Pakistan Entomologist

Journal homepage: www.pakentomol.com

EVALUATION OF SOME NEW CHEMISTRY INSECTICIDES AGAINST COTTON WHITEFLY (*BEMISIA TABACI* GENN.) (HEMIPTERA: ALEYRODIDAE)

Jamshaid Iqbal[1], Zulfiqar Ali[2], Muhammad Siddiq Aasi[2], Arsalan Ali[1*], Amer Rasul[2], Hussan Ara Begum[1] and Muhammad Nadeem[3]

[1]Department of Entomology, Gomal University, D. I. Khan
[2]Department of Pest Warning and Quality Control of Pesticide Punjab
[3]Arid Zone Research Institute, Bhakkar

ARTICLE INFORMATION

Received: October 07, 2017
Received in revised form: April 21, 2018
Accepted: April 28, 2018

***Corresponding Author**:
Arsalan Ali

E-mail: ento8305@gmail.com

ABSTRACT

A field experiment was conducted to evaluate the efficacy of various insecticides including spirotetramate (Movento 240 SC), imidacloprid (Confidor 20% SL), acetamiprid (Acelan 20% SL), diafenthiuron (Polo 50% SC) and pyriproxyfen (Progress10.8% EC) against whitefly *Bemisia tabaci* Genn. on cotton, *Gossypium hirsutum* (L.) grown at district Mianwali during the year 2015-16. Our data showed a significant difference with one another regarding their effectiveness. The application of insecticides resulted in immediate mortality of the test insect. Acetamiprid and imidacloprid showed the similar trend and were intermediate in their effectiveness while spirotetramate and pyriproxyfen were the most effective insecticide for the control of whitefly during the both years. The data regarding the treatment effect on whitefly population and percent reduction, at different post-treatment interval during the year 2015 indicates that spirotetramate was the most effective insecticide and caused 52.27% reduction in population, 15 days after application of 2nd spray which was at par with that of diafenthiuron which resulted 50.76% reduction in population of whitefly. During 2016, insecticides diafenthiuron and spirotetramate caused maximum population reduction and did not show significant difference from each other 15 days after application of 1st and 2nd spray.

Keywords: Cotton, Efficacy, Insecticides, Whiteflies

INTRODUCTION

Cotton *Gossypium hirsutum* (L.) is the most rather valued golden cash crop of the country, which has a first-rate contribution for food, agriculture and textile industries products. All plant components of the cotton are very useful in our daily life. The most important parts of the cotton are the cotton seed and fiber or lint (Sarwar *et al*., 2013 a). However, in terms of yield, cotton contributed 14.5 percent of GDP (PES, 2014-15). Cotton production stood at 13,983 thousand bales of cotton (PES, 2014-15). It also contributes 69.5% share in country wide oil production (Awan, 1994). There are a number of reasons for low cotton yield in Pakistan that includes lack of knowledge to farmers, deficiency of progressive technologies, higher incidence of insect and pest assault, high price of pesticides and contamination in pesticides (Ahmad and Sarwar, 2013).

Cotton is a very delicate crop in terms of pest complex being attacked by different insect pests from germination to harvesting (Sarwar, 2013 a). More than 1326 species of insects have been found to attack on cotton in the world (Atwal, 2002). Cotton is attacked by both sucking pests and bollworms. Among sucking pests whitefly, *Bemisia tabaci* Genn. is the most detrimental sucking pest (Amin *et al.,* 2008). It sucks the cell sap e from the underside of leaves and deposits the droplets of honeydew on the leaves, that results in sooty mold development. It also hinders the foliar photosynthesis and reduces yield and quality (Bi *et al.,* 2001). Whitefly is also liable for spreading cotton leaf curl virus (CLCV) ailment.

Plant protection plays crucial role in the successful production of cotton crop and saves it from the pest attack. In Pakistan, major emphasis is on the use of chemical insecticides and their use is increasing every year. Pesticides cost more than 10 billion rupees are imported, out of which about 70-80% are used against cotton pests (Anonymous, 2008). It is the dire need to use the new-chemistry insecticides which are not only specific to the targeted pest but also safer

Cite this article as: Iqbal, J., Z. Ali, M.S. Aasi, A. Ali, A. Rasul, H.A. Begum and M. Nadeem, 2018. Evaluation of some new chemistry insecticides against cotton whitefly (*Bemisia tabaci* Genn.) (Hemiptera: Aleyrodidae). Pak. Entomol., 40(1):19-23.

for the beneficial bugs and human beings. Chemical control is a vital component of crop protection in modern agriculture, although over-reliance on insecticides has caused resistance problems, ecological instabilities and higher costs to the growers. A rigorous research has been conducted for evaluating new insecticides with novel mode of action against whitefly (Nauen *et al.,* 1999). The contemporary study was designed to compare the efficacy of new chemistry insecticides against whitefly, under the field conditions on cotton.

MATERIALS AND METHODS

Present research trials were conducted to test the efficacy of new chemistry insecticides against cotton whitefly during 2015-16 at district Mianwali. Randomized complete block design (RCBD) was followed for the experiments. There were six treatments including control. The experiment was replicated thrice. The cotton variety *Bt*-886 was sown on 30-05-2015 and 15-05-2016. The net plot size was kept 4.57 m × 3.0 m. Plant to plant and row-to-row distance was kept 30 and 70 cm, respectively. For the control of weeds, pre-emergence weedicide, Dualgold (S-metolachlor) @ 1 litre/acre was applied during both years. The crop was irrigated when needed. All the other recommended agronomic practices were followed for the crop till harvesting. All the insecticides were purchased from the market and applied at their recommended doses. Hand operated knapsack sprayer with hollow cone nozzle was used for the application of insecticides. From each plot data was recorded early in the morning, 24 hours before spray and then 1, 3, 7 & 15 days interval after the spray. After 15 days, test insecticides were repeated and application of the 2nd spray was done. The data was recorded by counting number of whiteflies nymphs and adults with the help of magnifying glass from nine randomly selected plants in such a sequence that one leaf from the upper part of first plant, one from the middle part of the second plant and lower leaf of the third plant of similar age were taken. All the recorded data was averaged to aggregate means. The mean population of the pest was calculated separately by using the following formula:

Mean = $\sum x/n$

Where x = sum of values

n = Number of values

Data was subjected to analysis of variance to determine the significance of treatments using statistical package 8.1. The comparative efficacy of insecticides was considered to be an indirect reflection of whitefly population, per leaf.

The detail of treatments are given as under:

T_1 Spray with spirotetramate (Movento 240 SC) @ 125 mL/acre

T_2 Spray with imidacloprid (confidor 20% SL) @ 250 mL/acre

T_3 Spray with acetamiprid (Acelan 20% SL) @ 125 mL/acre

T_4 Spray with diafenthiuron (Polo 50%SC) @ 200 mL/acre

T_5 Spray with pyriproxyfen (Progress 10.8% EC) @ 500 mL/acre

T_6 Untreated control

RESULTS AND DISCUSSION

Mean comparisons of data as shown in Table 1, regarding the treatment effect on whitefly population during the year 2015-16. The results summarize the effect of various insecticides applied separately in suppressing the whitefly population at nymphal and adult stage on the cotton crop during 2015 and 2016. It is evident from the results that minimum whitefly nymph population was observed both in T_1 (spray with spirotetramate and T_5 (spray with pyriproxyfen) i.e. 1.61 nymph leaf^{-1} and followed by T_2 (spray with imidacloprid) with whitefly nymphal population 2.24 leaf^{-1}. T_3 (spray with acetamiprid) & T_4 (spray with diafenthiuron) both were found to be statistically at par with 2.54 & 2.42 nymph / leaf, respectively. While in case of whitefly adult population leaf^{-1} T_5 (pyriproxyfen) differ significantly from all the other treatments and found to be the most effective and it resulted in minimum whitefly adult population per leaf i.e., 2.58 whitefly against control 5.92 whitefly adult / leaf. All the treatments except control were statistically at par.

The results presented in Table 1 also revealed that T_5 (spray with pyriproxyfen) induced the maximum mortality i.e. 4.19 whitefly/leaf on cumulative basis i.e. for both adult and nymphal population during 2015 and differ significantly from all the other. Treatment T_1 (spray with spirotetramate) remain second in performance with 4.64 whitefly leaf^{-1}. It is evident from the results that the effect of T_2 (spray with imidacloprid), T_3 (spray with acetamiprid) and T_4 (spray with diafenthiuron) were low and did not differ significantly from each other with 5.36,5.50 and 5.37 whitefly / leaf, respectively and thus were the least effective. The result in (Table 1) also showed that treatment spray with imidacloprid, acetamiprid and diafenthiuron were intermediate in their response to the whitefly mortality with significant difference from all the other treatments during the year 2015. While during the year 2016, Acetamiprid and imidacloprid showed the similar trend and were intermediate in their effectiveness. In the present study spirotetramate and pyriproxyfen were the most effective insecticide for the control of whitefly during the both years i.e. 2015 & 2016. The present findings are in agreement with Kumar *et al.,* (2009) who found spirotetramate, imidacloprid and acetamiprid effective against whitefly causing maximum mortality over control.

The results (Table 1) regarding whitefly nymph population leaf^{-1} in different treatments during 2016 revealed a significant difference among the treatments. From the results, it was concluded that T_5 (spray with pyriproxyfen) was the most effective and resulted in maximum mortality of whitefly nymph population i.e., 1.66/leaf followed by T_1 (spray with spirotetramate) with 1.93 whitefly nymph population leaf^{-1} and differ significantly from all the other treatments. The effectiveness of T_3 (spray with acetamiprid) was found to be the minimum with 2.73 whitefly nymph population leaf^{-1} followed by T_2 (spray with imidacloprid) with 2.29 whitefly leaf^{-1} and T_4 (spray with diafenthiuron) 2.47 whitefly nymph leaf^{-1} as against 3.52 nymph leaf^{-1} in control treatment. T_2 (spray with imidacloprid) and T_4 (spray with diafenthiuron) both were statistically at par. While in case of whitefly adult population leaf^{-1} during year 2016, it is evident from the

results that the effectiveness of T_2 (spray with imidacloprid) was found to be the lowest with 3.21 whitefly adult / leaf and differ significantly as against 5.75 whitefly / leaf in control treatment. The treatment T_3 (spray with acetamiprid) was intermediate in response to the whitefly adult mortality with significant difference from T_2 (spray with imidacloprid). The minimum adult population was recorded 2.56 /leaf in T_4 (spray with diafenthiuron) application which was statistically at par with that of T_1 (spray with spirotetramate) and T_5 (spray with pyriproxyfen). The present findings are in partial agreement with those of Babar *et al*. (2013) who found acetamiprid followed by imidacloprid an effective insecticide in reducing whitefly population.

On cumulative basis for both nymph and adult during the year 2016, T_1 (spray with spirotetramate) and T_5 (spray with pyriproxyfen) were found to be the most effective and these resulted in minimum whitefly population 4.60 and 4.33 /leaf respectively, and showed the significant difference from all the other treatments. The effect of T_4 (spray with diafenthiuron) was intermediate with 5.03 whitefly /leaf. It is concluded from the results that the effectiveness of T_2 (spray with imidacloprid) and T_3 (spray with acetamiprid) was low as compared with other treatment at thus were least effective.

The result as shown in (Table 2) are mean comparison of data regarding the treatment effect on whitefly population and percent reduction, at different post-treatment interval during the year 2015. The insecticides were applied at ETL of whitefly. All the tested insecticides caused significant mortality of whitefly up to 7 days after treatment. The result showed that acetamiprid lost effectiveness, as the population of whitefly increased gradually and reached up to that of 8.6 whitefly/leaf and 10.1 whitefly/leaf 15 days after the application of 1st and 2nd spray, respectively. While spirotetramate was the most effective insecticide and caused 52.27% reduction in population, 15 days after application of 2nd spray which was statistically at par with that of diafenthiuron which result in 50.76% reduction in population of whitefly. The present findings are not in line with Kumar *et al*. (2009) who found acetamiprid effective in reducing whitefly population**.**

The results (Table 3) are the mean comparison of data regarding the treatment effect on whitefly, population and percent reduction, at different post-treatment interval during the year 2016. The insecticides were applied at ETL of whitefly. All the tested insecticides showed good results and caused whitefly mortality up to 7 days after application. The results showed that the effectiveness of acetamiprid was found lowest and was at par with imidacloprid, 15 days after the application of 1st and 2nd spray. The insecticides diafenthiuron and spirotetramate caused maximum population reduction and did not showed significant difference from each other 15 days after application of 1st and 2nd spray. In the present study, all the insecticides caused significant mortality 7 days after application while the effect of acetamiprid, imidacloprid was not so pronounced for the control of whitefly on cotton. The population of whitefly remained under ETL level up to 3 days, after application of insecticides and the percentage reduction in the population of whitefly, decreased steadily, on the subsequent date of observation. The present findings are in partial agreement with those of Amjad *et al.* (2009) and Afzal *et al.* (2014) who reported that all the tested insecticides caused significant mortality of whitefly up to seven days after treatment and (Acetamiprid) and (imidacloprid) were the most effective insecticides. The present findings are in agreement with the results of Mohan and Katiyar (2000) who reported that continuous use of confidor (Imidacloprid) resulted in increased whitefly population due to development of resistance in this pest against imidacloprid. The present findings can be compared with those of Aslam *et al.* (2004) who reported ineffective control against whitefly with the application of imidacloprid, acetamiprid and diafenthiuron. In present study pyriproxifen and spirotetramate were more effective for the control of whitefly.

Table 1.
Mean comparison of whitefly nymph and adult population leaf^{-1} during 2015 and 2016**.**

Treatments	2015			2016		
	Nymph	Adult	cumulative	Nymph	Adult	cumulative
Spirotetramate	1.62 d	3.02 b	4.64 c	1.93 d	2.67 cd	4.60 d
Imidacloprid	2.24 c	3.11 b	5.36 b	2.29 c	3.21 b	5.51 b
Acetamiprid	2.54 b	2.95 b	5.50 b	2.73 b	2.91 c	5.64 b
Diafenthiuron	2.42 b	2.95 b	5.37 b	2.47 c	2.56 d	5.03 c
Pyriproxyfen	1.61 d	2.58 c	4.19 d	1.66 e	2.67 cd	4.33 d
Control	3.61 a	5.92 a	9.53 a	3.52 a	5.75 a	9.28 a

Mean sharing same letter didn't differ significantly from each other at 0.05% level of probability.

Table 2.
Mean comparisons of data regarding the treatment effect on whitefly population and percent reduction, at different post-treatment interval during the year 2015 on cotton.

TREATMENT	24 HRS BEFORE 1ST SPRAY 2015		24 HRS AFTER 1ST SPRAY (12-AUGUST)		3 DAYS AFTER 1ST SPRAY (15-AUGUST)		7 DAYS AFTER 1ST SPRAY (18-AUGUST)		BEFORE 2ND SPRAY (26-AUGUST)		24 HRS AFTER 2ND SPRAY (27-AUGUST)		3 DAYS AFTER 2ND SPRAY (29-AUGUST)		7 DAYS AFTER 2ND SPRAY (1-SEPTEMBER)		15 DAYS AFTER 2ND SPRAY (10-SEPTEMBER)	
	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction
Spirotetramate	7.2ab	10	2 b	73.97	2.3 b	73.26	4.7 b	36.49	6.9 c	36.1	3.4 bc	73.02	3.6 c	66.67	5.1 c	33.77	6.3 d	52.27
Imidacloprid	6.3b	21.25	2.2 b	69.86	2.7 b	68.60	4.4 b	40.54	8.1 b	25	3.9 bc	69.05	4.9 b	54.63	6.2 b	19.48	9.6 bc	27.27
Acetamiprid	7.1ab	11.25	2 b	72.60	2.3 b	73.26	4.1 bc	44.59	8.6 b	20.37	3.4 c	73.02	4.8 b	55.56	6.9 b	10.39	10.1 b	23.48
Pyriproxyfen	7.7a	3.75	2.3 b	68.49	2.6 b	69.77	4.2 bc	43.24	7 c	35.19	4.83 b	61.67	5.3 b	50.93	5.1 c	33.77	8.9 c	32.58
Diafenthiuron	8a	12.5	1.3 b	82.19	1.6 b	81.40	3.5 c	52.70	6.1 d	43.52	3.3 c	73.81	3.1 c	71.30	4.2 c	45.45	6.5 d	50.76
Control	8 ab	0	7.3 a	0	8.6 a	0	7.4 a	0	10.8 a	0	12.6 a	0	10.8 a	0	7.7 a	0	13.2 a	0

Mean sharing same letter didn't differ significantly from each other at 0.05% level of probability.

Table 3.
Mean comparison of data regarding the treatment effect on whitefly population and percent reduction, at different post-Treatment interval during the year 2016.

TREATMENT	24 HRS BEFORE 1ST SPRAY 2016		24 HRS AFTER 1ST SPRAY (3- AUGUST)		3 DAYS AFTER 1ST SPRAY (6- AUGUST)		7 DAYS AFTER 1ST SPRAY (11-AUGUST)		BEFORE 2ND SPRAY (15- AUGUST)		24 HRS AFTER 2ND SPRAY (19-AUGUST)		3 DAYS AFTER 2ND SPRAY (22- AUGUST)		7 DAYS AFTER 2ND SPRAY (25-AUGUST)		15 DAYS AFTER 2ND SPRAY (3- SEPTEMBER)	
	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction	Population	% Reduction
Spirotetramae	5.7 a	10.94	2.8 b	56.25	1.6 c	78.95	4.6 c	52.08	6.5 de	39.81	4.7 b	50.86	3.7 c	62.63	4.9 c	52.88	6.4 e	43.86
Imidacloprid	5.4 a	15.63	2.2 b	65.63	2.3 bc	69.74	5.6 b	41.67	8.2 bc	24.07	4.2 b	55.17	4.9 b	50.51	6.5 b	37.50	9.7 b	14.91
Acetamiprid	6.3 a	1.56	2.4 b	62.50	2.7 b	64.47	5.4 bc	43.75	8.9 b	17.59	3.7 b	59.48	5.2 b	47.47	6.9 b	33.65	8.9 bc	21.93
Pyriproxyfen	5.1 a	20.31	2.2 bc	65.63	2.1 bc	72.37	4.8 bc	50.00	7.2 cd	33.33	3.9 b	57.76	5.5 b	44.44	6.2 bc	40.38	8.1 cd	28.95
Diafenthiuron	5.4 a	15.63	1 c	84.38	1.4 c	81.58	4.5 c	53.13	5.8 e	46.30	3.7 b	59.48	3.7 c	62.63	6.4 b	38.46	6.5 de	42.98
Control	6.4 a	0.00	6.4 a	0.00	7.6 a	0.00	9.6 a	0.00	10.8 a	0.00	10.56 a	0.00	9.9 a	0.00	10.4 a	0.00	11.4 a	0.00

Mean sharing same letter didn't differ significantly from each other at 0.05% level of probability.

ACKNOWLEDGEMENTS

Author thanks to Mr. Mian Aftab Ahmad Shah, Mouza Gulmeri Tehsil Mianwali for providing research area and labor.

AUTHORS' CONTRIBUTION

Jamshaid Iqbal planned and conducted whole research; while Zulfiquar Ali provided pesticides and collected the review material. Muhammad Siddiq Aasi supervised the whole research. Arsalan Ali collected the data and Amer Rasul analyzed the data. Hussan Ara Begum prepared the manuscript; while Muhammad Nadeem provided technical assistance and helped in paper write up.

REFERENCES

Afzal, M., S.M. Rana, M.H. Babar, I. Haq, Z. Iqbal and H.M. Saleem, 2014. Comparative efficacy of new insecticides against whitefly, *Bemisia tabaci* (Genn.) and jassid, *Amrasca devastans* (Dist.) on cotton, Bt-121. Biolo., (60): 117-121.

Ahmad, N., and M. Sarwar, 2013. The cotton bollworms: their survey, detection and management through pheromones, J. Agri. and Allied Sci., 2(3): 5-8.

Amjad, M., M.H. Bashir, M. Afzal and M.A. Khan, 2009. Efficacy of some insecticides against whitefly, *Bemisia tabaci* (Genn.) infesting cotton under field conditions. Pak. J. Life and Soci. Sci., 7(2): 140-143.

Anonymous, 2008. Economic survey of Pakistan, Ministry of food and Agriculture, Islamabad: pp. 17-37.

Amin, M.R., M.A. Ahmad, M.H. Hossain, S.M.A. Hossain and D.A. Tithi, 2008. Characteristics of some cotton varieties in relation to seasonal abundance of pests, predators and their impact on yield and quality. J. Agro. Environ., 2(2): 67-70.

Aslam, M., M. Razaq, S.A. Shah and F. Ahmad, 2004. Comparative efficacy of different insecticides against sucking pests of cotton. J. Res. Sci., 15(1): 53-58.

Awan, M.N., 1994. Evaluation of some insecticidal combinations and neem extracts for the control of cotton pests. M.Sc. (Hons.) Thesis, Department of Entomology, Faculty of Agriculture, Gomal University. D.I. Khan, Pakistan, pp. 92.

Atwal, A.S., 2002. Agricultural pests of South Asia and their management. Kalyani Publisher, Ludhiana, India, pp. 221.

Ahmad, N. and M. Sarwar, 2013. The cotton bollworms: their survey, detection and management through pheromones: A review. J. Agri. Allied Sci., 2(3): 5-8.

Babar, T.K., H. Karar, M. Saleem, A. Ali, S. Ahmad and A. Hameed, 2013. Comparative efficacy of various insecticides against whitefly, *Bemisia tabaci* (Genn.) adult (Homoptera: Aleyrodidae) on transgenic cotton variety Bt-886. Pak. Entomol., 35(2): 99-104.

Pakistan Economic Survey. 2014-2015. Agricultural Statistics of Pakistan, Govt. of Pakistan. Min. Food Agric. and Livestock, Eco. Wing, Finance Division, Islamabad, Pakistan, www.accountancy.com.pk.

Kumar, B.V., S. Kuttalam, S. Chandersekaran. 2009. Efficacy of new insecticides spirotetramate against cotton whitefly. Pestic. Res. J., 21(1): 45-48.

Mohan, M. and K.N. Katiyar, 2000. Impact of different insecticides used for bollworm control on the population of jassid and whitefly in cotton. Pestic. Res. J., 12(1): 99-102.

Nauen, R., U. Reckmann, S. Armborst, H.P. Stupp and F. Elbrt, 1999. Whitefly activity metabolites of imidacloprid, biological efficacy and translocation in cotton plants. Pest Manag. Sci., 55 (3): 265-271.

Sarwar, M., 2013a. Comparing abundance of predacious and phytophagous mites (Acarina) in conjunction with resistance identification between Bt and non-Bt cotton cultivars. Afr. Entomol., (21): 108-118.

Sarwar, M., M. Hameed, M. Yousaf and M. Hussain, 2013. Identification of resistance to insect pest's infestations in cotton (*Gossypium hirsutum* L.) varieties evaluated in the field experiment. Int. J. Sci. Res. Environ. Sci., 1(11): 317.