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Standardization of pheromone traps for mass trapping of pink bollworm, *Pectinophora gossypiella* (Saunders) in *Bt* cotton

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Abstract

The experiment was carried out to standardize number of pheromone traps required for mass trapping of pink bollworm at Sapa and Mangrol village of Karjan taluka of Vadodara district, Gujarat during Kharif, 2016-17 and 2017-18, respectively. There were total five treatments i.e. 30, 40, 50 and 60 traps/ha including control with 15 repetitions. Among all the treatments installation of 40 pheromone traps/ha, 30 cm above crop height at equidistantly one week prior to flowering and changing the lure at one month interval till last picking of *Bt* cotton is found effective and economical for management of pink boll worm, *Pectinophora gossypiella* in *Bt* cotton.

Keywords: *Pectinophora gossypiella*, moth catches, damage, pheromone traps

1. Introduction

Pink bollworm, *Pectinophora gossypiella* (Saunders) gained much momentous due to its progressive incidence over the seasons and inspite of its narrow host range, it has been noticed regularly on cotton. Seasonal incidence of pink bollworm was largely influenced by the weather factors Jha and Bisen (1994) [1] and its activity can be monitored by pheromone traps which help to develop the strategies for management. Singh and Lather (1989) Suresh (2001) [2, 3]. Steady increase in its incidence in the later stage of the crop reduces the cotton yield to the extent of 4 to 5 q/ha leading to low quality lint. Pink bollworm incidence goes unnoticed to the farmers since young larvae enter the cotton bolls in the developing stage and remains inside by feeding on seeds. Its damage will be seen only when bad opened bolls with damaged seeds were found at harvesting stage. Non removal of left over plant debris and discarded damaged bolls left over in the cotton fields for a larger period narrowed the interval between two seasons and it could support pest survival in off season and form an important link in the carryover of the pest. Jayaswal (1971) Simwat and Sidhu (1982) [4, 5]. Another reason for build-up of the pest is an emergence of pink bollworm adults from the seed cotton received regularly in the local cotton mills. Sidhu and Dhawan (1985) [6]. One of the most sensitive means of detecting invasive insects and monitoring their population levels is the use of traps baited with pheromones or other semiochemicals. Allen *et al.* (1986) Asaro *et al.* (2004) El-Sayed *et al.* (2006) [7, 8, 9]. Sex pheromone has been used for mating disruption and for population monitoring to enable more effective control than insecticides. Flint *et al.* (1976) [10]. Keeping the importance of pink bollworm of cotton in Gujarat this experiment was carried out to standardize the number of pheromone traps for the control of pink bollworm in *Bt* cotton and its impact on incidence this pest on flowers and green bolls.

2. Materials and Methods

The experiment was carried out at Sapa and Mangrol village of Karjan taluka of Vadodara district, Gujarat during *Kharif*, 2016-17 and 2017-18, respectively. *Bt* Cotton (BG II) was grown by following all the standard agronomical practices except pest control. The experiment was laid down in Large Plot Sampling (CRD) design with 1 acre/treatment plot size and 120 x 45 cm spacing. There were total five treatments *i.e.* 30, 40, 50 and 60 traps/ha including control with 15 repetitions.

The traps were installed equidistantly at one feet above the crop canopy one week prior to flowering stage as per treatments and lures were changed at 30 days interval. Number of moth catches/ trap at weekly interval were recorded and destroyed.

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For recording flower and green boll damage each field (1 acre) was divided in to 15 equal sectors and five plants were selected randomly from each sector. The yield was also recorded.

3. Results

Flower damage (Table 1)

The pooled over 12 periods of the year 2016-17 showed significant effect on flower damage caused by PBW. All the four treatments of pheromones differed significantly and recorded less flower infestation than untreated control. The lowest (4.13%) flower damage was found in 60 pheromone traps/ha followed by 50 (4.61%), 40 (6.09%) and 30 (10.74%) traps/ha. These four treatments differed significantly to each other and in descending orders.

During the year 2017-18, flower damage caused by pink bollworm showed significant effect of trap densities from flowering initiation to 10 weeks of periods. All the four treatments of pheromones differ significantly and recorded less flower damage than untreated control. The lowest (3.64%) flower damage was found in 60 pheromone traps/ha and it was at par with 50 (3.89%) and 40 (3.92%) traps/ha. Among the treatments of pheromones, significantly highest (8.26%) flower damage was recorded in the treatment of 30 traps/ha. In pooled over years, all the four treatments of pheromones significantly reduced the flower damage by pink bollworm. The lowest (4.07%) flower damage found in 60 pheromone

traps/ha and it was at par with 50 (4.42%) and 40 (5.14%) traps/ha. Of the evaluated treatments of pheromone, the highest (9.79%) flower damage recorded in the treatment of 30 traps/ha.

Green boll damage (Table 1)

Data recorded on green boll damage caused by pink boll worm in various treatments during the year 2016-17 were found significant. The lowest (7.85%) green boll damage was recorded in plots having 60 pheromone traps/ha followed by 50 (8.39%), 40 (11.15%) and 30 (16.58%) traps/ha. These four treatments of pheromones registered significantly less green boll damage due to *P. gossypiella* than untreated control.

During the year 2017-18, all the four treatments of pheromone traps significantly reduced the green boll damage caused by pink bollworm till 15 weeks of installation as well as in pooled over periods. The lowest (6.50%) green boll damage found in 60 pheromone traps/ha and it was at par with 50 (6.59%) and 40 (6.70%) traps/ha. Of the evaluated treatments of pheromone, the highest green boll damage noticed in low (30 traps/ha) number of traps.

In pooled over years, all the four treatments of pheromone traps reduced the green boll damage caused by pink bollworm than control plots. The lowest (7.16%) green boll damage recorded in plots having 60 traps/ha and it was at par with 50 (7.47%) and 40 (8.79%).

Table 1: Flower and green boll damage caused by pink bollworm in cotton in various treatment of pheromone traps

Sr. No.	Treatments	Flower damage (%)			Green boll damage (%)		
		2016-17	2017-18	Pooled	2016-17	2017-18	Pooled
1	30 traps/ha	19.13 (10.74)	16.70 (8.26)	18.23 (9.79)	24.03 (16.58)	18.79 (10.37)	21.40 (13.31)
2	40 traps/ha	14.29 (6.09)	11.42 (3.92)	13.11 (5.14)	19.51 (11.15)	15.00 (6.70)	17.25 (8.79)
3	50 traps/ha	12.40 (4.61)	11.37 (3.89)	12.13 (4.42)	16.84 (8.39)	14.88 (6.59)	15.86 (7.47)
4	60 traps/ha	11.73 (4.13)	11.00 (3.64)	11.64 (4.07)	16.27 (7.85)	14.77 (6.50)	15.52 (7.16)
5	Control	22.58 (14.74)	18.03 (9.58)	20.71 (12.51)	30.47 (25.71)	21.50 (13.43)	25.98 (19.19)
S. Em. \pm	T	0.12	0.12	0.84	0.11	0.10	1.50
	P	0.18	0.17	0.05	0.20	0.17	1.02
	TXP	0.42	0.39	0.12	0.46	0.38	0.42
C. D. at 5%	T	0.33	0.34	3.30	0.33	0.27	4.56
	P	0.52	0.49	0.15	0.57	0.47	3.08
	TXP	1.17	1.09	0.34	1.27	1.06	2.97
C.V. %		10.19	11.13	3.12	8.34	8.74	8.55

Figures in parentheses are retransformed values, those outside are arc sin transformed values.

Pooled over 12 and 10 periods of 2016-17 and 2017-18, respectively.

Moth catches (Table 2)

Mean results of *P. gossypiella* moth catches during the year 2016-17 indicated that the highest (250) catches were recorded in 60 traps/ha followed by 50 and 40 traps/ha which reflected on flower and green boll damage in *Bt* cotton.

During the year 2017-18, mean results on *P. gossypiella* moth catches during year 2017-18 exposed that highest (198) catches were found in 60 traps/ha followed by 50 (196) and 40 traps/ha (191) which reflected on flower and green boll damage in *Bt* cotton.

Table 2: Pink bollworm moth catches in various treatments of pheromone traps

Sr. No.	Treatments	No. of male moth caught			
		2016-17		2017-18	
		Total	Mean	Total	Mean
1	30 traps/ha	1663	139	1990	166
2	40 traps/ha	3248	203	3062	191
3	50 traps/ha	4429	221	3920	196
4	60 traps/ha	5997	250	4741	198

4. Discussion

Shah *et al.* (2011) ^[11] indicated that sex pheromones proved more effective for monitoring the adult moth of pink bollworm. The present study is also supported by Anonymous (2007) ^[12] who suggested installation of pheromone traps crop @ 20/ha for mating disruption and management of pink bollworm in cotton ecosystem. Flint *et al.* (1978) ^[13] also suggested that for higher male moth catches of pink bollworm, a density of 12 traps per hectare is optimum.

5. Seed cotton yield (Table 3)

The highest seed cotton yield (30.40 q/ha) was recorded in 60 traps/ha and it was at par with 50 (28.25 q/ha) and 40 (27.75 q/ha) traps/ha during 2016-17. Similarly, plots having 60 traps/ha recorded highest (31.18 q/ha) seed cotton yield and it was at par with 50 (31.02 q/ha) and 40 (30.16 q/ha) traps/ha during 2017-18. Pooled over year indicated that the highest (30.78 q/ha) seed cotton yield was recorded in 60 traps/ha and it was at par with 50 (29.63 q/ha) and 40 (28.95 q/ha) traps/ha. Of the evaluated treatments of pheromones the

lowest seed cotton yield was recorded from plots having 30 traps/ha in 2016-17, 2017-18 and pooled over the years.

6. Economics (Table 3)

The treatment of 60 traps/ha produced higher seed cotton

yield which having 50670 Rs/ha realization and 1: 9.83 ICBR followed by 50 traps/ha which having 45495 Rs/ha realization and 1: 10.44 ICBR and 40 traps/ha which having 42435 Rs/ha realization and 1: 11.93 ICBR.

Table 3: Effect of pheromone traps on yield of seed cotton and its economics

Sr. No.	Treatments	Yield (g/ha)			Realization (Rs./ha)	ICBR
		2016-17	2017-18	Pooled		
1	30 traps/ha	22.70	23.51	23.10	16110	1:5.85
2	40 traps/ha	27.75	30.16	28.95	42435	1:11.93
3	50 traps/ha	28.25	31.02	29.63	45495	1:10.44
4	60 traps/ha	30.40	31.18	30.78	50670	1:9.83
5	Control	19.00	20.12	19.52	-	-
S.Em. \pm	T	0.76	0.81	0.62	-	-
	Y	-	-	0.35	-	-
	TXY	-	-	0.79	-	-
C. D. at 5%	T	2.16	2.29	1.73	-	-
	Y	-	-	NS	-	-
	TXY	-	-	NS	-	-
C.V. %		11.56	11.58	11.58	-	-

7. Conclusion

Considering the flower and the green boll damage, moth catches, yield and economics 40 pheromone traps per hectare found effective and economical in managing pink bollworm in *Bt* cotton.

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