GAU Research Journal 42 (1) : 13-20 (January 2017)

Status of pink bollworm, *Pectinophora gossypiella* (Saunders) infesting *Bt* cotton under middle Gujarat conditions

R. K. THUMAR[1], P. K. BORAD[2], T. M. BHARPODA[3], M. V. PATEL[4] AND M. B. ZALA[5]

Department of Agricultural Entomology B. A. College of Agriculture
Anand Agricultural University, Anand-388 110 (Gujarat)

Received : 2 November, 2016

ABSTRACT

Field studies were conducted to know the status of pink bollworm infesting *Bt* cotton in two districts (Kheda and Vadodara) of Gujarat. The higher damage due to *Pectinophora gossypiella* (Saunders) was recorded in Karjan taluka of Vadodara district during the years 2014-15 and 2015-16. During 2014-15, the per cent infestation due to pink bollworm was found 26.29 and 5.52 in Kheda and Vadodara district, respectively. Similarly, per cent infestation caused by this pest was observed 31.10 and 15.28 in Kheda and Vadodara districts, respectively during 2015-16. The incidence of *P. gossypiella* was higher during 2015-16 as compared to 2014-15 in middle Gujarat.
and positively correlated with organic carbon content of soils.

Key word: Pink bollworm, *Bt* cotton,

Bt cotton is widely accepted by the cotton growers of India and Gujarat as well. In India, cotton crop cultivated about 118.81 lac hectares with the production of 352.00 lac bales, whereas in Gujarat, it was cultivated 27.61 Lac hectares with the production of 101.00 Lac bales during the year 2015-16 (http:// cotcorp.gov.in). In India, bollworms commonly encountered in cotton cultivation are spotted bollworm, *Earias vittella* (Fabricius), American bollworm, *Helicoverpa armigera* (Hubner) Hardwick, Tobacco leaf eating caterpillar, *Spodoptera litura* (Fabricius) and pink bollworm, *Pectinophora gossypiella* (Saunders). On introduction of *Bt* cotton, bollworms remained under control. However, pink bollworm showed increasing trend in *Bt* cotton. It has now become a most serious pest of *Bt* cotton in Gujarat since last two years causing losses in both yield and quality of cotton. During recent past, it has emerged as a threat to cotton growing areas of India. It causes loculi damage to an extent of 55 per cent and reduction in seed cotton yield in the range of 35-90 per cent. The losses due to this pest was estimated to the tune of 6525 metric tonnes of lint worth Rs.1216 million (Agarwal and Katiyar, 1979). World over, pink bollworm, *P. gossypiella* is the most destructive pest of cotton and is known to cause 2.8 to 61.9 per cent loss in seed cotton yield, 2.1 to 47.1 per cent loss in oil content and 10.7 to 59.2 per cent loss in normal opening of bolls (Patil, 2003). The destructive larvae usually feed on flower buds, bolls and seeds therein, which results in malformation, rotting, premature or partial boll opening, reduction in fibre length and overall reduced quality of the cotton due to staining of lint. The larval stage is usually buried within the cotton fruiting bodies making them inaccessible to insecticidal sprays owing to which its management is somewhat difficult. Pink bollworm management on cotton was thought to be tough because the larval stages were spent within the cotton bolls. Eggs are laid under the bracteoles, at the base of the boll and flowers particularly on green bolls. On hatching, larvae penetrate flowers or bolls within 20 min (Hutchison *et al.*, 1988) to 2h (Ingram, 1994). Therefore, conventional methods including insecticidal applications are difficult to manage the pest. It has also developed resistance to Cry I Ac as reported by Sharma (2009).

Ignorance of structured refugea strategy, raising of long term events, improper disposal of cotton sticks, limited natural enemies, changed schedule of insecticidal spray, development of resistance, hidden nature of the pest *etc.* are responsible for the unusual attack of pink bollworm even in BG-II.

The report of ineffectiveness of Bollgard (Cry I Ac) to pink bollworm in certain parts of Gujarat (The

[1] Assistant Professor, [2] Professor and Head, [3] Professor
[4] SRF [5] Assistant Professor, Agril. Research Station, Sansoli

Hindu, Dated 6.3.2010) has compelled to study the pink bollworm incidence in *Bt* cotton.

MATERIALS AND METHODS

Field studies were undertaken in Vadodara and Kheda districts of Gujarat on incidence of pink bollworm *P. gossypiella* in *Bt* cotton during 2014-15 and 2015-16. This work was carried out under the project entitled "Online Pest Monitoring and Advisory Services" sponsored by NCIPM, New Delhi. Karjan, Dabhoi and Savli talukas of Vadodara district and Kapadvanj, Kathalal and Thasra talukas of Kheda district were selected for the purpose. In each taluka, three villages were selected for study (Table 1 and 3). Green bolls were collected randomly from 2 fixed plots and 2 random plots from each selected villages and observed carefully in the laboratory through destructive sampling method. Out of collected green bolls, healthy and damaged bolls were separated and counted. Based on these data, the percentage of green boll damage was worked out. Green bolls were collected three times during 2014-15 and four times during 2015-16.All selected plots were of BG-II, irrespective of events/varieties.

RESULTS AND DISCUSSION

Vadodara District

The data on an incidence of pink bollworm recorded picking-wise in Vadodara district during 2014-15 and 2015-16 are presented in Table 1 and 2, respectively.

2014-15

During first picking (1st week of December), higher (15.00 %) incidence of pink bollworm (green ball damage due to pink ballworm) was recorded in village Kandari of Karjan taluka followed by village Kuvarpura of Dabhoi taluka (10.83%) and Khanpur of Dabhoi taluka (5.83%). Minimum percentage of damaged bolls (1.67 to 4.16 %) due to pink bollworm was observed in rest of the villages of Vadodara district. During 3rd week of December, green bolls were also examined and infestation of pink bollworm was recorded to the tune of 10.00 to 79.16 per cent in different villages surveyed. The highest (79.16%) boll damage due to pink bollworm was recorded in the village Kandari of Karjan taluka followed by Ganpatpura (75.83%) of Karjan taluka. In rest of the villages, it was in the range of 10.00 to 30.83 per cent. Late season *i.e.* during 1st week of January, green bolls were also collected and dissected. Out of nine villages of Vadodara district, the highest (78.33%) green bolls infested by pink bollworm was recorded in village Kandari (Karjan taluka) followed by Ganpatpura (58.33%) and Bamangam (50.00%) of the same taluka. In rest of the villages, it was to the tune of 20.83 to 43.33 per cent (Table 1). Of the three talukas of district surveyed, the highest (43.79%) boll damage was found in Karjan taluka followed by Dabhoi (22.59) and Savli (12.50).

Among the different villages, higher damage was recorded in Kandari (57.50%) and Ganpatpura (45.55%) of Karjan taluka followed by Bamangam of Karjan taluka (28.33%), Kuvarpura of Dabhoi taluka (24.16%), Khanpur of Dabhoi taluka (24.17%). On an average 26.29 per cent green boll was recorded due to pink bollworm in Vadodara.

2015-16

The higher (62.50 %) incidence of pink bollworm was recorded in village Sadrna of Karjan taluka followed by village Kuvarpura of Dabhoi taluka (52.50%) and Kandari of Karjan taluka (38.33%) during first picking (1st week of November, 2015), whereas in rest of the villages, it was in the range of 10.00 to 11.25 per cent boll damage. During 2nd week of October, green bolls were observed and infestation due to pink bollworm was recorded to the tune of 2.50 to 56.25 per cent in different villages surveyed. The highest (56.25%) boll damage due to pink bollworm was recorded in the village Ganpatpura followed by Kandari (38.75%) of Karjan taluka. During 1st week of November, it was in the range of 8.75 to 53.75 per cent and higher (53.75%) infestation was found in Kuvarpura of Dabhoi taluka followed by Kandari of Karjan taluka with the incidence of 48.75 per cent. Late season *i.e.* during 1st week of December, green bolls were also collected and observed for the infestation. Among the different villages of Vadodara district, the highest (72.50%) green bolls infested by pink bollworm was recorded in village Kandari (Karjan taluka) followed by Sadarna (58.75%) and Vasantpura (52.50%) of Savli taluka. In rest of the villages, it was in the range of 15.00 to 50.00 per cent (Table 2). The highest boll damage was found in Karjan taluka followed by Dabhoi and

Table 1 Infestation of pink bollworm, *P. gossypiella* in Bt cotton in Vadodara district during 2014- 15

Taluka	Village	Field No.	Picking wise green ball damage (%) due to pink bollworm				
			1st	2nd	3rd	Av. of field/ villages	Av. of Talukas
Karjan	Kandari	F1	10.00	83.33	73.33	55.55	43.79
		F2	13.33	63.33	93.33	56.66	
		R1	13.33	86.66	63.33	54.44	
		R2	23.33	83.33	83.33	63.33	
			15.00	79.16	78.33	57.50	
	Bamangam	F1	0.00	53.33	40.00	31.11	
		F2	3.33	16.66	50.00	23.33	
		R1	6.66	40.00	33.33	26.66	
		R2	6.66	13.33	76.66	32.22	
			4.16	30.83	50.00	28.33	
	Ganapatpura	F1	0.00	83.33	33.33	38.89	
		F2	0.00	80.00	90.00	56.67	
		R1	10.00	66.66	83.33	53.33	
		R2	0.00	73.33	26.66	33.33	
			2.50	75.83	58.33	45.55	
Dabhoi	Kuvarpura	F1	16.66	26.66	33.33	25.55	22.59
		F2	26.66	46.66	23.33	32.22	
		R1	0.00	16.66	40.00	18.89	
		R2	0.00	26.66	33.33	20.00	
			10.83	29.16	32.50	24.16	
	Khanpura	F1	13.33	10.00	50.00	24.44	
		F2	0.00	30.00	33.33	21.11	
		R1	0.00	40.00	56.66	32.22	
		R2	10.00	13.33	33.33	18.89	
			5.83	23.33	43.33	24.17	
	Menpura	F1	0.00	20.00	16.66	12.22	
		F2	6.66	13.33	50.00	23.33	
		R1	0.00	10.00	50.00	20.00	
		R2	0.00	33.33	33.33	22.22	
			1.67	19.17	37.50	19.44	
Savli	Gulabpura	F1	0.00	16.66	16.66	11.11	12.50
		F2	0.00	23.33	30.00	17.78	
		R1	0.00	3.33	33.33	12.22	
		R2	6.66	20.00	20.00	15.55	
			1.67	15.83	24.99	15.83	
	Ghothada	F1	0.00	23.33	30.00	17.78	
		F2	6.66	20.00	13.33	13.33	
		R1	0.00	10.00	26.66	12.22	
		R2	0.00	63.33	13.33	5.55	
			1.67	14.17	20.83	12.22	
	Anjesar	F1	0.00	10.00	10.00	6.67	
		F2	3.33	6.66	33.33	14.44	
		R1	3.33	10.00	23.33	12.22	
		R2	0.00	13.33	20.00	11.11	
			1.67	10.00	21.67	11.11	
Average of district							26.29

Note: F: Fixed plot; R: Random plot; 1st picking: 04/12/2014; 2nd picking: 19/12/2014, and 3rd picking: 03/01/2015

Table 2 Infestation of pink bollworm, *P. gossypiella* in Bt cotton in Vadodara district during 2015- 16

Taluka	Village	Field No.	Picking wise green ball damage (%) due to pink bollworm					
			1st	2nd	3rd	4th	Av. of field/ villages	Av. of Talukas
Karjan	Kandari	F1	65.00	25.00	55.00	75.00	55.00	43.85
		F2	25.00	40.00	65.00	65.00	48.75	
		R1	25.00	50.00	60.00	90.00	56.25	
		R2	NF	40.00	15.00	60.00	38.33	
			38.33	38.75	48.75	72.50	49.58	
	Ganpatpura	F1	35.00	60.00	15.00	15.00	31.25	
		F2	25.00	65.00	35.00	10.00	33.75	
		R1	NF	60.00	30.00	30.00	40.00	
		R2	NF	40.00	70.00	20.00	43.33	
			30.00	56.25	37.50	18.75	37.08	
	Sadarna	F1	100.00	20.00	25.00	60.00	51.25	
		F2	25.00	40.00	45.00	50.00	40.00	
		R1	NF	30.00	35.00	60.00	41.67	
		R2	NF	35.00	40.00	65.00	46.67	
			62.50	31.25	36.25	58.75	44.90	
Dabhoi	Kuvarpura	F1	75.00	50.00	45.00	55.00	56.25	31.84
		F2	45.00	10.00	50.00	35.00	35.00	
		R1	40.00	20.00	20.00	15.00	23.75	
		R2	50.00	10.00	100.00	50.00	52.50	
			52.50	22.50	53.75	38.75	41.88	
	Khanpura	F1	40.00	20.00	45.00	25.00	32.50	
		F2	0.00	10.00	30.00	20.00	15.00	
		R1	15.00	50.00	45.00	10.00	30.00	
		R2	NF	20.00	50.00	25.00	31.67	
			18.33	25.00	42.50	20.00	27.29	
	Chhatral	F1	55.00	20.00	40.00	30.00	36.25	
		F2	5.00	30.00	45.00	30.00	27.50	
		R1	5.00	30.00	20.00	25.00	20.00	
		R2	NF	10.00	25.00	30.00	21.67	
			21.67	22.50	32.50	28.75	26.35	
Savli	Vasantpura	F1	25.00	15.00	25.00	20.00	21.25	17.61
		F2	10.00	15.00	30.00	60.00	28.75	
		R1	10.00	20.00	15.00	30.00	18.75	
		R2	15.00	5.00	10.00	100.00	32.50	
			15.00	13.75	20.00	52.50	25.31	
	Ghothada	F1	15.00	0.00	10.00	15.00	10.00	
		F2	10.00	0.00	5.00	15.00	7.50	
		R1	10.00	0.00	5.00	15.00	7.50	
		R2	10.00	10.00	15.00	15.00	12.50	
			11.25	2.50	8.75	15.00	9.38	
	Anjesar	F1	5.00	0.00	5.00	45.00	13.75	
		F2	15.00	0.00	15.00	15.00	11.25	
		R1	10.00	0.00	25.00	65.00	25.00	
		R2	10.00	0.00	5.00	75.00	22.50	
			10.00	0.00	12.50	50.00	18.13	
Average of district								31.10

Note: F: Fixed plot; R: Random plot; 1st picking: 07/09/2015; 2nd picking: 12/10/2015, 3rd picking: 02/11/2015 and 4th picking:07/12/2015

Savli in which per cent boll damage registered as 43.85, 31.84 and 17.61 per cent, respectively.

Looking to the average of four pickings, the higher incidence was recorded in Kandari (49.58%) and Ganpatpura (44.90%) of Karjan taluka followed by Kuvarpura of Dabhoi taluka (41.88%), Ganpatpura of Karjan taluka (37.08%) and Khanpur of Dabhoi taluka recorded 27.29 per cent infestation (Table 2). As per the report of Kranthi (2015), pink bollworm survival on BG-II was recorded significantly higher in 2012, 2013 and 2014 mainly in Amreli and Bhavnagar districts of Saurashtra while the damage ranged between 0-80 per cent on Bollgard II in Bharuch, Vadodara, Anand, Bhavnagar, Amreli, Junagadh, Rajkot, Surendranagar and Ahmedabad districts of Gujarat. This report is in conformity with the present findings.

Kheda District

The data recorded on incidence of pink bollworm recorded during 2014-15 and 2015-16 are represented in Table 3 and 4, respectively. In Kheda, three talukas *viz.*, Kapadvanj, Kathalal and Thasra were selected for the purpose during both the years.

2014-15:

The higher (14.17 %) incidence of pink bollworm was recorded in village Ladvel of Kathalal taluka followed by village Antisar of Kapadvanj taluka (9.17%) during first picking (1st week of December, 2014). Minimum incidence (0.83 to 4.17%) of pink bollworm was recorded in rest of the villages of Kheda district. The infestation of pink bollworm was also recorded during 3rd week of December and it was to the tune of 1.67 to 6.66 per cent in different villages surveyed. Late season *i.e.* during 1st week of January, green bolls were also collected for checking the infestation. Out of nine villages of Kheda district, the highest (16.66%) green bolls infested by pink bollworm was observed in village Laxmipura (Kathalal) followed by Shivnagar (10.00%) and Vishwanathpura (8.33%) of the Thasra and Kathalal taluka, respectively. In rest of the villages, it was in the range of 0.83 to 5.00 per cent (Table 3). Maximum percentage of infestation (8.61%) was found in Kathalal taluka followed by Thasra (5.37%) and Kapadvanj (2.59%).

On an average, the higher incidence was recorded at Laxmipura (10.55%) and Ladvel (8.89%) villages of Kapadvanj and Kathalal talukas, respectively followed by Vishwanathpura of Kathalal taluka (6.39%), Devnagar, Shivnagar (5.83 %) and Labhapura (4.44%) of Thasra taluka (Table-3).

2015-16

Comparatively higher (10.00 %) incidence of pink bollworm was recorded in village Thavad of Kapadvanj taluka, Labhapura and Ajupura of Thasra taluka during first picking (1st week of September, 2015). Minimum incidence (3.75 to 5.00%) of pink bollworm was recorded in rest of the villages. During 2nd week of October, green bolls were observed and it was in the range of 5.00 to 27.50 per cent in different villages under study. The highest (27.50%) boll damage due to pink bollworm was recorded in village Sikandar porda of Kathalal taluka followed by Vishwanathpura (21.25%) of Kathalal taluka. The observations for third picking of green ball damage due to pink bollworm was also made on 1st week of November and data showed that infestation was 8.75 to 16.25 per cent. The higher (16.25%) pink bollworm infestation was found in Vishwanathpura of Kathalal taluka followed by Mugatpura (15.00%) of Thasra taluka and Laxmipura (13.75%) of Kathalal taluka. During 1st week of December, green bolls were also collected and observed for the infestation. Out of nine villages of Vadodara district, the highest (31.25%) infested green bolls were observed in village Mugatpura followed by Labhapura (28.75%) of Thasra taluka. In rest of the villages, it was in the range of 20.00 to 25.00 per cent (Table 4).

Looking to the average infestation of three pickings, higher incidence was recorded in villages Labhapura (28.75%) of Thasra taluka followed by Ladvel (19.58%), Shivnagar (19.38%), Vishwanathpura (19.06%), Laxmipura (15.00%), Devnagar (14.69%), Thavad (11.56%), Antisar (10.63%) and Kashipura (9.38%).

In nutshell, the incidence of pink bollworm in *Bt* cotton was higher in Vadodara district as compared to the Kheda district of middle Gujarat irrespective of different events/ varieties of BG-II.

REFERENCES

Agarwal, R. A. and Katiyar K. N. 1979. An estimate of losses of seed *kapas* and seed due to bollworms on cotton in India. *Indian Journal of Entomology*, **41**:143-148.

Hutchison, W. D., Beasley, C. A., Henne-berry, T. J. and Martin, J. M. 1988. Sampling pink bollworm (Lepidoptera: Gelechiidae) eggs of potential for improved timing and reduced use of insecticides. *Economic Entomology*, **81:** 673-678.

Table 3 Infestation of pink bollworm, *P. gossypiella* in Bt cotton in Kheda district during 2014 – 15

Taluka	Village	Field No.	Picking wise green ball damage (%) due to pink bollworm				
			1st	2nd	3rd	Av. of field/ villages	Av. of Talukas
Kapadvanj	Kashipura	F1	0.00	0.00	6.66	2.22	2.59
		F2	0.00	0.00	3.33	1.11	
		R1	0.00	0.00	10.00	3.33	
		R2	0.00	0.00	0.00	0.00	
			0.00	0.00	5.00	1.67	
	Antisar	F1	0.00	0.00	3.33	1.11	
		F2	20.00	3.33	0.00	7.78	
		R1	16.66	0.00	0.00	5.55	
		R2	0.00	3.33	0.00	1.11	
			9.17	1.67	0.83	3.89	
	Thavad	F1	3.33	6.66	3.33	4.44	
		F2	0.00	0.00	6.66	2.22	
		R1	0.00	0.00	6.66	2.22	
		R2	0.00	0.00	0.00	0.00	
			0.83	1.67	4.16	2.22	
Kathalal	Ladvel	F1	16.66	0.00	13.33	10.00	8.61
		F2	0.00	3.33	10.00	4.44	
		R1	10.00	13.33	3.33	8.89	
		R2	30.00	6.66	0.00	12.22	
			14.17	5.83	6.67	8.89	
	Vishwanathpura	F1	13.33	13.33	16.66	14.44	
		F2	0.00	6.66	3.33	3.33	
		R1	10.00	0.00	0.00	3.33	
		R2	0.00	0.00	13.33	4.44	
			5.83	5.00	8.33	6.39	
	Laxmipura	F1	0.00	6.66	3.33	3.33	
		F2	20.00	3.33	16.66	13.33	
		R1	6.66	0.00	26.66	11.11	
		R2	10.00	13.33	20.00	14.44	
			9.17	5.83	16.66	10.55	
Thasra	Labhapura	F1	0.00	6.66	10.00	5.55	5.37
		F2	0.00	3.33	3.33	2.22	
		R1	0.00	10.00	16.66	8.89	
		R2	0.00	0.00	3.33	1.11	
			0.00	5.00	8.33	4.44	
	Devnagar	F1	0.00	16.66	6.66	7.77	
		F2	0.00	6.66	16.66	7.77	
		R1	0.00	3.33	6.66	3.33	
		R2	13.33	0.00	0.00	4.44	
			3.33	6.66	7.50	5.83	
	Shivnagar	F1	10.00	6.66	6.66	7.77	
		F2	0.00	0.00	23.33	7.78	
		R1	0.00	0.00	10.00	3.33	
		R2	6.66	6.66	0.00	4.44	
			4.17	3.33	10.00	5.83	
Average of district							5.52

Note: F: Fixed plot; R: Random plot; 1st picking: 04/12/2014; 2nd picking: 19/12/2014 and 3rd picking: 03/01/2015

Table 4: Infestation of pink bollworm, *P. gossypiella* in *Bt* cotton in Kheda district during 2015 – 16

Taluka	Village	Field No.	Picking wise green ball damage (%) due to pink bollworm					
			1st	2nd	3rd	4th	Av. of field/ villages	Av. of Talukas
Kapadvanj	Kapadivav	F1	0.00	5.00	5.00	10.00	5.00	10.52
		F2	0.00	0.00	0.00	20.00	5.00	
		R1	0.00	10.00	15.00	40.00	16.25	
		R2	0.00	5.00	20.00	20.00	11.25	
			0.00	5.00	10.00	22.50	9.38	
	Antisar	F1	0.00	0.00	5.00	20.00	6.25	
		F2	5.00	10.00	5.00	25.00	11.25	
		R1	10.00	0.00	10.00	15.00	8.75	
		R2	0.00	10.00	20.00	35.00	16.25	
			3.75	5.00	10.00	23.75	10.63	
	Thavad	F1	5.00	10.00	5.00	20.00	10.00	
		F2	10.00	0.00	10.00	20.00	10.00	
		R1	15.00	5.00	5.00	20.00	11.25	
		R2	10.00	10.00	15.00	25.00	15.00	
			10.00	6.25	8.75	21.25	11.56	
Kathalal	Sikandar porda	F1	NF	20.00	10.00	25.00	18.33	17.88
		F2	NF	10.00	10.00	30.00	16.67	
		R1	NF	40.00	20.00	15.00	25.00	
		R2	NF	40.00	0.00	15.00	18.33	
			NF	27.50	10.00	21.25	19.58	
	Vishwanathpura	F1	0.00	15.00	20.00	20.00	13.75	
		F2	10.00	15.00	25.00	20.00	17.50	
		R1	NF	15.00	15.00	40.00	23.33	
		R2	NF	40.00	5.00	20.00	21.67	
			5.00	21.25	16.25	25.00	19.06	
	Laxmipura	F1	5.00	15.00	20.00	20.00	15.00	
		F2	NF	20.00	10.00	20.00	16.67	
		R1	5.00	0.00	15.00	20.00	10.00	
		R2	NF	25.00	10.00	20.00	18.33	
			5.00	15.00	13.75	20.00	15.00	
Thasra	Labhapura	F1	10.00	10.00	10.00	25.00	18.33	17.46
		F2	10.00	0.00	10.00	35.00	18.33	
		R1	NF	15.00	15.00	35.00	21.67	
		R2	NF	20.00	5.00	20.00	15.00	
			10.00	10.00	10.00	28.75	18.33	
	Ajupura	F1	10.00	5.00	0.00	30.00	11.25	
		F2	10.00	10.00	5.00	25.00	12.50	
		R1	NF	20.00	15.00	20.00	18.33	
		R2	NF	10.00	15.00	25.00	16.67	
			10.00	11.25	8.75	25.00	14.69	
	Mugatpura	F1	NF	5.00	10.00	25.00	13.33	
		F2	5.00	10.00	10.00	25.00	12.50	
		R1	NF	15.00	15.00	35.00	21.67	
		R2	NF	25.00	25.00	40.00	30.00	
			5.00	13.75	15.00	31.25	19.38	
Average of district								15.28

Note: F: Fixed plot; R: Random plot; 1st picking: 07/09/2015; 2nd picking: 12/10/2015, 3rd picking: 02/11/2015 and 4th picking:07/12/2015

Ingram. W. R. 1994. *Pectinophora* (Lepidoptera: Gelechiidae). In: Matthews, G. A., Tunstall, J. P. (Eds.). Insect Pests of Cotton. University Press, Cambridge, pp. 107-150.

Kranthi, K.R. 2015 *Cotton statistics & News*, **35** : 1-6.

Patil, S. B. 2003. Studies on management of cotton pink bollworm *Pectinophora* (Saunders) (Lepidoptera: Gelechiidae). Ph. D. Thesis, University of Agricultural Sciences, Dharwad.

Sharma, D. C. 2009. *The Hindu*, Dated 6.3.2010.