Effect of Different Synthetic Pesticides Against Pink Bollworm *Pectinophora gossypiella* (Saund.) On Bt. and non-Bt. Cotton Crop

Imran Ali Rajput*, Tajwer Sultana Syed, Arfan Ahmed Gilal, Agha Mushtaque Ahmed, Fahad Nazir Khoso, Ghulam Hussain Abro and Maqsood Anwar Rustamani

Department of Entomology, Faculty of Crop Protection, Sindh Agriculture University, Tandojam, Sindh, Pakistan

Abstract: The field studies were conducted at the farmer's field in 2015-2016 to determine the effect of three different insecticides (triazon, radiant and polytrin C) on Bt. and non-Bt. cotton varieties against pink bollworm. The results revealed that triazon was observed the most effective pesticide against PBW on both cotton varieties. The mortality reduction percent of 33.99 to 30.45% was recorded at triazon, 27.72 to 26.95% at radiant and 24.68 to 14.48% at polytrin C respectively, in 2015. However, in 2016 the mortality reduction percent decreased but effective trend of these selected pesticides were observed same with mortality reduction percent of 28.15 to 25.46% at triazon, 21.95 to 23.52% at radiant and 19.96 to 16.37% at polytrin C in Bt. and non-Bt. cotton varieties. In present investigation, triazon was observed the most effective pesticide than radiant and polytrin C on larvae of PBW in both Bt. and non-Bt. varieties.

Keywords: Pesticides, pink bollworm, Bt. and non-Bt. Cotton.

INTRODUCTION

Pink bollworm *Pectinophora gossypiella* (Saunders) is considered as one of the most serious insects pest of cotton crop attacking on fruiting bodies which may result indirect losses of yield and indirectly damage of cotton fiber quality. It has been estimated that the total losses first time caused by this insect pest was over one million in Egypt [1] which further advanced with time in different cotton growing countries of the world. The major constraint in controlling the pest through pesticides is the habitat of pest larvae feeds and develops inside of bolls [2] and difficult to get direct exposure of many pesticides. The recent introduction of microbial pesticides such as Spinosyn particularly against many lepidopteron pests have given a great solution as bio-control [3-6]. However, an application of repeating similar pesticides did not impact well in controlling the bollworm complex [7-9] and resulted in insect resistance. The great example in this regard was an introduction of *Bacillus thuringiensis* that previously provided an effective insecticidal activity against various lepidopterous species but such effect was later evolved in term of pest resistance particularly in *P. gossypiella* [10].

In country like Pakistan, where cotton is considered as golden fiber and most of the economy relies on cultivation of single crop, it is essential to know the preference of *P. gossypiella* on different varieties of Bt. and non-Bt. cotton. Only few studies, have been previously attempted however there is still lacking in regard to know the resistance development of pink bollworm on various commercial varieties of cotton available particularly in Sindh province. Therefore, this study was designed to observe the effect of different synthetic pesticides against PBW on Bt. and non Bt. cotton crop.

MATERIALS AND METHODS

The comparative effect of different pesticides against pink bollworm on cotton varieties was carried out during two consecutive growing years (2015 and 2016). The cotton varieties "Bt. MNH-886 and non-Bt. FH-1000 were used throughout the experiment at farmer's field of district Sanghar. The cotton was grown in area of half acre which was further divided into four blocks (Figure **1**) and each block was replicated four times and similar layout was applied in non-Bt. cotton crop.

The experiment was consisted of three pesticides (Trizon 40% EC, Radiant 120% SC and Polytrin C 440 EC) and one control plot as treatments. These pesticides were used at experimental plot according to their recommended doses (Table **1**).

These pesticides were applied four times at the interval of 15 days to both Bt. and non- Bt. cotton varieties. To observe the efficacy of selected pesticides against pink bollworm, 50 bolls from each replication (200 bolls/treatment) were observed before and after each spray. The pre-treatment observations were recorded at 24 hours before spray, however the post-treatment observations were taken at different hours

*Address correspondence to this author at the Department of Entomology, Faculty of Crop Protection, Sindh Agriculture University, Tandojam, Sindh, Pakistan; Tel: 0301-3454358; E-mail: ranaimran234@gmail.com

ISSN: 1814-8085 / E-ISSN: 1927-5129/17

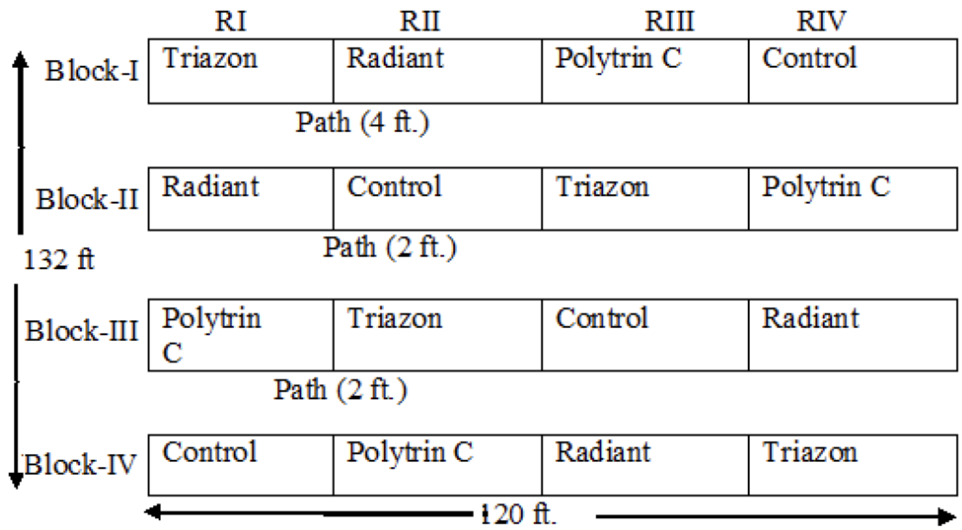

Figure 1: Field layout of experimentation.

Table 1: Recommended and Used Doses of Synthetic Pesticide

Treatments	Recommended Dose/ acre	Used Dose per plot
Trizon40% EC	1000ml	20.66ml/ 2.00L water
Radiant120% SC	80ml	0.82ml/ 2.00L water
Polytrin C 440 EC	500ml	12.39ml/ 2.00L water

(24, 48, 72 and 96), one week and two weeks of each pesticides spray, respectively. The data were later compared to control plot within both Bt. and non-Bt. varieties.

Data Analysis

The experiment was selected as Randomized Complete Block Design (RCBD) with four treatments and replications. The collected data were subjected to statistical analysis using three factorial analysis of variance (ANOVA). The analyzed means of all treatments were further compared through LSD (Least Significance Difference) at p value (0.05) using statistical software SAS (ver. 9.1). Moreover, the reduction percentage (%) of pink bollworm population was also calculated using following formula described by Abbot (1925).

$$\text{Reduction } \% = \frac{\text{Pre - treatment - Post treament}}{\text{Pre - treatment}} \times 100$$

RESULTS

The results regarding the efficacy of different pesticides spray against larval population of pink bollworm varied significantly at different intervals (24 hrs F= 209.60; 48 hrs F=281.89; 72 hrs F=282.83; 96 hrs F=406.17,1 week F=777.53; and 2 weeks F=1312.09, dF=3 at *P*<0.05). The results in Tables **2** and **3** further indicated the reduction percentage in larval population of pink bollworm on Bt. and non-Bt. cotton crops. The highest reduction percentage of 36.74 was recorded on Bt. cotton with pesticide application of triazon followed by radiant 27.72 % and polytrin C 24.68 %. However, similar effect of these pesticides was also observed on non-Bt. cotton with less reduction percentage as compared to Bt. cotton. A maximum mean reduction in larval population of 30.51% at triazon followed by radiant 27.33 % and polytrin C 16.23 %was recorded on non-Bt. cotton in 2015 shown in (Figure **2**). The trend of results in 2016 was observed with similar findings, however the overall maximum mean reduction population decreased and recorded 28.15 % at triazon followed by radiant (21.95%) and polytrin C (19.96%) in Bt. cotton crop and 25.46% at triazon followed by radiant (23.52%) and polytrin C (16.37 %) in non-Bt. cotton crop were respectively recorded (Figure **3**).

DISCUSSION

Pink bollworm *P. gossypiella* is a sever pest of cotton crop which affecting mostly fruiting bodies and huge losses of cotton production including lint qualities. Although, the introduction of Bt. cotton varieties have

Table 2: Overall Larval Mean Population of *P. gossypiella* after Application of Different Pesticides at Variable Intervals in 2015

Cotton	Treatments	Pre treatment	Post treatments						Mean
			24hrs	48hrs	72hrs	96hrs	1st week	2nd week	
Bt.	Triazon	10.56	5.12^{c}	5.43^{c}	6.43^{c}	7.25^{c}	8.31^{c}	9.32^{c}	6.97
	Radiant	10.75	6.00^{b}	6.43^{bc}	7.06^{bc}	8.12^{bc}	9.06^{bc}	9.94^{bc}	7.77
	Polytrin C	11.75	6.81^{b}	7.62^{b}	8.43^{b}	9.13^{b}	10.12^{b}	11.00^{b}	8.85
	Control	11.81	11.94^{a}	17.94^{a}	18.31^{a}	28.19^{a}	33.56^{a}	38.06^{a}	21.33
non-Bt.	Triazon	11.13	5.68^{c}	6.13^{b}	7.37^{b}	8.13^{b}	9.06^{b}	10.06^{b}	7.74
	Radiant	11.25	6.43^{bc}	6.75^{b}	7.82^{b}	8.56^{b}	9.25^{b}	10.50^{b}	8.22
	Polytrin C	11.68	9.93^{b}	8.50^{bc}	9.25^{bc}	9.44^{bc}	11.18^{bc}	12.00^{bc}	10.05
	Control	12.46	13.69^{a}	16.13^{a}	19.13^{a}	28.94^{a}	33.31^{a}	39.75^{a}	24.83

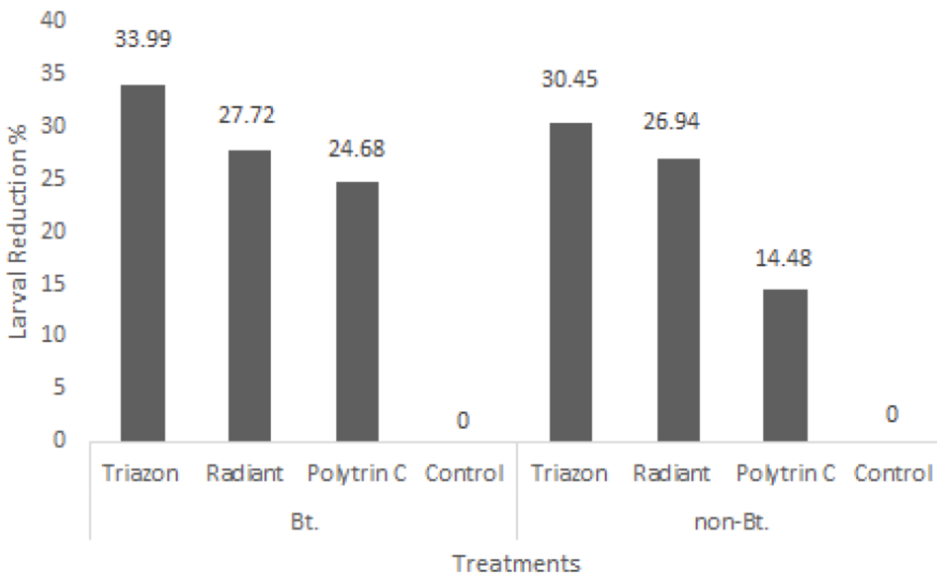

Figure 2: Reduction percentage of larval populations after application of different pesticides in Bt. and non-Bt. cotton during 2015.

Table 3: Overall Larval Mean Population of *P. gossypiella* after Application of Different Pesticides at Variable Intervals in 2016

Cotton	Treatments	Pre treatment	Post treatments						Mean
			24hrs	48hrs	72hrs	96hrs	1st week	2nd week	
Bt.	Triazon	10.37	5.93^{c}	6.44^{c}	6.94^{c}	7.81^{c}	8.32^{c}	9.25^{c}	7.45
	Radiant	10.25	6.31^{bc}	7.06^{bc}	7.45^{bc}	8.68^{bc}	9.06^{bc}	9.44^{c}	8.00
	Polytrin C	10.82	7.62^{b}	8.0^{b}	6.68^{b}	9.13^{b}	10.0^{b}	10.50^{b}	8.66
	Control	15.78	18.00^{a}	21.19^{a}	23.06^{a}	23.56^{a}	24.44^{a}	28.56^{a}	23.14
non-Bt.	Triazon	10.25	6.00^{c}	6.50^{c}	7.25^{c}	8.13^{c}	8.68^{c}	9.25^{c}	7.64
	Radiant	10.50	6.75^{bc}	7.0^{bc}	7.45^{c}	8.44^{c}	8.87^{c}	9.68^{c}	8.03
	Polytrin C	10.75	7.44^{b}	7.87^{b}	8.68^{b}	9.25^{b}	10.06^{b}	10.63^{bc}	8.99
	Control	16.37	17.25^{a}	18.06^{a}	19.56^{a}	21.31^{a}	24.25^{a}	29.75^{a}	23.36

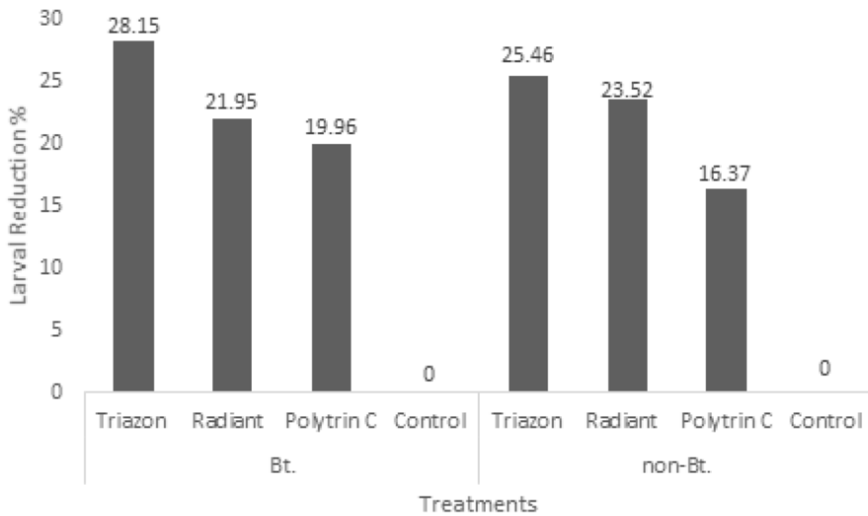

Figure 3: Reduction percentage of larval populations after application of different pesticides in Bt. and non-Bt. cotton during 2016.

indicated significant resistance against bollworm complex but reported resistance of *P. gossypiella* against Bt. cotton crop has opened a new gate of challenges for cotton growers. In this regards, the present study consisted of collective information of two (2015 and 2016) cotton growing years showing resistance of *P. gossypiella* against different pesticides on Bt. and non-Bt. cotton crops. The pesticides used in this study were observed more effective on Bt. cotton as compared to non-Bt. cotton crop in both years. It could be due to the less population of *P. gossypiella* was observed as compared to non-Bt. cotton crop. Thus, Bt. cotton showed deterrent against larval attack of *P. gossypiella* due to having *Bacillus thuringiensis* inside it and performed bio-insecticidal effect.

Overall, the maximum toxic effect persisted up to 24 hrs after application of all pesticides of different selected groups in both years of study on Bt. and non Bt. cotton crops. It could be possible due to developed resistance against long term usage of pesticides. Similarly, the less persistence of most pesticides has also been recorded previously against *P. gossypiella* on Bt. cotton [11]. The development of pest resistance against various pesticide in the field condition has also been reported by [12]. Thus, it showed that the repetition of similar application of pesticides generates pest resistance mainly and may also results in insect pest outbreak.

However, the maximum mean reduction percentage of *P. gossypiella* after application of these different pesticides was varied. The pest population in 2015 was observed much reduced on Triazon, as compared to Radiant and Polytrin C. in Bt. and non-Bt. cotton crops. Such findings showed that Triazon was much affected in controlling pink bollworm meanwhile more or less reduction percentage of pest was also observed on other pesticides. In addition, the results in 2016 were observed with similar findings in which the maximum mean reduction population percent was observed after application of triazon. Furthermore, [13] successfully managed the bollworms complex in cotton with timely spray schedule of synthetic pesticide with less repetition. Meanwhile, these insecticides may lost their effect if applied as a response to high pest population [14, 15]. Nevertheless, spinosyn, pyrethroids and other organophosphorus class of insecticides were reported frequently used against lepidopteran particularly bollworm complex [16] but the evolution of synthetic insecticides resistance has been developed worldwide as the most serious threat to the development of sustainable Integrated Pest Management practices [17]. Therefore, similar resistance indicated by *P. gossypiella* observed in this study against most these popular groups of insecticide on both Bt. and non-Bt. cotton crops at different intervals particularly after 24 hours of pesticide application in both years.

CONCLUSION

It is concluded through present investigation that the population of *P. gossypiella* was less observed on Bt. cotton as compared to non-Bt. cotton. Furthermore, from selected pesticides, the Triazon was observed much effective in controlling the larval population of *P. gossypiella* with maximum reduction percentage in both years from Bt. cotton fields.

REFERENCES

[1] Menally P, Mullins W. The role of prevado in western cotton IPM programs proceeding beltwide cotton conferences. Nashville, USA, 9-12 January 1996; 859-862.

[2] Lykouressis D, Perdikis D, Samartzis D, Fantinoub A, Toutouzas S. Management of the pink bollworm Pectinophora gossypiella (Saunders) (Lepidoptera: Gelechiidae) by mating disruption in cotton fields. Crop Protection 2005; 12(24): 177-183. https://doi.org/10.1016/j.cropro.2004.07.007

[3] Champagne DE, Isman MB, Neiltowers GH. Inesticidal activity of phytochemicals and extracts of the -Miliaceae (In: Arnason, J.T., Philogene, B.J.R. and Morand, P. Eds, Insecticides of plant. Origin Acs Symp Ser 387, Washington, D.C.) 2005.

[4] Temarak SA. 2007. Suscetibility of *Spodoptera littoralis* to old and new generation of Spinosyn products in five cotton. Resist. Pest Management 1989; 16(2): 34-47.

[5] Ghure ST, Kharbde BS, Patil DS. Bioefficacy of new pesticides against bollworm complex of cotton (*Gossypium spp*.). Int J Plant Protect 2008; 1(2): 106-109.

[6] Gosalwad SS, Kamble SK, Wadnerkar DW, Awaz KB. Efficacy of some newer insecticides for control of cotton bollworms. J Cotton Res and Develop 2009; 23(2): 282-285.

[7] Khidr AA, Desuky DMH, El-Sheakh AA, Araslan S. Sequential use of some insecticides against cotton bollworms in control trials. Egypt J Agric Res 1996; 74(2): 321-331.

[8] El-Sorady AEM, El-Zanan AAS, Abo-Sholoa MKA, El-Dahan AA. Influence of some insecticide sequences on natural and artificial infestation with pink bollworm *Pectinophora gossypiella* (Saund.). Egypt J Agric Res 1998; 76(2): 585-596.

[9] AbdEl-Mageed AEM, El-Gohary LR, Dahi HF. Evaluation of several programs of sequences pesticides application on cotton bollworms and some other sucking pest in cotton field. J Entomol 2007; 4: 93-103. https://doi.org/10.3923/je.2007.93.103

[10] Carpenter JE, Gianessi LP. Agricultural biotechnology: updated benefit estimates. National Center for Food and Agricultural Policy, Washington, D.C 2001.

[11] Qaim M, Zilberman D. Yield effects of genetically modified crops in developing countries. Science 2003; 299: 900-902. https://doi.org/10.1126/science.1080609

[12] Li CL, Beyers, Ismael Y, Piesse J. The impact of Bt. cotton in GM-technologies. Makhath in Flats, Kwa Zulu-Natal', World Development 2003; 31: 717-732. https://doi.org/10.1016/S0305-750X(03)00004-4

[13] Gupta GP, Sharma K. Neem based pest management strategy in cotton system. Pesticide Research Journal 1997; 9: 190-197.

[14] Widawsky D, Rozelle S, Jin S, Huang J. Pesticide productivity, hostplant resistance and productivity in China. Agric Economics 1998; 19: 203-217. https://doi.org/10.1016/S0169-5150(98)00049-8

[15] Huang J, Hu R, Rozelle S, Qiao F, Pray CE. Transgenic varieties and productivity of smallholder cotton farmers in China', Australian Journal of Agriculture and Resource Economics 2002; 46: 367-387. https://doi.org/10.1111/1467-8489.00184

[16] Thompson GD, Borth PW, Shaw MC, Huckaba RW, Nead BA, Peterson LG, Richardson JM, Porteous DJ. Spinosad and the new naturalyte insect control class, In Proceedings, Beltwide Cotton Conference, National Cotton Council, Memphis, TN. 2009; pp. 870-872.

[17] Lab P, Lenorm T, Raymond M. On the world wide spread of an insect resistance gene: a role for local selection. J Environ Biology 2005; 18(6): 1471-1484.

Received on 02-08-2017 Accepted on 04-08-2017 Published on 29-08-2017

https://doi.org/10.6000/1927-5129.2017.13.75