

Population Dynamics of Pink Bollworm *Pectinophora gossypiella* (Saunders) in Cotton Crop

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ABSTRACT

The pink bollworm, *Pectinophora gossypiella* infestation on flowers found higher in 2nd week of September with intensity of 6 and 7 larvae/ 30 flowers respectively during both years. While, peak larval population on bolls was recorded in the 2nd week of September with intensity of 7 larvae/30 bolls in 2012 and in 2013 peak infestation was recorded in 3rd week of September with intensity of 8 larvae/ 30 bolls. Larval population on flowers shows negative correlation with rainfall and age of crop and shows, positive correlation with maximum, minimum (temperatures) and morning, evening (relative humidity) during kharif 2012 while, in kharif 2013, larval population on flowers shows negative correlation with age of crop, maximum, minimum (temperatures) and evening relative humidity, while shows, positive correlation with morning relative humidity and rain fall. In kharif 2012, larval population on bolls shows negative correlation with rain fall, but shows positive correlation with age of crop, maximum, minimum (temperatures) and morning, evening (relative humidity), while in kharif 2013 shows negative correlation with age of crop, maximum, minimum (temperatures) and rain fall, but shows positive correlation with morning, evening (relative humidity). In kharif 2012 open boll damage to be recorded 28.88 per cent whereas, open locule damage to be recorded 17.22 per cent while, in kharif 2013 open boll damage to be recorded 29.99 per cent whereas, open locule damage to be recorded 18.05 per cent.

Key words: Kharif, Cotton Crop, Larval, Pink Bollworm

INTRODUCTION

Cotton (*Gossypium hirsutum* L.) is one of the most important fibre crops, playing key role in economic as well as social affairs of the world. It is the oldest among the commercial crops of the world. The area of cotton in India is 118.81 lakh hectares whereas production is 352 lakh bales and productivity is 504 kg/ha (Source-

Cotton Advisory Board(CAB). Cotton is grown chiefly for its fibre which is used in the manufacture of cloth for the mankind. It is also used for several other purposes like, making threads, for mixing in other fibers and extraction of oil from the cotton seed. Its wide spread use is largely due to the ease with which its fibre are spun into yarns.

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Cotton's strength, absorbency and capacity to be washed and dyed also make it adaptable to a considerable variety of textile products. The oil content in the cotton seed ranges from 15-25 per cent depending on the varieties. Cotton seed cake after extraction of oil is good organic manure and contains about 6% nitrogen, 3% phosphorus, 2% potash.

Successful cultivation of cotton requires a long frost-free period, plenty of sunshine and a moderate rainfall, usually from 600 to 1200mm. Soils usually need to be fairly heavy, although the level of nutrients does not need to be exceptional. In general, these conditions are met within the seasonally dry tropics and subtropics in the Northern and Southern hemispheres, but a large proportion of cotton grown today is cultivated in areas with less rainfall that meet their moisture requirements from irrigation.

METHOD AND MATERIALS

To determine the population dynamics of pink bollworm, the cotton variety RS-2013 was sown at Oil Seed Research Farm, Kalyanpur, Kanpur, on an area of 10.0 x 8.0 m². All the observations were made at weekly intervals on randomly selected 15 plants by avoiding border rows. The observations were taken from blooming till the final pickings.

Data collection and presentation:

The observations on flower rosetting, number of PBW larvae per 30 green bolls and per cent green boll damaged were recorded in cotton plots. Similarly, at the time of harvesting of the crop, 100 bolls were collected and counted for total damaged locules due to PBW larval infestation. The data were presented as per cent locule damaged.

Observations on the incidence of pink bollworm in green bolls were made at weekly intervals. For this purpose, 30 cotton green bolls of three-week age, were collected and brought to the laboratory for further observations. In laboratory, each green boll was cut opened along with ridges of the locules with the help of a sharp cutter carefully and pink bollworm larvae of all the age groups were counted. Then total numbers of pink bollworm larvae per 30 bolls were worked out and correlate with weather parameters.

In kharif 2012:

Pink bollworm larvae on cotton flowers appeared 59 days after sowing of the crop

during 3rd week of July with intensity of (1larva/30 flowers) causing 3.33 per cent damage. Highest larval population (6 larvae/30 flowers) was recorded in 2nd and 3rd week of September at 31.7 °C (maximum) during both the weeks and 24.8°C and 23.4°C (minimum) temperatures, with 93 and 90 per cent relative humidity in morning and 77 and 68 per cent in evening and rain fall 87.8 mm and 2.0 mm causing 26.66 and 23.33 per cent damage respectively. Larval population decreased from 3rd week of September and no larval population was found during last stage of crop (3rd and 4th week of November). Larval population on flowers shows negative correlation with age of crop and rainfall. However, shows positive correlation with temperature (maximum and minimum), relative humidity (morning and evening). Damage per cent shows negative correlation with rainfall and shows positive correlation with age of crop, temperature (maximum and minimum), relative humidity morning and evening (Table-5 & 6).

Larvae in cotton bolls appeared 66 days after sowing of the crop in 4th week of July with intensity of (1larva/30 bolls) causing 3.33 per cent damage. Highest larval population (7 larvae/30 bolls) was recorded in 2nd and 3rd week of September when crop age was 122 days at 31.7 °C and 31.7°C (maximum), 24.8°C and 23.4°C (minimum) temperatures, with 93 and 90 per cent relative humidity in morning and 77 and 68 per cent in evening and rain fall 87.1 mm whereas, maximum damage was caused in 3rd and 4th week of September with 30.00 per cent damage. Larval population decreases from 4th week of September and no larval population was found during last stage of crop (3rd and 4th week of November). Larval population on bolls shows negative correlation with rainfall however, shows positive correlation with age of crop, temperature (maximum and minimum), relative humidity (morning and evening). Damage per cent shows negative correlation with evening relative humidity and rainfall where as shows positive correlation with age of crop, temperature (maximum and minimum) and evening relative humidity (Table-5 & 6).

In kharif 2013:

The pink bollworm larvae on cotton flowers appeared 54 days after sowing of the crop in

2nd week of July with intensity of (1larva/30 flowers) causing 3.33 per cent damage. Highest larval population (7 larvae/30 flowers) was recorded in 2nd week of September at 33.6^oC (maximum) and 22.4^oC (minimum) temperatures, with 86 per cent relative humidity in morning and 71 per cent in evening and rain fall 14.4 mm causing 26.66 per cent damage. Larval population decreases from 4th week of September and no larval population was found during last stage of crop (4th week of November). Larval population on flowers shows negative correlation with age of crop, temperature (maximum and minimum), and evening relative humidity however, shows positive correlation with morning relative humidity and rainfall. Damage per cent shows negative correlation with age of crop, temperature (maximum and minimum), evening relative humidity and rainfall and shows positive correlation with evening relative humidity (Table-7 & 8).

Pink bollworm larvae in cotton bolls appeared 61 days after sowing of the crop in 3rd week of July with intensity of (1larva/30 bolls) causing 3.33 per cent damage. Highest larval population (8 larvae/30 bolls) was recorded in 3rd week of September when crop

age was 117 days and damage is caused 33.33 per cent at 33.6^oC (maximum) and 22.3^oC (minimum) temperature, with 87 per cent morning relative humidity and 62 per cent evening relative humidity and rain fall 27.4 mm. Larval population decreases from 4th week of September and no larval population was found during last stage of crop (4th week of November). Larval population on bolls shows negative correlation associated with age of crop, temperature (maximum and minimum) and rainfall. However, shows a positive correlation with relative humidity (morning and evening). Damage per cent shows negative correlation with temperature (maximum and minimum), evening relative humidity and rainfall whereas shows positive correlation with age of crop, morning relative humidity (Table-7 & 8).

Per cent damage caused by pink bollworm in cotton:

It is obvious from the Table-9 that, in *kharif* 2012 open boll damage was observed to be 28.88 per cent and open locule damage was 17.22 per cent. In *kharif* 2013 open boll damage was recorded as 29.99 per cent and open locule damage was 18.05 per cent.

Table 1: Seasonal incidence of pink bollworm, *Pectinophora gossypiella* in cotton in relation to meteorological condition: Kharif 2012

Months	Age of Crop	S.W.	Larvae / 30		Damage (%)		Meteorological Observation				Rain fall (mm)
			Flowers	Bolls	Flowers	Bolls	Temperature ^o C		R H (%)		
							Max.	Min.	Morning	Evening	
July	45	27	0.00	0.00	0.00	0.00	33.9	24.8	83	74	273.8
	52	28	0.00	0.00	0.00	0.00	33.8	24.0	82	71	44.2
	59	29	1.00	0.00	3.33	0.00	34.7	23.6	85	62	9.5
	66	30	1.00	1.00	6.66	3.33	32.2	25.6	91	77	51.7
August	73	31	2.00	2.00	6.66	10.00	31.6	25.5	92	80	66.4
	80	32	3.00	3.00	10.00	13.33	32.7	25.8	88	79	38.7
	87	33	3.00	4.00	13.33	16.66	33.1	25.8	88	70	31.1
	94	34	4.00	4.00	16.66	16.00	31.3	25.5	91	76	11.1
	101	35	5.00	5.00	16.66	20.00	33.8	25.9	90	72	4.8
September	108	36	5.00	6.00	20.00	26.00	32.9	24.8	88	68	25.8
	115	37	6.00	7.00	26.66	26.00	31.7	24.8	93	77	87.1
	122	38	6.00	7.00	23.33	30.00	31.7	23.4	90	68	2.0
	129	39	5.00	6.00	20.00	30.00	34.3	22.4	84	55	0.0
October	136	40	4.00	6.00	16.66	26.66	34.9	20.6	86	44	0.0
	143	41	4.00	5.00	13.33	23.33	33.5	18.2	85	45	0.0
	150	42	3.00	5.00	13.33	23.33	33.3	17.0	90	39	0.0
	157	43	3.00	4.00	10.00	20.00	30.3	14.3	85	39	0.0
	164	44	2.00	3.00	10.00	16.66	30.3	11.9	90	38	0.0
November	171	45	1.00	2.00	6.66	10.00	29.9	12.1	85	37	0.0
	178	46	1.00	1.00	3.33	6.66	28.1	10.9	89	46	0.0
	185	47	0.00	0.00	3.33	3.33	27.0	9.1	88	41	0.0
	192	48	0.00	0.00	0.00	0.00	26.1	8.3	87	38	0.0

Table 2: Seasonal incidence of pink bollworm, *Pectinophora gossypiella* in cotton in relation to meteorological condition: Kharif 2013

Months	Age of Crop	S.W.	Larvae / 30		Damage (%)		Meteorological Observation				
			Flowers	Bolls	Flowers	Bolls	Temperature °C		R H (%)		Rain fall (mm)
							Max.	Min.	Morning	Evening	
July	47	28	0.00	0.00	0.00	0.00	32.4	23.7	92	80	44.8
	54	29	1.00	0.00	3.33	0.00	32.4	24.1	91	82	123.1
	61	30	2.00	1.00	10.00	3.33	33.3	24.1	90	75	103.8
	68	31	2.00	3.00	10.00	10.00	33.8	24.5	88	73	49.0
August	75	32	3.00	4.00	13.33	16.66	31.2	23.3	96	84	54.6
	82	33	4.00	5.00	16.66	16.66	32.4	22.9	91	81	25.4
	89	34	4.00	5.00	16.66	20.00	32.8	24.4	88	71	0.0
	96	35	5.00	6.00	20.00	23.33	30.9	23.0	94	86	65.0
September	103	36	6.00	7.00	23.33	26.66	33.6	22.9	82	65	0.0
	110	37	7.00	7.00	26.66	30.00	33.6	22.4	86	71	14.4
	117	38	6.00	8.00	26.66	33.33	33.6	22.3	87	62	27.4
	124	39	5.00	7.00	23.33	30.00	32.2	22.3	86	79	39.0
October	131	40	4.00	6.00	20.00	26.66	28.5	20.6	90	80	143.2
	138	41	3.00	5.00	16.66	20.00	30.9	20.3	85	64	0.0
	145	42	3.00	4.00	13.33	16.66	31.3	17.8	90	55	0.0
	152	43	2.00	4.00	13.33	16.66	31.0	16.2	89	46	0.0
	159	44	2.00	3.00	10.00	13.33	31.2	12.8	90	36	0.0
November	166	45	1.00	2.00	6.66	10.00	45	26.9	105	91.7	0.0
	173	46	1.00	2.00	6.66	6.66	46	26.5	7.4	89	0.0
	180	47	1.00	1.00	3.33	6.66	47	26.9	7.8	86	0.0
	188	48	0.00	0.00	3.33	3.33	48	26.7	8.9	86	0.0

Table 3: Correlation coefficient between the seasonal abundance of pink bollworm larvae with environmental factors and age of crop: 2012

S. No.	Environmental factors		Correlation coefficient			
			Larvae on		Per cent damaged	
			Flowers	Bolls	Flowers	Bolls
1.	Age of crop		-0.01	0.11	0.04	0.20
2.	Temperature °C	Maximum	0.40*	0.38*	0.34	0.34
		Minimum	0.44*	0.32	0.40*	0.21
3.	Relative humidity (%)	Morning	0.37*	0.31	0.43*	0.25
		Evening	0.24	0.07	0.21	-0.05
4.	Rain fall (mm)		-0.24	-0.26	-0.23	-0.32

Statistical significance of 'r' Value=0.36

* showed significant

Table 4: Correlation coefficient between the seasonal abundance of pink bollworm larvae with environmental factors and age of crops: 2013

S. No.	Environmental factors		Correlation coefficient			
			Larvae on		Per cent damaged	
			Flowers	Bolls	Flowers	Bolls
1.	Age of crop		-0.19	-0.03	-0.09	0.06
2.	Temperature °C	Maximum	-0.50*	-0.50*	-0.51*	-0.45*
		Minimum	-0.22	-0.32	-0.30	-0.32
3.	Relative humidity (%)	Morning	0.39	0.39	0.40*	0.35
		Evening	-0.21	0.28	-0.27	-0.28
4.	Rain fall (mm)		0.01	-0.09	-0.01	-0.09

Statistical significance of 'r' Value=0.40

* showed significant

Table 5: Infestation of boll and locule by pink bollworm, *Pectinophora gossypiella* in cotton: Kharif 2012 & 2013

Picking	Per cent damage			
	2012		2013	
	Open boll damage	Open locule damage	Open boll damage	Open locule damage
1 st picking	30.00	18.33	33.33	19.16
2 nd picking	30.00	17.50	30.00	18.33
3 rd picking	26.66	15.83	26.66	16.66
Average	28.88	17.22	29.99	18.05

DISCUSSION

The observations were recorded on intensity of pink bollworm (*Pectinophora gossypiella*) consequently in two years.

Pink bollworm, *Pectinophora gossypiella* was found active on flowers from 3rd week of July to 2nd week of November with intensity of 1-6 larvae/30 flowers causing 3.33-26.66 per cent damage. Whereas, larval population on bolls was found active from 4th week of July to 2nd week of November with intensity of 1-7 larvae/30 bolls, causing 3.33 - 30.00 per cent damage. The population on flowers and bolls was low in the beginning and there after it continuously increased upto 3rd week of September at 31.70 °C maximum and 23.4 °C minimum temperatures, 90 per cent humidity in morning, 68 per cent in evening and 2.00 mm rain fall in *kharif* 2012. While, in *Kharif* 2013, pink bollworms were found active on flowers from the 2nd week of July to 3rd week of November with intensity of 1-7 larvae/30 flowers causing 3.33 -26.66 per cent damage.

Larval population on bolls was found active from 3rd week of July to 3rd week of November with intensity of 1-8 larvae/30 bolls causing 3.33 -33.33 per cent damage. The population on flowers was low in the beginning and there after it continuously increased up to 2nd week of September at 33.60 °C maximum and 22.40 °C minimum temperatures, 86 per cent humidity in morning, 71 per cent in evening and 14.40 mm rain. Whereas, population on bolls was low in the beginning and there after it continuously

increased up to 3rd week of September at 33.60 °C maximum and 22.30 °C minimum temperatures, 87 per cent humidity in morning, 62 per cent in evening and 27.40 mm rain fall. Dhaka and Pareek² noticed infestation of pink bollworm (*Pectinophora gossypiella*) started in the second fortnight of July and reached its maximum (9.75%) in the last week of September and first week of October. Jindal *et al.*³ noticed that, pink bollworm is no longer a major pest in Punjab, but its peak incidence was recorded during 2nd fortnight of September to end-October.

Larval population on flowers showed negative correlation with rainfall and age of crop and shows, positive correlation with maximum, minimum (temperature) and morning, evening (relative humidity) while, on bolls shows negative correlation with rain fall, but shows positive correlation with age of crop, maximum, minimum (temperatures) and morning, evening (relative humidity), open boll damage to be recorded 28.88 per cent whereas, open locule damage was recorded as 17.22 per cent in *kharif* 2012. However, in *kharif* 2013, larval population on flowers showed negative correlation with age of crop, maximum, minimum (temperatures) and evening relative humidity and a positive correlation was observed with morning relative humidity and rain fall while, on bolls shows negative correlation with age of crop, maximum, minimum (temperatures) and rain fall, but shows positive correlation with morning, evening (relative humidity), open boll damage to be recorded 29.99 per cent

whereas, open locule damage to be recorded 18.05 per cent (Table-8 & 9). Shivanna *et al.*⁴ noticed that trap catches of *P. gossypiella* had significant positive correlation with minimum temperature however, significant negative correlation was obtained with humidity and rainfall. Mahalakshmi *et al.*⁵ noticed that, minimum temperature showed significant negative influence on the larval incidence of pink bollworm.

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