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INCIDENCE AND POPULATION DYNAMICS OF THRIPS (*THRIPS TABACI*) ON DIFFERENT COTTON VARIETIES IN TANDOJAM, SINDH, PAKISTAN

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ABSTRACT

Cotton thrips is the major hindrance to cotton yield in Pakistan since the start of the 20th century. It is a polyphagous pest that remains active in field all over the year due to the constant availability of alternate host plants. In present study, six cotton varieties (FH-142, BS-15, FH-598, MNH-992, IUB-13 and NIA-NOORI) were evaluated for seasonal population dynamics of thrips under natural prevailing conditions. All the entities exhibited a varying population of thrips during the period of study and no entity was completely immune from thrips infestation during the experiment duration. Thrips infestation started increasing in the 4th week of June and exceeds the threshold level (8-10 adult or nymph per leaf) during July. The month of July was found most favorable for thrips and peak abundance was recorded. Among all the varieties, NIA- NOORI showed the lowest mean population of thrips (3.64/leaf) while MNH-992 harbored highest population (4.46/leaf). Correlation matrix revealed that population of thrips correlated positively with minimum temperature, maximum temperature, and sunshine but negative association was observed with relative humidity. These outcomes are helpful for appropriate management of thrips considering its population dynamics during the period of crop.

Keywords: Thrips, varieties, tolerance, abiotic factors, correlation

INTRODUCTION

Cotton becomes an essential part of human agriculture for centuries. It plays a vital role in the economy of Pakistan by providing raw material for the textile industry, fiber for export, animal food and edible oil (Ozyigit *et al*., 2007). Regarding world's cotton production, Pakistan occupies 4th position after China, India, and USA (Iqbal *et al*., 2010). It is the 2nd major cultivated crop in Pakistan after wheat by contributing 5.1% in value addition and 1.0% in GDP. During 2017-18, the crop was cultivated on an area of 2.699 million hectares. The production stood at 11.935 million bales against the target of 14.04 million bales showed decline of 14.99 % (Government of Pakistan, 2018). Cotton yield per hectare halts below average owing to severe attack of insect pests, improper or excessive use of fertilizers, water scarcity, disease attack and weed invasion (Ahmed *et al*., 2009; Asif *et al*., 2016; USDA *et al*., 2016; Rehman *et al*., 2019).

Among the sucking pests complex, thrips attack repeatedly causes severe damage to cotton plants (Arif *et al*., 2005). They are minute insects possessing orange yellowish to brown color with strippy wings (Lewis, 1997; Maas, 2013). Thrips completes its life cycle by sucking cell sap from lower side of leaves, close to midribs. The infested leaves appeared silvery and at later stages margins of leaves curled upward and formed cup-shaped structure (Akram et al., 2013). Previous studies revealed 37.6% reduction in yield of cotton due to the combined infestation of jassid (4.6/leaf) and thrips (14.6/ leaf) (Attique and Ahmad, 1990). Ottens *et al.* (2004) documented that severe infestation of thrips can cause yield loss up to 50-60% if not prohibited.

Insect control through synthetic chemicals is generally considered as the cheapest and most effective method to control pests. However, injudicious use of insecticides creates various problems to living organisms (Malik et al., 2015). It has been documented that about forty thousand people died due to insecticide poisoning and about two million peoples affected directly or indirectly due to its exposure (Akubue, 1997). Host plant resistance is the most significant technique of insect pest management. This can quell insect pest populations (Khan *et al*., 2010). Cultivation of varieties having resistant traits is the most operative, environment friendly and economic approach which proves to be the most successful in boosting crop production (Khan, 2011).

Weather factors, such as relative humidity, temperature and rainfall play significant role in the population fluctuation of insect pests. Spatial distribution, behavioural and physiological features are severely affected by these climatic parameters (Kingsolver, 1989). Temperature plays a crucial role in the regulation of pests (Weisser *et al*., 1997). Theoretical ecologist primarily focused climatic factors for the development of pest forecasting model (Wallner, 1987). These models are being formulated to make farmers aware of the future outbreaks of the pests for the effective preventive measure to counter pest population (Hameed *et al*. 2014). Therefore, comprehensive development of pest forecasting model is significantly crucial for adopting effective techniques to suppress the threat (Atlamaz *et al*. 2007). Therefore, the present study was designed to evaluate the resistance/susceptible response of cotton varieties under agro climatic conditions of Tandojam, Sindh and to calculate the influence of different abiotic factors in the population dynamics of cotton thrips.

MATERIALS AND METHODS

Field study was conducted to determine the dynamics and intensity of thrips population on different varieties. Six varieties (FH-142, BS-15, FH-598, MNH-992, IUB-13 and NIA-NOORI) of cotton were grown during Kharif 2018 under RCBD replicated thrice at the experimental area of Nuclear Institute of Agriculture, Tandojam. Difference in population of thrips over time showed the performance of tested entities. The area was distributed into 18 plots of 6 m x 5 m each and 1 m distance between plots. The varieties were sown by seed drill method during 1st week of May 2018. P x P distance was maintained at 30 cm and R x R distance at 75 cm. Recommended practices regarding irrigation and fertilizer were adopted during the entire crop period as prerequisite and no crop protection measures were applied to manage the thrips population.

Cotton thrips abundance was recorded by counting the nymphs and adults on upper, middle, and lower leaves of randomly selected five plants per plot (Asif *et al*., 2017). The data were recorded at weekly intervals from 23rd June to 31st August 2018. Meteorological data i.e. minimum and maximum temperature, sunshine and relative humidity were obtained from Regional Agromet Centre Tandojam. The data was analyzed with ANOVA (Analysis of variance) through computer software Statistix and means were compared with LSD test at 5% probability level. Correlation of weekly thrips population with individual weather parameters was computed through StatSoft Statistica 10.

RESULTS

Table 1 indicated that thrips population was non-significantly different among tested cotton varieties during all the dates of observations. The genotype BS-15 harbored the lowest population (0.46/leaf) of thrips on 23rd June 2018 followed by IUB-13 and FH-142 with mean population of 1.15/leaf while highest population (1.60/leaf) was observed in FH-598. During the month of July thrips population increased and FH-142 harbored highest population mean (14.64/leaf) on 6th July, whereas lowest population mean was observed in IUB-13 (10.0/leaf) and NIA-NOORI (11.60/leaf). Drastic decline in thrips abundance was noticed during August on all cotton varieties. The lowest population mean of 0.86/leaf was recorded on NIA-NOORI while MNH-992 exhibited highest population mean of 1.48/leaf on 31st August 2018. The overall mean by combining abundance of thrips on each tested variety for entire study period showed that minimum thrips population was observed in NIA-NOORI (3.64/leaf) followed by 3.66/leaf in IUB-13 and maximum population was recorded in MNH-992 (4.46/leaf). However, all the varieties were found statistically at par with each other.

Table 1. Population trend of thrips during different dates of observation in six cotton varieties.

Dates of observation	Varieties (Thrips population / leaf)					
	FH-142	BS-15	FH-598	MNH-992	IUB-13	NIA-NOORI
23.06.18	1.15 a ± 0.67	0.46 a ± 0.29	1.60 a ± 0.31	1.37 a ± 0.17	1.15 a ± 0.90	1.24 a ± 0.45
30.06.18	1.88 ab ± 0.60	2.68 a ± 0.55	1.95 ab ± 0.12	2.0 ab ± 0.61	1.68 b ± 0.36	1.42 b ± 0.63
06.07.18	14.64 a ± 2.49	12.68 a ± 4.03	12.13 a ± 4.41	14.20 a ± 1.38	10.00 a ± 2.14	11.60 a ± 1.81
13.07.18	6.24 a ± 0.37	6.40 a ± 0.84	7.22 a ± 1.00	6.80 a ± 0.27	5.64 a ± 0.56	6.75 a ± 0.21
20.07.18	6.75 a ± 0.73	5.82 a ± 0.58	7.08 a ± 1.36	5.44 a ± 0.92	5.97 a ± 1.30	6.73 a ± 0.74
27.07.18	4.80 ab ± 0.30	4.91 ab ± 1.22	5.24 ab ± 0.53	6.53 a ± 0.87	4.37 ab ± 0.48	3.71 b ± 0.23
03.08.18	4.57 a ± 0.22	3.40 a ± 0.84	3.44 a ± 0.09	4.31 a ± 1.34	2.73 a ± 0.30	2.42 a ± 0.71
10.08.18	3.31 a ± 0.19	2.13 a ± 0.67	3.04 a ± 0.48	3.06 a ± 0.48	4.17 a ± 1.31	2.97 a ± 0.56
16.08.18	1.73 a ± 0.46	1.13 a ± 0.25	1.93 a ± 0.70	1.80 a ± 0.29	1.44 a ± 0.19	1.60 a ± 0.54
23.08.18	1.71 a ± 0.74	1.11 a ± 0.65	0.86 a ± 0.59	2.06 a ± 0.46	1.75 a ± 0.58	0.80 a ± 0.10
31.08.18	1.37 a ± 0.46	0.91 a ± 0.39	1.17 a ± 0.31	1.48 a ± 0.78	1.31 a ± 0.29	0.86 a ± 0.43
Overall Mean	4.38 a ± 0.08	3.78 a ± 0.62	4.15 a ± 0.39	4.46 a ± 0.24	3.66 a ± 0.45	3.64 a ± 0.25

Means sharing similar letter in rows are not significantly different at $p<0.05$.

Table 2 displayed the mean thrips population and data regarding meteorological observation on weather factors i.e. maximum and minimum temperature, relative humidity and sunshine during the course of study. The data of population abundance showed that thrips population appeared in the 3rd week of June but stayed below ETL level. It increases substantially in the month of July and showed peak abundance on 6th July with maximum temperature of 38.35 °C, minimum temperature of 25.57 °C, relative humidity of 59.28 % and sunshine of 7.95 hrs by crossing threshold level (8-10 adults or nymph per leaf) and then started declining. Decline in population was also observed in the month of August with maximum temperature ranging from 35-36 °C, minimum temperature of 23-24 °C, relative humidity of 65-68% and sunshine of six hours.

Correlation matrix showed that overall mean population of thrips exhibited positive correlation with minimum and maximum temperature and sunshine while negatively correlated with relative humidity. However, these correlations were found statistically non-significant except two varieties such as FH-598 and NIA-NOORI in which thrips population showed significant positive correlation with minimum temperature (Table 3).

Table 2. Mean thrips population and data regarding meteorological observations on various factors during 2018.

Dates of observation	Mean thrips population	Temperature (°C)		Relative humidity (%)	Sunshine (h)
		Maximum	Minimum		
23.06.18	1.16 e ± 0.03	39.28	25.42	56.71	8.9
30.06.18	1.94 de ± 0. 45	37.07	24.92	64.71	6.04
06.07.18	12.54 a ± 1.96	38.35	25.57	59.28	7.95
13.07.18	6.51 b ± 0.31	37	25.5	62	8.52
20.07.18	6.30 b ± 0.80	36.14	25.21	69.42	3.58
27.07.18	4.92 bc ± 0.18	36.42	24.71	63.85	6.38
03.08.18	3.48 cd ± 0.27	36.28	24.42	60	8.27
10.08.18	3.11 cde ± 0.04	35.71	24.21	66.42	5.77
16.08.18	1.60 de ± 0.22	36	24.42	67.85	2.87
23.08.18	1.38 e ± 0.39	35.78	23.5	65	5.64
31.08.18	1.18 e ± 0.27	35.92	23	65.14	5.98

Means sharing similar letter in columns are not significantly different at $p<0.05$.

Table 3. Correlation (r) matrix of thrips population with mean abiotic factors in cotton varieties.

Varieties	Temperature (°C)		Relative Humidity (%)	Sunshine (h)
	Max.	Min		
FH-142	0.320	0.556	-0.246	0.255
BS-15	0.326	0.601	-0.229	0.265
FH-598	0.328	0.655*	-0.195	0.235
MNH-992	0.335	0.551	-0.299	0.316
IUB-13	0.235	0.566	-0.120	0.189
NIA-NOORI	0.326	0.642*	-0.166	0.207
Overall	0.318	0.601	-0.217	0.251

*= Significant at $p<0.05$.

DISCUSSION

Thrips is a polyphagous insect pest and cause substantial loss to different economically significant crops. Therefore, its management through environment friendly techniques is desired. In this perspective, six cotton genotypes were evaluated for their tolerance ability to resist the attack of cotton thrips under field conditions. The results revealed non-significant variation among the tested varieties in their susceptibility against thrips. However, minimum population of thrips was observed in NIA-NOORI and IUB-13 and maximum in MNH-992. These results are in accordance with the work of Udikeri *et al*. (2003), Kengegowda (2003), Ali and Aheer (2007) and Amjad *et al*. (2009) who also reported non-significant difference in thrips population among the tested genotypes. Likewise, Arshad *et al*. (2010) indicated no significant variation in thrips population between varieties, but difference was significant among insecticides treated and untreated plots. Contrary to these findings, many other workers i.e. Khan *et al*. (2011), Naveed *et al*. (2011), Akram *et al*. (2013), Babar *et al*. (2013), Saleem *et al*. (2013) and Asif *et al*.

(2018) reported significant variation in thrips population among the screened genotypes. These contradictions may be due to the difference in varietal combinations tested by them and their physico-morphic characteristics.

In the present study, July was found most favorable for the thrips population and peak abundance was recorded. These findings are in accordance with Nizamani *et al*. (2002) who reported that the population of thrips increased rapidly in the start of July and then sharply declined in the month of August. Similarly, Khan *et al*. (2012) also reported peak in the thrips population during the month of July. Similarly, Asif *et al*. (2017) who reported maximum population of thrips on cotton genotypes in the month of July.

Meteorological factors play significant role in the sucking pests population dynamics (Gogoi and Dutta, 2000; Panickar and Patel, 2001; Murugan and Uthamasamay, 2001). Temperature is the prime abiotic factor which has major influence in the population abundance of pests (Bale *et al*., 2002). The present study has indicated a non-significant and negative correlation of thrips population with relative humidity while positive correlation with sunshine, minimum and maximum temperature. These findings are in confirmatory with the work of Saleem *et al*. (2013) who reported that temperature had non-significant relationship with thrips population. Patel *et al*. (2013) also found non-significant positive correlation of maximum and minimum temperature with thrips whereas negative with rainfall. Similarly, Akram *et al*. (2013) reported positive association between thrips population and maximum and minimum temperature while negative with relative humidity. These results are also in line with Shivanna *et al*. (2011) who documented non-significant correlation of relative humidity and minimum temperature with thrips abundance. Ali *et al*. (1993) and Patel *et al*. (1997) observed negative and non-significant relationship of thrips population with relative humidity. Likewise, correlation of relative humidity also coincides with Khan and Ullah (1994), Khan *et al*. (2008) and Shahid *et al*. (2012) who reported negative correlation with thrips population.

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