ASSESSMENT OF DIFFERENT SYNTHETIC INSECTICIDES FOR THE MANAGEMENT OF TOMATO LEAF MINER (*TUTA ABSOLUTA*)

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ABSTRACT: Tomato is the most important vegetable crop attack by many insect pests. Among them tomato leaf miner is the most serious and destructive one. Experiment used was Randomized complete block design with five treatments along with control, replicated thrice. The insecticides used *viz.*, Lambda cyhlothrin 2.5% EC, Ulala (Flanicamid 50% WG), Acetamiprid 20 SP and Imidacloprid 25% WP. The crop was sprayed twice at 20 days interval. Percent damaged after two spray application was observed. The lowest percent damage of tomato leaf miner infestation was recorded in lambda cyhalothrin treated plot (10.96%) followed by Imidacloprid (13.76%) which was statistically similar with Ulala (Flanicamid 50% WG) (14.64%) and Acetamiprid (14.93%) respectively while highest damage was reported from check plot (30.79%). Results showed that highest yield was recorded from lambda cyhalothrin (2661.7 kg ha^{-1}) treated plot followed by Imidacloprid 25% WP (1979 kg ha^{-1}). The control plot showed significantly lowest yield (1277.7 kg ha^{-1}) as compare to all other treatment. Cost benefit ratio was recorded highest in plot treated with Lambda cyhalothrin (1:6.3) and lowest was observed Ulala (Flanicamid 50% WG) (1:3.2) respectively. It was concluded from the above study that the insecticides Lambda cyhlothrin 2.5% EC showed least percent damage, highest yield Kg/ha and highest CBR as compared to other treatments.

Key words: Tomato, leaf miner, chemicals insecticides, Peshawar.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mills) is considered as a famous vegetable ranked third after potato belonging to family Solanaceae. Tomato has high nutritional value, used in various product or form via, fresh used as salads, cooking purposes and processed into ketchup (Saeed *et al.,* 2007; Akhtar *et al.,* 2010). Tomatoes is a well-balanced and healthy food. Tomato has high vitamins minerals, essential amino acids dietary fibers and sugars contents. Tomato is rich in iron, vitamin B and C and phosphorus. Vitamin A contents are high in yellow tomatoes as compare to red tomato, but lycopene contents are high in red tomatoes, which is an anti-oxidant provide protection against carcinogenic substances. In Pakistan tomato has cultivated on 101577 ha with production of 561293 tons (FAO STAT, 2021). In Khyber Pakhtunkhwa 5812ha area are under cultivation with total production of 66,420 tons. Baluchistan has an average production of 87,753 tons cultivated in an area of 6609ha. In Punjab, the area under cultivation is 6556ha with production of 86,269 tons and Sindh cultivated has area of 3542 ha having total production of 73,275 tons (MNFSR, 2018-019).

Comparatively, the tomato production is very low in Pakistan due to several factors including insect pest on top. Insect pests considerably reduce the tomato production by infesting different growth stages (Hoffmann *et al.,* 2007). The tomato crop susceptibility is high to insect pests, they not only attack fruits but also infest stem, leaves and flowers. The highest economic damage in tomato crop is caused by fruit borer while aphid, stink bugs, leaf footed bugs and leaf miner also contribute to low yield. One of the emerging serious insect treat to tomato crop is the leaf miner (*Tuta absoluta* (Meyrick) Lepidoptera: Gelechiidae) that cause up to 50-80% damage in tomato (Haque, 2015). Tomato growers worldwide are suffering from severe losses in tomatoes production due to *T. absoluta* infestation (Reyes *et al.,* 2012; Materu *et al.,* 2016; Chidege *et al.,* 2016). Once infestation occurred, *T. absoluta* spread from one field to another by fruits and seedlings, infesting vines and used containers (Arnó and Gabarra, 2010; Amizadeh *et al.,* 2015). The extreme infestation causes severe losses in tomato production, ranging from 80 to 100 percent in both covered and open fields (Korycinska and Moran, 2009).

Botanical extracts are environmentally friendly as compared to pesticides. It comes under the category of green pesticides. More than 2400 bioactive plants species have been identified to

have an antipathogenic and insecticidal properties (Karunamoorthi, 2012). Keeping in view the importance to this destructive pest, this study was conducted with the primary goals of evaluating the efficacy of 5 botanical insecticides along with a synthetic insecticide for comparison against *T. absoluta* in tomato crop field at swat.

MATERIAL AND METHODS

Field experiment was conducted to study efficacy of different synthetic insecticide against tomato leaf miner (*T. absoluta*) in tomato crop during cropping season 2022.

Experimental Design

The experiment was laid out in Randomized complete block design (RCBD) having 5 treatments including control, replicated 3 times with some distance to avoid the effect of treatment on each other. Nursery for tomato variety F1 hybrid (1359) was grown in the month of March 2022 and transplantation were done in May 2022. Plant to plant distance was 1.5 feet and Row to Row distance was 3 feet. Uniform cultural / Agronomic practices were performed in all treatments. Fifteen plants were selected from each treatment by random selection of five plants per replication and each plant were divided into three portion, bottom, middle and upper to record the damage caused by larva and was then converted into percent damage. In order to evaluate yield, the weight of each treatment was taken separately from initial picking to last picking for comparison.

Insecticide Applied

All the insecticides were purchased from local market and were applied at its recommended dose mentioned against tomato leaf miner at 20 days interval.

Parameters investigated

Tomato leaf miner (*T. absoluta*)

The data was recorded before application and then after 24hrs, 10days and 20days of treatment application. Percent damage in tomato leaf miner population were calculated by following formula.

$$\textbf{Percent damage} = \frac{\text{infested leaves} - \text{uninfested leaves}}{\text{Total leaves}} \times 100$$

Yield kg ha^{-1}

Tomato yield (kg ha^{-1}) was calculated after each picking by using the following formula:

$$\textbf{Yield kg per ha}^{-1} = \frac{\text{Yield weight}}{\text{Area harvested } (m^2)} \times 10000$$

Cost benefit ratio

Best effective treatment in term of CBR was calculated by using the method (Usman *et al.*, 2015).

Statistical Analysis

Efficacy Assessment of botanical extracts were recorded on various parameters and it was analyzed through statistical software (STATISTIX 8.1). Mean was separated using LSD Test at $P \leq 0.05$.

RESULTS

Percent damage of tomato leaf miner (*Tuta absoluta*) infestation after 1st and 2nd spray application

Percent damage of tomato leaf miner infestation after 1st spray application has been reflected in Table1. Minimum percent damage of tomato leaf miner infestation after one day was noted in plot treated with lambda cyhalothrin i.e., 12.55% which was significantly different from all other treatments. Percent damage 15.43% was recorded from Imidacloprid 25% WP treated plot followed by Ulala (Flanicamid 50% WG) and Acetamiprid 20 SP which were 16.93% and 16.76% respectively. The highest percent leaves damage was recorded in Control plot 28.75% respectively.

Similarly, after 20days of 1st application lowest percent damage of tomato leaf miner infestation was recorded in lambda cyhalothrin (8.38%) treated plot followed by Imidacloprid 25%

WP (10.33%), Acetamiprid 20 SP (10.60%) and Ulala (Flanicamid 50% WG) (10.93%) respectively. Highest damage was reported from check plot (30.10%) which was significantly high from all other treatments. Similarly, after 10days of 2nd application lowest percent damage of tomato leaf miner infestation was recorded in lambda cyhalothrin (6.15%) treated plot followed by Imidacloprid 25% WP (12.33%), Ulala (Flanicamid 50% WG) (12.43%) and Acetamiprid 20 SP (12.76%) and respectively. Highest damage was reported from check plot (32.60%) which was significantly high from all other treatments. After 20days of 2nd application lowest percent damage of tomato leaf miner infestation was recorded in lambda cyhalothrin (1.21%) treated plot followed by Imidacloprid 25% WP (3.66%), Ulala (Flanicamid 50% WG) (5.10%) and Acetamiprid 20 SP (5.60%) and respectively. Highest damage was reported from check plot (33.26%) which was significantly high from all other treatments. Overall means, of two different spray application lowest percent damage of tomato leaf miner infestation was recorded in lambda cyhalothrin (10.96%) treated plot followed by Imidacloprid 25% WP (13.76%), Ulala (Flanicamid 50% WG) (14.64%) and Acetamiprid 20 SP (14.93%) and respectively. Highest damage was reported from check plot (30.79%) which was significantly high from all other treatments.

Yield of tomato crop (kg ha^{-1})

Table 2 shows data recorded on yield of tomato crop after different botanicals extracts and a synthetic insecticide application against tomato leaf miner (*Tuta absoluta*) infestation during cropping season 2022 in Peshawar. Results showed in table 2 revealed that highest yield was recorded from lambda cyhalothrin (2661.7 kg ha^{-1}) treated plot followed by Imidacloprid 25% WP (1979 kg ha^{-1}), Acetamiprid 20 SP (1770.0 kg ha^{-1} Ulala (Flanicamid 50% WG) (1592 kg ha^{-1}). Plot treated with all the chemicals were significantly different from each other. The control plot showed significantly lowest yield (1277.7 kg ha^{-1}) as compare to all other treatment. Yield data of lambda cyhalothrin treated plots was also significantly different from each other and from all other compared treatments**.**

Cost benefit ratio of different treatments

The economics of different botanicals extracts and a synthetic insecticide is presented in table (3). That the highest cost benefit ratio was recorded in plot treated with Lambda cyhalothrin

(1:6.3), which is then followed by Imidacloprid 25% WP (1:4.9), Acetamiprid 20 SP (1:4.3) and lowest was observed Ulala (Flanicamid 50% WG) (1:3.2) respectively.

Table 1. Percent leaf damage of tomato leaf miner (*Tuta absoluta*) infestation treated with different Synthetic insecticide during 2022 at Peshawar.

Treatments	24BSA	% damage 1st SA		% damage 2nd SA		
		10 DAS	20DAS	10DAS	20DAS	Means
Ulala (Flanicamid 50% WG)	27.85	16.93 ab	10.93 b	12.43 b	5.10 bc	14.64c
Acetamiprid 20 SP	28.96	16.76 abc	10.60 b	12.76 b	5.60 bc	14.93c
Imidacloprid 25% WP	27.05	15.43 abc	10.33 b	12.33 b	3.66 c	13.76c
Lambda cyhalothrin2.5% EC	26.55	12.55 d	8.38 d	6.15 d	1.21 e	10.96b
Control	28.75	29.26 a	30.10 a	32.60 a	33.26 a	30.79 a
LSD value	5.35	4.34	3.23	5.18	5.11	3.12

Any two means having similar letters in a column are significantly not different on 5% level of significance.

Table 2. Mean yield (kg ha^{-1}) of tomato (*Lycopersicon esculentum*) after treated with different synthetic insecticide against tomato leaf miner (*Tuta absoluta*).

S.NO.	Treatments	Yield (Kg ha^{-1})
1	Ulala (Flanicamid 50% WG)	1592.0 d
2	Acetamiprid 20 SP	1770.0 c
3	Imidacloprid 25% WP	1979.0 b
4	Lambda cyhalothrin2.5% EC	2661.7 a
5	Control	1277.7 e
6	LSD value	203.84

Means of different letters indicates in each column are statistically significant to each other at 5% level of significance ANOVA followed by LSD Test.

Table 3. Cost benefit ratio of Different Synthetic Insecticide against Tomato leaf miner (*Tuta absoluta*) in district Swat 2022.

Treatments	Marketable Yield (kg ha^{-1})	Gross Income	Cost of Control	Return Over Control	Net Increase Over Control	CBR
	A	B	C	D=B-C	E=D-C	F=D/C
Ulala (Flanicamid 50% WG)	1592	63680	15344	48336	32992.00	3.2
Acetamiprid 20 SP	1770	70800	13442	57358	43916.00	4.3
Imidacloprid 25% WP	1979	79160	13453	65707	52254.00	4.9
Lambda cyhalothrin 2.5% EC	2661.7	106468	14654	91814	77160.00	6.3
Control	1277.7	51108	--	---	--	--

Price one Kg PKR=40

DISSCUSION

The experiment was done on "Efficacy of different synthetic insecticide against tomato leaf miner (*T. absoluta*) tomato in district Peshawar Khyber Pakhtunkhwa Pakistan 2022" are discussed in this portion.

Statistical analysis of data indicates a significant effect of botanical extracts and a synthetic insecticide against tomato leaf miner (*T.absoluta*). Tomato F1 hybrid (1359) variety were grown in the month of March and tomato plants transplanted in the month of May. The present study was carried out on Randomized Complete Block Design (RCBD) having 7 treatments and replicated 3 times in Agriculture research institute Mingora swat during 2021 the data on tomato leaf miner was recorded one day before treatment application and after 10 day and 20 days, after two spray application, percent damage was recorded by counting damage and healthy leaves. After 25 days of tomato plantation tomato leaf miner infestation was observed in the tomato field, a total of 3 application were done during the cropping season. After 1st application the lowest percent damage

was recorded in plot treated with Lambda cyhalothrin and the highest percent damage was recorded with Control plot (no insecticides applied). Similarly, after second treatment application same trend was recorded. These results are similar with findings of Bughdady *et al,* (2020) Nesreen *et al.* (2016), Kar (2017) and Bala *et al.* (2019) who recorded lambda cyhlothrin as most effective against tomato leaf miner. Similarly, Alam *et al,* (2019) and Illakwahhi *et al,* (2019) found that Neem leaf extract was most effective against tomato leaf minor in all the tested botanicals insecticides which is at par with findings of the current study.

Yield of tomato (kg ha^{-1}) was also improved with application of botanical extracts and synthetic insecticide highest yield 2761.7kg ha^{-1} was recorded from plot treated with lambda cyhalothrin. These results are similar with the findings of Floret *et al* (2018), Noor *et al,* (2015), Badii *et al* (2015) and Singh *et al,* (2005) who recorded that lambda cyhalothrin gives highest yield production in tomato. Usman *et al,* (2012), Nahak and Sahu (2015) also reported that neem leaf extract application provided high yield of tomato as compared to other botanical treatments. In the current study neem extract was also found best among the botanical extract.

Cost benefit ratio was also checked from different treatment applications. Plot treated with lambda cyhalothrin showed minimum cost of control for tomato leaf miner and provided maximum yield among all treatments. Cost benefit ratio was also high (1: 6.3) for Lambda cyhalothrin and was found more economical as compare to all other treatments.

CONCLUSION

Synthetic insecticide Lambda cyhalothrin was found most effective in suppressing tomato leaf miner. Similarly, the highest yield was recorded in synthetic insecticide Lambda cyhalothrin treated plot followed by neem extract. Cost benefit ratio were also high for Lambda treated plot as compared to other chemical insecticides.

Acknowledgements

The author are grateful to Dr. Fazal Maula (SRO) Agricultural Research Institute Mingora Swat and Gulwarin Khan for taking their keen interest and encouragement to carry out this research work.

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