

## Seasonal Dynamics of Insect Pests of Cotton in Scarce Rainfall Zone of Andhra Pradesh

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### ABSTRACT

Experiment conducted during *kharif*, 2015-16 at RARS, Nandyal with two test hybrids for the incidence of sucking pests revealed that per in DCH 32 and RCH 2 Bt BG II, the leafhopper population attained with two peaks with the first peak during the 35<sup>th</sup> standard meteorological week (SMW) with 14.5 leafhoppers /3 leaves and the second peak was observed during 42<sup>nd</sup> SMW with 16.8 leafhoppers/3 leaves whereas in RCH 2 Bt BGII, the leafhopper population attained two peaks with the first peak during the 35<sup>th</sup> SMW with 8.7 leafhoppers /3 leaves and the second peak was observed during 42<sup>nd</sup> SMW with 9.3 leafhoppers/ 3 leaves Though the incidence of thrips, aphids and whitefly was there, they have not crossed Economic Threshold Level (ETL) during the cropping period. However, the incidence of other sucking pests like thrips, aphids and whitefly was there, they have not crossed ETL. The incidence of *Helicoverpa armigera* and *Spodoptera exigua* in the field was negligible during the cropping period. However, for almost all the bollworms, the mean trap catches attained two peaks during the season. The trap catches of *Helicoverpa* attained two peaks with the first peak during 35<sup>th</sup> SMW (33.6 moths/trap/week) followed by the second peak during 45<sup>th</sup> SMW (12.5 moths/trap/week). The incidence of *Spodoptera litura* was observed throughout the season with first peak during 45<sup>th</sup> SMW with 37.3 moths/trap/week and second peak during 2<sup>nd</sup> SMW of 2016 with 41.0 moths/trap/week. The pink bollworm appeared in middle of the season and the peak catches were recorded during 45<sup>th</sup> SMW (41.6 moths/trap/week) and thereafter the trap catches declined towards the end of the season. The spotted bollworm (*E. insulana*) catches were highest during 45<sup>th</sup>, 48<sup>th</sup> and 50<sup>th</sup> SMW with 19.7, 19.0 and 13.4 moths/trap/week, respectively whereas *E. vittella* trap catches were highest during 41<sup>st</sup> std. week with 10.3 moths/trap/week

**Key words** cotton, sucking pests, abiotic factors

Cotton (*Gossypium* spp.) is the most important commercial crop in India and plays a vital role in agricultural, industrial, social and monetary affairs of the country. About 60 million people of the country are involved directly or indirectly in cotton production, processing, textiles and related activities. India is the only country in the world where all the four cultivated species of cotton, viz. *Gossypium arboreum* L., *G. hirsutum* L., *G. herbaceum* L. and *G. barbadense* L. 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). Cotton insect pests can primarily be divided into sucking pests and bollworms. After the introduction of Bt cotton during 2002, the bollworm attack on crop has drastically reduced and the sucking pests gained major importance. Among the sucking pests, leafhoppers, mirids in South India and whitefly in North India are of immense importance. Weather plays a key role as it influence the incidence of the major insect pests and to develop long term forecasting models the relationship between incidence of the major insect pests and the weather parameters are to be investigated. Therefore, 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 was focused on location specific seasonal occurrence of insect pests and their relationship with weather parameters was taken up for formulating timely and effective management of insect pests on cotton.

### MATERIAL AND METHODS

Present investigations on the seasonal incidence of sucking pests were recorded on two cotton hybrids i.e., DCH 32 and RCH 2BT BG II during *kharif*, 2015 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<sup>2</sup> 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 upper canopy before 10 AM in the morning at weekly interval, i.e. Standard Meteorological Weeks (SMW) throughout the cropping season.

The data obtained were converted to mean population by using window MS excel functions including the following formulae:

Where Mean (X) = Average/mean population

N= no. of plants

∑x = Sum of population of all plants

The data on various meteorological parameters was 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.

**Table 1. Population dynamics of sucking pests and pheromone trap catches of bollworms in relation to weather parameters**

Std. week	Leafhoppers/ 3 leaves		Natural enemies/ plant		Moth catches / Trap / week					Temp -rature (°C)		RH (%)		Rainfall (mm)
	RCH 2 BG II	DCH 32	Spiders	Lady birds	<i>S. litura</i>	<i>H. armigera</i>	<i>E. insulana</i>	<i>E. vittella</i>	PBW	Max.	Min.	Mor	Eve	
35	8.7	14.5	1	0.5	19.0	33.67	2.00	0.00	0	35	25.9	70.4	47.3	4.7
36	8.3	12.8	2	0.5	8.8	13.00	2.00	2.00	0.86	36.4	24.8	76	53.4	26.2
37	6.3	9.1	0	1.5	2.4	2.57	2.29	1.86	0.71	31	24.1	88	75.7	145.8
38	5.6	8.8	1	2	7.0	3.71	2.83	5.50	0.29	32.9	25.1	80.4	58.4	26.6
39	6.5	7.2	0.5	0.5	6.0	4.14	5.57	2.57	0.43	34.8	25.1	81.3	64.6	78.4
40	6.6	9.6	2	0.5	22.29	11.71	4.00	5.00	0.71	32.3	24.4	88	71	34.1
41	9.2	13.7	0	0.5	19.00	1.14	2.29	10.29	1.43	34.5	24.8	85.6	55.1	0
42	9.3	16.8	0.5	0.5	28.29	6.57	6.00	6.71	1.00	35.5	24.1	73	49.1	0
43	5.5	13.4	3	0	29.14	10.00	4.86	1.43	17.57	35.2	21.6	72.9	47.7	0
44	4.4	10.2	2	0.5	18.31	10.29	4.84	5.20	24.94	34.1	23.9	79.6	57.9	0
45	4.8	11	2	2.5	37.38	12.50	19.75	5.50	41.63	32.6	23.3	74.1	55.1	3.8
46	1.7	4.8	1	0.5	16.29	3.29	5.14	4.71	39.86	30.4	20.7	84.6	60.1	7.4
47	2.2	3.3	1.5	0	14.00	3.29	7.57	5.86	11.14	30.4	22.4	82.9	65.7	5.6
48	1.4	3.9	3	1.5	12.33	3.00	19.00	3.17	22.83	31.3	21.2	88.3	57.7	18.3
49	0.7	1.6	0	0	5.86	2.57	5.86	2.29	25.14	31.2	19.3	87.9	52.3	0
50	0.5	1.7	0.5	0	6.29	7.14	13.43	2.57	23.71	32.4	19.2	87.7	59.3	0
51	0.3	0.3	0	0	24.29	6.57	3.14	2.14	22.57	32.1	18.5	90	59	0
52	0.2	2.2	0	0	7.13	3.75	8.00	0.63	24.25	32.5	18.1	77.6	45	0
1	0.2	0.3	0	0	15.71	3.57	3.43	2.86	20.43	32.09	16.00	86.14	45.14	0.00
2	0	0.1	0	0	41.00	4.86	3.29	2.71	19.14	31.64	14.83	73.71	37.14	0.00
3	0	0	1	0	21.00	4.57	5.14	2.43	21.57	30.29	18.51	84.57	56.29	1.03
4	0	0	0	0	6.57	3.57	4.14	7.71	11.71	32.34	19.23	88.57	66.14	0.00
5	0	0	0	0	4	0	1.67	2.67	8.00	35.17	18.80	85.00	51.33	0.00

## RESULTS AND DISCUSSIONS

### Sucking pest population dynamics

The incidence of leafhopper was noticed throughout the cropping period in both the test hybrids. In DCH 32, the leafhopper population attained with two peaks with the first peak during the 35<sup>th</sup> SMW with 14.5 leafhoppers /3 leaves and the second peak was observed during 42<sup>nd</sup> SMW with 16.8 leafhoppers/ 3 leaves whereas in RCH 2 Bt BGII, the leafhopper population attained two peaks with the first peak during the 35<sup>th</sup> SMW with 8.7 leafhoppers /3 leaves and the second peak was observed during 42<sup>nd</sup> SMW with 9.3 leafhoppers/ 3 leaves Though the incidence of thrips, aphids and whitefly was there, they have not crossed ETL during the cropping period. The natural enemy population was also very meagre (Table 1).

### Bollworm population dynamics

For recording bollworm data, sucking pests were managed by spraying monocrotophos @ 1.6ml/l and with neem oil @ 5ml/l. The incidence of *Helicoverpa armigera* and *Spodoptera exigua* in the field was negligible during

the cropping period. However, for almost all the bollworms, the mean trap catches attained two peaks during the season. The trap catches of *Helicoverpa* attained two peaks with the first peak during 35<sup>th</sup> SMW (33.7 moths/trap/week) followed by the second peak during 45<sup>th</sup> SMW (12.5 moths/trap/week). The incidence of *Spodoptera litura* was observed throughout the season with first peak during 45<sup>th</sup> SMW with 37.4 moths/trap/week and second peak during 2<sup>nd</sup> SMW of 2016 with 41.0 moths/trap/week. The pink bollworm appeared in middle of the season and the peak catches were recorded during 45<sup>th</sup> SMW (41.6 moths/trap/week) and thereafter the trap catches declined towards the end of the season. The spotted bollworm (*E. insulana*) catches were highest during 45<sup>th</sup>, 48<sup>th</sup> and 50<sup>th</sup> std. weeks with 19.75, 19.00 and 13.43 moths/trap/week, respectively whereas *E. vittella* trap catches were highest during 41<sup>st</sup> std. week with 10.3 moths/trap/week (Table 1).

The correlation studies between the insect pest populations and weather parameters revealed a significant and positive correlation between leafhoppers population and both the maximum and minimum temperature on both the test hybrids at both the levels of significance tested

**Table 2.** Correlation between pest incidence and weather parameters (with same SMW weather data)

Weather parameters	Leafhoppers/ 3 leaves		Natural Enemies/ plant		<i>S. litura</i>	<i>H. armigera</i>	<i>E. insulana</i>	<i>E. vittella</i>	Pink bollworm
	DCH 32	RCH 2 Bt BG II	Spiders	Lady bird beetles					
Temp. Max (°C)	0.629**	0.633**	0.136	-0.029	0.024	0.387	-0.273	0.003	-0.500*
Temp. Min (°C)	0.890**	0.841**	0.402	0.527**	-0.114	0.419*	-0.045	0.270	-0.529**
RH Mor. (%)	-0.456*	-0.574**	-0.281	-0.140	-0.509*	-0.568**	0.012	0.180	0.082
RH Eve. (%)	0.146	0.028	0.101	0.278	-0.430	-0.179	0.038	0.282	-0.218
Rainfall (mm)	0.340	0.192	-0.069	0.397	-0.381	-0.104	-0.144	-0.178	-0.426*

$r_{tab}$  (21df, 0.05) = 0.413       $r_{tab}$  (21df, 0.01) = 0.526      \*significant at 5%      \*\*significant at both 5% and 1%

whereas the correlation was significant and negative between the leafhoppers population and morning relative humidity. Among natural enemies, lady birds population showed a significant and negative correlation with minimum temperature ( $r=0.527$ ). The moth catches of *Spodoptera litura* and *Helicoverpa armigera* showed a significant and negative correlation with morning relative humidity ( $r = -0.509$  and  $r=-0.568$ , respectively). The moth catches of *Helicoverpa armigera* had a significant and positive correlation with minimum temperature ( $r=0.419$ ). The moth catches of *Earias insulana* and *Earias vittella* did not have any sort of correlation with all the weather parameters tested. This year only, the moth catches of pink bollworms were higher after the introduction of Bt cotton in India. The moth catches of pink bollworm showed a significant but negative correlation with maximum temperature ( $r= -0.500$ ), minimum temperature ( $r= -0.529$ ) and rainfall ( $r= -0.426$ ) (Table 2).

The correlation studies between insect pests, natural enemies, moth trap catches and weather parameters indicated that leafhopper population showed a significant and positive correlation with maximum temperature ( $r = 0.4443$ ) in both the test hybrid RCH 2 BG II. The present findings are in agreement with Bhute *et al.* (2012) who reported that leafhopper population showed a significant

and positive correlation with maximum temperature. The present investigations are in conformity with Ramesh babu and Meghwal (2014), Shivanna *et al.* (2009), Patel (1992) and Mohapatra (2008) who also reported a positive correlation between leafhopper population and temperature. The present investigations are also in line with Desai (2009) who reported that there was a significant and positive correlation between minimum temperature and leafhoppers population. However, the present findings of significant and negative correlation between leafhopper population and RH (mor) are in negation with the reports of Selvaraj *et al.* (2011), Laxman *et al.* (2014), Shitole and Patel (2009), Kaur *et al.* (2009), Prasad *et al.* (2008) who reported significant and positive correlation between leafhoppers and relative humidity.

The moth catches of *Helicoverpa armigera* showed a significant but negative correlation with minimum temperature ( $r = -0.4346$ ) and the present investigations are in conformity with Hameed *et al.* (2015) who reported that there was a significant and negative correlation between moth catches of *H. armigera* and minimum temperature whereas the results are in negation with Yogesh and Rajnish Kumar (2014) who reported that the moth catches of *H. armigera* showed a significant and positive correlation with minimum temperature.

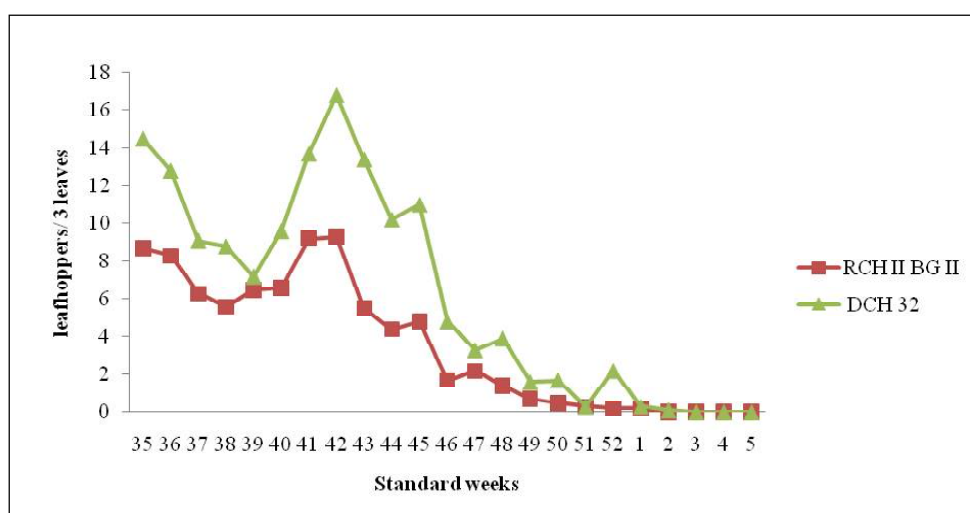


Fig. 1. Dynamics of leafhoppers on cotton during kharif 2015

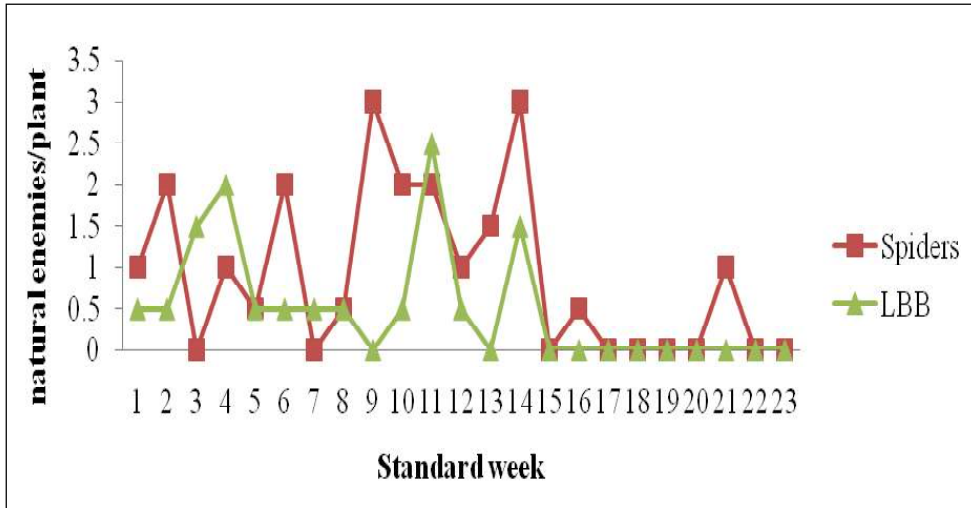


Fig. 2. Dynamics of natural enemies on cotton during *kharif* 2015

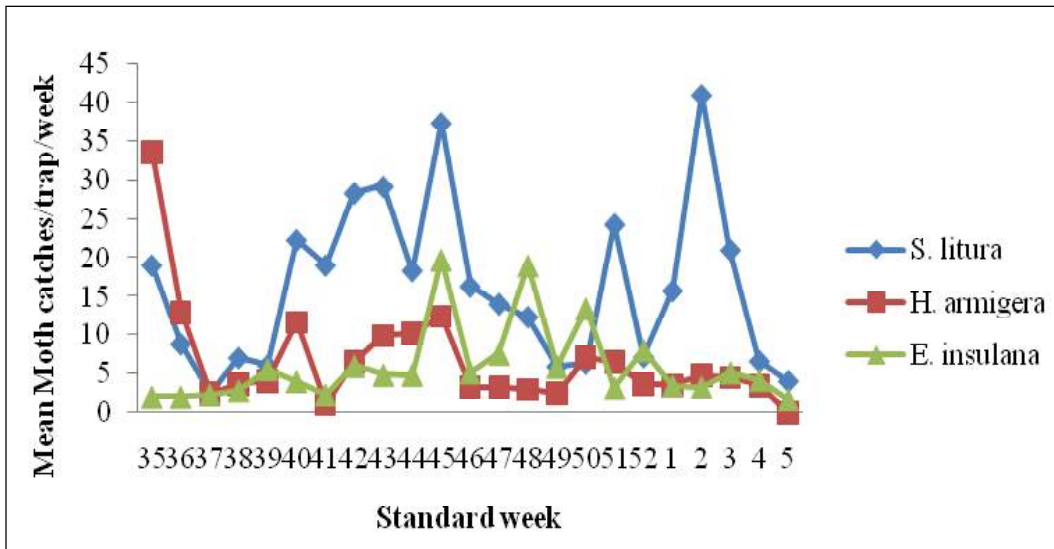


Fig. 3. Trap catches of bollworms during *kharif* 2015 in cotton

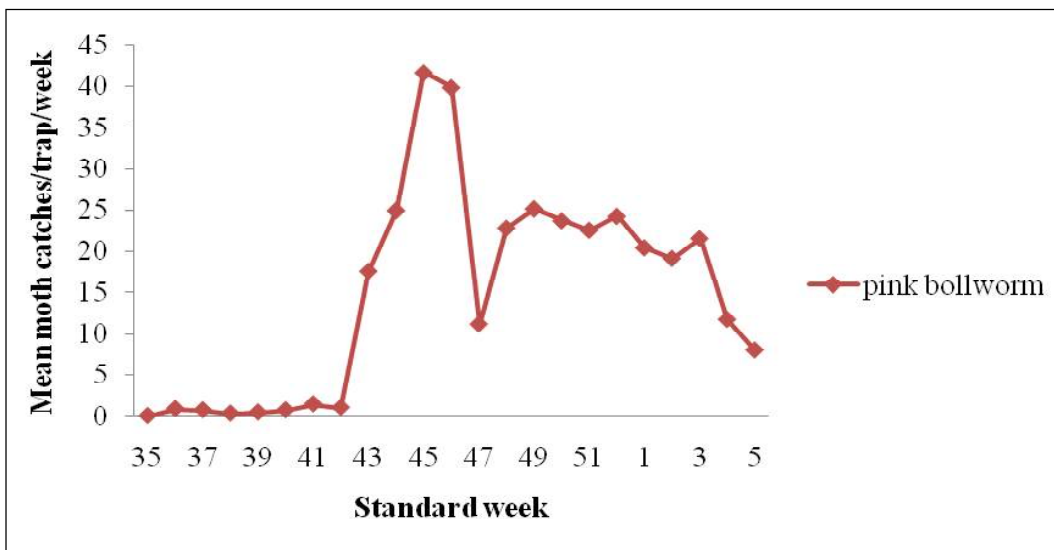


Fig. 4. Pink boll worm trap catches during *kharif* 2015 in cotton

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