



## STUDY ON INFESTATION OF SUCKING INSECT PESTS ON Bt-COTTON AND NON Bt- COTTON FIELDS IN WARANGAL -TELANGANA

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### ABSTRACT

Extensive field survey was conducted for infestation of sucking insect pests on Bt-cotton and non Bt-cotton fields during June 2011- March 2012 and June 2012 to March-2013 in Warangal District, Telangana, India. Five sucking insect pests were recorded viz, aphids (*Aphis gossypii* Glover), whitefly (*Bemisia tabaci* Gennadius), leafhopper (*Amrasca biguttula biguttula* Ishida), mealy bug (*Phenococcus solenopsis* Tinsky) and stink bug (*Acrosternum hilare* Say). Aphids infestation was recorded for the first time in 3<sup>rd</sup> week of crop and maximum infestation was recorded ( $45 \pm 19.097$ ) in Bt –cotton and ( $41.86 \pm 1.32$ ) in non Bt-cotton in 23<sup>rd</sup> week of crop. Whitefly infestation was recorded in 3<sup>rd</sup> week of crop and continued it up to 25<sup>th</sup> week of crop high percentage of infestation was recorded ( $40.26 \pm 1.60$ ), in Bt ( $36.44 \pm 1.81$ ) in non Bt-cotton. Leaf hopper infestation was started from 3<sup>rd</sup> week of crop and acquired its peak in 21<sup>st</sup> week of crop and maximum percentage of infestation was recorded ( $39.66 \pm 0.69$ ) in Bt and ( $33.99 \pm 1.76$ ) in non Bt. In case of mealy bug infestation was recorded 12<sup>th</sup> week of crop and with peak ( $47.33 \pm 2.84$ ) in Bt, ( $39.86 \pm 1.83$ ) in non Bt-cotton continues infestation up to 24<sup>th</sup> week in both crops. The infestation of sting bug was recorded in 12<sup>th</sup> week of crop and continued it infestation in 21<sup>st</sup> week of crop in Bt-cotton and in non Bt-cotton with peak ( $29.83 \pm 0.99$ ) in Bt, ( $25.91 \pm 0.77$ ) non Bt. Aphids, whitefly, leafhopper, mealy bug and sting bug infestation showed positive correlation with morning relative humidity and negative correlation with maximum and minimum temperature, evening relative humidity and rainfall in Bt-cotton and non Bt-cotton.

**KEY WORDS:** Bt-cotton, Non Bt-cotton, Sucking insect pests and correlation with weather factors.

### INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is the one of the important cash crops of the India. It occupies a very prominent position in the economy of the country. Because it provides livelihood to millions of people and is also one of the major foreign earner of the country. It is cultivated about 9.2 million ha with a production of 21.3 million bales of seed cotton (Anon, 2005). The average productivity of cotton in Indian is 463kg per ha (Anon., 2006). India is the third largest cotton producer contributing 18.3% of world production (Anon., 2007). Thus India ranks first in area and fourth in production on global basis. About 162 species of insects occur in cotton at various stages of growth of which 15 are key pests (Kannan *et al* 2004). The low productivity of cotton is caused by many factors but the most serious one is the infestation of insect pests attack. Among sucking insect pests, whitefly (*Bemisia tabaci* Gennadius), aphid (*Aphis gossypii* Glover), leafhopper (*Amrasca biguttula biguttula* Ishida), mealy bug (*Phenococcus solenopsis* Tinsky) and stink bug (*Acrosternum hilare* say) are major pests in India and cause considerable damage in Bt and non Bt- cotton. These are very destructive pests during seeding and vegetative phase of cotton as they suck the sap of the plant, make it weak and in case of severe infestation wilting shedding of leaves occur (A bro *et al* 2004). The present study was undertaken to conduct survey in Bt and non Bt-cotton fields in Warangal District, AP. during -2011-2012

and 2012-2013 to find out the infestation level of sucking insect pests which would help in formulating the integrated management strategy for sucking insect pests in Bt and non Bt-cotton, with regular occurrence at different growth stages reducing the growth and yield.

### MATERIALS & METHODS

We carried out a survey by fixed plot method, Govindaiah and Gunashekar V. (1992) in five Bt-cotton fields and five non Bt- cotton fields in intensive cotton growing areas of Warangal District during to study infestation of sucking pest (2011-2012 and 2012-2013). At each selected cotton field five plots of 5 m × 5 m were marked out ( one each in the four corners, 10m away from the border, and one in the center), thus making a total of 25 plots. In each field the total number of plants and as well as numbers of sucking insect pests infested plants were counted and percentage of infestation was calculated every week.

### RESULTS & DISCUSSION

#### Sucking insect pests in Bt- Cotton and non Bt-cotton

**Aphids: (*Aphis gossypii* (Glover):** No infestation was recorded during the first three weeks of both crops Bt and non Bt- cotton fields and its infestation was recorded on 3<sup>rd</sup> week of crop (July) at the apical shoots and increased gradually and reached at maximum during 24<sup>th</sup> week (first week of December) (Table-1,2).

**TABLE 1:** Percentage of Bt and non Bt plants attached by sucking insect Pests. (Mean and SE) 2011-2012

Sl. No	Month	Aphids		Whitefly		Leaf hopper		Mealy bug		Stink bug	
		Bt	Non Bt	Bt	Non-Bt	Bt	Non-Bt	Bt	Non-Bt	Bt	Non-Bt
1	Jun	0	0	0	0	0	0	0	0	0	0
2	July	1.19 ± 0.87	1.66 ± 1.00	3.33 ± 2.00	0.99 ± 0.33	2.99 ± 1.66	2.33 ± 1.00	0	0	0	0
3	Aug	5.49 ± 0.91	3.49 ± 0.91	4.16 ± 0.99	2.16 ± 0.87	4.99 ± 0.69	2.99 ± 0.69	0	0	0	0
4	Sep	7.82 ± 2.58	6.16 ± 1.70	5.33 ± 2.16	3.99 ± 1.30	5.16 ± 1.28	4.07 ± 1.05	1.66 ± 1.10	1.16 ± 0.78	1.99 ± 0.66	0.99 ± 0.63
5	Oct	19.59 ± 1.58	15.46 ± 1.14	17.46 ± 1.62	13.19 ± 0.97	18.13 ± 2.35	14.39 ± 2.01	8.66 ± 1.43	6.39 ± 1.12	5.59 ± 0.80	4.26 ± 0.74
6	Nov	31.82 ± 2.98	27.49 ± 2.74	29.82 ± 2.98	25.83 ± 2.55	31.99 ± 1.90	25.16 ± 2.02	25.49 ± 3.79	18.99 ± 2.58	17.49 ± 3.01	13.99 ± 2.81
7	Dec	38.32 ± 2.08	31.99 ± 1.46	35.32 ± 1.56	28.16 ± 3.29	25.16 ± 2.21	19.82 ± 2.75	36.16 ± 2.46	29.83 ± 1.39	10.99 ± 2.28	9.08 ± 1.80
8	Jan	30.39 ± 3.53	24.93 ± 2.60	29.32 ± 2.80	22.93 ± 2.94	11.59 ± 2.33	7.59 ± 1.61	23.99 ± 3.78	20.26 ± 3.10	1.46 ± 0.95	0.99 ± 0.66
9	Feb	9.66 ± 2.18	5.99 ± 1.92	8.32 ± 2.99	4.49 ± 1.68	1.49 ± 0.68	0.99 ± 0.79	7.83 ± 2.13	6.66 ± 1.65	0	0
10	Mar	1.16 ± 0.78	0	0.99 ± 0.63	0	0	0	1.16 ± 0.78	0	0	0

**TABLE 2:** Percentage of plants attached by sucking insect Pests. (Mean and SE) 2012-2013

Sl. No	Month	Aphids		Whitefly		Leaf hopper		Mealy bug		Stink bug	
		Bt	Non Bt	Bt	Non-Bt	Bt	Non-Bt	Bt	Non-Bt	Bt	Non-Bt
1	June	0	0	0	0	0	0	0	0	0	0
2	July	3.55 ± 1.17	3.99 ± 1.38	3.33 ± 1.01	4.88 ± 1.17	2.99 ± 0.76	3.99 ± 1.01	0	0	0	0
3	August	6.99 ± 1.03	8.99 ± 1.13	6.16 ± 1.16	7.49 ± 0.91	5.49 ± 1.16	7.66 ± 1.03	0	0	0	0
4	September	10.13 ± 3.01	7.99 ± 2.78	8.26 ± 2.52	5.49 ± 1.54	8.66 ± 3.49	5.16 ± 1.25	6.66 ± 2.13	4.88 ± 2.31	4.66 ± 1.15	2.66 ± 0.66
5	October	27.66 ± 2.86	25.46 ± 3.35	22.41 ± 2.75	19.06 ± 2.60	30.66 ± 2.91	22.52 ± 2.53	24.33 ± 3.7	18.66 ± 2.25	16.49 ± 2.54	11.86 ± 2.05
6	November	42.99 ± 1.93	40.49 ± 0.99	35.82 ± 1.25	32.99 ± 1.93	39.66 ± 0.69	33.99 ± 1.76	45.49 ± 2.21	36.58 ± 2.12	29.83 ± 0.99	25.91 ± 0.77
7	December	45.19 ± 0.97	41.86 ± 1.32	40.26 ± 1.60	36.44 ± 1.81	31.73 ± 2.05	26.66 ± 1.75	47.33 ± 2.84	39.86 ± 1.83	18.26 ± 2.34	16.26 ± 2.35
8	January	31.82 ± 2.97	25.49 ± 3.92	20.49 ± 4.07	19.66 ± 2.84	13.82 ± 2.91	13.91 ± 2.31	29.32 ± 2.62	23.24 ± 2.74	3.33 ± 1.15	3.99 ± 1.33
9	February	8.21 ± 2.70	6.44 ± 1.73	6.99 ± 1.66	3.99 ± 2.66	4.66 ± 1.33	3.33 ± 2.00	7.33 ± 2.31	5.99 ± 1.76	0	0
10	March	0	0	0	0	0	0	0	0	0	0

**TABLE-3.**Correlation coefficient of sucking insect pests infestation with weather factors -2011-2012

		Correlation coefficient ( r ) 2011-2012									
Sl. No	Weather factors	Aphids	Whitefly	Leaf hoper	Mealy bug	Stink bug	Stink bug				
1	Max. Tem(°c)	-0.614**	-0.623**	-0.629**	-0.600**	-0.564**	-0.540**	-0.533**	-0.545**	-0.395*	-0.391*
2	Min Tem(°c)	-0.865**	-0.848**	-0.874**	-0.844**	-0.590**	-0.567**	-0.913**	-0.928**	-0.486**	-0.497**
3	R. H.M%	0.209	0.200	0.201	0.174	0.283	0.269	0.079	0.092	0.136	0.136
4	R.H.E%	-0.026	-0.062	-0.067**	-0.096**	0.056	0.059	-0.208	-0.214	-0.027	-0.047
5	Rainfall(mm)	-0.559**	-0.514**	-0.519**	-0.515**	-0.387*	-0.374*	-0.542**	-0.532**	-0.344*	-0.346*

**TABLE-4.**Correlation coefficient of sucking insect pests infestation with weather factors -2012-2013

Sl. No	Weather factors	Correlation coefficient ( r ) 2012-2013									
		Aphids	Whitefly	Leaf hoper	Mealy bug	Stink bug	Stink bug	Stink bug	Stink bug	Stink bug	Stink bug
1	Max. Tem(°c)	-0.609**	-0.602**	-0.584**	-0.594**	-0.440**	-0.508**	-0.547**	-0.548**	-0.327*	-0.365*
2	Min Tem(°c)	-0.758**	-0.715**	-0.701**	-0.704**	-0.509**	-0.566**	-0.750**	-0.754**	-0.378*	-0.441**
3	R. H.M%	0.313*	0.297	0.267	0.285	0.264	0.2934	0.250	0.236	0.215	0.216
4	R.H.E%	-0.387*	-0.374*	-0.412**	-0.391*	-0.366*	-0.315*	-0.433**	-0.442**	-0.318*	-0.313*
5	Rainfall(mm)	-0.472**	-0.450**	-0.450**	-0.414**	-0.421**	-0.405**	-0.527**	-0.525**	-0.397*	-0.419**

\*Correlation is significant at the 0.05 level; \*\*Correlation is significant at the 0.01 level  
 Max. Tem (Maximum Temperature), Min .Tem (Minimum Temperature),  
 R. H.M (Relative humidity morning), R. H.E (Relative humidity evening).



A



B

**FIGURE 1.** *Aphis gossypii* Glover (aphid) in Bt-cotton (A) and Non Bt-cotton fields (B)

Then slowly decreased up to the 2<sup>nd</sup> week of February. The infestation was recorded throughout the year in Bt and non Bt-cotton. The nature of damage of adults was recorded sucking the cell sap from tender plants, than leaves turn in to yellow or pale colored and dry up. The present findings are inline with the finding of Bakhetia and sidhu (1976) who revealed that the aphid infestation remaining active throughout the year. However, the findings are not agreement with the findings of Dugger and Richter (1998) who reported peak aphid incidence on cotton during July months. (Fig. 1)

**Whitefly:** *Bemisia tabaci* (Gennadius) Whitefly infestation was recorded initially on 3<sup>rd</sup> week of crop

(July) that increased gradually and reached at maximum during the 2<sup>nd</sup> week of crop (December) on Bt- and non Bt- cotton. Heavy infestation by whitefly cause yellowing of leaves and wilting in both crops. The infestation was declined during January to fort night of February in both crops. The nature of damage caused by adults and nymphs suck the cell sap from the leaves which turn pale and dry up. The present findings are in close agreement with the findings of Jayakumar, Anitha and Nandihalli (2008) who reported peak incidence of whitefly in last week of April (Fig. 2).



**FIGURE 2.** *Bemisia tabaci* Gennadius (whitefly) in Bt-cotton (A) and Non Bt-cotton fields (B)

**Leafhopper:** *Amrasca biguttula biguttula* (Lsida): Leafhopper infestation was noticed in 3<sup>rd</sup> week of crop. Maximum infestation of leafhopper was recorded in 21<sup>st</sup> week in Bt and non Bt cotton. The infestation was

continued up to first fortnight of February. The reports of Senapete and Mohan (1980), Anitha and Nandihalli (2008) and Arif et al (2003) supporting the present findings (Fig. 3).



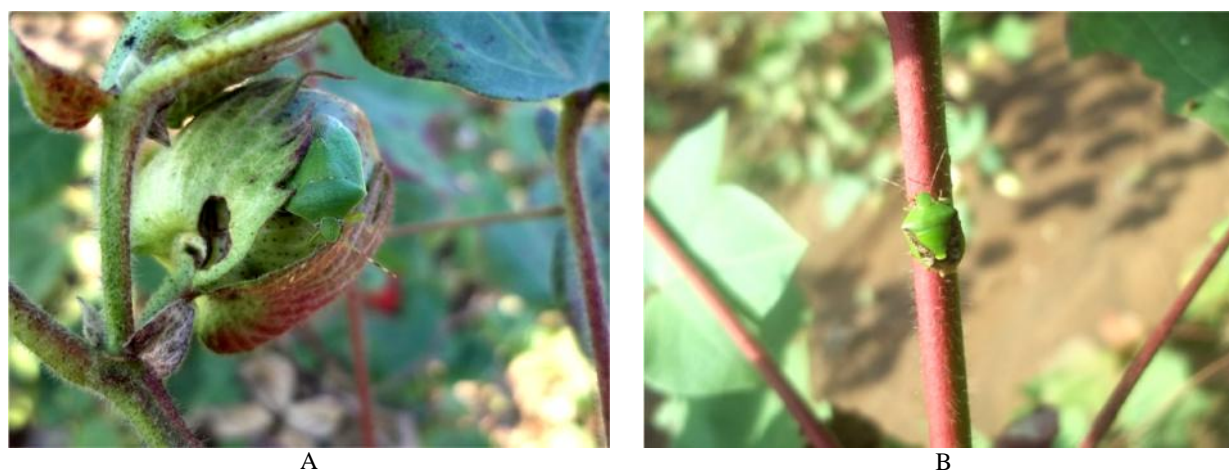
**FIGURE 3.** *Amrasca biguttula biguttula* (Ishida) (leafhopper) in Bt-cotton (A) and Non Bt-cotton fields (B)

**Mealy bug:** *phenococcus solenopsis* (Tinsky). The infestation of mealy bug was recorded on the stems and leaves of the Bt and non Bt- cotton plants at the apical shoots was during the 12<sup>th</sup> week of crop. The maximum infestation of mealy bug was recorded in 24<sup>th</sup> week of crop. The infestation was recorded up to end of the cropping season in both crops. The nature of damage of mealy bug was found curling and drying of leaves and some of the severely infested plants died. Present results supported by Laxman et al (2009). (Fig. 4)

**Stink bug:** *Acrosternum hilare* (Say). The infestation of stink bug noticed in 12<sup>th</sup> week of crop in both Bt and non Bt- cotton crops. The maximum infestation of stink bug was recorded in 22<sup>nd</sup> week of crop (November). The infestation was remained active up to 30<sup>th</sup> week of crop (January). Its damage was noticed on developing bolls external signs of feeding injury include the appearance of circular black lesions on surface of bolls. Observed significant symptoms on developing bolls, Present observation supported by Barbour et al (1988), Greene and Herzog (1999b). (Fig. 5)



**FIGURE 4.** *Phenococcus solenopsis*(Tinsky)(mealy Bug) in Bt-cotton (A) and Non Bt-cotton fields (B)



**FIGURE 5.** *Acrosternum hilare* (say) (stink bug) in Bt-Cotton (A) and Non Bt-cotton fields(B)

Sucking insect pests infestation, such as aphids, whitefly, leafhopper, and stink bug in Bt-cotton and non Bt-cotton showed negative correlation with rainfall and they did not exhibit any association with maximum temperature, minimum temperature, and relative humidity (morning and evening). In case of mealy bug infestation in Bt-cotton and non Bt-cotton showed negative correlation with minimum temperature and rainfall and did not exhibit any association with maximum temperature and relative humidity (morning and evening) (Table-3,4)

The present findings are in agreement with the finding of Umar et al (2003) and Bishnoi et al. (1996), who reported that leafhopper infestation increased with maximum temperature, the maximum temperature also correlated positively with aphids, whitefly, mealy bug and stink bug infestation. The minimum temperature, relative humidity and rainfall were negatively correlated with infestation and non-significant. The present findings are inline with the findings of Patel et al. (1997) who reported the aphid infestation did not attain peak in rainy season.

## CONCLUSION

Over all sucking insect pest was increased as secondary pests in Bt and non Bt-cotton fields. However, insect

problems that is likely to increase in Bt-cotton than non Bt-cotton.

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