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Population dynamics of insect pests of cotton in scarce rainfall zone of Andhra Pradesh

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ABSTRACT: Experiment conducted during *kharif*, 2017-2018 at RARS, Nandyal with two test hybrids for the incidence of sucking pests revealed that in RCH 2 *Bt* BG II, the leafhopper population was above ETL from 36th standard meteorological week (SMW) to 41st SMW with peak population during 36th, 39th and 41st SMW by recording 12.40, 16.00 and 10.40 leafhoppers/ 3 leaves, respectively whereas in DCH 32, the leafhopper population was above ETL from 36th SMW to 50th SMW and achieved peak during 36th, 39th and 40th SMW by recording 22.60, 22.90 and 15.60 leafhoppers/ 3 leaves, respectively. The remaining sucking pests such as thrips, whitefly and aphid did not cross ETL during the period of study. The field incidence of American bollworm and tobacco caterpillar was negligible during the cropping period. However, among the bollworms, the moth catches were high for pink bollworm and tobacco caterpillar and the trap catches of others were almost negligible. The pink bollworm appeared from the beginning of the season and the trap catches were high from 41st SMW to 52nd SMW with maximum trap catch of 55.68 moths/ trap/week during 50th SMW. The incidence of *Spodoptera litura* was observed throughout the season with first peak during 38th SMW with 27.79 moths/trap and second peak during 42nd SMW with 14.00 moths/trap. Correlation studies revealed a significant and positive correlation between leafhopper population and both temperature (minimum) and relative humidity (evening) by recording correlation coefficient values r= 0.754 and r=0.535 in RCH 2 BG II and r = 0.817 and r=0.724 in DCH 32 whereas the pink bollworm trap catches had a significant but negative correlation with Temperature (minimum) and Relative Humidity (evening) with correlation coefficient values r = -0.736 and r= - 0.674, respectively. However, the trap catches of *Spodoptera litura* and *Helicoverpa armigera* did not show any significant correlation with the abiotic factors.

Key words : Abiotic factors, cotton, sucking pests

Cotton is the most important commercial crop in India and plays a vital role in agricultural, industrial, social and monetary affairs of the country. India is the only country in the world where all the four cultivated species of cotton, viz., *Gossypium arboreum*, *G. hirsutum*, *G. herbaceaum* and *G. barbadense* along with intra and inter specific hybrids are cultivated. The production and productivity in India is of great concern owing to the demand for cotton all over the world. Insect pests are the major bottle necks for the poor yields in cotton. Cotton is attacked by a herd of insect pests. During the growth period, 148 insect pests have been recorded on cotton crop, out of which only 17 species have been reported as major insect pests of cotton crop (Abbas, 2001). With the introduction of *Bt* cotton during 2002, the bollworm attack on crop has

drastically reduced and the sucking pests gained major importance wherein leafhopper, mirids in South India and whitefly in North India are of immense importance. Weather plays a vital role as it influences the incidence of the major insect pests and it is required to develop long term forecasting models, thus, the relationship between incidence of the major insect pests and the weather parameters is to be investigated. A thorough understanding of interaction between crop growth stages and pest dynamics in relation to meteorological parameters is a pre-requisite for weather based pest forecasting model. Hence, the present study focused on location specific seasonal dynamics of insect pests and their relationship with weather parameters for formulating timely and effective management of insect pests on cotton.

Observations on sucking pests were recorded on two cotton hybrids *i.e.*, DCH 32 and RCH 2BT BG II during *kharif*, 2017 at Regional Agricultural Research Station, Acharya N.G. Ranga Agricultural University, Nandyal, Kurnool District, Andhra Pradesh. The crop was grown in a plot size of 1000 m^2 at planting geometry of 90 × 60 cm for DCH 32 and 90 ×45 cm for RCH 2 *Bt* BG II and was kept unsprayed throughout the cropping season. All the recommended agronomic practices were followed to raise the crop except for crop protection measures. The population of sucking insect pests was estimated from 10 plants selected randomly from 3 fully formed leaves of the canopy one each from upper, middle and lower leaves before 10 AM in the morning at weekly interval, *i.e.* Standard Meteorological Weeks (SMW) throughout the cropping season. The data on various meteorological parameters were obtained from Department of Meteorology, RARS, Nandyal. 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.

Leafhopper : The leafhopper attained two peaks with first peak during 36th SMW (12.40 leafhoppers/ 3 leaves) and the second during 39th SMW (16.00 leafhoppers/ 3 leaves) in RCH 2 *Bt*. However, during the season, the leafhoppers crossed ETL during 36th to 39th , 41st , 47th and 49th SMWs whereas in DCH 32, the peak population of leafhoppers was observed in 36th SMW (22.60 leafhoppers/ 3 leaves) and the population declined slightly during 37th and 38th SMWs (>14 leafhoppers/ 3 leaves) and then increased during 39th SMW (22.90 leafhoppers/ 3 leaves). The leafhoppers crossed ETLs during 36th to 41st SMW and 43rd to 50th SMWs (Table 1).

Thrips, aphid and whitefly : The population of thrips, aphid and whitefly did not cross ETLs during the season.

Natural enemies: Natural enemy population was observed to be very low during the season in both the test hybrids (Table 1).

Bollworms : The field incidence as well as the trap catches of *H. armigera* and *Earias* spp. were low during the season. Though there were trap catches of *S. litura*, the larval incidence in the field was almost negligible (Table 2).

The moth catches of *Spodoptera* peaked during 37th and 38th SMWs (26.29 and 27.79

Table 1. Population dynamics of sucking pests and natural enemies during 2017-2018

Standard Meteorological week	Sucking pests (RCH 2 BG II)/5 plants				Sucking pests (DCH 32) /5 plants				Predators/plant*	
	Aphid/ 3 leaves	Jassid/ 3 leaves	Thrips/ 3 leaves	Whitefly/ 3 leaves	Aphid/ 3 leaves	Jassid/ 3 leaves	Thrips/ 3 leaves	Whitefly / 3 leaves	(RCH 2 BG II)	(DCH 3)
36	0.00	12.40	0.00	0.00	0.00	22.60	0.00	0.30	0.00	0.20
37	0.00	8.10	1.50	0.20	0.00	14.30	0.00	0.10	0.20	0.00
38	0.00	6.60	2.10	0.20	0.00	14.30	0.00	0.00	0.10	0.00
39	0.00	16.00	0.60	0.10	0.00	22.90	0.00	0.00	0.00	0.20
40	0.00	5.00	0.00	0.60	0.00	15.60	0.00	0.10	0.20	0.00
41	0.00	10.40	0.00	0.20	0.00	13.60	0.00	0.40	0.40	0.00
42	0.00	5.00	0.00	0.60	0.00	5.80	0.00	1.00	0.20	0.00
43	0.00	3.90	0.00	0.10	0.00	6.30	0.00	0.40	0.10	0.00
44	0.00	2.60	0.00	0.20	0.00	9.00	0.00	0.00	0.00	0.20
45	0.00	3.50	0.00	1.00	0.00	7.70	0.00	0.00	0.90	0.00
46	0.00	3.30	0.00	0.20	0.00	8.80	0.00	0.20	0.20	0.00
47	0.00	7.60	0.00	0.60	0.00	7.60	0.00	0.60	0.00	0.00
48	0.00	5.10	0.00	0.20	0.00	9.30	0.00	0.00	0.00	0.00
49	0.00	6.2	0.00	0.8	0.00	8.8	0.00	0.00	0.3	0
50	0.00	3.9	0.00	0.2	0.00	6.1	0.00	0.00	0.2	0.2
51	0.00	3.6	0.00	0.2	0.00	2.8	0.00	0.00	0.2	0.2
52	0.00	3	0.00	0.2	0.00	3.2	0.00	0.00	0.2	0.2

Table 2. Pheromone trap catches of bollworms and weather parameters

Stan-	Meteorol-ogical week	Trap catches/week (mean of 4 traps)				Abiotic factors				
dard	*Helicoverpa*	*Pectinophora*	*Earias*	*Earias*	*Spodoptera.*	Temp. (°C)		RH (%)		Rainfall
week	*armigera*	*gossypiella*	*insulana*	*vittella*	*litura*	Max.	Min.	Mor.	Eve.	(mm)
36	2.00	1.09	0.00	0.00	12.17	33.2	25.1	85.6	65.6	16.2
37	3.07	3.48	0.21	0.50	26.29	33.7	24.7	81.4	63.1	58.4
38	9.21	1.80	0.00	0.00	27.79	31.8	24	83.6	61.1	18.2
39	1.07	3.24	0.71	0.00	5.29	32.4	24.8	88.7	72.6	8
40	0.86	5.33	1.50	0.00	6.64	31.5	24.5	90	69.09	52.6
41	0.50	9.38	0.86	0.36	8.64	30.9	23.9	91.7	70.7	46.6
42	0.86	8.08	0.71	0.71	14.00	32.9	23.6	88.4	61.7	25.6
43	0.86	5.67	1.50	0.50	5.07	33.6	23.5	79.9	50.6	0
44	1.21	8.80	0.71	0.64	3.64	32.3	22.7	74.4	44.3	0
45	0.57	5.93	1.00	1.14	4.36	32.1	21.9	86.1	53.1	3.2
46	1.57	12.38	0.86	0.50	2.71	32.7	23.3	77.3	47.3	0
47	0.07	21.80	4.29	0.21	10.14	33.3	22.9	85.7	51	0
48	0.14	25.17	2.43	0.29	9.07	31.5	20.6	82.7	48.1	0
49	0.00	27.62	1.79	1.07	11.00	31.3	19.4	86.6	47.3	0
50	0.64	55.68	4.21	0.43	14.07	33	19	83.4	41.1	0
51	0.14	22.99	2.86	0.00	6.21	30.8	17	85	40.9	0
52	0.19	23.78	1.56	0.81	8.56	30.9	16.4	86.8	39.5	0

moths/ trap / week, respectively). The incidence of pink bollworm started during beginning of the season, and attained ETL during 46th SMW and reached peak during 50th SMW (55.68 moths/ trap/week). However, the trap catches crossed ETLs from 46th to 52nd SMWs (Table 2).

Correlation studies : The leafhopper population had a significant and positive correlation with minimum temperature (r= 0.535, r= 0.724) and evening relative humidity (r= 0.754, r= 0.817) in RCH 2 *Bt* and DCH 32, respectively (Table 3). Though correlation exists between leafhopper population and maximum temperature, morning relative humidity and rainfall, it was not significant in both the test hybrids. The correlation between trap catches of pink bollworm and minimum temperature (r= -0.736) and evening relative humidity (r= -0.674) was significant but negative correlation whereas the trap catches of other bollworms and weather parameters did not have any significant correlation. The trap catches of *H. armigera* and *S. litura* did not show any correlation with any of the abiotic factors (Table 3).

The present finding revealed that the leafhopper had a significant and positive correlation with minimum temperature but in negation with Bhute *et al.*. (2012) who reported that leafhopper population had a significant and positive correlation with maximum temperature. But, the present results are in conformity with findings of Ramesh babu and Meghwal (2014), Shivanna *et al.* (2009), Patel (1992) and Mohapatra (2008) that a positive correlation existed between leafhopper population and temperature. The present findings are also in line with Desai *et al.* (2009) who revealed that there was a significant and positive correlation between minimum temperature and leafhopper population. However, the present findings on significant and positive correlation between leafhopper population and RH (eve) are in accordance with the reports of Selvaraj *et al.* (2011), Laxman *et al.* (2014), Shitole and Patel (2009), Kaur *et al.* (2009) and Prasad *et al.* (2008) who revealed significant and positive correlation between leafhopper and relative humidity.

No correlation existed between the moth catches of *H. armigera* and abiotic factors (r = -0.4346) which is in negation with reports of Hameed *et al.* (2015) that there was a significant and negative correlation between moth catches of *H. armigera* and minimum temperature and also with the reports of Yogesh and Kumar (2014)

Table 3. Correaltion between the insect pests of cotton and weather parameters.

Abiotic factors	Leafhoppers population/3 leaves		Bollworm trap catches(moths/trap)		
	RCH 2 BG II	DCH 32	*Pectinophora gossypiella*	*Spodoptera litura*	*Helicoverpa armigera*
T- Max (^{0}C)	0.154	0.186	-0.156	0.224	0.116
T- Min (^{0}C)	0.535 *	0.724**	-0.736**	0.192	0.381
RH (Mor) (%)	0.460	0.244	-0.031	0.054	-0.176
RH (Eve) (%)	0.754**	0.817**	-0.674**	0.248	0.292
Rainfall (mm)	0.316	0.450	-0.449	0.447	0.243

Correlation coefficient 'r'$_{(15,\ 0.05)}$ = 0.482 $r_{(15,\ 0.01)}$= 0.606

who reported that the moth catches of *H. armigera* showed a significant and positive correlation with minimum temperature.

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