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Efficacy of Synthetic Pesticides Against Thrips, *Thrips tabaci* Lindeman (Thysanoptera: Thripidae) on Okra *Abelmoschus esculentus* (L.) Moench

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Abstract

Okra (*Abelmoschus esculentus* L.) is an essential vegetable crop with good nutritional significance. Insect pests are the major threat for poor production of the okra crop. Thrips of vegetable crops are known to be serious pests on a wide range of fruit, vegetable, flower, and agronomic crops. The present field study was carried out to know the efficacy of different insecticides (acetamiprid 19% weightable water (ww), lambda 25% ww, colarphipare 32% ww, lambda 2.5% ww and abamectin 1.3% ww) against Thrips, *Thrips tabaci* (Lindeman) on okra crop during the year 2019, and observations against *T. tabaci* (Lindeman) were recorded after 24 hrs, 48 hrs, 72 hrs and 07 days of each spray in all the treatments. The pre-treatment count of thrips on okra was non-significant ($P > 0.05$); while the evaluated efficacy of different insecticides against thrips was significant ($P < 0.01$). It was noted that all the insecticides showed their highest efficacy after 7 days of spray and acetamiprid 19% weightable water (ww) was more efficient to combat the *T. tabaci* as compared to other pesticides that produced field efficacy of 73.92 and 74.91% against thrips after 7 days of 1st and 2nd spray respectively. Abamectin, 1.3% ww, was reasonably successful, yielding 53.81 and 56.66% field efficacy against *T. tabaci* (Lindeman) after 7 days of first and second spray. Also, moderately effective was colarphipare 32% ww, which developed field effectiveness of 56.41 and 61.49% against *T. tabaci* (Lindeman) after 7 days of first and second spray, respectively.

Keywords: efficacy, pesticides, acetamiprid, colarphipare, lambda, abamectin, Thrips, okra

1. Introduction

Okra (*Abelmoschus esculentus* L.) is important vegetable, belonging to the family Malvaceae. It is commonly known as Lady's finger, as well as by several names, including bhindi, okra, okura, lai long ma, gombo, bamia, and quimgombo, in the different geographical regions of its cultivation (Jain et al., 2012). Okra is probably a proficient dietary constituent rather than a staple food crop. Small industries (Surajbala Exports Private Limited, New Delhi, India and Hunan QiyiXinye culture media, Hunan, China) have utilized okra seeds for oil extraction in 2021. The most important facilities for okra are tropics, but subtropical frost sensitive (Oyelade et al., 2003), sensitive to low temperatures (Cheng & Bradford, 1999), water stress (May et al., 1990; Baloch, 1990; Yadav et al., 2001). Water-sensitive okra is a plant of the richest and lowest for the taste and state of nutritionally rich vegetables (Gopalana et al., 2007).

Thrips, *T. tabaci* (Lindeman) is a main limiting factor in reducing productivity and has been reported to cause significant economic losses of up to 30-50% (Nault and Shelton 2012). *T. tabaci* (Lindeman) is a worldwide pest that has been found on over 300 different host plants, including okra, onion, cabbage, garlic, cereals, and cotton, particularly wheat (Nault & Hessney, 2010). The damaging stages are nymphs and adults, which feed by rasping the leaves and other tissues of plants and sucking the sap, causing silver patches and streaks on the leaves. It can aggravate purple blotch indirectly, in addition to causing direct damage to foliage (Straub & Emmett, 1992).

Growers are usually exposed to the threat of insecticides, and 145 insect pest species attack the okra plant include mainly bollworms, sucking complexes (thrips, jassid, whitefly, piglets), mites, termites, leaf rollers, and cuts (Dhaka & Pareek, 2007). An infestation of sucking insect pests is always responsible for considerable economic losses in the production of okra crop in these significant insect pests (Mahal et al., 1994). Many researchers have reported and control of these insect pests through synthetic pesticides (Pawar et al., 1988; Mazumder et al., 2001; Kumar, 2004; Mani et al., 2005; Priya & Misra, 2007).

Continued use of toxic chemicals as pesticides is still a useful tool to deal with (Wahlla et al., 1998); pesticide resistance in targeted insect pests is also developed (Ahmad et al., 2010). Their efficacy must be assessed time after time to introduce new insecticides to ensure the quality and effectiveness of insect pest control (Singh & Singh, 1998).

One of the most common and popular controlling method of thrips on okra crop is the use of insecticides. These insecticides must be used with for management or control of any key pest, such as *T. tabaci* (Lindeman), considering cost economics and environmental damage. In light of this, an experiment was carried out to assess the efficacy of synthetic insecticides against *T. tabaci* (Lindeman) on okra under field conditions, and compare other insecticides for their effectiveness.

2. Method

2.1 Experiment Site

This study focused on the efficacy of synthetic pesticides against thrips, *T. tabaci* (Lindeman) on okra *Abelmoschus esculentus* (L.) Moench field. This research was performed at the Agriculture Research Institute Tandojam, Sindh, Pakistan, on 15th March 2019. The experiment was laid out in a Randomized Complete Block design (RCBD) with three replicated. Homogenous seeds of the okra variety, such as sabz pari, which is the standard commercial okra variety in Pakistan. This variety was grown on well-prepared ridges. The distance between a height to the ridge was 70 cm. Thinning was performed after a month of sowing, and the plant spacing was maintained by 30 cm. Six plots were designed for six treatments, contained within five synthetic pesticides and one control (untreated). Three times those six plots were replicated to adjust the overall variance.

2.2 Application of Pesticides

Pesticides were sprayed on okra crop against *T. tabaci* (Lindeman), when the apparent population of the *T. tabaci* (Lindeman) was at an economic threshold level (ETL) 5 to 10 thrips per plant, and the insect population was compared with control (untreated). A spray tank was cleaned carefully to avoid adding mixture before spraying of each insecticide. The knapsack sprayer which was hollow cone nozzles-disc and core type, powered by hand. Usually, in the morning, the spray was conducted.

These synthetic pesticides (acetamiprid 19% weightable water ww, lambda 25% ww, colarphipare 32% ww, lambda 2.5% ww, and abamectin 1.3% ww) were applied at their recommended dose (Table I). There was a total of six treatments. Five were insecticides, and one was control (untreated).

Table 1. The dose of treatments used against thrips *Thrips tabaci* (Lindeman)

Treatments	Active ingredient	Active ingredient Calculated dose Rate/16 liter water
T1	Acetamiprid	19% ww, 25 cc/16 litre water (500 ml/acre)
T2	Lambda	25% ww, 40 g/16 litre water (250 g/acre)
T3	Colarphipare	32% ww, 35 cc/16 litre water (250 ml/acre)
T4	Lambda	2.5% ww, 80 cc/16 litre water (1000 ml/acre)
T5	Abamectin	1.3% ww, 30 cc/16 litre water (500 ml/acre)
T6	Control (untreated)	(untreated)

2.3 Data Collection

The thrips pre-treatment observation count was recorded one day before each spray, while thrips post-treatment count was made after 24 hours, 48 days, 72 hours, and one week after each spray of respective insecticides. The population of thrips observed based on three leaves per plant of okra crop (one each from the top, middle, and bottom parts) in its early stage of growth and at the time of harvesting, fruiting bodies were picked out from control and treated plots, and compared to observe the efficacy of synthetic pesticides against thrips, *T. tabaci* (Lindeman) on okra and its average was a workout.

2.4 Statistical Analysis of Data

Analysis of the difference was carried out on all data collected by the average reduction percentage and preceded by Gomez and Gomez (1984) to determine treatment superiority, Statistical analysis of data with the help of Satistix 8.1 software.

2.5 Research Design of Experiment

The experiment was planned as a randomized complete block design (RCBD) for a plant of 3 × 5 meters (15 m^2). Each plot was measuring 1 m × 3 m had three replications and 1 m alloys between the plots and blocks. 45 plots with 24 plants stretching 60 cm × 45 cm per plot were created.

RI		RII		RIII
T4	PATH	T2	PATH	T5
T2		T6		T3
T5		T4		T6
T1		T3		T2
T3		T1		T4
T4		T5		T1

3. Results

3.1 1st Spray

Different insecticides controlled the insect population to evaluate their efficacy against thrips *T. tabaci* (Lindeman), and the results showed that the differences in thrips population in plots kept for various treatments was non-significant for pre-treatment insect population (F = 1.11; DF = 17; P > 0.4355); and the thrips population varied significantly when the observation was made after 24 hours of spray (F = 5.67; DF = 17; P = 0.0093), after 48 hours of spray (F = 12.32; DF = 17; P < 0.0000), after 72 hours of spray (F = 37.65; DF = 17; P < 0.0000) and at final observation after seven days of spray (F = 65.66; DF = 17; P < 0.0000). The *T. tabaci* (Lindeman) mortality recorded at different intervals after treatment due to various synthetic pesticides up to one week after spray is presented in Table-II. The efficacy of insecticides increased with the progression in time after spray. After 24 hrs, 48 hrs, 72 hrs, and 07 days of the first spray, the efficacy of acetamiprid 19% ww against thrips was highest (16.00, 29.44, 40.73, and 73.92%), followed by colarphipare 32% ww (17.00, 29.98, 41.89 and 56.41%), abamectin 13% ww (19.00, 27.91, 42.26 and 53.81%), lambda 2.5% ww (20.00, 30.40, 39.45 and 48.53%) and lambda 25% ww (5.00, 19.25, 36.01 and 46.25%), respectively. Thrips population was minimized from okra crop in plots where the acetamiprid 19% ww was sprayed with 73.92% insect mortality when recorded after one week of spray. Acetamiprid proved to be maximally effective to combat thrips infestation from okra fields. Among the other evaluated insecticides, colarphipare 32% ww and abamectin 13% ww also gave good thrips mortality; but lambda 25% ww and lambda 2.5% ww remained on the lower side of efficacy against thrips. It was concluded that for achieving effective control of thrips, the pesticide acetamiprid 19% WW might be sprayed.

3.1 2nd Spray

The efficacy of synthetic pesticides against thrips *T. tabaci* (Lindeman) population was investigated, and the second spray results revealed that there was a non-significant difference in thrips population between treatments for pre-treatment (F = 1.12; DF = 17; P > 0.4071); and significant difference in thrips population was recorded when the observation was made after 24 hours of spray (F = 4.46; DF = 17; P = 0.0214), after 48 hours of spray (F = 6.67; DF = 17; P < 0.0056), after 72 hours of spray (F = 11.56; DF = 17; P < 0.0007) and when recorded after seven days of spray (F = 31.77; DF = 17; P < 0.0000). The second spray efficacy data of certain pesticides against *T. tabaci* (Lindeman) at different intervals after treatment up to one week of spray are shown in Table-III. There was simultaneous improvement in the pesticide efficacy with the advancement of time after spray. After 24 hrs, 48 hrs, 72 hrs, and 07 days of the second spray, the efficacy of acetamiprid 19% ww against thrips was 17.99, 32.19, 42.96 and 74.91%, followed by colarphipare 32% ww (19.94, 36.04, 51.86 and 61.49%), abamectin 13% WW (6.01, 14.36, 44.39 and 56.66%), lambda 25% ww (19.06, 33.42, 44.65 and 58.49%) and lambda 2.5% ww (21.03, 35.42, 43.79 and 52.28%), respectively. It is evident from the results that acetamiprid 19% ww produced a remarkable performance with the highest thrips mortality, and thrips population was diminished to the lowest in plots where acetamiprid was sprayed; while colarphipare 32% ww and abamectin 13% ww showed a little recovery, but lambda 25% ww and lambda 2.5% ww were least effective against the thrips on okra crop. Hence, for dealing with thrips population on okra, the crop may be sprayed with acetamiprid 19% ww as the mortality of thrips was higher in plots sprayed with acetamiprid compared to the rest of the evaluated pesticides.

Table 2. Effect of synthetic pesticides on the population of thrips, *Thrips tabaci* (Lindeman) on okra at different intervals after the first spray

Treatments	Pre-treatment	24-hrs		48-hrs		72-hrs		7-days	
		Decrease	Efficacy %	Decrease	Efficacy %	Decrease	Efficacy %	Decrease	Efficacy %
Acetamiprid 19% ww	10.39	1.66	16.00	3.06	29.44	4.23	40.73	7.68	73.92
Lambda 25% ww	11.98	0.60	5.00	2.31	19.25	4.31	36.01	5.54	46.25
Colarphipare 32% ww	9.61	1.63	17.00	2.88	29.98	4.03	41.89	5.42	56.41
Lambda 2.5%ww	9.83	1.97	20.00	2.99	30.40	3.88	39.45	4.77	48.53
Abamectin 1.3% ww	10.28	1.95	19.00	2.87	27.91	4.35	42.26	5.53	53.81
Control	11.00	0.34	3.00	0.45	3.97	0.56	4.93	0.11	1.00
S.E.±			*0.663*		*0.563*		*0.446*		*0.335*
LSD 0.05			*1.406*		*1.265*		*0.956*		*0.777*
CV%			*14.43*		*16.14*		*15.79*		*17.44*

Table 3. Effect of synthetic pesticides on the population of thrips, *Thrips tabaci* (Lindeman) on okra at different intervals after the second spray

Treatments	Pre-treatment	24-hrs		48-hrs		72-hrs		7-days	
		Decrease	Efficacy %	Decrease	Efficacy %	Decrease	Efficacy %	Decrease	Efficacy %
Acetamiprid 19% ww	8.17	1.47	17.99	2.63	32.19	3.51	42.96	6.12	74.91
Lambda 25% ww	7.66	1.46	19.06	2.56	33.42	3.42	44.65	4.48	58.49
Colarphipare 32% ww	7.27	1.45	19.94	2.62	36.04	3.77	51.86	4.47	61.49
Lambda 2.5% ww	8.13	1.71	21.03	2.88	35.42	3.56	43.79	4.25	52.28
Abamectin 1.3% ww	7.66	0.46	6.01	1.10	14.36	3.40	44.39	4.34	56.66
Control	7.62	0.23	3.02	0.30	3.94	0.27	3.54	0.01	0.13
S.E.±			*0.402*		*0.548*		*0.554*		*0.492*
LSD 0.05			*0.896*		*1.222*		*1.234*		*1.097*
CV%			*7.44*		*11.71*		*14.25*		*15.84*

4. Discussion

Insecticide resistance has become a significant concern, and new insecticides of the modern formulation are registered to tackle the infestation of insect pests. The goal of this study is to examine the effectiveness of certain synthetic pesticides such as acetamiprid, 19% ww, lambda, 25% ww, colarphipare, 32% ww, lambda, 2.5% ww, and abamectin, 1.3% ww against Thrips, *T. tabaci* (Lindeman) on okra crop.

The results of this study revealed that all the insecticides tested had the highest effectiveness in combating target insect pests after 7 days of spraying, and acetamiprid's 19% of ww was more successful than other insect pests achieving field efficacity of 73.92 and 74.91% against thrips after 7 days of first and second sprays. The effectiveness of abamectin 13% ww was medium to 53.81% and 56.66% against thrips, *T. tabaci* (Lindeman) after 7 days of first and second sprays also reasonably successful was colarphipare 32% WW to achieve field effectiveness of 56.41 and 61.49% against thrips after 7 days of first and second spray, respectively. acetamiprid, 19% of ww, reported a higher efficacy against Thrips, *T. tabaci* (Lindeman), followed by colarphipare 32% of ww and abamectin 1.3% of ww, while lambda 25% of the ww and lambda 2.5% of the ww have become a less efficient substance in terms of performance. Several previous scholars somewhat supported the above results. Many insecticides are currently present in the local market, but in recent years, the effectiveness of these insecticides was a question mark for farmers Akbar et al. (2012) proposed the maximal reduction in the whitefly population (70.54%) in okra, jassid (73.08%) and aphid (74.58%) by novastar, with endosulphan and prophenofos, while Jarwa et al. (2014) demonstrated that Novastar 56 EC (bifenthrien 6% and abamectin 0.07%). Novastar also decreased the population with full thrips (66.48%). In the sense of pesticide use for okra insect pests, Mahmood et al. (2014) recorded a 92.62% reduction in the population. Muhammad et al. (2004) tested many synthetic pesticides for their effectiveness with insecticides and found that the management of okra insect pests is effective with all synthetic pesticides. Hassan et al. (2006) analyzed fenoxycarb against sucking the cotton/okra insect pest complex and reported that fenoxycarb application against sucking insect pests was less successful. Dhaka and Pareek (2007) reported that okra is being invaded heavily by the sucking of insect pests. The chemical regulation of sucking insects on okra was found by Bardin et al. (2008) to be more effective than any other control steps. Yadav et al. (2008) observed that endosulfan okra treatment decreased the jassids population to 0.68 per 5 plants at 15 days, while Pareet and Basavanagoud (2008) established that emamectin benzoate and spinosad (158.51 and 153.23 q/ha respectively) had the highest marketable fruit yields. Vishwakarma et al. (2009) found that synthetic pesticides were efficient in their efficacy when used alone. Still, the effectiveness in the control of insect pests was significantly improved when synthetic pesticides and plant extracts were mixed. Dimethoate application (234.9 g) and lamb dacyhalothrin (244.9 g) has been successfully controlled for Hasan (2010) with the effectiveness of eight insecticides and with the highest yield. The findings and outcomes of the current research carried out in various parts of the world are similar. Chemicals are recorded in multiple countries and sold with different labels; nevertheless, their effectiveness varied due to genetic resistance in the plant varieties. The factors related to resistance to the suction complex have also been recorded in the studies. Further studies are required as acetamiprid was found to yield desirable results in 19% WW, particularly because this product gave 100% effectiveness against thrips, *T. tabaci* (Lindeman) severely infested okra crop. In contrast, other products were moderate to least effective against thrips, *T. tabaci* (Lindeman).

5. Conclusions

Acetamiprid 19% ww showed higher efficacy against *T. tabaci* (Lindeman), followed by colarphipare 32% ww, abamectin 1.3% ww, lambda 25% ww and lambda 2.5% ww. All the insecticides showed their highest efficacy after 7 days of spray. Second spray efficacy of synthetic pesticides was relatively higher than their first spray efficacy. Pesticides colarphipare 32% ww and abamectin 1.3% ww showed some encouraging results regarding their efficacy against the *T. tabaci* (Lindeman); but lambda 25% ww or lambda 2.5% ww did not produce promising results regarding their efficacy against the *T. tabaci* (Lindeman).

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