BIOEFFICACY OF NEW CHEMISTRY INSECTICIDES FOR MANAGEMENT OF THRIPS TABACI LIND. (THYSANOPTERA: THRIPIDAE) AT EARLY GROWTH STAGE OF BT COTTON.

M. R. Asi, M. Akram, Mehfooz-ul-Haq, M. H. Bashir* I. A. Tabassum and M. Amjad.

Department of Pest Warning and Quality Control of Pesticides, Punjab, Pakistan.
*Department of Agri. Entomology, University of Agriculture, Faisalabad-Pakistan.
Corresponding author: E. mail: ramzan_asi@yahoo.com.

ABSTRACT: The current studies were carried out at Government Agricultural Farm, Vehari, Pakistan to evaluate the toxicity of new chemistry insecticides for thrips (*Thrips tabaci*) management at early growth stage of Bt cotton during 2012. Chemical insecticides, viz. Pirate 360SC, Tracer 240SC, Radiant 120SC, Confidor 200% SL, Actara 25WG, Acephate 75SP and Novastar 56EC were applied twice at an interval of 15 days when population of the pest reached at economic threshold level. Pirate, Novastar, Tracer, Radiant and Acephate were highly effective against *T. tabaci* after 7 days of spray, while Confidor was comparatively less effective. Actara gave reduction in population of the pest up to three days after spray and it proved ineffective with increase in its population seven days after application. Pirate, Novastar, Tracer, Radiant and Acephate may be recommended to farmers for management of *T. tabaci* in Bt cotton under field conditions.

Key words: Bt cotton, insecticides, Pirate, Radiant, Tracer, *Thrips tabaci*.

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INTRDUCTION

Cotton (*Gossypium hirsutum* L.) is an important cash crop of Pakistan. Pakistan occupies fourth position in terms of production among major cotton producing countries of world. The average per acre yield of cotton in Pakistan is still low when compared to other countries (Bakhsh *et al*., 2005). Pests cause severe loss to the crop. About 145 arthropod pests attack on cotton crop in Pakistan (Huque, 1994). Among arthropod pests, *Thrips tabaci* (Thysanoptera: Thripidae) is very serious threat to the cotton (Cook *et al*., 2013). Cotton seedlings are most susceptible to *T. tabaci* injury during the first 4 to 5 weeks after plant emergence.

They injure leave by sucking and exuding cell sap by piercing under side of leaf tissues and finally reduce crop vitality. Heavy infestations may reduce 50 to 60% crop yield, if no control measures are applied (Ottens *et al.*, 2004). To date, no variety of transgenic Bt cotton has resistance against *T. tabaci* (Arbo *et al*., 2004). Many strategies have been developed to manage this pest below economic threshold level in cotton. However, cotton growers prefer to protect the crop from pests using chemical insecticides as they are highly effective and often have knock down effect. Many conventional and new chemistry insecticides have been investigated for their efficacy against *T. tabaci* (Tayyib *et al.*, 2005; Singh and Kumar, 2006; Asi *et al.*, 2008; Sadozai *et al*., 2009; Shivanna *et al.*, 2011; Giulia *et al.*, 2012). But continuous exposure of field population of a pest to particular insecticide over long period causes resistance in the pest against the insecticide. Incidence of insect resistance against insecticides has been reported from various parts of the world (Thalavaisundaram *et al*., 2008; Herron and Mo, 2010; Wang *et al*., 2011). Therefore effective chemical products against particular pest must be identified and manipulated to reduce the risk of resistance in insects against insecticides. The main objective of present study was to assess susceptibility response of field population of *T. tabaci* to new insecticides having different mode of action on early growth stage of Bt cotton under field conditions.

MATERIALS AND METHODS

The experiment was conducted in Randomized Complete Block Design with three replications of each treatment at Government Agricultural Farm, Vehari, Pakistan during 2012. Cotton variety Bt- 886 was sown on April 10, 2012 with net plot size of 15.24 x 6.35 m. There were 8 rows in each plot, 75 cm apart; while plant to plant distance of 25-30 cm was maintained during thinning. There were seven treatments including a control. Chemical insecticides, viz. Pirate 360SC, Tracer 240SC, Radiant 120SC, Confidor 200% SL, Actara 25WG, Acephate 75 SP and Novastar 56EC were applied in the form of spray at field recommended doses at early growing stage of Bt cotton when population of the pest reached economic threshold level. The insecticides were sprayed with the help of hand operated knapsack sprayer fitted with hollow cone nozzle. Control plot was sprayed with water only. Application of insecticides was repeated

after 15 days of 1st spray. All agronomic practices were kept uniform throughout the experiment in all treatments.

The population of *T. tabaci* was recorded from twenty plants selected randomly from each plot. The number of insects was recorded from upper, middle and lower portion of alternate plant a day before, one, three and seven days after both sprays. Percent population change (increase or decrease) was calculated using modified Abbot's formula (Fleming and Ratnakaran, 1985) as below:

The final data was subjected to analysis of variance (Scheffe, 1959) using SAS System 2004 and means were compared by the Tukey's HSD test at ($P \leq 0.05$).

Table 1: Showing insecticides tested against *Thrips tabaci*.

Sr. No.	Chemical insecticides used in experiment		Dose (ml or gm/acre))
	Trade Name	**Common Name**	
1	Pirate 360SC	Chlorfenapyre	100
2	Tracer 240SC	Spinosad	40
3	Radiant 120SC	Spinetoram	50
4	Confidor 200 SL	Imidachloprid	80
5	Actara 25 WG	Thiamethoxam	24
6	Acephate 75SP	Acephate	250
7	Novastar 56 EC	Abamectin + Bifenthrin	500

RESULTS

All insecticides tested significantly reduced mean percent population of *T. tabaci* on one, three and seven days after 1st spray. Maximum reduction in population was recorded in plots treated with Acephate followed by Novastar and Pirate (Table 2). Population reduction caused by Acephate, Novastar and Pirate was statistically same. *T. tabaci* population reduction in plots treated with Pirate, Tracer and Radiant was equal in terms of statistics but significantly higher than that in Actara treated plots. Confidor was statistically at par with Radiant. Actara remained least effective, resulting in minimum decrease in *T. tabaci* population. Three days after 1st spray, Pirate resulted in the highest population reduction followed by Novastar, Acephate and Tracer, respectively. Population reduction caused by Tracer and Acephate was equal in terms of statics. The population reduction caused by Tracer and Radiant was same but significantly higher than population reduction caused by Confidor. Actara again remained least effective with minimum reduction in *T. tabaci* population.

Seven days after 1st spray, Pirate and Novastar caused the highest reductions in *T. tabaci* population, followed by Tracer, Radiant and Acephate respectively. Population reduction in plots treated with Novastar and Tracer was statistically equal. Similarly, Radiant and Acephate were also at par with each other in terms of statistics. The minimum reduction in *T. tabaci* population was recorded in plots treated with Confidor; while Actara proved ineffective and resulted in increase in population of the pests seven days after spray.

Similar variations in *T. tabaci* population reduction were noted on one, three and seven days after 2nd spray. One day after 2nd spray, Acephate, resulted in the highest population reduction followed by Novastar, Pirate, Tracer and Radiant, respectively. Pirate, Tracer and Radiant caused statistically equal population reduction. Confidor and Actara were least effective against *T. tabaci* among insecticides tested. Three days after 2nd spray, Pirate and Novastar proved highly effective against *T. tabaci* followed by Tracer, Acephate and Radiant which were at par in terms of statistics. Confidor caused population reduction of 40.44% which was significantly different from all other treatments; while minimum population reduction was caused by Actara three days post treatment. Seven days after the spray, maximum decrease in population was observed in plots treated with Pirate followed by Novastar, Tracer and Radiant respectively. Population reduction caused by Novastar, Tracer and Radiant was statistically same. Population reduction in plots treated with Acephate was lower than Radiant but higher than that in Confidor. Actara remained ineffective with increase in *T. tabaci* population.

Table 2: Showing mean per leaf and percent change (increase or decrease in parenthesis) in population of *T. tabici* on Bt cotton before and after 1st spray.

Treatments	1DBT	Percent Population Change (– or +)		
		1DAT	3DAT	7DAT
Control	10.30	10.67	11.57	14.37
Pirate 360SC	11.40	(50.63abc)	(88.70a)	(77.42a)
		5.83	1.47	3.60
Tracer 240SC	12.17	(49.19bc)	(65.84bc)	(64.10b)
		6.40	4.67	6.17
Radiant 120 SC	12.80	(41.97cd)	(60.33c)	(51.76c)
		7.67	5.70	8.90
Confidor 200SL	11.27	(33.13d)	(44.02d)	(30.37d)
		7.80	7.10	11.00
Actara 25WG	8.33	(19.87e)	(31.12e)	(-11.32e)
		7.17	6.70	13.50
Acephate 75SP	10.63	(59.36a)	(72.48b)	(44.43c)
		4.47	3.27	8.23
Novastar 56EC	9.57	(51.43ab)	(75.51b)	(71.51ab)
		4.83	2.67	3.77
F	-	55.18	80.22	249.21
P-value	-	< 0.0001	< 0.0001	< 0.0001

DBT- Day before treatment
DAT- Day after treatment
Means in columns followed by different letters are significantly different according to Tukey's HSD Test at P = 0.05. NS = non significantly different.

Table 3: Showing mean per leaf and percent change (increase or decrease in parenthesis) in population of *T. tabici* on Bt cotton before and after 2nd spray.

Treatments	1DBT (NS)	Percent Population Change (– or +)		
		1DAT	3DAT	7DAT
Control	11.37	12.86	13.10	16.20
Pirate 360SC	12.10	(55.34ab)	(87.24a)	(81.00a)
		6.10	1.77	3.33
Tracer 240SC	13.93	(51.56ab)	(71.07bc)	(68.15b)
		7.63	4.67	6.27
Radiant 120SC	13.43	(47.07b)	(66.34c	(60.73b)
		8.07	5.23	7.67
Confidor 200SL	13.93	(25.87c)	(40.44d)	(31.64d)
		11.70	9.57	13.67
Actara 25WG	12.47	(12.38d)	(19.26e)	(-4.28e)
		12.40	10.20	18.90
Acephate 75SP	13.73	(57.43a)	(68.39bc)	(47.90c)
		6.57	4.97	10.63
Novastar 56EC	14.33	(56.09ab)	(78.70ab)	(68.90b)
		7.13	3.50	6.30
F	-	89.31	88.26	204.34
P-value	-	< 0.0001	< 0.0001	< 0.0001

DBT- Day before treatment
DAT- Day after treatment
Means in columns followed by different letters are significantly different according to Tukey HSD Test at P = 0.05. NS = non significantly different.

DISCUSSION

Insecticides tested showed varying degree of potential against *T. tabaci* corroborating findings of Tayyib *et al* (2005) and Sadozai *et al* (2009). They observed variation in toxicity response of different insecticides to *T. tabaci*. The differences in toxicity could be attributed to the nature of insecticide, their mode of action, short residual effect and resistance in *T. tabaci* population. Our investigations revealed that insecticidal treatments, except Actara, gave significant reduction in *T. tabaci* population. The data indicated that Pirate, Novastar, Tracer, Radiant and Acephate gave excellent control and continued to give significant reduction in *T. tabaci* population till seven days after spray. Previous investigations indicated that *T. tabaci* population was highly susceptible to chlorfenapyre and spinosad, (Seal *et al*., 2006; Mahmoud and Osman, 2007; Broughtton and Herron, 2009).

Nault *et al* (2010) reported that spinetoram was highly effective against *T. tabaci*. These studies proved that Acephate gave the maximum reduction of *T. tabaci* population one day after both sprays. But it lost its efficacy to a maximum extent seven days after the sprays. It may be due to its short residual activity under field conditions.

Confidor was found less effective as compared with Pirate, Novastar, Tracer, Radiant and Acephate. These findings do not agree with those of Aslam *et al* (2004) and Asi *et al* (2008), who reported that confidor was highly effective against *T. tabaci*. Reduced efficacy of Confidor may be due to development of resistance in *T. tabaci* population against the insecticide used (Zhao *et al*, 1995; Wang *et al*., 2011). Herron and Mo (2010) detected 6 fold resistance in *T. tabaci* population against imidacloprid. Actara gave reduction up to three days after spray and population of *T. tabaci* increased seven days after spray. These findings have been supported by the findings of Aslam *et al* (2004) who observed that Acatara gave satisfactory control up to three days after spray.

Conclusion: The results of our study indicated that the effect of the new chemistry insecticides varied considerably in their toxicity. Pirate, Novastar, Spinosad, Radiant and Acephate provided excellent control at the recommended doses. The insecticides look promising and could be alternative insecticides in the future for controlling *T. tabaci*.

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