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Population dynamics of insect pests of cotton in Southern dry zone of Karnataka

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Abstract

A field experiment was conducted during *khari* season of 2019-20 at AICRP on Cotton scheme, Chamarajanagara, to study the seasonal variation of sucking pests incidence in non *Bt* cotton hybrid (DCH -32). From the data it is observed that the population of leafhopper was above ETL in almost all standard meteorological week (SMW) with peak population of 7.20 and 6.80/3 leaves during 35th and 36th SMW, respectively. While, the occurrence of aphids was noticed throughout the cropping season. The peak incidence was observed at 36th SMW (55.15/3leaves). Mirid bug incidence was started from 35th SMW and attained its peak during 42nd SMW and declined thereafter. The population of whiteflies and thrips didn't cross ETL during the entire cropping season. Correlation study revealed that the morning and evening relative humidity had a positive influence on the population of sucking insect pests including the activity of natural enemy (coccinellid beetles). Whereas, maximum and minimum temperature had a detrimental effect on the population of sucking insect pests.

Keywords: cotton, whiteflies, aphids, thrips, leafhoppers, correlation, population dynamics

Introduction

Among several constraints in crop production, insect pests play a major role in reducing the productivity of cotton. About 148 insect pests have been recorded on cotton during the growth period, of which only 17 species are considered as major insect pests of cotton crop Abbas (2001) ^[1]. With the introduction of *Bt* cotton during the year 2002, the incidence of bollworm has drastically reduced to a greater extent, but the sucking pests incidence has become a major problem. In Southern India leaf hopper and mirid bug, while in Northern India whiteflies are causing considerable damage to the cotton crop. Weather conditions prevailing during the crop growth stage has a greater influence on the occurrence of major insect pests. Hence, thorough understanding of insect pests in relation to weather parameters at different stages of crop growth is necessary to develop suitable weather based pest forecasting model, which helps the cotton growing farmers to take up timely plant protection measures. Keeping these in consideration the present study was conducted to know the seasonal variation of insect pest population and its impact on cotton crop in Southern Dry Zone of Karnataka.

Material and Methods

A field experiment was conducted at AICRP on Cotton scheme, Chamarajanagara during *khari* season of 2019-20. The non *Bt* cotton (DCH-32) hybrid was successfully grown by following the package of practices recommended by UAS, Bangalore. The crop was unsprayed throughout the cropping season to record the population dynamics of the insect pests. The observations on incidence of leafhoppers, whiteflies, thrips and aphids were collected from 10 randomly selected plants. In each plant 3 fully formed leaves were selected, one each from upper, middle and lower canopy and the observations were taken before 10 AM in the morning at weekly interval *i.e.*, Standard Meteorological Week (SMW) throughout the cropping season. The mean population data obtained from weekly observations were subjected to simple correlation analysis with meteorological parameters *viz.* maximum and minimum temperature, morning and evening relative humidity and rainfall. The weather parameters were collected from Regional Sericulture Research Station, Chamarajanagara.

Results and Discussion

Leaf hoppers

From the data (Table-1) it has been observed that the incidence of leafhoppers was started from the last week of July (30th SMW) and attained two peaks with first peak during 35th and 36th SMW (7.20 and 6.80/ 3 leaves, respectively) and the second peak at 43rd SMW (4.40/3 leaves). However, between 33rd to 38th, 43rd to 49th SMW the leaf hopper incidence was above ETL. The population declined slightly from 50th and 51st SMWs (>2 leafhoppers/3 leaves) onwards.

Whiteflies

In general, the population of whiteflies was moderate throughout the season. The incidence was started during second week of August and continued up to December (fig. 1). The maximum population was noticed during 35th and 36th SMW and declined thereafter up to 41st SMW and slight increase was noticed during 47th SMW and declined gradually (Table.1). However, during the entire cropping season the population of whitefly did not cross ETL.

Thrips

The thrips population did not cross the ETL during cropping season. However, The incidence of thrips was noticed during the early stages of the crop growth. Maximum population was

observed during the first week of September with 7.80 thrips/3 leaves). The population was decreased from 37th SMW to 41st SMW and again there was slight increment, but at the end of the season thrips population was found to be negligible (Table.1).

Aphids

Aphid population was medium to high during the season. The incidence was started from last week of July (30th SMW) and increased thereafter (Fig 1). The peak incidence was recorded during 36th standard week (55.15/3leaves) and the pest activity was continued up to 43rd SMW in considerable manner and declined afterwards.

Mirid bugs

Incidence of mirid bugs was also observed during the cropping season. The incidence was noticed from last week of August and it increased with the increase crop growth. Maximum population (25 mirid bugs/25 squares) was noticed during 42nd standard week and decreased thereafter (fig -2).

Natural Enemies

The population of Predators (Coccinellids adults and grubs) was also recorded along with pest population as they are density dependent, their activity was noticed up to fortnight of November (fig -3).

Table 1: Population of sucking insect pests on DCH-32 Non *Bt* cotton during 2019-20

Standard Meteorological Week (SMW)	Sucking pests population /3 leaves				Mirid bugs/ 25 squares	Coccinellid beetles/ plant
	Leafhoppers	Whiteflies	Thrips	Aphids		
25	0.00	0.00	0.00	0.00	0.00	0.00
26	0.00	0.00	0.00	0.00	0.00	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00
28	0.00	0.00	0.00	0.00	0.00	0.00
29	0.00	0.00	1.50	0.00	0.00	0.00
30	1.25	0.00	2.50	5.60	0.00	0.00
31	1.70	0.00	2.25	10.20	0.00	0.00
32	1.30	1.25	1.00	5.40	0.00	1.20
33	2.15	1.60	2.15	5.25	0.00	0.80
34	3.20	1.50	2.50	25.25	0.00	3.60
35	7.20	3.20	6.25	34.80	5.00	5.25
36	6.80	3.10	7.80	55.15	17.00	6.50
37	5.20	2.50	5.26	50.50	18.00	4.15
38	2.50	1.80	4.30	35.30	21.00	4.50
39	1.75	1.00	1.40	21.25	20.00	4.10
40	2.50	1.20	1.80	20.40	24.00	3.50
41	1.26	0.60	0.80	18.50	18.00	2.10
42	1.30	0.75	2.30	17.26	25.00	2.15
43	4.40	1.50	2.75	12.30	12.00	4.20
44	4.10	2.10	2.10	8.25	9.00	3.10
45	2.25	1.80	2.10	10.30	8.00	1.10
46	3.20	2.00	0.75	12.12	9.00	0.80
47	2.50	1.60	0.60	8.26	7.00	0.00
48	2.40	0.40	0.20	9.25	0.00	0.00
49	3.15	0.20	0.00	7.50	0.00	0.00
50	1.52	0.00	0.00	4.25	0.00	0.00
51	0.20	0.00	0.00	3.50	0.00	0.00
52	0.00	0.00	0.00	2.50	0.00	0.00

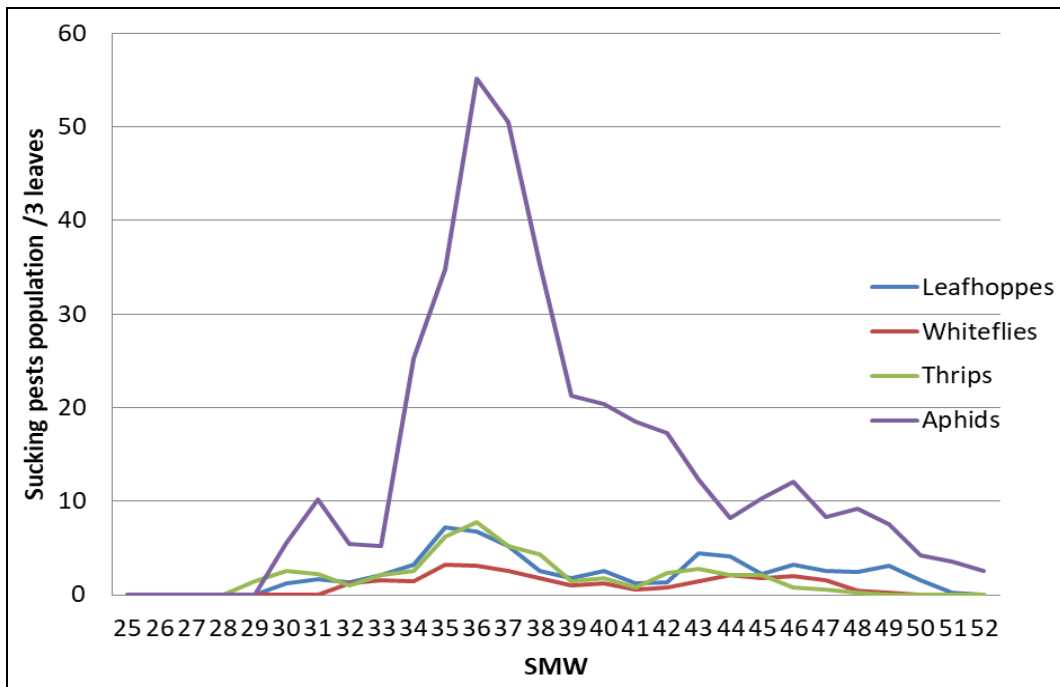


Fig 1: Variation in population of sucking pests in different SMW

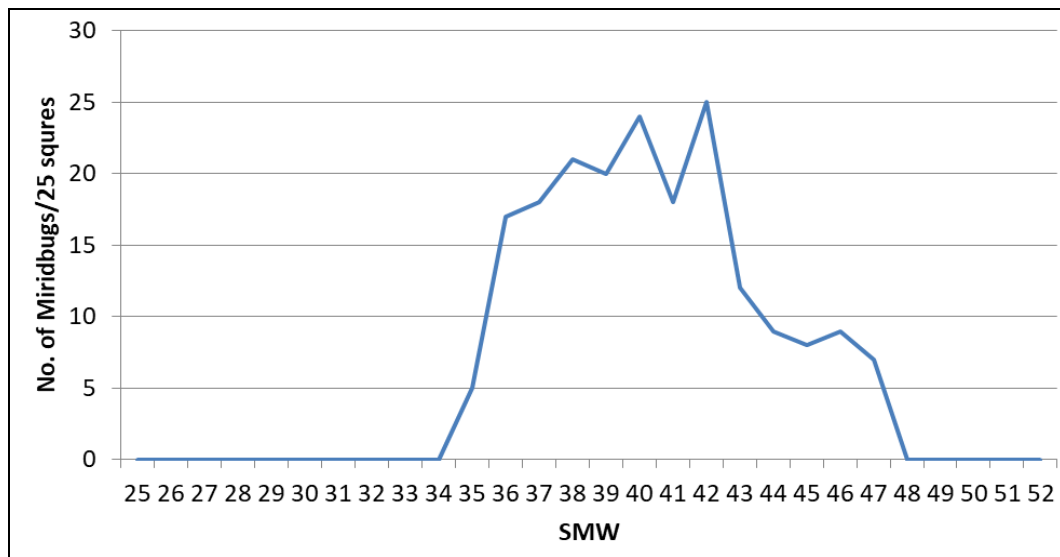


Fig 2: Variation in population of Mirid bugs in different SMW

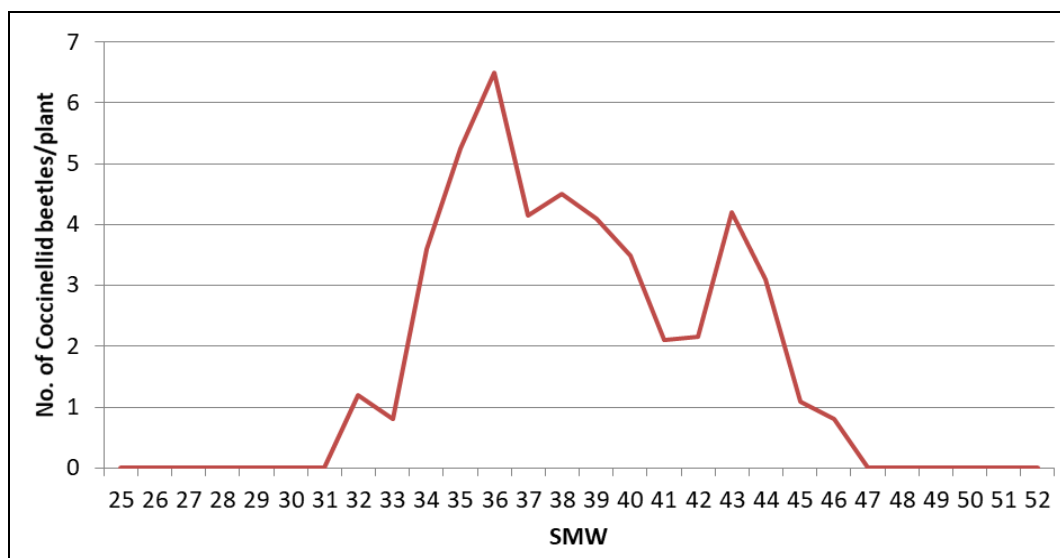


Fig 3: Activities of Coccinellid beetles in different SMW

Correlation studies (Table-2)**Leafhoppers**

The data indicated that the population of leaf hoppers was positively correlated with morning and evening relative humidity. The morning RH is significantly correlated, but the evening RH is found to be not significant. The results are in agreement with the earlier findings of Ramesh Babu and Madanlal Meghwal (2014) [6], Laxman *et al.* (2014) [4], Shitole and Patel (2009) [8] and Kaur *et al.* (2009) [3]. Prasad *et al.* (2008) [5] observed significant and positive correlation between population of leafhopper and relative humidity. While, maximum and minimum temperature and rainfall had non-significant negative correlation with leafhopper population.

Whitefly

The maximum and minimum temperature had a negative correlation with respect to whitefly population. The results are in accordance with the findings of Sharma and Yogesh Kumar (2014) [7]. Morning relative humidity was the main significant contributing factor for the maximum occurrence of whitefly in cotton with correlated 'r' value of 0.445 (P=0.05). The

findings are in accordance with Ramesh Babu and Madan Lal Meghwal (2014) [6] and Sharma and Yogesh Kumar (2014) [7]. They reported significant and positive correlation of whitefly population with morning relative humidity.

Thrips

Thrips population was positively correlated with all the weather parameters, except maximum and minimum temperature which had non-significant negative correlation. The results are in agreement with the finding of Ramesh Babu and Madan Lal Meghwal (2014) [6]. On the contrary Bhute *et al.* (2012) [2] observed positive correlation between maximum temperature and thrips population.

Aphids and miridbug

It is noticed that the morning and evening relative humidity had a great influence on build up of aphid and mirid bug population. Similarly, rainfall had significant and positive correlation with respect to miridbug incidence. Coccinellids activity also influenced by relative humidity and rainfall as it is density dependent *ie.* higher pest load was noticed in same environmental condition

Table 2: Correlation between the population of insect pests in cotton and weather parameters.

Abiotic factors	Leafhoppers/ 3leaves	Whiteflies/ 3leaves	Thrips/ 3leaves	Aphids/ 3leaves	Miridbugs/ 25 squares	Coccinellids
T- Max (°C)	-0.362	-0.317	-0.29	-0.172	0.022	-0.169
T- Min (°C)	-0.223	-0.061	-0.084	-0.118	-0.077	-0.101
RH(Mor) %	0.422 **	0.445 **	0.294	0.342	0.336	0.316
RH(Eve) %	0.385	0.389	0.351	0.330	0.376	0.384
Rainfall (mm)	-0.033	0.121	0.051	0.168	0.516**	0.31

Correlation coefficient 'r'(0.05) = 0.39; r(0.01) = 0.50

Conclusion

The present studies on population dynamics of pests in cotton clearly indicated that sucking pests *viz.*, leafhoppers, whiteflies, thrips, aphids and Miridbugs are major pests on cotton as their incidence recorded throughout the season. The correlation studies indicated that the correlation exist between pest population with different weather parameters. Also there was a combined effect of weather parameters on pest population and their incidence on cotton. Correlation study revealed that the morning and evening relative humidity had a positive influence on the population of sucking insect pests including the activity of natural enemy (coccinellid beetles). Whereas, maximum and minimum temperature had a detrimental effect on the population of sucking insect pests. It showed per cent variation in pest population and their incidence along with their direct and indirect effects.

Acknowledgement

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