Pak. J. Agri. Sci., Vol. 50(2), 223-228; 2013
ISSN (Print) 0552-9034, ISSN (Online) 2076-0906
http://www.pakjas.com.pk

PERFORMANCE OF NOVEL VS TRADITIONAL INSECTICIDES FOR THE CONTROL OF *Amrasca biguttula biguttula* (HOMOPTERA, CICADELLIDAE) ON COTTON

Haider Karar[1,*], Tauseef Khan Babar[1], M. Faisal Shahazad[1], M. Saleem[2], Amjad Ali [2] and M. Akram [3]

[1]Entomological Research Sub Station, Multan, Pakistan; [2]Entomological Research Institute, Faisalabad, Pakistan; [3]Cotton Research Station, Multan, Pakistan
[*]Corresponding author's e-mail: haider853@gmail.com

Amrasca biguttula biguttula (Ishida) can reduce the yield of cotton approximately 25%. No potential predators have been recorded in the field for its control. To overcome this pest insecticides play significant role in the improvement of crop yields all over the world during the last four to five decades. To save the crop from this notorious pest, ten formulations of insecticides viz., acephate 75SP (Acephate) @ 625g, imidacloprid 25WP (Imidacloprid) @188g, thiamethaxim25WG (Actara) @ 60g, imidacloprid 70WG (Confidor) @ 43g, dimethoate 40EC (Sanitox) @ 1000 ml, nytonpyron10SL (Pyramid) @ 500ml, lambdacyhlothrin2.5E (Kango) @ 825 ml, thiachloprid 480SC (Talent) @ 63 ml, imidacloprid 25SL (Confidor) @ 500ml, and diafenthiuron 500SC (Polo), @ 500ml, per hectare were sprayed in the field having maximum population of nymphs and adults of Jassid at Cotton Research Station, Multan on cotton variety Bt- 886 in the month of July, 2011 and 2012. The maximum mortality of jassid was observed in those treatments, where acephate was applied with 79, 72, 65 mortality, nytonpyron with 69, 63, 55 and imidacloprid 68, 63, 57 percent mortality after 24, 72 and 168 h of spray. Minimum mortality of jassid was observed in the treatments where talent was applied having 25, 17 and 16 percent mortality 24, 72 and 168 h after spray. By the application of acephate, pyramid and confidor 25SL on cotton crop the yield can be increased.

Keywords: Jassid, *Amrasca biguttula biguttula*, insecticides, transgenic cotton bt- 886, Pakistan

INTRODUCTION

Cotton, *Gossypium hirsutum* L. is commonly known as silver fiber which is the backbone of the Pakistani economy (Tayyib *et al.*, 2005). An important natural fiber, it contributes about 68% to the foreign exchange earning of Pakistan (Khan and Khan 1995). Pakistan ranks 4th as a producer and 3rd as an exporter of raw cotton in the world (Ahmad, 1999), but cotton yield is very low as compared to other cotton growing countries. A lot of factors are contributing towards low yield, but the intense attack of sucking insect pest complex play an important role in the reduction of yield (Aslam *et al.*, 2004). Insect pests are the key source of crop damage in Pakistan and elsewhere in the world, reducing the yield and deteriorating the quality of the end product. Cotton crop known as white gold is the most hit crop in Pakistan by various insect pests. About 162 species of insect pests attack on various growth stages of cotton (Kannan *et al.*, 2004). But the pests like jassid, thrips, whitefly, aphids, boll worms and spider mites are posing severe threat to this high cost cash crop. Therefore, production losses in cotton due to pest attack are reported to have been increasing every year and these losses were found to be 3.1 million bales in 1998-99 (Ahmad and Poswal, 2000). The sucking pests causes about 40-50% damage to cotton crop. Jassid, *Amrasca biguttula biguttula* Dist. (Hemiptera: Cicadellidae), a sucking pest alone causes 24.45% (Bhat *et al.*, 1986), 18.78% (Ali, 1992) reduction in cotton production. The pest sucks the cell sap and reduces the photosynthetic area of the plant. Both nymphs and adults cause damage to the crop by injecting its toxic saliva into tissues. Further investigation has found that extreme damage during mid season reduce yield and if the same amount of damage occurs late in season yield is heavily reduced (Borah,1995; Patel and Patel,1998; Rafique and Shah,1998; Sudhakar *et al.*,1998). Transgenic cotton can effectively control specific lepidopterous species (Arshad *et al*., 2009), but there is lack of resistance against sucking insect pests (Hofs *et al.*, 2004) and this requires continuous use of pesticides and other control tactics for effective management (Hilder and Boulter, 1999; Hofs *et al.*, 2004). The reduction of chemicals in transgenic cotton can boost the population of sucking insect pests (Men *et al*., 2005; Wu *et al*., 2002). So it is very important to overcome the incidence of insect pests attack in order to fulfill the food and clothing necessities of the country. The most successful method in managing cotton insect pests after resistant varieties is chemical control, but should only be used as final option (Korejo *et al.*, 2000).

Chemicals are to be used wisely in combination with proper spray technology. Economic threshold levels have been suggested to reduce pesticide loads (Bakhetia *et al.*, 1996).
The present study was conducted to manage this notorious pest of cotton by comparing the efficacy of novel vs. old chemicals against Jassid to choose the best chemical for inclusion in IPM programme of cotton as well as to know that either of these insecticides can reduce the populations of this pest under field conditions.

MATERIALS AND METHODS

Following insecticides viz., acephate 75SP (Acephate) (Company Pan Gold) @ 625 g, Imidacloprid 25WP (Imidacloprid) (Company Four Brothers) @ 188 g, thiamethaxim 25WG (Actara) (Company Sygenta) @ 60 g, imidacloprid 70WG (Confidor) (company Bayer Crop Science) @ 43 g, dimethoate 40EC (Sanitox) (Company Pak Agro Chemicals) @ 1000 ml, nytonpyron10SL (Pyramid) (Company Kanzo Ag) @ 500ml, lambdacyhlothrin 2.5E (Kango) (Company Bayer Crop Science) @ 825ml, thiachloprid 480SC (Talent) (Company BioTraders) @ 63 ml, imidacloprid 25SL (Confidor) (Company) @ 500 ml, and diafenthiuron 500SC (Polo) (Company Syngenta) @ 200 ml, dose per hectare were sprayed in the field on cotton variety bt-886 having maximum population of nymphs and adults of Jassid at Cotton Research Station, Multan. There were eleven treatments including a control under three replications. The plot size for each treatment was 7.58 x 12.12 m. There were sixteen lines in each plot, 75 cm apart; while plant-to plant distance was 23 cm. All the inputs applied were same in all the treatments. The population of Jassid was counted from upper, middle and lower leaves of fifteen plants selected at random from each treatment before spray and then 24h, 72h and 168h after spray. Calibration was done before spray for measuring the quantity of water used by each treatment.

Percent mortality was calculated by using the below mentioned formula:

$$\% \text{ Mortality} = \frac{\text{(Pop, before spray – Pop. after spray) x 100}}{\text{Population before spray}}$$

The data was consolidated and percent mortality was calculated, analyzed through Statistix Version- 9 (www.statistix.com/free trial.html) and means were compared by Tukey's HSD.

RESULTS

Mortality of Cotton Jassid during cropping season 2011

Mortality of Jassid 24 hours after spray: The data regarding percent mortality of jassid 24 hours after spray are given in (Table 1). Highly significant differences were found between treatments. The maximum mortality of the pest was observed in those treatments where acephate was sprayed having 83 percent mortality of the pest, which is statistically similar to dimethoate with 78 percent mortality of the jassid. The minimum morality of the pest i.e. 37 and 36 percent was observed in those treatments where talent and thiamethaxim were sprayed.

Mortality of Jassid 72 hours after spray: Variations were found to be significant among treatments (Table 1). The highest mortality of the pest was recorded to be 68, 66 and 64 percent in those treatments where acephate, nytonpyron and imidacloprid (25SL) were sprayed and are statistically similar. The lowest mortality of the pest was observed to be

Table 1. Mean comparison of percent mortality of Jassid 24, 72 and 168 after spray during 2011

Insecticides		Dose/ha.	Post treatment percent mortality of Jassid after		
Tech. Name	**Common Name**	**ml/g**	**24h**	**72h**	**168h**
Acephate	acephate 75SP	625g	83± 1.12a	68±0.94 a	64± 1.41a
Imidacloprid	imidacloprid 25WP	187.5g	61± 0.91d	49 ±0.52b	21± .28def
Actara	thiamethaxim25WG	60g	36 ±0.82f	34 ±0.66 c	28± 0.63 cd
Confidor	imidacloprid 70WG	42.5g	61± 0.39d	29 ±0.44cd	23± 0.95cde
Sanitox	dimethoate 40EC	1000m	77± 1.23ab	34 ±0.60c	30± 0.58c
Pyramid	nytonpyron10SL	500ml	67 ±0.94cd	66 ± 1.17a	57± 0.90ab
Kangro	lambdacyhalothrin2.5EC	825ml	50±0.75 e	23± 0.39de	15± 0.66 ef
Talent	thiachloprid 480SC	62.5ml	37± 0.58f	17 ±0.56e	15 ±0.46f
Confidor	imidacloprid 25SL	500ml	71 ±0.67bc	64 ±1.69a	59± 1.11a
Polo	diafenthiuron 500SC	500ml	67 ±1.04cd	51 ±0.83b	50 ±0.66b
Control	-	-	3 ±0.13g	5± 0.29f	7 ±0.46g
F-value			230.55	198.50	159.51
Tukey's HSD value @5%			7.78	7.72	8.18

Means sharing similar letters are not significantly different by Tukey Test at $P < 0.05$; HSD = Highly Significant Differenence

23 and 17 percent in those treatments where thiachloprid and lambdacyhalothrin were sprayed, respectively and did not show significant difference with each other.

Mortality of Jassid 168 hours after spray: Significant differences were found between treatments regarding mortality of jassid 168 hours after spray (Table 1). The results reveal that acephate with 64 and imidacloprid 25SL with 59 percent mortality were found to be the most effective insecticide resulted in maximum mortality of the pest statistically similar to pyramid having 57 percent mortality of jassid. Minimum mortality of jassid was recorded in those treatments where imidacloprid (25WP), lambdacyhalothrin and thiachloprid were sprayed having 21, 15 and 15 percent mortality of the pest.

Mortality of Cotton Jassid during cropping season 2012

Mortality of Jassid 24 hours after spray: Significant variation was found among treatments after 24 hours of spray (Table 2) during 2012. The highest mortality of the pest was recorded to be 90 and 85 percent in those treatments where acephate and dimethoate were sprayed and are statistically similar. The lowest mortality of the pest was observed to be 33 percent in those treatments where thiamethaxim and thiachloprid were sprayed, and are statistically similar with each other.

Mortality of Jassid 72 hours after spray: The data regarding percent mortality of jassid 72 hours after spray are given in (Table 2). Highly significant differences were found between treatments. The maximum mortality of the pest was observed in those treatments where acephate was sprayed having 77 percent mortality of the pest followed by diafenthiuron, imidacloprid (25SL) and nytonpyron having 65, 62 and 60 percent mortality of the jassid. The minimum morality of the pest i.e. 17 and 16 percent was observed in those treatments where thiachloprid and lambdacyhalothrin were sprayed.

Mortality of Jassid 168 hours after spray: Significant differences were found between treatments regarding mortality of jassid shown (Table 2). The results reveal that acephate 67 and diafenthiuron 62 were found to be the most effective insecticide resulted in maximum mortality of the pest and are statistically similar. Minimum mortality of jassid was recorded in those treatments where thiachloprid and lambdacyhalothrin were sprayed having 17 and 13 percent mortality of the pest 168 hours after spray.

Average Mortality of Cotton Jassid during cropping season 2011 and 2012

Mortality of Jassid 24 hours after spray: Significant variations were found among treatments on an average of two years after 24 hours of spray (Table 3) during 2011 and 2012. The highest mortality of the pest was recorded to be 79 percent in the treatment where acephate was sprayed followed by nytonpyron and imidacloprid 25SL with 69 and 68 percent mortality of jassid and are statistically similar. The lowest mortality of the pest was observed to be 25 percent in the treatment where thiachloprid was sprayed.

Mortality of Jassid 72 hours after spray: The data regarding percent mortality of jassid 72 hours after spray are given in (Table 3). Highly significant differences were found between treatments. The maximum mortality of the pest was observed in the treatment where acephate was sprayed having 73 percent mortality of the pest followed by nytonpyron and imidacloprid having 63 percent mortality of the jassid. The minimum morality of the pest i.e. 17 and 16 percent was observed in those treatments where thiachloprid and lambdacyhalothrin were sprayed.

Table 2. Mean comparison of percent mortality of Jassid 24, 72 and 168 after spray during 2012

Insecticides		Dose/ha.	Post treatment percent mortality of Jassid after		
Tech. Name	**Common Name**	**ml/g**	**24h**	**72h**	**168h**
Acephate	acephate 75SP	625g	90±1.85a	77± 0.69a	67±0.82 a
Imidacloprid	imidacloprid 25WP	187.5g	57± 0.79c	54± 0.50c	20 ±0.49de
Actara	thiamethaxim25WG	60g	33±0.87 d	34 ±0.59d	33± 0.78c
Confidor	imidacloprid 70WG	42.5g	54± 0.92c	21± 0.71f	22± 0.45de
Sanitox	dimethoate 40EC	1000m	85± 0.51a	28± 0.70e	25±0.56 d
Pyramid	nytonpyron10SL	500ml	71± 0.55b	60± 0.83b	52±0.78 b
Kangro	Lambdacyhalothrin 2.5EC	825ml	56± 0.68c	16±0.42 g	13± 0.08f
Talent	thiachloprid 480SC	62.5ml	33± 0.86d	17± 0.32fg	17± 0.69ef
Confidor	imidacloprid 25SL	500ml	73± 0.68b	62±0.59 b	55±0.89 b
Polo	diafenthiuron 500SC	500ml	72± 1.05b	64± 0.74b	62± 0.65a
Control			3±0.12 e	4± 0.24h	6± 0.16g
F-value			246.81	508.47	352.08
Tukey's HSD value @5%			8.39	5.57	5.83

Means sharing similar letters are not significantly different by Tukey Test at $P < 0.05$ HSD = Highly Significant Difference

Table 3. Mean comparison of percent mortality of Jassid 24, 72 and 168 after spray during 2011 & 2012

Insecticides		Dose/ha.	Post treatment percent mortality of Jassid after		
Tech. Name	**Common Name**	**ml/g**	**24h**	**72h**	**168h**
Acephate	acephate 75SP	625g	79± 0.92a	73 ±0.42a	65±0.54 a
Imidacloprid	imidacloprid 25WP	187.5g	53± 0.39d	51 ±0.88d	21 ±0.87de
Actara	thiamethaxim25WG	60g	34± 0.44f	34 ±0.03e	30± 0.48c
Confidor	imidacloprid 70WG	42.5g	42 ±0.46e	25 ±0.20f	23± 0.64b
Sanitox	dimethoate 40EC	1000m	60 ±0.25c	31 ±0.28e	27± 0.22c
Pyramid	nytonpyron10SL	500ml	69 ±0.28b	63 ±0.23b	55± 0.82b
Kangro	Lambdacyhalothrin 2.5EC	825ml	39 ±0.34e	19 ±0.39g	14±0.29 f
Talent	thiachloprid 480SC	62.5ml	25 ± 0.43g	17 ±0.42g	16 ±0.26ef
Confidor	imidacloprid 25SL	500ml	68± 0.34b	63 ±0.55b	57 ±0.55b
Polo	diafenthiuron 500SC	500ml	62 ±0.52c	58± 0.38c	56 ±0.35b
Control			4 ±0.06h	4± 0.17h	6 ±0.22g
F-value			626.70	1410.88	471.44
Tukey's HSD value @5%			4.55	3.09	4.86

Means sharing similar letters are not significantly different by Tukey Test at P < 0.05 HSD = Highly Significant Difference

Mortality of jassid 168 hours after spray: Significant differences were found between treatments regarding mortality of jassid shown (Table 3). The results reveal that acephate 65 percent was found to be the most effective insecticide resulted in maximum mortality of the pest followed by imidacloprid, diafenthiuron and nytonpyron having 57, 56 and 55 percent and are statistically similar. Minimum mortality of jassid was recorded in those treatments where thiachloprid and lambdacyhalothrin were sprayed having 16 and 14 percent mortality of the pest 168 hours after spray.

DISCUSSION

Different control measures viz. cultural, biological and chemical are being adopted worldwide for the management of jassid on various crops. But the success of control measure is judged by the outcome and the most acceptable control strategy is that which gives suitable control against the target organism, so that the crop should be saved well in time. To overcome the jassid insecticides are considered the only source of quick control measures which save the crop losses and is an important practice of IPM (Mohyuddin *et al*. 1997; Sarfraz *et al*., 2005 and Gogi *et al.*, 2006). No doubt some chemicals have toxic effects on some non-target organisms, but these are still the best management practices known to save the crop from pest outbreak. In our experiment, ten chemicals were tested against jassid adults and nymphs under field conditions, among these chemicals some were found effective against jassid while others were found to be less effective. Our results suggested that acephate was found to be the most effective insecticide resulted in significant reduction of jassid adults and nymphs populations as compared to all other insecticides up to one week. Dimethoate belongs to OP's was also effective against jassid population. But its population resurged after 3 days. The reason could be that dimethoate has a knockdown effect on jassid. The results agree with of the findings of Eijaza (2012) who reported that acephate and dimethoate are best insecticides for the control of jassid. Nytonpyron give an intermediate mortality of jassid. These findings are similar to Karar and Shahzad (2011) who reported that pyramid 10SL control jassid 50%. Thiamethaxim, imidacloprid 25WP, imidacloprid 70WG, imidacloprid 25SL and diafenthiuron 500SC give lesser mortality of jassid. The results did not match with the findings of Khattak et al. (2004), Saleem and Khan (2001) and Natarajan (2007) who reported that new chemistry insecticides like thiamethaxim, diafenthiuron, imidacloprid gave control of jassid. The reason could be that theses new chemistry has developed resistance against jassid. Hence the mortality becomes less as compared with the previous year's mortality. Lambdacyhalothrin did not give the good mortality that may be due to resistance in jassid against pyrethroids. The results are similar to Ahmad (1999) who reported that jassid has developed resistance against pyrethroids in the field and mechanism of resistance is possessed by jassid.

Conclusion: The present study indicates that acephate is the most effective insecticide against jassid adults and nymphs as compared to all other insecticides tested. These insecticides can be included in the IPM module of jassid management, so that the cotton crop during early and late stage as well as other crops can be saved against this notorious pest

***Acknowledgement*:** Current studies were conducted at Cotton Research Station, Multan- Punjab, Pakistan with the cooperation of Cotton Botanist, Multan, Government of the Punjab, Agricultural Department.

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