), the population of thrips commenced at 25th SMW is presented in figure 3. The significant difference was observed among the population of thrips on different genotypes of cotton at 26th SMW. Maximum population were recorded on genotype S 07 H 878 BGII (1.11 thrips/leaf) followed by SP 7007 BGII (0.56 thrips/leaf) and RCH 314 BGII (0.61 thrips/leaf). Minimum population were recorded on HHH 223, RCH 653 BGII, SP 7010, PRCH 333 BGII and PCH 406 BT (0.06 thrips/leaf) and it were statistically on par with H 1226 (0.07 thrips/leaf), PCH 876 BT (0.11 thrips/leaf), SP 7171 BGII (0.11 thrips/leaf), KDCHH 541 BGII (0.11 thrips/leaf), BIOSEED 6588 BGII (0.11 thrips/leaf), KSCH 210 BGII (0.11 thrips/leaf) and KSCH 209 BGII (0.16 thrips/leaf). Standard meteorological week 26th onwards population of thrips started increasing and reached to its peak at 33rd SMW (Fig. 3). At peak, population ranged from 11.12 to 41.57 thrips/leaf. Maximum population was recorded on RCH 314 BGII (41.57 thrips/leaf) and it were statistically on par with KCH 14 K 59 BGII (33.49 thrips/leaf), GBCH 85 BGII (34.02 thrips/leaf), Western Niroga 151 BGII (35.42 thrips/leaf) and S 07 H 878 BGII (37.14 thrips/leaf). Genotype H 1226 (11.12 thrips/leaf) was recorded with minimum population of thrips and it were statistically on par with HHH 223 (11.99 thrips/leaf), RCH 653 BGII (13.33 thrips/leaf), PCH 876 BT (14.40 thrips/leaf), SP 7010 (14.65 thrips/leaf), PRCH 333 BGII (14.87 thrips/leaf), PCH 877 BGII (15.73 thrips/leaf), Bioseed6588 BGII (16.35 thrips/leaf), VICH 310 BTII (16.64 thrips/leaf), KSCH 210 BGII (17.12

thrips/leaf) and SP 7007 BGII (18.39 thrips/leaf). After 33rd SMW, thrips population started declining and last observation was recorded on 41st SMW before picking. Maximum thrips population was recorded on RCH 314 BGII (1.16 thrips/leaf) and it were statistically on par with KCH 14 K 59 BGII (0.90 thrips/leaf), GBCH 85 BGII (0.95 thrips/leaf), Western Niroga 151 BGII (0.99 thrips/leaf) and S 07 H 878 BGII (1.00 thrips/leaf). Mean population of thrips were recorded on different genotypes of cotton and it ranged from 4.08 to 14.58 thrips/leaf (Table 1). Maximum thrips population were recorded on RCH 314 BGII (14.58 thrips/leaf) while, minimum were on H 1226 (4.08 thrips/leaf).

Table.1 Average population of thrips (*Thrips tabaci*) on American cotton genotypes

S. No.	Genotypes	Thrips/leaf		
		2014	2015	Pooled
1	SP 7010	4.93 (2.44)	5.34 (2.52)	5.14 (2.48)
2	PRCH 333 BGII	4.94 (2.44)	5.59 (2.57)	5.26 (2.50)
3	VICH 310 BT II	5.16 (2.48)	5.74 (2.60)	5.45 (2.54)
4	GBCH 85 BG II	12.88 (3.73)	10.38 (3.37)	11.63 (3.55)
5	KSCH 210 BG II	5.68 (2.58)	6.04 (2.65)	5.86 (2.62)
6	S 07 H 878 BG II	14.26 (3.91)	11.78 (3.57)	13.02 (3.74)
7	SP 7007 BGII	5.99 (2.64)	7.16 (2.86)	6.57 (2.75)
8	KSCH 209 BG II	11.14 (3.48)	8.92 (3.15)	10.03 (3.32)
9	KSCH 541 BGII	7.48 (2.91)	7.49 (2.91)	7.48 (2.91)
10	KDCHH 541 BGII	8.75 (3.12)	8.26 (3.04)	8.50 (3.08)
11	PCH 876 BT	4.78 (2.40)	5.19 (2.49)	4.98 (2.45)
12	PCH 406 BT	8.15 (3.02)	8.18 (3.03)	8.16 (3.03)
13	KCH 14 K 59 BG II	12.73 (3.71)	10.06 (3.33)	11.40 (3.52)
14	NCS 9002 BG II	7.64 (2.94)	7.81 (2.97)	7.72 (2.95)
15	PCH 877 BG II	5.25 (2.50)	5.80 (2.61)	5.52 (2.55)
16	WESTERN NIROGA 151 BG II	13.76 (3.84)	10.82 (3.44)	12.29 (3.65)
17	ANK 3028 BG II	7.48 (2.91)	7.79 (2.96)	7.63 (2.94)
18	SP 7171 BG II	6.68 (2.77)	7.27 (2.88)	6.97 (2.82)
19	RCH 653 BG II	4.20 (2.28)	4.95 (2.44)	4.58 (2.36)
20	BIOSEED 6588 BG II	5.60 (2.57)	5.84 (2.62)	5.72 (2.59)
21	RCH 314 BG II	16.13 (4.14)	13.02 (3.74)	14.58 (3.95)
22	HHH 223	3.77 (2.18)	4.71 (2.39)	4.24 (2.29)
23	H 1226	3.52 (2.13)	4.64 (2.37)	4.08 (2.25)
	C.D.	(0.25)	(0.18)	(0.20)
	SE(m)	(0.09)	(0.06)	(0.07)

Figures in parentheses are $\sqrt{X+1}$ transformed values

Table.2 Correlation of thrips population with weather parameter

Pest	Thrips		
	2014	2015	Pooled
Temperature (maximum)	-0.244	-0.593**	-0.493*
Temperature (minimum)	0.409	0.543*	0.529*
RH (morning)	0.268	0.673**	0.585*
RH (evening)	0.412	0.677**	0.745**
Rainfall	-0.176	-0.079	-0.129
Wind Speed	0.121	0.367	0.247
Sunshine hours	0.235	-0.442	-0.565

*Significant at 5%, **Significant at 1%

Fig.1 Population dynamic of thrips in relation to weather parameters 2014

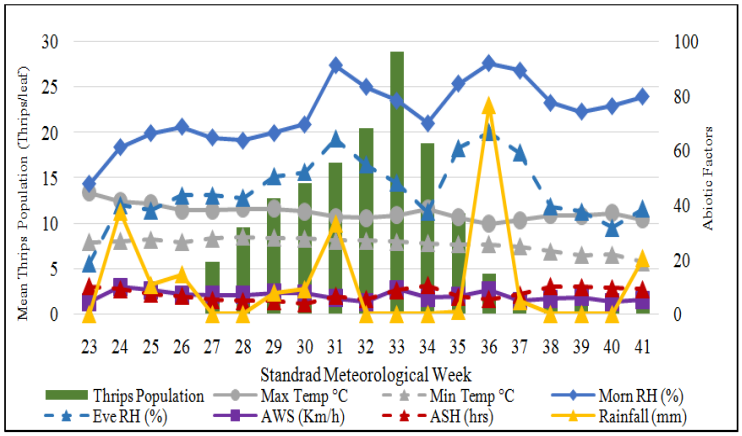


Fig.2 Population dynamic of thrips in relation to weather parameters 2015

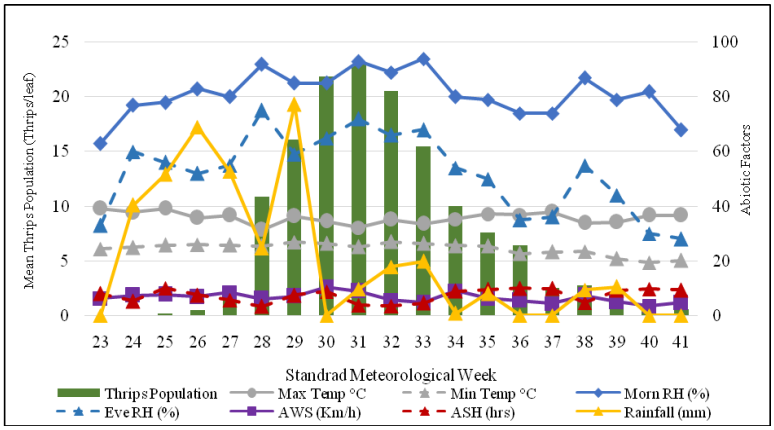
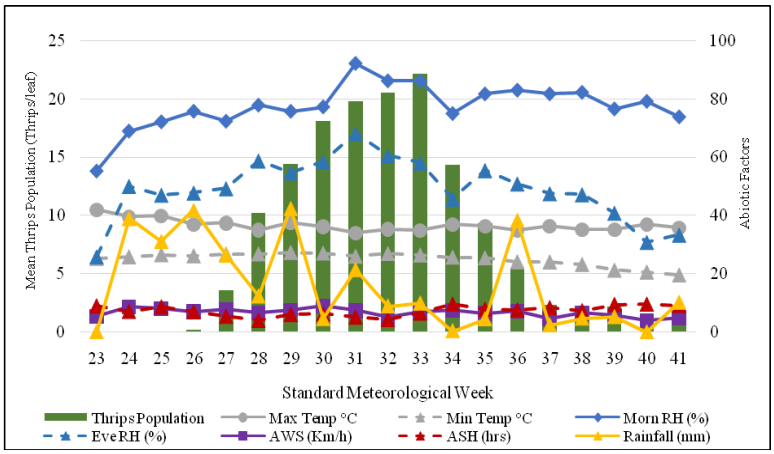


Fig.3 Population dynamic of thrips in relation to pooled weather parameters



The present findings are in agreement with Kengegowda *et al.*, (2005) who reported incidence of thrips started in the month of August. Roomi (2015) reported that the peak incidence was observed at 33rd SMW at Hisar. Bhute *et al.*, (2012) conducted the experiment

at Parbhani (MH) during 2007-08 and observed that thrips remained active from 32nd to 52nd SMW and reached to its peak at 40th SMW with 110.10 thrips/3 leaves. Similar results were attained by Arshad and Suhail (2010) who reported that the thrips attained its peak during third week of August. Prasad and Rao (2008) reported that incidence started in month of June and remained active upto 52nd SMW. The findings of Babu and Meghwal (2014) are not in conformity with our present study and they reported that the maximum thrips population was observed during the 39-41 SMW.

Correlation with the weather parameters and *T. thrips* during 2014

Non-significant correlations were recorded between thrips population and weather parameters are presented in table 2.

Correlation with the weather parameters and *T. thrips* during 2015

The data showed in the table 2 presented the correlation coefficient between the thrips populations with weather parameters. Maximum temperature correlated significantly negative with population and it were r= -593**. The correlation coefficient of population with minimum temperature, morning and evening relative humidity were r= 0.543*, 0.673** and 0.677**, respectively.

Correlation with the weather parameters and *T. thrips* during both seasons

During pooled analysis of both the years (2014 and 2015), similar trend were followed as in *kharif* 2015, significant and negative correlation of population with maximum temperature were r= -0.493* while, significant and positive r= 0.529*, 0.585* and 0.745** with minimum temperature, morning and evening temperature, respectively presented in the table 2.

These present findings are in agreement with Saleem *et al.*, (2013) who found that the weather factors were non-significantly correlated with thrips populations during 2008 while only relative humidity showed positive correlation in 2009. Zala *et al.*, (2014) conducted an experiment at Anand during *kharif*, 2011-12 and showed that the maximum temperature was significantly negative association with the thrips population. Selvaraj and Adiroubane (2012) they reported that thrips population was positive correlated with temperature, relative humidity and sunshine hour. Gosalwad *et al.*, (2009) who reported negative significant correlation with maximum temperature, the results are in conformity with the present findings.

It may be concluded that the climatic factors determined seasonal activity and population dynamics of thrips in cotton. This information generated in present study would be helpful in developing efficient pest management strategies against insect pests of cotton crop for increased production efficiency, profit, besides safety to the environment.

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