INTERNATIONAL JOURNAL OF SCIENCE AND NATURE

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BIO EFFICACY OF NEW INSECTICIDES AGAINST SUCKING INSECT PESTS OF TRANSGENIC COTTON

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ABSTRACT
The efficacy of new insecticides against sucking insect pests *viz.*, leafhopper, aphid, whitefly and thrips in cotton were determined. Seven insecticides *viz.*, Dimethoate 30 EC, Triazophos 40 EC, Fenpropathrin 30EC, Imidacloprid 17.8 SL, Spinosad 45 SC, Eco neem 3% and standard check Acetamiprid 20 SP were sprayed based on ETL in order to ascertain the mortality of the pests of transgenic cotton sown at Zonal Agricultural Research Station, College of Agriculture, Shimoga during 2008. All the treatments are superior to untreated check. Among the treatments one day after spraying Fenpropathrin showed superior efficacy in bringing down all the sucking pest population followed by Dimethoate, Imidacloprid and standard check Acetamiprid. Dimethoate and Imidacloprid were most effective against aphid and Dimethoate alone was most effective on leafhopper, whitefly and thrips at three days after spraying which were found to be superior over other treatments followed by Imidacloprid, Acetamiprid, Triazophos, Fenpropathrin, Eco neem and Spinosad. The similar trend was also observed even at seven days after spray.

KEYWORDS: insecticides, efficacy, transgenic cotton, sucking pests.

INTRODUCTION

Cotton is an important fibre crop of global significance cultivated in more than seventy countries. It is an important raw material for the Indian textile industry and plays a key role in the national economy in terms of both employment generation and foreign exchange. Main losses in cotton production are due to its susceptibility to about 162 species of insect pests and a number of diseases (Manjunath, 2004). Among insects, cotton bollworms are the most serious pests of cotton in India causing annual losses to the tune of Rs.1200 crores. After introduction of Bollgard technology (Bt) in 2002, the productivity of cotton is increased, losses due to insect pests are decreased and the insecticide use is also reduced. However, these changes have allowed other pests to survive and emerge as economic pests.

Among the important key pests of cotton the sucking pests *viz.*, leafhopper, *Amrasca biguttula biguttula* (Ishida), aphid, *Aphis gossypii* (Glover), whitefly *Bemisia tabaci* (Gennadius) and thrips, *Thrips tabaci* (Linnman) cause severe damage and serious threat to the crop at early stage of the crop growth and can also affect the crop stand and yield of cotton. Heavy infestation at times reduces the crop yield to the extent of 21.2 per cent (Patil, 1998 and Dhawan and Sidhu, 1986). Some sucking pests are cosmopolitan, polyphagus, widely distributed in tropical, subtropical and temperate regions and are also vectors for a number of viral diseases in large number of plants (Serdar *et al.*, 1999). Therefore chemical control is necessary to keep the population of sucking pests below ETL. In the present study some new insecticides have been used to test their efficacy against the sucking pests.

MATERIALS AND METHODS

Field experiment was conducted at ZARS, College of Agriculture, Shimoga during 2008-09. The experiment was laid out in randomized complete block design. Including control there were eight treatments and each treatment was replicated thrice. All together there were 24 plots with plot size of 4.50 x 3.60 m each. Row to row and plant to plant distance was maintained at 90 and 60 cm respectively. All agronomic practices were followed as per the package of practices recommended by the University of Agricultural Sciences, Bangalore**.**

Seven different insecticides namely; Dimethoate 30 EC (Hygro), Triazophos 40 EC (Hostathion), Fenpropathrin 30 EC (Meothrin), Imidacloprid 17.8 SL (Confidor), Spinosad 45 SC (Tracer), Acetamiprid 20 SP (Prime) and Econeem 3 Per cent were evaluated against sucking insect pests *viz.*, Aphid (*Aphis Gossypii* Glover), leafhopper (*A. biguttula biguttula* Ishida), thrips (*Thrips tabaci* Linn.) and whitefly (*Bemisia tabaci* Genn.) on transgenic cotton variety MRC 7201 Bt (BG-II). The insecticides used in the experiment were obtained from the local market. The insecticides were sprayed whenever the population of pest reached the economic threshold level. The ETL for sucking insect pests were considered as 10 aphids per leaf, 2 to 5 leafhoppers per leaf, 8 to10 thrips per leaf and 8-10 whiteflies per leaf. Spray applications were made with hand operated knapsack sprayer. Observations were made on top, middle and bottom leaves of 10 randomly selected plants from each plot. Population of insect pests were recorded at one, three and seven days after the treatment. The mean population of sucking insect pests were worked and the data were arc sine transformed and subjected to Anova to determine treatment effects.

RESULTS AND DISCUSSION

Efficacy of insecticides against aphid (*Aphis gosssypii* Glover)

Significant reduction of aphid population was noticed in all the treatments (Table 1). One day after spray Fenpropathrin 30 EC recorded 56.10 per cent mortality which was significantly better than the Standard check Acetamiprid 20 SP (36.49 %). Dimethoate 30 EC (39.43 %) and Imidacloprid 17.8 SL (38.58 %) are the next best

treatments which are on par with standard check. Three days after treatment Dimethoate 30 EC and Imidacloprid 17.8 SL recorded maximum mortality of 59.59 Per cent and 54.10 per cent, respectively. These treatments being on par with each other and standard check Acetamiprid 20 SP (55.11 %). Least mortality of 41.03 per cent was noticed in Spinosad 45 SC which was significantly different from standard check. Seven days after treatment 66.45 % mortality of aphid population with Dimethoate 30 EC was significantly superior than 56.34 % mortality with standard check Acetamiprid 20 SP, 54.51% with Imidacloprid, 50.94 % with Triazophos 40 EC, 47.72 % with Econeem, 40.32% with Fenpropathrin and 36.65 % with Spinosad (Table 1).

TABLE 1: Efficacy of insecticidal treatments against cotton aphid

Sl. No.	Treatment	1 DBT	Mortality (%)		
			1 DAT	3DAT	7DAT
T_1	Dimethoate 30 EC	31.24	18.61	8.05	5.08
	300 g a.i./ha	(5.49) ^{a}	(39.43)^{b}	(59.59) ^{a}	(66.45) ^{a}
T_2	Triazophos 40 EC	37.33	24.82	13.23	14.82
	600 ml a. i./ha	(6.00) ^{a}	(35.24) ^{bcd}	(53.50) ^{b}	(50.94) ^{bc}
T_3	Fenpropathrin 30 EC	35.46	11.04	12.70	20.60
	120 ml a. i./ha	(5.96) ^{a}	(56.10) ^{a}	(53.26) ^{b}	(40.32) ^{d}
T_4	Imidacloprid 17.8 SL	40.50	24.70	13.94	13.66
	44.5 ml a.i./ha	(6.32) ^{a}	(38.58) ^{bc}	(54.10) ^{a}	(54.51) ^{b}
T_5	Spinosad 45 SC	27.96	21.06	15.87	17.97
	45 ml a.i./ha	(5.30) ^{a}	(29.69) ^{d}	(41.03) ^{c}	(36.65) ^{d}
T_6	Eco neem 3 %	29.51	20.75	15.19	13.35
	120 ml a.i./ha	(5.45) ^{a}	(32.26) ^{cd}	(44.13) ^{c}	(47.72) ^{c}
T_7	Acetamiprid 20 SP	30.62	19.77	10.03	9.42
	60 g a.i./ha (Std. check)	(5.56) ^{a}	(36.49) ^{bc}	(55.11) ^{a}	(56.34) ^{b}
T_8	Untreated check	33.30	33.83	34.91	33.46
		(5.74) ^{a}	(0.00) ^{e}	(0.00) ^{d}	(0.00) ^{e}
S. Em. ±		0.84	1.94	1.93	2.12
CD (0.05)		2.56	5.89	5.84	6.42
CV (%)		6.10	10.04	7.40	8.31

DBT- Day before treatment
DAT-Day after treatment
Figures in the parenthesis are angular transformed values
Means in the same column showing similar alphabets are on par.

TABLE 2: Efficacy of insecticidal treatments against cotton leafhopper

Sl.No.	Treatment	1 DBT	Mortality (%)		
			1 DAT	3DAT	7DAT
T_1	Dimethoate 30 EC	13.65	7.47	2.56	3.37
	300 g a.i./ha	(3.77) ^{a}	(42.27) ^{b}	(64.50) ^{a}	(60.32) ^{a}
T_2	Triazophos 40 EC	16.46	10.78	6.27	8.09
	600 ml a. i./ha	(4.08) ^{a}	(35.90) ^{cd}	(51.90) ^{b}	(45.47) ^{bc}
T_3	Fenpropathrin 30 EC	13.75	3.21	5.43	8.79
	120 ml a. i./ha	(3.72) ^{a}	(61.17) ^{a}	(51.05) ^{bc}	(36.85) ^{de}
T_4	Imidacloprid 17.8SL	15.33	10.00	4.77	6.05
	44.5 ml a.i./ha	(3.98) ^{a}	(36.09) ^{cd}	(56.12) ^{b}	(51.09) ^{b}
T_5	Spinosad 45 SC	16.26	12.15	9.72	11.67
	45 ml a.i./ha	(4.00) ^{a}	(30.08) ^{e}	(39.29) ^{d}	(31.99) ^{e}
T_6	Eco neem 3 %	19.15	13.86	9.52	10.25
	120 ml a.i./ha	(4.35) ^{a}	(31.68) ^{de}	(45.15) ^{cd}	(42.65) ^{cd}
T_7	Acetamiprid 20 SP	21.35	12.84	7.02	9.35
	60 g a.i./ha (Std. check)	(4.65) a	(39.10) ^{bc}	(55.05) ^{b}	(48.54) ^{bc}
T_8	Untreated check	13.24	14.90	13.30	12.98
		(3.66) ^{a}	(0.00) ^{f}	(0.00) ^{e}	(0.00) ^{f}
	S. Em. ±	0.67	1.66	1.99	2.04
	CD (0.05)	2.03	5.04	6.05	6.17
	CV (%)	5.80	8.33	7.61	8.90

DBT- Day before treatment
DAT-Day after treatment
Figures in the parenthesis are angular transformed values
Means in the same column showing similar alphabets are on par

The present findings are in agreement with the reports of Vadodaria *et al.* (2004) who reported Fenpropathrin (500 ml/ha) was found to be effective in reducing the aphid population. Choudary *et al.* (2004) reported Dimethoate (0.045 %) was best in controlling aphid population. The reports of Monika and Adarsh (2007) on Imidacloprid (45 g a. i. /ha) and Acetamiprid (50 g a. i. /ha) indicates their effectiveness in controlling aphids and are in support with the present findings.

Efficacy of insecticides against leafhopper (*Amrasca biguttula biguttula* Ishida)

One day after treatment the maximum mortality of leafhopper 61.17 per cent was shown in Fenpropathrin 30 EC, which was statistically significant from rest of the treatments including standard check Acetamiprid 20 SP (39.10 %). The minimum mortality of 30.08 per cent was found in Spinosad 45 SC which was significantly different from standard check (Table 2). Three days after treatment Dimethoate 30 EC recorded maximum leafhopper mortality of 64.50 per cent which was significantly superior to the rest of the treatments. Imidacloprid 17.8 SL (56.12 %) and Triazophos 40 EC (51.90 %) are the next best treatments which were on par with standard check Acetamiprid 20 SP (55.50 %) and significant over rest of the treatments.

A slight decrease in the efficacy of the tested insecticides was noticed at seven days after treatment as compared to three days after treatment. Seven days after treatment the leafhopper mortality of 60.32 per cent in the Dimethoate 30 EC was significantly better than 51.09 per cent with Imidacloprid 17.8 SL, 48.54 per cent with Acetamiprid 20 SP, 45.47 per cent with Triazophos 40 EC, 42.65 per cent with Econeem 3%, 36.85 per cent with Fenpropathrin 30 EC and 31.99 per cent with Spinosad 45 SC. Maximum mortality of 61.17 per cent recorded in Fenpropathrin 30 EC at one DAT was decreased to 36.85 per cent mortality at seven days after treatment (Table 2).

The present findings are inline with the findings of Dhawan and Brar (1995) who reported Fenpropathrin (75 g a. i. /ha) was effective in controlling sucking pests. Similarly the reports of Singh and Kumar (2006) supports the present findings who revealed that Imidacloprid 70 WG 40 g a. i. /ha and Acetamiprid 20 SP 50 g a. i. /ha are effective on *Amrasca biguttula biguttula* in okra. Muhammad Tayyib *et al.* (2005) reported that Confidor 20 SL @ 250 ml/ha was effective in controlling sucking pests was almost in close comparison with the present study.

TABLE 3: Efficacy of insecticidal treatments against whitefly

Sl.No.	Treatment	1 DBT	Mortality (%)		
			1 DAT	3DAT	7DAT
T_1	Dimethoate 30 EC	25.05	11.91	4.49	3.94
	300 g a.i./ha	(5.00) ^{a}	(46.67) ^{b}	(65.19) ^{a}	(66.80) ^{a}
T_2	Triazophos 40 EC	20.65	11.01	7.95	6.81
	600 ml a. i./ha	(4.53) ^{a}	(43.07) ^{bc}	(51.65) ^{bc}	(54.99) ^{b}
T_3	Fenpropathrin 30 EC	20.33	4.65	6.44	9.26
	120 ml a. i./ha	(4.41) ^{a}	(61.50) ^{a}	(55.57) ^{b}	(47.55) ^{c}
T_4	Imidacloprid 17.8 SL	24.47	12.52	6.93	6.14
	44.5 ml a.i./ha	(4.46) ^{a}	(44.30) ^{b}	(57.93) ^{b}	(59.98) ^{b}
T_5	Spinosad 45 SC	18.13	12.31	10.26	11.23
	45 ml a.i./ha	(4.24) ^{a}	(34.42) ^{d}	(41.15) ^{d}	(38.05) ^{d}
T_6	Eco neem 3 %	21.75	13.47	9.96	10.4
	120 ml a.i./ha	(4.66) ^{a}	(38.03) ^{cd}	(47.40) ^{cd}	(46.24) ^{c}
T_7	Acetamiprid 20 SP	24.96	13.45	8.68	8.22
	60 g a.i./ha (Std. check)	(4.98) ^{a}	(42.73) ^{bc}	(53.89) ^{bc}	(55.03) ^{b}
T_8	Untreated check	24.66	27.15	24.05	23.36
		(4.88) ^{a}	(0.00) ^{e}	(0.00) ^{e}	(0.00) ^{e}
	S. Em. ±	0.90	1.81	2.07	1.92
	CD (0.05)	2.72	5.49	6.27	5.83
	CV (%)	7.17	8.07	7.68	7.22

DBT- Day before treatment
DAT-Day after treatment
Figures in the parentheses are angular transformed values
Means in the same column showing similar alphabets are on par

Efficacy of insecticides against whitefly (*Bemisia tabaci* Gennadius)

One day after treatment Fenpropathrin 30EC was significantly superior over others with 61.50 per cent mortality of whitefly population and it was followed by Dimethoate 30 EC, Imidacloprid 17.8 SL, and Triazophos 40 EC with 46.67, 44.30 and 43.07 per cent of mortality of population, respectively which are on par with standard check Acetamiprid 20 SP (42.73%) (Table 3). Three days after treatment Dimethoate 30 EC recorded highest mortality of 65.19 per cent which was significantly superior to standard check Acetamiprid 20 SP (53.89 %). Least mortality of 41.15 per cent noticed in Spinosad 45 SC was significantly inferior over standard check. Seven

days after treatment Dimethoate 30 EC (66.80 % mortality) ranked first among all the treatments. The next best were Imidacloprid 17.8 SL (59.98 %) and Triazophos 40 EC (54.99 %) both being on par with each other and with standard check Acetamiprid (55.03 %) followed by Fenpropathrin 30 EC (47.55 %), Econeem 3% (46.24 %) and Spinosad 45 SC (38.05 %) all were significantly superior to untreated check (Table 3).

TABLE 4: Efficacy of insecticidal treatments against thrips

Sl. No.	Treatment	1 DBT	Mortality (%)		
			1 DAT	3DAT	7DAT
T_1	Dimethoate 30 EC 300 g a.i./ha	26.43 (5.12) [a]	13.73 (43.85) [b]	6.22 (61.09) [a]	5.98 (61.68) [a]
T_2	Triazophos 40 EC 600 ml a. i./ha	24.50 (4.92) [a]	13.67 (41.63) [b]	9.38 (51.79) [bc]	8.39 (54.20) [b]
T_3	Fenpropathrin 30 EC 20 ml a. i./ha	18.33 (4.24) [a]	5.57 (56.63) [a]	7.93 (48.86) [cd]	10.14 (41.90) [c]
T_4	Imidacloprid 17.8 SL 44.5 ml a.i./ha	20.25 (4.48) [a]	10.54 (43.78) [b]	5.92 (57.37) [ab]	5.61 (58.27) [ab]
T_5	Spinosad 45 SC 45 ml a.i./ha	18.71 (4.27) [a]	10.24 (42.26) [b]	9.22 (45.38) [cd]	9.85 (43.46) [c]
T_6	Eco neem 3 % 120 ml a.i./ha	20.36 (4.42) [a]	13.19 (36.34) [c]	10.40 (44.34) [d]	9.73 (46.25) [c]
T_7	Acetamiprid 20 SP 60 g a.i./ha (Std. check)	23.33 (4.75) [a]	13.00 (41.67) [b]	9.22 (51.03) [bcd]	7.89 (54.45) [b]
T_8	Untreated check	22.40 (4.68) [a]	21.08 (0.00) [d]	23.13 (0.00) [e]	22.26 (0.00) [d]
	S. Em. ±	0.91	1.66	2.11	2.04
	CD (0.05)	2.76	5.04	6.39	6.20
	CV (%)	7.35	7.51	8.12	7.86
Sl. No.	Treatment	1 DBT	1 DAT	Mortality (%) 3DAT	7DAT

DBT- Day before treatment
DAT-Day after treatment
Figures in the parentheses are angular transformed values
Means in the same column showing similar alphabets are on par

Dhawan and Brar (1995) reported that Fenpropathrin 75 g a. i/ha was effective in controlling in sucking pests of cotton. Similar types of results are also given by Anuradha and Arjuna Rao (2005). Singh and Kumar (2006) who reported Acetamiprid 20 SP 20 g a.i. /ha was effective in controlling insect pests of cotton.

Efficacy of insecticides against thrips (*Thrips tabaci* Linnman)

One day before treatment the thrips population ranged from 18.33 to 26.43 per three leaves per plant was statistically non significant (Table 4).

One day after treatment Fenpropathrin 30 EC recorded 56.63 % mortality which was superior over rest of the treatments and its efficacy gradually decreased at 3 DAT (48.86 %) and 7 DAT (41.90 %) . Three days after treatment mortality of thrips was high in Dimethoate 30 EC (61.09 %) and Imidacloprid 17.8 SL (57.37 %) followed by standard check Acetamiprid 20 SP (51.03 %) and Triazophos 40 EC (51.79 %). Minimum mortality of 44.34 per cent with Econeem 3% was on par with standard check. 7 DAT Dimethoate 30 EC recorded maximum mortality of 61.68 per cent as compared to Imidacloprid (58.27 %), standard check Acetamiprid 20 SP (54.45 %), Triazophos 40 EC (54.20 %), Econeem 3% (46.25 %), Spinosad 45 SC (43.46 %) and Fenpropathrin 40 EC (41.90 %). All the treatments are superior over untreated check.

The present findings are inline with the findings of Khattak *et al*. (2004) who reported Confidor 200 SL which was effective in controlling all the sucking pests. The present findings are in conformity with the reports of Saleem and Khan (2001) who reported good control of sucking insects with Imidacloprid 20 SL@250 ml/acre.

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