Research Article

Efficacy of New Insecticides against Pink Bollworm, *Pectinophora Gossypiella* Saunders (Lepidoptera: Gelechiidae) on Rainfed Cotton

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Abstract

An experiment was conducted at Regional Agricultural Research Station, Lam, Guntur for two successive seasons i.e. Kharif 2016-17 and 2017-18 to evaluate the field efficiency of certain insecticides against pink bollworm in cotton. The synthetic pyrethroids such as bifenthrin 10 EC @ 800 ml/ha and cypermethrin 25 EC @ 500 ml/ha were found effective over the conventional insecticides such as thiodicarb 75 WP and profenophos 40 EC and new molecules such as spinosad 45 SC, emamectin benzoate 5 SG and chlorantraniliprole 20 SC in reducing the larval population of pink bollworm along with less boll damage.

Keywords: Pink bollworm, New insecticides, bifenthrin, cotton

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Introduction

Cotton (*Gossypium hirsutum* L.) which is popularly known as white gold is one of the major cash crop in India with a total production of 360 lakh bales from a total area of 125 lakh hectares. Though there was no significant reduction in area, the average productivity is 486 kg lint/ha during 2019-20 when compared to 542 kg/ha during 2016-17 [1]. The reduction in productivity can be attributed to re-emergence of pink bollworm in Bt cotton in all the cotton growing states. The pink bollworm incidence was reported from 2010-2012 from few cotton growing states of India which was almost negligible for a decade from 2002 onwards after the introduction of Bt cotton in India. Gradually, the incidence of pink bollworm increased and appeared severely from 2016-17 onwards, hence the average productivity was reduced though there was increase in total area under cotton cultivation. CICR, Nagpur also established that the pink bollworm has developed resistance to Cry 1 Ac, Cry2 Ab and Cry 1 Ac + Cry 2 Ab proteins. After re-emergence of pink bollworm, because of concealed nature of larvae in the infested boll itself, farmers mostly rely upon insecticides only to combat from its menace and to attain good kapas both in terms of quality as well as quantity. Hence, it is essential to evaluate the efficacy of some new insecticides against pink bollworm, since many of the insecticides were tested for their efficacy against pink bollworm at a decade back. Many new molecules with new chemistries were developed which were not tested against pink bollworm during the recent past. Thus, a study was conducted to evaluate the field efficacy of some new insecticides against pink bollworm in rainfed cotton.

Materials and Methods

The experiment was conducted for two successive seasons i.e. Kharif 2016-17 and 2017-18 at Regional Agricultural Research Station, Lam, Guntur. The cotton variety, Suraj was selected as test variety and it was sown in second fortnight of July at 105 X 60 cm spacing during both the seasons. Randomised block design was adopted for the trial with nine treatments including untreated control which were replicated thrice. Three sprays were imposed at 15 days interval from 90 DAS onwards i.e at 90, 105 and 120 DAS to know the efficacy of insecticides against pink bollworm. Low volume sprayer was used with a spray fluid of 500 l/ha for foliar sprays. The data was recorded through destructive sampling of green bolls i.e. 10 green bolls were collected at 135 DAS randomly from each treatment and the data on larval incidence and percent locule damage in green bolls was recorded by dissecting the green bolls on the same day of collection from all the treatments. The open boll damage and the data on seed cotton yield was recorded at the time of harvesting. Blanket sprays of selective insecticides were given thrice in all the treatments uniformly against sucking pests to avoid yield loss due to damage by the sucking pests and to maintain good crop condition. The data thus obtained was subjected to statistical analysis after using appropriate transformations.

Locule damage % = (No. of infested locules / Total no. of locules) x 100

Open Boll damage % = (No. of infested bolls / Total no. of bolls) x 100

Results and Discussion

The larval population ranged from 2.67 to 11.84/ 10 green bolls in different treatments which showed significant differences statistically. The larval population was numerically low in bifenthrin 10 EC (2.67/ 10 green bolls), but it was found statistically at par with cypermethrin 25 EC (3.00/10 green bolls), thiodicarb 75 WP @ 750 g/ha (3.48/ 10 green bolls) and profenophos 40 EC @ 1000 ml/ha (3.58/ 10 green bolls). The next best treatment was quinalphos 25 EC @ 1000 ml/ha with less than 5.0 larvae/10 green bolls. The new molecules such as spinosad 45 SC @ 150 ml/ha, emamectin benzoate 5 SG @ 200 g/ha and chlorantraniliprole 20 SC @ 150 ml/ha were found less effective in reducing the larval population of pink bollworm which recorded around 8.0 larvae/ 10 bolls. However, the number of larvae was significantly higher in untreated control with 11.84 larvae/10 green bolls which was significantly higher when compared to the larvae from insecticidal treated plots (**Table 1**).

Table 1 Efficacy of certain insecticides against pink bollworm in cotton at RARS, Lam, Guntur, Andhra Pradesh

Treatment	Formulation (Dosage/ha)	Mean No.of Larvae/10 green bolls*	Per cent Locule damage in green bolls**	Per cent open boll damage**	Yield (Q/ha)
Spinosad 45 SC	150 ml	7.92(2.99)	49.91(44.97)	41.50(40.13)	11.61
Emamectin benzoate 5 SG	200 g	8.92(3.15)	53.14(46.82)	50.67(45.41)	10.19
Chlorantraniliprole 20 SC	150 ml	8.34(3.06)	52.45(46.42)	45.63(42.51)	11.23
Bifenthrin 10 % EC	800 ml	2.67(1.91)	19.77 (26.41)	10.73(19.13)	14.30
Profenophos 40 EC	1000 ml	3.58(2.14)	24.82(29.89)	15.53(23.22)	12.35
Thiodicarb 75 WP	750 g	3.84(2.20)	28.26(32.13)	16.37(23.88)	12.15
Cypermethrin 25 EC	500 ml	3.00(2.00)	19.97(26.55)	11.50(19.83)	14.74
Quinalphos 25 EC	1000 ml	4.83(2.41)	39.28(38.83)	20.90(27.22)	12.14
Untreated Control	--	11.84(3.58)	66.67(54.76)	53.73(47.16)	9.21
F test		Sig	Sig	Sig	Sig
SE(m) ±		0.14	1.63	1.37	0.97
C.D (p=0.05)		0.41	4.90	4.12	2.86
C.V %		9.75	8.70	7.40	14.00

* Figures in parenthesis are SQRT (X+1) transformed values, ** Figures in parenthesis are arcsine transformed values

The locule damage in green bolls was ranged from 19.97 to 66.67 per cent among the different treatments with significant differences. The locule damage in green bolls was lowest with bifenthrin 10 EC (19.97 %) which was statistically on par with cypermethrin 25 EC (19.97 %) and profenophos 40 EC (24.82 %), but superior over the rest of the treatments. The other best treatment was thiodicarb 75 WP with less than 30.0 % locule damage in green bolls. The new molecules such as spinosad 45 SC @ 150 ml/ha, emamectin benzoate 5 SG @ 200 g/ha and chlorantraniliprole 20 SC @ 150 ml/ha recorded around 50 % locule damage by the pink bollworm in green bolls which indicating that these new insecticides were less effective when compared to synthetic pyrethriods and conventional OP compounds. However all the treatment were significantly superior over the untreated control in reducing the locule damage in green bolls due to pink bollworm (Table 1).

The open boll damage was recorded at the time of harvesting revealed that bifenthrin 10 EC (10.73 %) was found superior over the new insecticide molecules such as spinosad 45 SC @ 150 ml/ha, emamectin benzoate 5 SG @ 200 g/ha and chlorantraniliprole 20 SC @ 150 ml/ha which were found least effective in reducing the open boll damage by pink bollworm in cotton. The other insecticides in the order of efficacy are cypermethrin 25 EC, profenophos 40 EC, thiodicarb 75 WP and quinalphos 25 EC which recorded less than 20.0 % open boll damage by the pink bollworm in cotton.

The kapas yield was ranged from 9.21 to 14.74 q/ha was recorded from the ndifferent insecticide treatments. The highest kapas yield was recorded from synthetic pyrethroids, i.e. cypermethrin 25 EC (14.74 q/ha) followed by bifenthrin 10 EC (14.30 q/ha) which were found statistically at par with ovicides i.e. profenophos 40 EC and thiodicarb 75 WP and also with quinolphos 25 EC which recorded more than 12.0 q/ha of kapas yield. But, there was no significant differences statistically among the new insecticides such as spinosad 45 SC, emamectin benzoate 5 SG and chlorantraniliprole 20 SC which recorded more than 10 q/ha and untreated control (9.21 q/ha) regarding kapas yield.

In the current study, the conventional insecticides were found effective against pink bollworm which is in accordance with the many of the earlier reports. The efficacy of quinolphos 25 EC @ 0.5 kg a.i/ha [2], profenophos 50 EC @ 500 to 1000 g ai/ha [3, 4] and thiodicarb 75 WP @ 750 g a.i./ha [5, 6] was reported earlier against pink bollworm.

The better efficacy of synthetic pyrethroids, such as cypermethrin and deltamethrin 2.8 EC [5], [7], [8] alfamethrin at 0.025 kg a.i/ha [1], lambda-cyhalothrin 5 EC @75 - 100 g ai/ha [5], [9], bifenthrin [10], β-cyfluthrin 5 EC @ 18.7 g a.i/ha [4] was reported by many of the research workers against pink bollworm which are in accordance with the results obtained in the current study.

The study revealed that among the different insecticides, synthetic pyrethroids were more effective against pink bollworm when compared to organophosphates or carbamates which is in proximity with [5] and [11] who reported that, the synthetic pyrethroid, lambda cyhalothrin and deltamethrin exhibited the greatest reduction in bollworms infestation compared with the organo phosphorus insecticides.

In contrast to the current study, new insecticide molecules, such as spinosad 45 SC @ 75 to 100 g a.i/ha [3], indoxacarb 14.5 SC @ 75 to 100 g ai/ha and emamectin benzoate 5 SG [12], chlorantraniliprole 20% SC and spinetoram 12% SC [13] were reported effective in suppressing the pink bollworm larvae with minimum locule damage and bad open bolls. But, in corroboration with the current study, chlorantraniliprole 20 SC showed less efficacy (51.6%) when compared to triazophos + deltamethrin 40EC+2.5EC @ 2500+1000ml/ha, gamma cyhalothrin 60 CS, deltamethrin 2.5 EC and triazophos 40 EC [14].

The better efficacy of synthetic pyrethroids, thiodicarb and profenophos when compared to new insecticide molecules can be attributed to their ovicidal action also. Several investigators reported the ovicidal action of thiodicarb 75 WP and profenophos 25 EC [15], [16]. The per cent mortality of *S. litura* eggs was high with thiodicarb 75 WP @ 1 g/l when compared to flubendiamide 480 SC @ 0.2 ml/l and emamectin benzoate 5 SG @ 0.25 g/l [17]. There were reports on ovicidal activity of synthetic pyrethroids also against lepidopteran pests. The ovipositional repellent property of thiodicarb and cypermethrin against *H. armigera* was reported by [18]. The synthetic pyrethroids such as fenvalerate and cypermethrin also showed the ovicidal activity along with methomyl, triazophos, quinalphos against *H.armigera* [19]. Similarly, [20] recorded the highest egg mortality of *H.armigera* with chloropyrifos followed by deltamethrin, profenofos, lambada-cyhalothrin and methomyl.

However, inspite of higher efficacy, synthetic pyrethroids can be used as a final resort as many reports were available on pyrethroid induced resurgence of whiteflies in cotton and synthetic pyrethroids can be used by alternating with conventional organophosphates to control pink bollworm in cotton as a component in integrated pest management strategy.

References

[1] AICCIP (All India Coordinated Cotton Improvement Project), Annual Report 2019-20.

[2] Dandale, H.G., Thakare, A.Y. and Rao, N.G.V. (1998). Management of cotton bollworms with non pyrethriodal insecticides in central India. Pestol., 22:46.

[3] Ghure, S.K. and Patil, S.D (2008). Bioefficacy of new pesticides against bollwarm complex of cotton (Gossypium spp.) Int. J. Plant. Prot., 1(2) : 106-109.

[4] Kharbade, S.B. and Wayal, C.B. (2009). Evaluation of some insecticide molecules against pink boll worm, Pectinophora gossypiella (Saunders) on cotton. J.Cot.Res.Dev., 23(1): 149-151.

[5] Prasad, N.V.V.S.D., Mahalakshmi, M.S., and Rao, N.H.P. (2007). Efficacy of insecticides against pink bollworm, Pectinophora gossypiella (Saunders) on cotton. Ind. J. Environ. Ecoplan., 14(3):459-462.

[6] Dharajothi, B., Gopalakrishnan, N., Natarajan, K. and Manjula, T. R. (2009). Evaluation of certain insecticides against pink bollworm, Pectinophora gossypiella Saunders. J. Ind. Soc. Cot. Improv., 34(2): 91-95

[7] Khurana, A.D. and Verma, A.N. (1991). Bioefficacy of some synthetic pyrethroids and conventional insecticides against pink bollworm on cotton. Ind. J. Agril. Res., 25(1):27-32.

[8] Dandale, H.G., Rao, N.G.V., Tikar, S.N., and Nimbalkar, S.A. (2001). Efficacy of spinosad against cotton bollworms in comparison with some synthetic pyrethriods. Pestol., 25(3):24-28.

[9] Wayal, C.B, Kharbade, S.B., Dethe, M.D., Chandele, A.G. and Mehetre, S.S. (2007). Bioefficacy of lambda-cyhalothrin 5 CS formulation against pink bollworm Pectinophora gossypiella (Saunders) on cotton. Pestology, 31(9):15-19.

[10] Attique, M.R., Ahmad, Z., Mohyuddin, A.I. and Ahmad, M. M. (2001). Studies on Pectinophora gossypiella (Saunders) and its control strategy in the Punjab, Pakistan. Pak. J. Zool., 33(2):115-123.

[11] Younis, A. M.; Hamouda, H. H. S.; Ibrahim, A. S. and Zeitoum, M. A. Z. (2007). Field evaluation of certain pesticides against the cotton bollworms with special reference to their negative impact on beneficial arthropoda. African Crop Science conference Proceedings 8th African Crop Science Society, Elminia, Egypt, October 27-31, pp. 993-1002.

[12] Shivanna, B.K., Kumar, K. S., Manjunatha, M., Harish Babu, S., Raghunath, B.V., Soumya, B.R. and Shilpa, M.E. (2012). Efficacy of Insecticides on Pink Bollworm Infesting Bt Cotton. The IUP J. Gene. Evol., 5 (1): 19-30.
[13] Sabry, A.H., Hassan, K.A. and Rahman, A.A. (2014). Relative toxicity of some modern insecticides against the pink bollworm, Pectinophora gossyipiella (Saunders) and their residues effects on some natural enemies. Int. J. Sci. Environ. Tech., 3 (2): 481-491.
[14] Sanghi, A H, Ahmed T, Aslam M, Khalid L and Aslam A. (2018). Efficacy of different insecticides against pink bollworm Pectinophora gossypiella (Saund.) (Lepidoptera:Gelechiidae) on cotton crop in ecological zone Of rahim yar Khan. Int. J. Compr. Res. Biol. Sci. 5(7): 15-22.
[15] Raja Reddy A and Divakar B J (1998) Ovicidal action of certain insecticides on Spodoptera litura. Indian J. Pl. Protec. 26(1), 78-79.
[16] Ahmed K V, Rao H and Rao P P (2001). Promising new insecticides as potential ovicidal against eggs of Spodoptera litura. Pestology 25(3), 20-21
[17] Natikar P. K and Balikai R. A., (2015). Ovicidal action of newer insecticide molecules against the eggs of tobacco caterpillar, Spodoptera litura (Fabricius) J. Exp. Zool. India Vol. 18(2), pp. 993-995.
[18] Mala S R., Peter C and David B V (1993). Ovipositional behavior and eclosion of eggs of Helicoverpa armigera as affected by insecticides. Entomon 17, 177-181.
[19] Kathuria V., Ram Pala, Saini R.K (2000). Susceptibility of *Heliothis armigera* (Hübner) eggs to different insecticides. Journal of Entomological Research, 24 (3): 213-217.
[20] Sayed, A.A., Amer A.E.A. and Zaki A.A.A. (2013). Effect of some different compounds on American bollworm, Helicoverpa armigera (Hubner) in cotton fields. J. Plant Prot. and Path., Mansoura Univ., Vol. 4 (2): 207 – 214.

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