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Population of Coccinellids in Bt cotton

T. INDRA PRIYADARSHINI AND K. KUMAR

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See end of the article for authors' affiliations

Correspondence to:

K.KUMAR
Dept. of Entomology, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, PUDUCHERRY (U.T.) INDIA

ABSTRACT

Population of Coccinellids in transgenic Bt cotton and non Bt cotton *viz*., MECH 162 Bt, MECH 184 Bt, RCH2 Bt, and their non Bt (NBt) counterparts along with the check varieties MCU 7, SVPR3 were investigated in the two field experiments conducted during summer 2006 and winter 2006 at Karaikal district, U.T. of Puducherry. The mean population of Coccinellids was higher in check varieties MCU7 (9.48 and 10.37) and SVPR3 (9.98 and 11.36) compared to the Bt varieties MECH162 Bt (2.23 and 8.70), MECH 184 Bt (2.58 and 8.64) and RCH2 Bt (3.06 and 8.39per 10 plants) in summer and winter crop, respectively. It was found that the Bt hybrids recorded a low population of Coccinellids and the population in NBt hybrids is comparable with the check varieties MCU7 and SVPR3.

Key words : Bt cotton, NBt cotton, Coccinellids, Population.

Among the pests in cotton, bollworm complex (Coccinellids) is very serious throughout the country and pose a serious threat to cotton cultivation in many agro-ecological zones (Uthamasamy, 1994). To reduce the damage, more than 70 per cent of the insecticides are applied for the management of bollworms alone. Application of insecticides to manage the insect pests has resulted in the resurgence of sucking pest and resistance of the target insect pests. Besides, enormous production and use of insecticides has ecocidal effects. Development of an ecofriendly and potent method to reduce the incidence of this pest is highly imperative at this juncture (Bharathan, 2000; Sharma, 2001). To overcome these problems Bt gene was identified. Transgenic cotton engineered to continuously express delta endotoxin from the Bt gene, holds great promise for controlling bollworm complex (Gould, 1998). Host plant resistance provides sound platform for pest management and therefore it has been considered as an important component in any IPM modules. The transgenic cotton expressing delta endotoxin protein of Bt could reduce the impact of chemical insecticides and create ecologically sound breeding programmes without reducing crop production as a part of IPM strategy (Lutterell and Herzog, 1994.). In this, transgenic cotton cultivation may encourage the development new pest biotypes due to lack of natural enemies. The present study was undertaken to evaluate the transgenic cotton safety against the natural enemies.

MATERIALS AND METHODS

Population of Coccinellids in transgenic Bt cotton and non Bt cotton *viz.*, MECH 162 Bt, MECH 184 Bt, RCH2 Bt, and their non Bt (NBt) counterparts along with the check varieties MCU 7 and SVPR3 were investigated in the two field experiments conducted during summer 2006 and winter 2006 at Pandit Jawaharlal Nehru College of Agriculture and Research Institute (PAJANCOA and RI), Karaikal, U.T. of Puducherry. The experiment was laid out in a Randomized Block Design (RBD) with three replications and eight treatments in 8x5 square metre plots. The treatments included MECH 162 Bt, MECH 162 NBt, MECH 184 Bt, MECH 184 NBt obtained from Maharashtra Hybrid Seed Company (MAHYCO), Jalna, India and RCH2 Bt and RCH2 NBt obtained from Rasi Seeds Pvt. Ltd., Tamil Nadu, India along with check varieties, MCU7 and SVPR3.The agronomic practices were carried out as per the crop production guide of TamilNadu Agricultural University, Coimbatore, India.

The population of Coccinellids was recorded and *in situ* counts were taken at weekly intervals in the middle two rows, leaving the border row plants. The total number of Coccinellids were counted and expressed as number per 10 plants. The observations recorded for natural enemies were transformed by using formula $\sqrt{X+0.5}$ and used for statistical analysis. The data obtained from field experiments were analysed in a Simple Randomised Block Design by 'F' test for significance as described by Panse and Sukhatme (1958). Critical difference values were calculated at 5 per cent probability level and the treatment mean values of the experiment were compared using Duncans Multiple Range Test (DMRT) (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

The Coccinellids, *Harmonia octomaculata* (Fab.), *Micraspis* sp., *Coccinella transversalis* (Fab.), *Menochilus sexmaculatus* (Fab.) in the Bt cotton at

PAJANCOA and RI, Karaikal were observed. The results on the population of Coccinellids in different hybrids during summer 2006 are given in Table 1. The population of Coccinellids was observed two weeks after sowing. It was found that upto 29 DAS, there was no significant difference in the population of Coccinellids among the hybrids. There was an increase in population at 57 DAS which ranged from 1.33 to 12.00/10 plants irrespective of the hybrids. At 71DAS, the population of Coccinellids ranged from 0.33 to 11.33./10 plants. A higher population was observed in the check variety, SVPR3 (11.33) while a lower population was observed in RCH2 Bt hybrid (0.33). There was no significant difference in the population of Coccinellids among the treatments at 85DAS.Similar trend was observed from 99DAS and continued upto 148 DAS. The mean population ranged from 2.23 to 9.98 / 10 plants. The population number of Coccinellids in MECH162 Bt hybrids was low (2.23/10 plants) followed by MECH 184 *Bt* (2.58/10 plants) and RCH2 Bt (3.06/10 plants) while the population was higher in NBt hybrids, MECH 184 NBt (9.37 / 10 plants), RCH2 NBt (8.37/10 plants), and MECH 162 NBt (8.28/10 plants). However, the population of Coccinellids in NBt hybrids was comparable with varieties SVPR 3 (9.98/10 plants) and MCU 7 (9.48/10 plants). It was found that the population number of Coccinellids was very low in Bt hybrids and was higher in NBt and also in check varieties, MCU 7 and SVPR3.

Occurrence of Coccinellid beetles on cotton hybrids during winter 2006 are presented in Table 2. The population of Coccinellids was observed two weeks after sowing. It was found that from 15 DAS to 29 DAS, the population number of Coccinellids ranged from 0.67 to 13.00 / 10 plants. In all the hybrids upto 29 DAS, there was no significant difference in the population of Coccinellids. Similar trend was observed upto 85 DAS. At 99DAS, the population ranged from 2.33 to 11.33. A lower population was recorded in RCH2 Bt (2.33) while a higher population was observed in MECH162 Bt (11.33) and were found to be at par with the check variety SVPR3 (10.67). At 113 DAS, there was an increase in the population where the highest population was recorded in the RCH2 NBt hybrid (14.00) while the lowest was recorded in RCH2 Bt *(*8.33).The mean population ranged from 8.39 to 11.36 / 10 plants. Among the hybrids RCH2 Bt hybrids recorded a low population of Coccinellids (8.39 / 10 plants) followed by MECH 184 Bt (8.64 / 10 plants), MECH 162 Bt (8.70 / 10 plants) compared to MECH 162 NBt (9.70 / 10 plants), RCH 2 NBt (9.97 / 10 plants) and MECH 184 NBt (10.22 / 10 plants). However, it was found that the Bt hybrids recorded a low population of Coccinellids and the population in NBt hybrids was comparable with check varieties MCU 7(10.37 / 10 plants) and SVPR 3 (11.36 / 10 plants).

In the first field experiment (Summer 2006) population number of Coccinellids among the Bt cultivars ranged from 2.23 to 3.06 per 10 plants. In the second

Table 1 : Population of Coccinellid beetles in Bt and non Bt cotton – Summer 2006 (Number/10 plants, Mean of 3 replications)

Sr. No.	Hybrids /Varieties	15DAS	29DAS	43DAS	57DAS	71DAS	85DAS	99DAS	113DAS	127DAS	141DAS	148DAS	Mean
1.	MECH 162*Bt.*	0.33	1.67	1.68	1.33	1.00	1.00	2.33	2.00	2.00	1.00	3.00	2.23
		(0.88)	(1.46)	(1.35)^{b}	(1.34)^{b}	(1.09)^{b}	(1.17)	(1.66)^{c}	(1.56)^{c}	(1.47)^{c}	(1.17)^{c}	(1.78)^{b}	
2.	MECH 184 *Bt.*	0.33	2.67	2.00	2.67	1.33	1.67	2.00	3.00	4.00	3.00	3.04	2.58
		(0.88)	(1.77)	(1.56)^{c}	1.67)^{d}	(1.27)^{b}	(1.38)	(1.56)^{c}	(1.86)^{c}	(2.06)^{c}	(1.71)^{bc}	(1.86)^{b}	
3.	MECH162 *NBt.*	0.67	1.67	3.00	7.67	11.00	6.00	8.67	5.67	16.33	11.00	11.67	8.28
		(1.00)	(1.44)	(1.86)^{bc}	(2.85)^{b}	(3.39)^{a}	(2.51)	(3.01)^{b}	(2.46)^{bc}	(4.09)^{ab}	(3.39)^{ab}	(3.48)^{a}	
4.	MECH 184 *NBt*.	0.67	3.00	4.33	9.00	10.33	4.67	12.67	10.00	21.33	13.67	19.00	9.37
		(1.05)	(1.86)	(2.19)^{ab}	(3.07)^{ab}	(3.24)^{a}	(2.25)	(3.60)^{ab}	(3.22)^{ab}	(4.66)^{a}	(3.76)^{a}	(4.41)^{a}	
5.	RCH 2 *Bt.*	0.67	1.67	1.67	1.33	0.33	1.33	2.00	2.00	3.00	5.00	1.67	3.06
		(1.05)	(1.44)	(1.44)^{c}	(1.27)^{d}	(0.88)^{b}	(1.29)	(1.56)^{c}	(1.56)^{c}	(1.70)^{c}	(2.12)^{abc}	(1.35)^{b}	
6	RCH2 *NBt.*	0.33	2.00	5.67	10.33	7.67	11.33	16.00	11.67	10.33	13.00	18.33	8.37
		(0.88)	(1.56)	(2.48)^{a}	(3.28)^{ab}	(2.84)^{a}	(3.34)	(4.06)^{a}	(3.47)^{ab}	(3.29)^{b}	(3.22)^{ab}	(4.33)^{a}	
7.	MCU 7	1.33	2.00	5.67	10.33	7.67	14.67	10.00	15.33	14.67	12.00	19.67	9.48
		(1.34)	(1.56)	(2.48)^{a}	(3.28)^{ab}	2.84)^{a}	(3.88)	(3.20)^{ab}	(3.74)^{ab}	(3.87)^{ab}	(3.53)^{ab}	(4.46)^{a}	
8.	SVPR3	1.67	3.33	6.00	12.00	11.33	9.67	15.33	6.33	19.33	12.67	18.67	9.98
		(1.46)	(1.95)	(2.54)^{a}	(3.52)^{a}	(3.43)^{a}	(3.18)	3.87)^{a}	(2.42)^{ab}	(4.45)^{a}	(3.57)^{ab}	(4.30)^{a}	
	C.D. (P=0.05)	NS	NS	0.43**	0.55**	0.63**	NS	0.94**	1.16**	0.89**	1.73**	1.04*	0.94**

* and ** Significance of values at P = 0.05 and 0.01, respectively. NS - Not significant,DAT -Days after treatments, DAS- Days after sowing.
In a column means followed by a common letter are not significantly different by DMRT(P=0.05)
Values in parentheses are transformed values $\sqrt{x}+0.5$

Table 2: Population of Coccinellid beetles in Bt and non Bt cotton– Winter 2006 (Number/10 plants, Mean of 3 replications)

Sr.No.	Hybrids/Varieties	15DAS	29DAS	43 DAS	57 DAS	71 DAS	85DAS	99DAS	113DAS	127DAS	141DAS	148DAS	Mean
1.	MECH 162*Bt*	1.67	5.67	11.00	8.00	11.33	13.00	11.33	12.33	8.33	2.00	3.67	8.70
		(1.39)	(2.46)	(3.39)^{bc}	(2.89)^{c}	(3.34)	(3.66)	(3.43)^{a}	(3.57)^{a}	(2.97)^{de}	(1.32)^{bc}	(2.01)^{c}	
2.	MECH 184 *Bt*	1.33	4.67	11.00	12.67	10.00	13.33	7.67	9.33	6.67	3.67	5.33	8.64
		(1.18)	(2.25)	(3.37)^{bc}	(3.62)^{ab}	(3.24)	(3.71)	(2.86)^{a}	(3.13)^{b}	(2.62)^{ef}	(1.87)^{ab}	(2.41)^{abc}	
3.	MECH162*NBt*	2.67	5.67	10.00	10.33	10.00	14.67	10.00	12.33	10.33	2.33	4.67	9.70
		(1.74)	(2.40)	(3.24)^{c}	(3.28)^{bc}	(3.24)	(3.89)	(3.23)^{a}	(3.58)^{a}	(3.29)	(1.68)^{abc}	(2.27)^{bc}	
4.	MECH 184*NBt*	1.00	8.67	19.33	14.00	11.33	12.33	9.33	12.33	8.67	4.67	6.00	10.22
		(1.17)	(3.10)	(4.45)^{a}	(3.81)^{ab}	(3.44)	(3.58)	(3.13)^{a}	(3.58)^{a}	(3.03)^{de}	(2.27)^{ab}	(2.54)^{ab}	
5.	RCH 2 *Bt*	0.67	5.33	9.67	13.00	7.67	12.33	2.33	8.33	5.67	5.67	4.67	8.39
		(1.00)	(2.39)	(3.17)^{c}	(3.66)^{ab}	(2.84)	(3.57)	(1.57)^{b}	(2.97)^{b}	(2.48)^{f}	(2.48)^{a}	(2.27)^{bc}	
6	RCH2 *NBt*	2.33	5.00	14.00	13.00	11.67	12.67	9.00	14.00	12.33	0.00	6.67	9.97
		(1.64)	(2.30)	(3.81)^{b}	(3.66)^{ab}	(3.48)	(3.39)	(3.07)^{a}	(3.81)^{a}	(3.58)^{bc}	(0.71)^{c}	92.67)^{ab}	
7.	MCU 7	1.67	6.67	11.33	15.67	12.67	13.00	9.67	12.33	13.67	1.67	7.33	10.37
		(1.44)	(2.66)	(3.43)^{bc}	(4.01)^{a}	(3.62)	(3.67)	(3.15)^{a}	(3.58)^{a}	(3.76)^{ab}	(1.39)^{bc}	(2.80)^{a}	
8.	SVPR3	3.00	8.00	8.67	16.00	12.33	15.00	10.67	13.33	16.00	4.67	6.00	11.36
		(1.86)	(2.91)	(3.02)^{c}	(4.06)^{a}	(3.58)	(3.93)	(3.33)^{a}	(3.71)^{a}	(4.06)^{a}	(2.25)^{ab}	(2.53)^{ab}	
	C.D. (P=0.05)	NS	NS	0.43**	0.49**	NS	NS	0.72**	0.35**	0.46**	0.96*	0.97*	0.58**

* and ** Significance of values at P = 0.05 and 0.01, respectively. NS - Not significant, DAT -Days after treatments, DAS- Days after sowing.
In a column means followed by a common letter are not significantly different by DMRT(P=0.05)
Values in parentheses are transformed values $\sqrt{x+0.5}$

field trial (Winter, 2006) population in Bt cultivars ranged from 8.39 to 8.70 per 10 plants (Tables 1 and 2). In both the trials, the check varieties MCU 7 (9.48 and 10.37/10 plants) and SVPR3 (9.98 and11.36/ 10plants) recorded higher population. It was found that a low population of Coccinellids was observed in Bt hybrids and population in NBt was higher and was at par with the check varieties. It was found that, during the summer season, the population of Coccinellids (grubs and adults) was in a medium range while in winter, the population of natural enemies was higher. Probably, this difference in load might be attributed due to the higher sucking pests load in winter crop rather than in the summer. Among the varieties/ hybrids, the check varieties, MCU 7 and SVPR3 recorded a higher population of natural enemies and were comparable with NBt cultivars, while the Bt cultivars showed a low population of natural enemies in both the trials (Fig. 1). This might be due to low pest load in Bt hybrids and higher pest load in the NBt and check varieties. Hence, it was concluded that, the Bt hybrids showed significantly low population of natural enemies than in check varieties and NBt cultivars.

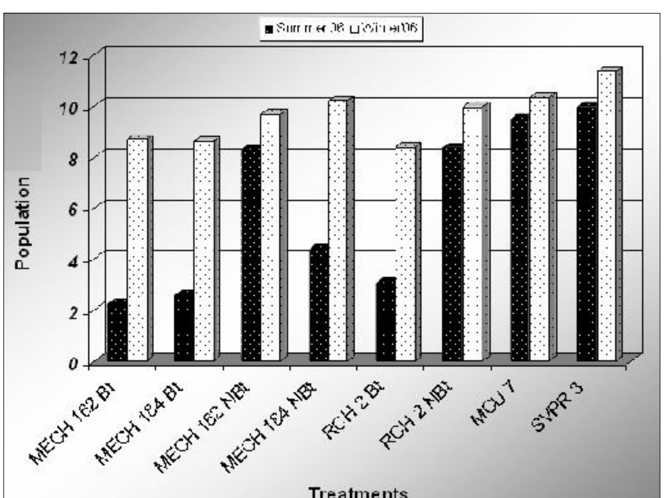

Fig.1: Mean population of Coccinellids in Bt cotton

The results are in accordance with Hegde *et al*. (2004) where it was mentioned that there was no statistical difference between the hybrids in harbouring the population of predators Coccinellids and *Chrysoperla* sp. Kulkarni *et al*. (2004) reported that higher natural enemies population (Coccinellids, *Chrysoperla carnea* and syrphids) was observed in natural control system of Biointensive Integrated Pest Management (BIPM) in Bt and NBt hybrids. It was also reported that Bt cotton increased the diversity of arthropod communities and pest sub communities. However, it decreased the diversities of natural enemies of sub communities. Huang *et al*. (1999) stated that transgenic Bt cotton can affect natural enemies indirectly.

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Authors' affiliations:
T. INDRA PRIYADARSHINI, Department of Entomology, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, PUDUCHERRY (U.T.) INDIA

REFERENCES

Bharathan, G. (2000). Bt cotton in India: anatomy of a controversy. *Curr. Sci.*, **79:** 1067-1075.

Gomez, K.A. and Gomez, A.A. (1984). Statistical Procedures for Agricultural Research. Second edition. Wiley Inter Science, New York. p. 680.

Gould, F. (1998). Evolutionary biology and genetically engineered crops. *Bioscience*,**38 :** 26-33.

Hegde, M., Nidagundi, J.M., Birxdar, D.P., Udikeri, S.S. and Khadi, B.M. (2004). Performance of Bt and non Bt hybrids against insect pests under irrigated condition. *In: International Symposium on strategies for sustainable cotton production – A Global Vision 3. Crop Protection. 23-25, Nov. Univ. Agric. Sci.* Dharwad, Karnataka, India. pp.143-145.

Huang, F., K. Zhu, Y., Buschman, L.L., Higgins, R.H. and Oppert, B. (1999). Comparison of midgut proteinases in *Bacillus thuringiensis* - Susceptible and Resistant European Corn borer, *Ostrinia nubilalis* (Hub.) (Lepidoptera: Pyralidae). *Pestic. Biochem. Physiol.*, **65 :** 132-139.

Kulkarni, K.A., Kambrekar, D.N., Gundann Avan, K.P., Devaraj, K. and Udikeri, S.S. (2004). Biointensive Integrated Pest Management for Bt cotton. *In: International Symposium on strategies for sustainable cotton production – A Global Vision 3. Crop Protection. 23-25, November. Univ. Agric. Sci.* Dharwad, Karnataka, India pp. 149-151.

Lutterell, R.G. and Herzog, G.A. (1994). Potential effect of transgenic cotton expressing Bt on cotton IPM programme. In: Proc. Beltwide Cotton Conf., **5(8) :** 806-809.

Panse, V.G. and Sukhatme, P.V. (1958). *Statistical methods for agricultural workers*. Indian Council of Agricultural Research, New Delhi, 327pp.

Sharma, D. (2001). The introduction of transgenic cotton in India. *Biotechnol. Developt. Monitor*, **44 :** 10-13.

Uthamasamy, S. (1994). Intra and inter plant behavioural dynamics of the cotton bollworm complex. *In Functional dynamics of phytophagous insects* (Eds. Ananthakrishnan, T. N.) Oxford and IBH publishers. New Delhi. pp. 115-131.

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