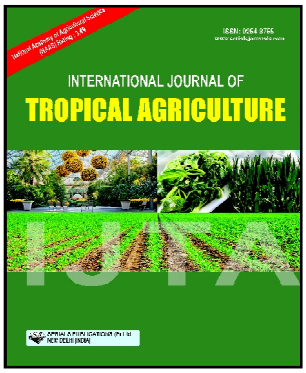

INTERNATIONAL JOURNAL OF TROPICAL AGRICULTURE

ISSN : 0254-8755

available at http: www.serialsjournals.com

Volume 36 • Number 2 • 2018

Evaluation of New Pheromone Based Mating Disruption Technology for Pink Bollworm in Cotton

D. M. Jethva, A. M. Bhimani and P. S. Wadaskar

Biocontrol Research Laboratory, Department of Entomology, Junagadh Agricultural University, Junagadh, India- 362 001
E-mail: dr_dharmraj@yahoo.co.in

Abstract: A field trial was carried out during *kharif*, 2016 to evaluate pheromone based mating disruption technology against pink bollworm (*Pectinophora gossypiella* Saunders) in cotton on farmers field of Jamnagar in Saurashtra region. The mating disruption paste was applied in field and compared with the farmers practices plot results of the year 2016-17 showed that the pink bollworm damage and moth catches per trap in cotton was found significant in treated plot over farmer's practices plot. The data showed that the per cent rosette flower (1.90%) was recorded least in treated plot as compared to farmer's practices plot. Similar trend was also found in per cent green boll, open boll and locule damage, as it recorded 1.33, 2.88 and 3.58% damage, respectively in treated plot, which was significantly least than the farmer's practices plot. The data of moth catches per trap reflects that the least (3.90 moths/trap) moths were recorded in treated plot as compared to farmer's practices plot (54.99 moths/trap). The highest yield (3089 Kg/ha) with the net realization (47,575 Rs./ha) and ICBR (1:8.93) in treated plot as compared to farmer's practices plot in which lowest (2081 Kg/ha) yield was recorded in cotton.

Key words: Cotton, mating disruption, *Pectinophora gossypiella* Saunders, pheromone

INTRODUCTION

Cotton is the most important crop producing natural fibre which has been under commercial cultivation for domestic consumption and export needs of about 111 countries in the world and hence called "King of fibres" or "White gold". India is an important grower of cotton on a global scale. Among the bollworms, pink bollworm assumed major pest status in recent past (Ghosh, 2001). Worldwide, pink bollworm *Pectinophora gossypiella* (Saunders) has become economically the most destructive pest of cotton and has 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).

Pink bollworm has now become a most serious pest of *Bt* cotton in Gujarat since last three 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 has been reported by Narayanan (1962). The pink bollworm larvae feed on buds, flowers, and bolls of the cotton plant and because of their widespread distribution, voracious appetite, and enormous population cause severe economic losses to cotton growers. While chemical pesticides are useful in the control of the pink bollworm. The indiscriminate and continuous use of chemical pesticides has created a number of problems including pesticide resistance and secondary pest outbreaks. The pink bollworm sex pheromone has been successfully used for sexual communication disruption between adult moths resulting in the reduction of larvae infesting cotton bolls.

Thus, present study was designed with regard to the mode of pest control so far proposed, a pheromone component is loaded in wax based paste carrier by means of impregnation or inclusion, with such a design that the pheromone component is vaporized gradually into the air to disturb communication between male and female insects of pink bollworm.

MATERIALS AND METHODS

The present investigations on evaluation of new pheromone based mating disruption technology for pink bollworm in cotton was carried out on farmer's field of Jamnagar district of Gujarat during *kharif*, 2017.

The first application of mating disruption paste (400 g) was uniformly distributed in 1000 dots in one-hectare area after the initiation of pest infestation (Flowering stage). Similarly, second and third application of this paste was given at 30 days interval after first application. With the help of injection, each dot of mating disruption uniformly applied in between twigs. The following observations were taken at 10 days interval after each application from treated and farmer's practices plot.

A) Per cent rosette flower per plant

At the time of flowering, number of healthy and rosette flower counted from five randomly selected plants from 20 spots. Based on this, per cent rosette flower per plant were worked out by

$$\text{Per cent rosette flower} = \frac{\textit{Number of rosette flower } X\,100}{\textit{Total healthy flower}}$$

B) Per cent green boll damage

20 green bolls randomly selected from 20 spots, the number of healthy and damaged bolls by pink bollworm were counted by dissecting them and expressed in terms of per cent green boll damage as it was worked out by using following formula.

$$\text{Per cent green boll damage} = \frac{\textit{Number of damaged green boll} \times 100}{\textit{Total number of green boll observed}}$$

C) Per cent open boll damage per plant

At the time of each picking, number of healthy and damaged bolls counted from five randomly selected plants from 20 spots. Based on this, per cent open boll damage was worked out by using following formula.

$$\text{Per cent open boll damage} = \frac{\textit{Damaged open bolls} \times 100}{\textit{Total open bolls}}$$

D) Per cent locule damage per plant

At the time of each picking, number of healthy and damaged locule counted from five randomly selected

plants from 20 spots. Based on this, per cent locules damage was worked out by using following formula.

$$\text{Per cent locule damage} = \frac{\textit{Damaged locules} \times 100}{\textit{Total numbers of locules}}$$

E) Seed cotton yield

From treated and untreated plot, weight of seed cotton (Kg/ha) during each picking were recorded.

F) Moth caches per trap

For recording the moth activity in treated and farmers practices plot, 5 traps per hectare was installed in the field.

RESULTS AND DISCUSSION

Per cent rosette flower

The data presented in Table 1 revealed that the flower damage in both treated and farmers plot was differed significantly with each other. The result showed that the percent rosette flower in treated plot was range from 0.75 to 2.60% after all three application in treated plot whereas, it was recorded between 19.50 to 22.00% in farmers practices plot. The lowest (1.90%) mean per cent rosette flower was observed in treated plot which was far least as compared to farmers practices plot (20.43%).

Green and open boll damage

The mean data of all the three applications revealed that the green boll damage in the treated plot was 1.33% as against 14.99% in farmers practices plot. The open boll damage was 2.88% in treated plot whereas, it was comparatively lower (14.99%) than farmers practices plot (Tables 2 and 3). The present findings corroborate with the results reported by Radhika and Reddy (2006) who observed that the boll damage in the demonstrated block was lower (5.88 %) as compared to control block (12.47%). The present findings are supported by the results reported by Patil *et al.* (2007) who noted 14.89 and 14.89% of open boll damage in treated blocks whereas, 47.83 and 44.02% damage in control block during two respective years.

Locule damage

The mean pink bollworm incidence on locule basis was significantly low i e., 3.58% in mating disruption treated plot as compared to 24.03% in farmers practices plot after three picking of cotton during the experimental season (Table 4). This shows the superiority of mating disruption paste over the farmers regular practices used for the management of pink bollworm. These findings are in conformity with the observation of Sohi *et al.,* (1999) who recorded significantly low per cent locule damage in the fields treated with mating disruption along with the insecticide compared to field treated with insecticide alone who reported less pink bollworm infestation of locules in treated block. The results recorded by Patil *et al.* (2007) are in line with the present results who noted that the locule damage was 2.85% and 0.84% in demonstrated block for big and small bolls respectively as against 5.00% and 2.94% in control block.

Moths catch per trap

Observations on moth trap catches were initiated at weekly interval during the cropping period. The density of male moths varied to a greater extent between both the plots with the advancement of cropping period. Significantly lower moth trap catch was observed in treated plot where target specific treatment of mating disruption was applied in place of regular plant protection schedule. The mean number of moths trapped in treated plot was 3.90 moths/trap which was least as compared to 54.99% moths/trap in farmers practices plot (Table 5). These findings are in agreement with Patil *et al.*, (2004) who recorded an average of 0.8 moths/ trap/ night when mating disruption was used as against 2.6/trap/night

Table 1
Effect of mating disruption on rosette flower due to pink bollworm in cotton

Treatment	*Per cent rosette flower*			
	10 DAFA	*10 DASA*	*10 DATA*	*Mean*
Treated	0.75	2.36	2.60	1.90
Farmers practices	19.80	22.00	19.50	20.43
SD	13.10			
S.Em.±	0.59			
Cal t*	31.25			
Tab t	2.00			

DAFA- Days After First Application **DASA-** Days After Second Application
DATA- Days After Third Application * Significant at 5 % level

Table 2
Effect of mating disruption on green boll damage due to pink bollworm in cotton

Treatment	*Per cent green boll damage*			
	10 DAFA	*10 DASA*	*10 DATA*	*Mean*
Treated	0.29	1.53	2.18	1.33
Farmers practices	2.28	21.55	21.15	14.99
SD	9.66			
S.Em.±	1.20			
Cal t*	11.42			
Tab t	2.00			

DAFA- Days After First Application **DASA-** Days After Second Application
DATA- Days After Third Application * Significant at 5 % level

Table 3
Effect of mating disruption on open boll damage due to pink bollworm in cotton

Treatment	*Per cent open boll damage*			
	1st Picking	*2nd Picking*	*3rd Picking*	*Mean*
Treated	1.79	2.70	4.15	2.88
Farmers practices	21.55	23.15	26.10	23.60
SD	14.65			
S.Em.±	0.64			
Cal t*	32.56			
Tab t	2.00			

* Significant at 5% level

Table 4
Effect of mating disruption on locule damage due to pink bollworm in cotton

Treatment	*Per cent locule damage*			
	1st Picking	*2nd Picking*	*3rd Picking*	*Mean*
Treated	2.19	3.44	5.10	3.58
Farmers practices	21.5	23.75	26.85	24.03
SD	14.47			
S.Em.±	0.62			
Cal t*	32.80			
Tab t	2.00			

* Significant at 5 % level

in control plots. This was further supported by Radhika and Reddy (2006), who suggested that moth catches in the control plot were comparatively very high throughout the crop season as compared to mating disruption treated plots.

Yield and economics

The data on yield was observed significantly differed in both treated and farmers practices plots and found higher in treated plot (3089 Kg/ha) as compared to farmer's practices plot (2081 Kg/ha) in cotton (Table 5). The results on economics of mating disruption against pink bollworm in cotton showed the net realization of 47,575 Rs./ha in treated plot as compared to farmers practices plot and the ICBR of 1:8.93 was found in treated plot (Table 6). The present results are in line with the results of (Patil *et al.*, 2004), who revealed that the application of mating disruption along with insecticidal spray recorded higher seed cotton yield. The demonstration block recorded 24.95 q/ha yields of seed cotton against 22.45 q/ha in control block (Radhika and Reddy, 2006).

Table 5
Mean effect of mating disruption on moth catches of pink bollworm per trap and yield of cotton

Treatment	*Mean moths/trap*	*Yield/Kg/ha*
Treated	3.90	3089
Farmers practices	54.99	2031
SD	36.13	748
S.Em.±	8.98	31.70
Cal t*	5.69	11.13
Tab t	2.14	4.30

* Significant at 5 % level

Table 6
Economics of mating disruption for the management of pink bollworm in cotton

Sr.	*Treatment*	*Yield (Kg/ha)*	*Yield increased over control (Kg/ha)*	*Additional income (Rs.)*	*Cost of treatment with labor charge Rs/ha*	*Net realization Rs/ha*	*ICBR*
1.	Treated plot	3089	1058	52,900	5325	47,575	1:8.93
2.	Farmers practices	2031	0	0	6905	-	-

1. **Quantity of water:** 500 lit. /ha
2. **Cost of inputs:** **In treated plot-** Mating disruption paste for pink bollworm- 5400 Rs./ha
   In farmers practices- Five spray of commonly used insecticides was carried out against pink bollworm
3. **Labour charge for application of mating disruption paste=** 200 Rs./application
   Labour charge for spraying of insecticides= 316 Rs./spray
4. **Sale price of cotton** Rs. 50 per kg

REFERENCES

Ghosh, S. K. (2001). GM Crops: Rationally irresistible. *Current Science*, **6**: 655-660.

Narayanan, E. S. (1962). Biology and method of control of some important insect pests of cotton in India. Indian Central Cotton Committee Publication, Bombay, p. 44.

Patil, B. V.; Bheemanna, M.; Hanchinal, S. G. and Anand Kumar, V. (2004). Management of cotton pink bollworm using PB Rope L mating disruptant. International symposium on "Strategies for Sustainable Cotton Production – A Global Vision" 3.Crop Protection, 23 – 25 November 2004, University of Agricultural Sciences, Dharwad, Karnataka, India. Pp. 176-179.

Patil, S. B. (2003). Studies on management of cotton pink bollworm *Pectionophora gossypiella* (Saunders) (Lepidoptera: Gelechiidae). Ph. D. Thesis (unpublished) submitted to University of Agricultural Sciences, Dharwad (India).

Patil, S. B.; Bambawale, O. M.; Tanwar, R. K.; Udikeri, S. S. and Renuka H. B. (2007). Mating disruption using PB Rope L: A promising option for pink bollworm (*Pectiphora gossypiella* Saunders) management in cotton. The World Cotton Research Conference-4, 10-14 September, 2007, Civic Center in Lubbock, Texas, USA. pp. 155-160.

Radhika, P. and Sahadeva Reddy, B. (2006). Management of pinkbollworm, *Pectinophora gossypiella* (Saunders) with PB ropel and IPM approach. *Asian Journal of Bioscience* **2**(1): 68-69.