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IMPACT OF ACETAMAPRID, IMIDACLOPRID AND DIAFENTHIURON ON *BEMISIA TABACI* AND TOMATO LEAF CURL VIRUS DISEASE INCIDENCE

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A B S T R A C T

Five tomato varieties/lines (viz:Thorgal, Morgal, Rio- Grande, Baby Red and Nagina) were sown in randomized complete block design with three replications in the experimental area of Plant Pathology Department, University of Agriculture, Faisalabad. A highly susceptible variety Nagina was sown as spreader in between the test varieties to produce the maximum disease. Four treatments including untreated control, Acetamaprid, Imidacloprid and Diafenthiuron were evaluated against *Bemisia tabaci* population and Tomato Leaf Curl Virus disease under natural field condition. Treatments were applied randomly to each block of variety. Acetamaprid was found to be the most effective against the reduction of vector population as well as Tomato Leaf Curl Virus disease followed by imidacloprid and Diafenthiuron as compared to the untreated control.

Keywords: Evaluation, insecticides, *Bemisia tabaci,* tomato leaf curl virus

INTRODUCTION

Tomato (*Lycopersicon esculentum Mill*.) is an important horticultural crop, belonging to the family *Solanaceae* and ranks second in importance among vegetables (Glick *et al* 2009). Tomato contains most important sources of health promoting and health protecting compounds, which play an excellent role in energy balancing, weight management and reducing the risk of cancer, cardiovascular diseases as well as age-related macular degeneration (Helyes and Lugasi, 2006; Dorais *et al*., 2008). Total domestic production estimates of tomatoes in Pakistan during 2014-15 is 3,561,000 tons, including 30,000 tons in Balochistan, 126,000 tons in Khyber-Pakhtunkhwa, 4,000 tons in Sindh and 3,400,000 tons in Punjab (Anonymous, 2014).

This is an extremely low yield and this low yield can be attributed to various biotic, abiotic constraints. Under conducive conditions, the diseases caused by the devastating pathogens such as viruses, fungi, nematodes and bacteria singly, or collectively can cause a significant loss in both quality and quantity of the vegetables crops.

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Among diseases Tomato Yellow Leaf Curl Virus disease (TYLCVD) is most important viral disease of tomato crop that arose first time somewhere in the Middle East during 1930 to 1950 and then spread worldwide and causes severe economic losses around the globe (Lefeuvre *et al.,* 2010). TYLCV belong to genus *Begomovirus* family *Geminiviridae* cause tomato production losses in tropical and sub-tropical regions (Skaljac and Ghanim, 2010; Xie *et al*., 2013). TYLCD produce typical symptoms such as plant show stunted growth, new leaves reduced in size, wrinkled and yellowed between the veins, leaves margins show upward curling and give cup like appearance and flower drop before fruit setting (Melzer *et al*., 2009). TYLCV is only transmitted by sweet potato whitefly (*Bemisia tabaci*) and silver leaf whiteflies (*Bemisia argentifolii*) (Sugano *et al*., 2011). Aim of this study was to test the efficacies of insecticides for the management of vector and to manage the disease in economical way for the successful tomato production under natural field conditions.

MATERIALS AND METHODS

Five tomato varieties/lines (viz:Thorgal, Morgal, Rio-Grande, Baby Red and Nagina) were selected for the

present study. The Seed of these varieties were obtained from Vegetable Research Institute, AARI, Faisalabad. The trial was conducted in randomized complete block design (RCBD) with three replication during 2014-2015. Trial was sown in the research area of Department of Plant Pathology, University of Agriculture, Faisalabad. A highly susceptible variety Nagina was sown as disease spreader in between the test varieties to produce the maximum disease. The data on whitefly population was recorded early in the morning 24 hours before spray and then 48 hours after the spray. Three plants were selected at random from each plot and population of whitefly was recorded from upper, middle and lower leaves per plant. Three insecticides Acetamaprid, Imidacloprid and Diafenthiuron were applied randomly for management of whitefly vector. One treatment kept untreated was considered as control. Data regarding the TLCV disease incidence was recorded two days before the spray of chemicals and on five days interval after each spray.

T1 = Acetamaprid
T2 = Imidacloprid
T3 = Diafenthiuron
T4 = Control

The chemicals were sprayed in month of March, April and May at five different dates. The treatments were repeated after 12 days and total five sprayed were applied. The data of TLCV disease incidence was recorded by following formula.

$$\text{Disease incidence} = \frac{\text{No. of infected plants}}{\text{Total No. of plants}} \times 100$$

(Muqit *et al*., 2006).

RESULTS AND DISCUSSION

The TLCV disease incidence was greatly reduced in all the treatments as compared to the control (Table 1). In table letter "a" represent maximum disease incidence and letter "d" indicate minimum disease incidence. At the first date, mean value of disease incidence in tomato plants where Acetamaprid was applied was only 22.62% whereas mean value of disease incidence in control was 36.32%. Similarly at second, third, fourth, and fifth spray dates percent disease incidence was 25.34, 28.43, 32.46 and 31.96 respectively but in control percent disease incidence was much higher which was 42.58, 50.2, 60.43 and 65.04 at second, third, fourth and fifth dates respectively. Acetamaprid spray resulted in reduction of disease incidence as compared to the others treatments. At first date disease incidence in tomato plants where Imidacloprid was sprayed mean disease incidence was 24.69% while in control it was 36.32%. Similarly at second, third, fourth and fifth dates mean value of percent disease incidence in plants where Imidacloprid was sprayed was 27.68, 32.69, 37.91 and 37.35 respectively while in control it was 42.58, 50.2, 60.43 and 65.04 percent at second, third, fourth and fifth dates respectively. Efficacy of Diafenthiuron was less as compare to the Acetamaprid and Imidacloprid. At first spray of Diafenthiuron disease incidence was 29.11% whereas in control it was 36.32%.

The effects of different chemicals (Acetamaprid, Imidacloprid and Diafenthiuron) were different on five varieties/ lines. Acetamaprid was most effective minimum disease incidence was observed on variety Thorgal where mean value of disease incidence was 26.02% and in highly susceptible variety Nagina Acetamaprid showed lower effect and mean value of disease incidence was 30.21%. Similarly in case of Imidacloprid disease incidence was 29.07% in variety Thorgal that was its maximum effect. Maximum effect of Diafenthiuron recorded in variety Thorgal where mean value of disease incidence was 33.32% but Diafenthiuron was least effective as compared to the Acetamaprid and Imidacloprid (Table 2). These results indicated that all chemicals suppressed the TLCV disease incidence but Acetamaprid was most effective (Figure 1).

The whitefly (*Bemisia tabaci*) was decreased in all the treatments as compared to the control (Table 3). In the table letter "a" show maximum whitefly population and letter "c" indicate minimum whitefly population. At the first date, mean value of whitefly population on tomato plants where Acetamaprid was sprayed, was only 1.38, while the mean value of whitefly population in control was 2.47. Similarly at second, third, fourth, and fifth dates mean whitefly population was 1.69, 1.97, 2.26 and 2.20 respectively but in control mean value of whitefly population was greater which was 4.85, 3.77, 4.63 and 5.18 at second, third, fourth and fifth dates respectively. Acetamaprid spray resulted in reduction of whitefly population as compared to the others treatments. At first date mean value of whitefly population on tomato plants where Imidacloprid was applied was 1.78 whereas in control it was 2.47. Likewise at second, third, fourth and fifth dates mean value of whitefly population on plants where Imidacloprid was sprayed was 2.00, 2.34, 2.65 and 2.60 respectively while in control it was 4.85, 3.77, 4.63 and 5.18 at second, third, fourth and fifth dates

respectively. Efficacy of Diafenthiuron was less as compare to the Acetamaprid and Imidacloprid. At first spray of Diafenthiuron mean value of whitefly population was 2.07 whereas in control it was 2.47.

The impact of chemicals on five varieties/ lines (Thorgal, Morgal, Rio Grande, Baby red and Nagina) were different (Table 4). Acetamaprid was most effective against whitefly population on variety Thorgal where mean value of whitefly population was recorded 1.75 and in Nagina variety Acetamaprid showed least effects against whitefly population and mean value of whitefly population was 2.04. Similarly in case of Imidacloprid whitefly population was 2.13 in variety Thorgal that was its maximum effect. Maximum effect of Diafenthiuron against whitefly population was recorded in variety Thorgal where mean value of whitefly population was 2.39 but Diafenthiuron was least effective against whitefly population as compared to the Acetamaprid and Imidacloprid and Acetamaprid was most effective (Figure 2).

Results illustrated that all the chemicals suppressed the whitefly population. Our results thus supports the findings of Palumbo *et al.,* (2001) who reported that the insecticides with advanced chemistries which have the rapid impact on *B. tabaci* control have been introduced for the management of virus vector in vegetable production systems. The whitefly population mortality occurs significantly with the application of acetamaprid (Aslam *et al*., 2003). There are various neonicotinoids which manage the TLCV disease incidence and vector at the different concentration but acetamaprid, imidacloprid, thiomethoxam, and dinotefuron have been used to reduce TLCV disease incidence in many tropical countries (Jane and Lapidot, 2007). Endosulfan, imidacloprid, acetameprid and diafenthiuron suppress the population of whitefly. It was observed that all the *B. tabaci* populations were susceptible to these pesticides, sensible application of these insecticides play a significant role in management of *Bemisia tabaci* and disease incidence (Hameed *et al*., 2010).

Table 1. Interaction of treatments and Dates for evaluation of insecticides to control tomato leaf curl virus under field conditions.

	Treatments	Dates					Means
		17-03-2015 (D1)	29-03-2015 (D2)	09-04-2015 (D3)	22-04-2015 (D4)	07-05-2015 (D5)	
Chemicals	Acetamaprid	22.62	25.34	28.43	32.46	31.96	28.16d
	Imidacloprid	24.69	27.68	32.69	37.91	37.35	32.06c
	Diafenthiuron	29.11	31.73	36.6	42.95	42.4	36.56b
	Control	36.32	42.58	50.2	60.43	65.04	50.91a
	Means	28.185e	31.83d	36.98c	43.44b	44.187a	

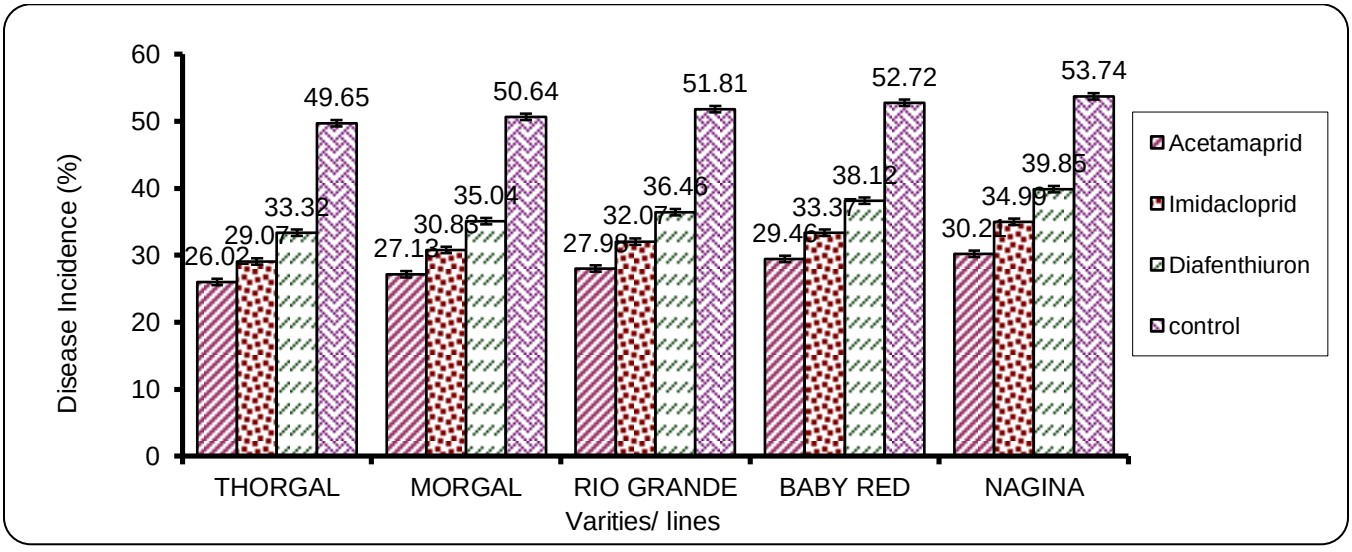

Figure 1. Interaction of treatments and Varieties for evaluation of insecticides to control tomato leaf curl virus under field conditions

Table 2. Interaction of treatments and Varieties for evaluation of insecticides to control tomato leaf curl virus under field conditions.

Treatments		Varieties/ lines					Means
		THORGAL (V1)	MORGAL (V2)	RIO GRANDE (V3)	BABY RED (V4)	NAGINA (V4)	
Chemicals	Acetamaprid	26.02	27.13	27.98	29.46	30.21	28.16d
	Imidacloprid	29.07	30.83	32.07	33.37	34.99	32.06c
	Diafenthiuron	33.32	35.04	36.46	38.12	39.85	36.56b
	Control	49.65	50.64	51.81	52.72	53.74	51.71a
	Means	34.51e	35.91d	37.08c	38.42b	39.70a	

Table 3. Interaction of treatments and Dates for evaluation of insecticides to control whitefly population under field conditions.

Treatments		Dates					Means
		17-03-2015 (D1)	29-03-2015 (D2)	09-04-2015 (D3)	22-04-2015 (D4)	07-05-2015 (D5)	
Chemicals	Acetamaprid	1.38	1.69	1.97	2.26	2.20	1.90c
	Imidacloprid	1.78	2.00	2.34	2.65	2.60	2.27bc
	Diafenthiuron	2.07	2.24	2.67	3.06	3.13	2.64b
	Control	2.47	4.85	3.77	4.63	5.18	4.18a
	Means	1.93b	2.69a	2.69ab	3.15a	3.28a	

Table 4. Interaction of treatments and Varieties for evaluation of insecticides to control whitefly population under field conditions

Treatments		Varieties/ lines					Means
		THORGAL (V1)	MORGAL (V2)	RIO GRANDE (V3)	BABY RED (V4)	NAGINA (V5)	
Chemicals	Acetamaprid	1.75	1.8	1.87	2.04	2.04	1.90c
	Imidacloprid	2.13	2.18	2.24	2.43	2.47	2.29bc
	Diafenthiuron	2.39	2.54	2.62	2.78	2.85	2.64b
	Control	3.09	3.14	3.23	3.34	5.41	3.64a
	Means	2.34b	2.42b	2.49b	2.65ab	3.19a	

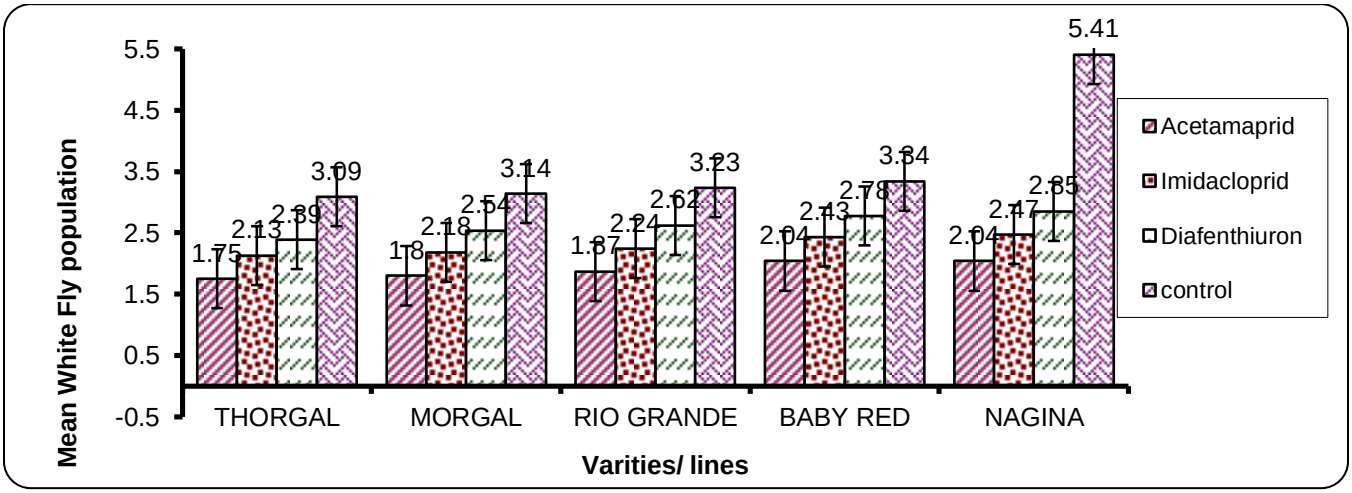

Figure 2. Interaction of treatments and Varieties for evaluation of insecticides to control whitefly population under field conditions.

CONCLUSION

Based on the above data, it was concluded that three chemicals (Acetamaprid, Imidacloprid and Diafenthiuron) were applied at recommended concentration. All the treatments caused significant reduction in whitefly population and disease incidence of TLCV. Acetamaprid was sprayed @125ml/ acre, its lower mean value (2.9683) suggested that this chemical was more toxic to the pests as compared to the Imidacloprid and Diafenthiuron with mean values of (3.3496) and (3.6392) respectively.

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