The Andhra Agric. J 59(4):588-592, 2012

Relationship of Weather Parameters With Population Dynamics of Sucking Pests in Cotton

A Rohini, N V V S D Prasad and M S V Chalam
Department of Entomology, Agricultural College, Bapatla-522101, Andhra Pradesh, India

ABSTRACT

Studies on seasonal incidence of sucking pests on cotton were conducted at Regional Agricultural Research Station, Lam, Guntur during *kharif* 2009-2010. The incidence of aphids, thrips, leafhoppers and whiteflies were observed at 38th std. week and continued up to 4th std. week. The peak incidence of aphids was observed during 45th std. week. Thrips population reached peak during 41st std. week. Leafhopper population reached its peak in 42nd std. week and the peak activity of whiteflies was observed in 46th std. week. The correlation between aphids and evening relative humidity was positive and significant. The correlation between leafhopper and maximum temperature and minimum temperature showed significant positive influence. The correlation between thrips and morning relative humidity showed significant negative influence, whereas maximum temperature and minimum temperature showed significant positive influence on thrips population. The correlation between whitefly and morning relative humidity and evening relative humidity showed significant positive influence. The peak activity of spiders and coccinellids were observed during 3rd week of November.

Key words : Cotton, Natural enemies, Sucking pests, Weather parameters.

Cotton (*Gossypium hirsutum* L.) a major commercial fibre crop grown under diverse agro climatic conditions around the world. It plays a vital role in social and monetary affairs of India. Besides the several factors responsible for low productivity and quality deterioration of cotton, the damage caused by insect pests is the most important, which plays a significant role in its cultivation for achieving optimum yield potential. Among vast array of insect pests, the problem of sap sucking pests has become more serious from seedling stage there by resulting in considerable reduction in seed cotton yield. A reduction of 22.85 per cent in seed cotton yield due to sucking pests has been reported by Satpute *et al.,* 1990.

The meteorological factors play a vital role in the development and population build up of insect species. These parameters include temperature, relative humidity, rain fall and sunshine hours. Furthermore, the weather parameters vary greatly from place to place and season to season. In a region, the size of the population of pests and the severity of damage they inflict can be governed by the environmental factors as well as by the number of enemies (Becker, 1974). Hence, studies were undertaken to study the seasonal occurrence of sucking pests at different crop growth stages and its correlation with weather parameters in cotton.

MATERIAL AND METHODS

Investigation was carried out at Regional Agricultural Research Station, Lam, Guntur during *kharif* 2009-2010. Cotton genotype L-752 was raised in a bulk plot of 1000 square meters under unprotected conditions following normal agronomic practices to study the seasonal incidence of sucking pests of cotton. The population of sucking pests and natural enemies were recorded at weekly intervals with the initiation of the pest and continued till the end of the crop growth from 25 randomly selected tagged plants. The adult population of sucking pests such as aphids, leafhoppers, whiteflies and thrips were counted from three leaves each from top, middle and bottom canopy of the plant and natural enemies on whole plant basis. The data on sucking pest population and natural enemies were pooled standard week wise and subjected to correlation analysis with major weather parameters of corresponding standard week *viz*., maximum temperature, minimum temperature, rainfall, number of rainy days, morning and evening relative humidity. Regression studies were also worked out between sucking pests *Vs* weather parameters, using MSTATC statistical package.

RESULTS AND DISCUSSION

Seasonal incidence of sucking pests:

(a) Aphids:

The incidence of aphids was observed from 38th standard week (3rd week of September) with a population of 2.32/3 leaves/plant (Table 1). The population was initially low upto 41st std. week with a gradual increase in population from 42nd std. week (2nd week of October) to 48th std. week attaining peak during 45th std. week (2nd week of November). Thereafter, the population declined gradually and reached to the lowest by 4th std. week (4th week of January) with a population of 1.00/3 leaves/plant. There is a sudden decline in maximum temperature from 45th to 47th std. week during which period peak population of aphids was observed in the cropping season. The present findings on maximum activity of aphids during November corroborate with the observations of Sesha Mahalakshmi (2007), Soujanya *et al*., (2010) and Sitaramaraju *et al*., (2010).

(b) Thrips:

The population of thrips was high in initial crop growth period from 38th std. week (3rd week of September) to 42nd std. week with peak activity (16.88 thrips/3 leaves/plant) during 41st std. week (2nd week of October). There was gradual decline in population from 43rd std. week and reached to lowest by 4th std. week (4th week of January) with 0.08/3 leaves/plant. When the maximum and minimum temperatures were high from 38th to 41st std. week, thrips population was also high during the corresponding period. The present findings were in accordance with the findings of Sesha Mahalakshmi (2007) and Soujanya *et al*., (2010) who reported that the peak incidence of thrips was from second fort night of August to first fort night of November.

(c) Leafhoppers:

Leafhopper population was active throughout the season crossing Economic Threshold Level many times. The incidence of leafhoppers crossed ETL on the first observation itself (30 DAS) in 38th std. week (3rd week of September) with population of 6.28/3 leaves/plant. The population of leafhoppers remained below ETL for a short period between 39th and 41st std. week. There is a sudden increase in population from 42nd std. week (3rd week of October) to 45th std. week with a peak population of 9.32/3 leaves/plant in 42nd std. week. A gradual decrease in population was observed from 46th std. week and reached to the lowest by 4th std. week (4th week of January) with 0.68 leafhoppers/3 leaves/plant. The maximum and minimum temperatures were high during 42nd std. week during which period peak population of leafhoppers was observed during cropping season. The present observations are in agreement with Sesha Mahalakshmi (2007) and Soujanya *et al*., (2010) who reported that the incidence of leafhoppers was from second fort night of August to the end of crop growth in all the hybrids with peak activity during mid September to mid November.

(d) Whiteflies:

The occurrence of whiteflies was low throughout the season ranging from 0.12 to 4.32 whiteflies/3 leaves/plant. The peak incidence of whiteflies was observed in 46th (3rd week of November). Sitaramaraju *et al*., (2010) and Sesha Mahalakshmi (2007) also reported high incidence of whiteflies during 3rd week of November.

Influence of weather factors on incidence of sucking pests

Aphids:

The correlation analysis revealed positive correlation between aphids population and minimum temperature, morning and evening relative humidity and rainfall, while there was negative correlation with maximum temperature which were non significant except evening relative humidity (Table 2). The multiple linear regression analysis revealed that the major abiotic factors together were responsible for a total influence of 33.92 per cent (R^2 value) (Table 3) in aphid population. The present findings are in agreement with Soujanya *et al*. (2010) who reported that maximum temperature had significant negative influence, while evening relative humidity had significant positive influence on the population of aphids and all the weather parameters together were responsible for 32 per cent of total variation.

Thrips:

The correlation studies between thrips and abiotic factors showed positive correlation between thrips population and maximum temperature, minimum temperature, evening relative humidity and rainfall, while the correlation was negative with morning relative humidity. However, morning relative humidity showed significant negative influence, where as maximum and minimum temperatures showed significant positive influence on the population of thrips. The multiple linear regression analysis revealed that all the abiotic factors together accounted for 84.36 per cent of total variation in thrips population. The present findings were in accordance

Table 1. Seasonal incidence of sucking pests and natural enemies on cotton and weather parameters during kharif, 2009-10.

Std. week	Period	Max. Temp (°C)	Min. Temp (°C)	Mor. RH (%)	Eve. RH (%)	Rainfall (mm)	Sucking pest no./3 leves plant^{-1}				Natural enemies plant^{-1}	
							Aphids	Thrips	Leaf hoppers	White files	Spiders	Coccinellids
38	Sep 17 to Sep 23	33.70	23.30	85.50	65.50	0.00	2.32	15.40	6.28	0.12	0.20	0.16
39	Sep 24 to Sep 30	32.60	22.70	82.10	63.50	73.2	1.00	15.52	5.72	0.16	0.36	0.24
40	Oct 1 to Oct 7	32.40	21.90	82.10	67.80	15.4	1.36	15.92	4.92	0.24	0.40	0.32
41	Oct 8 to Oct 14	33.80	21.60	83.80	59.00	7.00	3.52	16.88	4.60	0.80	0.44	0.40
42	Oct 15 to Oct 21	34.20	22.50	86.70	54.10	0.00	11.76	10.36	9.32	1.04	0.52	0.48
43	Oct 22 to Oct 28	33.50	20.90	79.10	48.70	0.00	13.08	9.52	8.60	1.28	0.60	0.68
44	Oct 29 to Nov 4	32.70	19.80	82.40	60.40	0.00	25.36	7.36	9.08	2.04	0.84	0.92
45	Nov 5 to Nov 11	29.80	19.90	90.50	73.50	20.8	26.48	5.72	8.28	3.24	1.04	1.16
46	Nov 12 to Nov 18	29.80	20.50	93.70	98.50	28.2	23.52	3.20	4.04	4.32	1.32	1.28
47	Nov 19 to Nov 25	29.40	20.20	95.20	77.70	80.0	17.88	3.76	3.88	4.04	0.80	0.76
48	Nov 26 to Dec 2	32.10	17.70	88.00	58.50	0.00	13.16	3.68	4.08	4.24	0.60	0.56
49	Dec 3 to Dec 9	29.70	17.30	93.20	57.70	0.00	10.96	3.80	3.84	3.80	0.52	0.48
50	Dec 10 to Dec 16	30.10	18.00	87.10	56.70	0.00	9.80	1.92	3.40	2.12	0.40	0.36
51	Dec 17 to Dec 23	29.40	19.00	90.20	58.10	9.40	6.52	1.84	3.52	2.12	0.36	0.28
52	Dec 24 to Dec 30	32.60	20.70	93.70	57.10	0.00	4.88	1.00	3.40	2.20	0.32	0.24
1	Dec 31 to Jan 6	29.70	16.50	90.50	50.10	0.00	4.04	0.36	1.88	1.64	0.28	0.20
2	Jan 7 to Jan 13	29.50	16.00	86.20	61.40	0.00	3.40	0.24	1.90	0.96	0.24	0.12
3	Jan 14 to Jan 20	29.40	15.70	87.70	43.70	1.96	2.20	0.16	0.80	0.84	0.16	0.08
4	Jan 21 to Jan 27	29.70	15.20	86.10	45.10	0.00	1.00	0.08	0.68	0.72	0.08	0.04

with Sitaramaraju *et al*. (2010) who reported significant positive correlation with maximum and minimum temperatures and significant negative correlation with morning relative humidity. Soujanya *et al*., (2010) reported that all the weather parameters together were responsible for 82.08 per cent of total variation.

Leafhoppers:

The correlation analysis revealed positive and significant correlation between leafhopper population and maximum temperature (r=0.5583), minimum temperature (r=0.7241). While there was positive correlation with evening relative humidity (r=0.3688) and rainfall (r=0.2018), where as negative correlation with morning relative humidity (r=-0.2673) which were non significant (Table 2). The multiple linear regression studies showed that all the weather parameters together were responsible for 56.15 per cent (R^2 value) of total variation in leafhopper population. The present findings are in agreement with Dheeraj Purohit *et al*., (2006) who reported that leafhopper population showed a significant positive correlation with minimum temperature and Shivanna *et al.,* (2009) findings of significant positive correlation with maximum temperature. The results are close conformity with Srinivasa Rao (2004) and Sesha Mahalakshmi (2007) who reported that the total variation due to all weather parameters was around 55 per cent.

Whiteflies:

The correlation studies between whitefly and abiotic factors showed negative correlation for maximum temperature (r=-0.4268) and minimum temperature (r=-0.2007), while the correlation was positive with morning relative humidity (r=0.7147), evening relative humidity (r=0.4999) and rainfall (r=0.1770). However, the morning and evening relative humidity showed significant positive influence on the population of whiteflies (Table 2). The multiple linear regression analysis showed that all the weather parameters together were responsible for 66.19 per cent (R^2 value) of total variation in whitefly population. The present findings are in agreement with Sewa Singh *et al*., (2004) who reported that the relative humidity showed positive correlation with the population of whiteflies. Pradeep

and Narayan (2004) stated that relative humidity and sunshine hours were positively and significantly correlated with adult count of whitefly. Sitaramaraju *et al*., (2010) reported that the total variation due to all weather parameters was up to 66 per cent.

Seasonal incidence of natural enemies:

Spiders:

The population of spiders remained more or less similar throughout the season ranging from 0.08 to 1.32 /plant with higher activity from 45th to 47th std. week corresponding to peak activity of aphid and whitefly population. The present observation is in conformity with the findings of Sitaramaraju *et al*. (2010) who reported that the peak incidence of spiders was during mid November.

Coccinellid beetles (Ladybird Beetles):

The activity of coccinellid beetles was seen throughout the season with peak activity ranging from 43rd std. week (0.68) to 46th std. week (1.28/ plant) which correspond to peak activity of leafhoppers, aphids and whiteflies. The present findings are parallel with the findings of Srinivasa Rao (2004) who reported that the peak activity of ladybird beetles was during the first fort night of November.

LITERATURE CITED

Becker P C 1974 Pest of ornamental plants. Ministry of Agriculture, Fisheries and Food, London.

Dheeraj Purohit, Ameta O P and Sarangdevot S S 2006 Seasonal incidence of major insect pests of cotton and their natural enemies. *Pestology,* 30 (12): 24-33.

Pradeep S and Narayan R 2004 Population build up of the cotton whitefly, *Bemisia tabaci* Genn., in relation to weather factors at Hisar, Haryana. *Pest Management and Economic Zoology,* 12(1):33-38.

Satpute U S, Patil V N, Katole S R, Men V B, Bhagwat V R and Thakare A V 1990 Avoidable field losses due to sucking pests and bollworms in cotton. *Journal of Appliend Zoological Res*earch 1: 67-72.

Table 2. Correlation between weather parameters and incidence of sucking pests on cotton during kharif, 2009-10.

pets	Correlation coefficient values				
	Max. temp	Min. temp	Mor. RH	Eve. RH	Rainfall
Aphids	-0.1108	0.1162	0.2764	0.5446*	0.1542
Thrips	0.7731**	0.8231**	-0.6055**	0.1533	0.2226
Leafhoppers	0.5583*	0.7241**	-0.2673	0.3688	0.2018
Whiteflies	-0.4268	-0.2007	0.7147**	0.4999*	0.1770

* Significant at 5% level ** Significant at 1% level

Table 3. Multiple linear regression analysis between sucking pests of cotton and weather parameters.

pets	Regression equation	R^2
Aphids	$Y= -49.35+1.15X_1-1.04X_2+0.16X_3+0.49X_4-0.04X_5$	0.3392
Thrips	$Y= 16.06+0.31X_1+1.42X_2-0.55X_3+0.02X_4+0.02X_5$	0.8436
Leafhoppers	$Y= -5.40+0.12X_1+0.60X_2-0.10X_3+0.06X_4-0.01X_5$	0.5615
Whiteflies	$Y= -26.18+0.48X_1-0.44X_2+0.20X_3+0.07X_4+0.005X_5$	0.6619

X_1- Maximum temperature
X_2- Minimum Temperature
X_3- Morning relative humidity
X_4- Evening relative humidity
X_5- Rainfal

Sesha Mahalakshmi M 2007 Impact of *Bt* cotton on the incidence and management of Bollworm complex. Thesis submitted to Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad.

Sewa Singh, Ram Niwas, Saini R K and Khichar M L 2004 Relationship of micro climatic parameters with population dynamics of leafhopper and whitefly in cotton. Abstracts of national symposium on "Changing World Order Cotton Research, Development and Policy in Context" August 10-12, 2004, ANGRAU, R. Nagar, Hyderabad. pp.104.

Shivanna B K, Nagaraja D N, Manjunatha M and Mohan l Naik 2009 Seasonal incidence of sucking pests on transgenic *Bt* cotton and correlation with weather factors. *Karnataka Journal of Agricultural Sciences*, 22(3): 666-667.

Sitaramaraju S, Prasad N V V S D and Krishnaiah P V 2010 Seasonal incidence of sucking insect pests on Bt cotton in relation to weather parameters. *Annals of Plant Protection Sci*ences, 18 (1):49-52.

Soujanya P L, Prasad N V V S D and Rao P A 2010 Population dynamics of sucking pests and their relation to weather parameters in *Bt*, stacked *Bt* and Non *Bt* cotton hybrids. *Trends in Biosciences,* 3 (1): 15-18.

Srinivasa Rao N 2004. Performance of transgenic *Bt* cotton on the seasonal incidence and management of bollworms compared to local Bunny through the joint toxic action of Novaluron, A new chitin inhibitor. Ph.D Thesis, Acharya N.G. Ranga Agricultural University, Rajendranagar, Hyderabad.

(Received on 08.02.2011 and revised on 07.04.2011)