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Efficacy of Synthetic Pesticides against Whitefly, *Bemisia tabaci* (Genn.) in Okra

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Abstract- The field evaluation of some synthetic pesticides (Acetamiprid 19% weightable water (WW), Lambda 25% WW, Colarphipare 32% WW, Lambda 2.5% WW, and Abamectin 1.3% WW), for their efficacy, were performed against Whitefly, *Bemisia tabaci* (Genn.) on okra crop, Tandojam, Sindh, Pakistan during 2016 and observations were to against the target insect pests after 24 hrs., 48 hrs., 72 hrs., and 07 days of each spray in all the treatments. The pre-treatment count of the whitefly on okra was non-significant different from the toxicity of pesticides ($P>0.05$). In contrast, the evaluated efficacy of different insecticides against whitefly was significantly different from the toxicity of pesticides ($P<0.01$). All the pesticides showed their highest efficacy after seven days of spray, and Acetamiprid 19% weightable water (WW) was more useful to combat the target insect pests as compared to other pesticides that produced field efficacy of 93.06 and 95.47% against whitefly after seven days of 1st and 2nd spray respectively. Abamectin, 1.3% WW, was moderately effective that produced field efficacy of 57.44 and 50.91% against whitefly after seven days of 1st and 2nd spray, respectively. Colarphipare, 32% WW, was also moderately effective that produced field efficacy of 66.73 and 62.31% against whitefly after seven days of 1st and 2nd spray, respectively. Acetamiprid, 19% WW, showed higher efficacy against sucking complex, followed by Colarphipare 32% WW and Abamectin 1.3% WW, while Lambda 25% WW and Lambda 2.5%WW were least effective. Acetamiprid 19% showed 100% efficacy against whitefly both during 1st and 2nd spray after 07 days of spray.

Keywords- Bemisia tabaci (Genn.), Pesticides, Acetamiprid, Colarphipare, Lambda, Abamectin.

I. INTRODUCTION

Okra is also called lady's finger in English and Bhindi in South Asian languages, while botanically, it is named *Abelmoschus esculentus* (L.) Moench. It is a vegetable crop in the Malvaceae family [1], originated in different African regions, including Ethiopia and Sudan. Okra is well-known for its taste and status of nutritionally rich vegetables [2], liked by rich and poor alike, particularly in the south Asian region. It thrives best is tropics as well as subtropics but frost sensitive [3], sensitive to low temperature [4], and water stress [5],[6],[7],[8],[9]. A wide range of adaptability has been reported for soils [10], but drained and fertile soil is most suitable under optimum levels of soil organic matter. Other essentials required nutrient elements [11],[12].

The growers usually face the threat of insect pests. Some 145 species of insect pests attack okra plant mainly include bollworms, sucking complex whitefly mites, termite, leaf-roller, and cutworm [13] of these significant insect pests, sucking insect pest infestation always causes high economic losses in okra crop [14], which mainly included whitefly [15] and control of these insect pests by the synthetic pesticides have reported by many researchers [16],[17],[18],[19].

Chemical control of the sucking complex is yet an effective tool to deal with [20]. With the introduction of new insecticides, their efficacy level needs to be evaluated from time to time to ensure their quality and efficacy to control insect pests [22]. Evaluated a few synthetic pesticides for controlling okra insect pests, including cypermethrin, carbaryl, abamectin, deltamethrin, diflubenzuron, fenvalerate, fluvalinate, monocrotophos, and quinalphos [23]. [24] recommended cypermethrin, fenvalerate, or decamethrin to combat sucking complex resulting yields of 2.23, 2.26 and 2.14 tons ha^{-1}, respectively. [32] stated that of okra insect pests treated with alphamethrin, fenvalerate, cypermethrin, chlorpyrifos, and triazophos @250, 250, 500, 1000 and 1500 ml ha^{-1}, respectively resulted in 100% mortality when monitored after 72 hours of spraying.

The insect pests invade okra fields from germination to maturity and reported yield losses of 19-20 percent [21]. In treated plots, the insect pest infestation was only 03 percent, and it was well below the economic threshold

level of different insect pests attacking okra and cotton [22]. Cypermethrin, carbaryl, deltamethrin, diflubenzuron, fenvalerate, fluvalinate, monocrotophos, and quinalphos were effective pesticides for okra and cotton insect pests [23],[24]. [25] showed that sucking complex population was reduced maximally for whitefly (70.54%) in okra, while Novastar maximally reduced jassid (73.08%) and aphid (74.58%) population; moreover, Novastar also reduced maximum thrips population (66.48%). Hence, the present study was taken into consideration to evaluate the efficacy of some insecticides available in the market against the sucking complex of okra under field conditions.

Objectives

1. To examine the efficacy of different insecticides against sucking complex on okra.
2. To compare different insecticides for their efficacy against sucking complex on okra.

II. RELATED WORK

To investigate the effectiveness of various insecticides available in the market against okra insect pests and found cypermethrin, carbaryl, abamectin, deltamethrin, diflubenzuron, fenvalerate, fluvalinate, monocrotophos and quinalphos effective against sucking complex in okra [23]. To examine losses in okra, yield due to insect pest invasion, and reported that the insect pests invade okra fields from germination to maturity and reported yield losses of 19-20 percent [21]. The effectiveness of various synthetic pesticides against sucking complex in okra and reported that Novastar and Abamectin showed maximum reduction in whitefly population (70.54%) in okra; while jassid (73.08%) and aphid (74.58%) population was maximally reduced by Novastar; moreover, Novastar also reduced maximum thrips population (66.48%) [25]. Muhammad et al. (2004) performed experiments to evaluate the efficacy of different synthetic pesticides including Nighaban, Talstar, Patriot, Taophos, Larvin, Tracer, Lorsban, Vital, Tracer and sprayed for their efficacy against okra insect pests and found that all the synthetic pesticides were effective to control okra insect pests [27].

III. METHODOLOGY

During 2016, this study focused on the efficacy of synthetic pesticides against whitefly, *bemisia tabaci* (genn.) in okra field. This research was performed at the agriculture research institute Tandojam. The study was carried out with three replicates in a randomized complete block design (rcbd). Homogenous seeds of the okra type, such as sabz pari, which were grown on well-prepared ridges on 9 March 2016, with a ridge up to a ridge of 70 cm. thinning was performed after a month of sowing, and the field spacing was maintained by 30 cm. Six plots were designed for six treatments, including synthetic pesticides and control (untreated). Such six plots were repeated to change the average variance by three quarters. Once the obvious population of the target pests at economic threshold levels (etls) and of insects relative to control (untreated) is released on okra crop against whitefly the pesticides as indicated in the treatment program. The spray tank was washed carefully before each insecticide was sprayed. A knapsack sprayer powered by hand. Usually spray of pesticides, done during the morning time. The pre-treatment observation on each pest count was recorded one day before each spray, while post-treatment pest count was made after 24 hours, 48 days, 72 hours, and one week after each spray of respective insecticides. Pest population observed based on three leaves per plant of okra crop (one each from the top, middle, and bottom portion) 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 whitefly, *Bemisia tabaci* (genn.) in okra and its average was a workout.

Data analysis

To determine the superiority of the mean treatment L.S.D test followed by Gomez and Gomez (1984); all the data collected were subject to analysis of variation by software Statistix 8.1.

Layout plan of Experiment

Design : RCBD
Plot Area : 3 x 5 meter (15m2)
Replications : Three

T4	PATH	T2	PATH	T5
T2		T6		T3
T5		T4		T6
T1		T3		T2
T3		T1		T4
T4		T5		T1

Treatments:

There were total six treatments. Five were insecticides and one was control (untreated). They are:

- T1 = Acetamiprid 19% WW, 25 cc/16 lit water (500 ml/acre)
- T2 = Lambda 25% WW, 40 g/16 lit water (250 g/acre)
- T3 = Colarphipare 32% WW, 35 cc/16 lit water (250 ml/acre)
- T4 = Lambda 2.5% WW, 80 cc/16 lit water (1000 ml/acre)
- T5 = Abamectin 1.3% WW, 30 cc/16 lit water (500 ml/acre)
- T6 = Control (untreated)

IV. RESULTS AND DISCUSSION

1st Spray

The efficacy of insecticides against whitefly *Bemisia tabaci* population after first spray was non-significant for pre-treatment insect population (F=0.69; DF=17; P>0.6664); and significant for observation after 24 hours of spray (F=16.41; DF=17; P=0.0003), after 48 hours of spray (F=37.33; DF=17; P<0.0000), after 72 hours of spray (F=76.32; DF=17; P<0.0000) and after seven days of spray (F=107.29; DF=17; P<0.0000). The efficacy of selected insecticides against *Bemisia tabaci* after a certain time of periods up to one week of spray, presented in Table-1.

Table 1: Effect of Synthetic Pesticide on the Population of Whitefly in 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	5.19	1.87	36.03	3.07	59.15	4.68	90.17	4.83	93.06
Lambda 25% WW	5.51	1.11	20.15	1.77	32.12	1.92	34.85	2.81	51.00
Colarphipare 32% WW	5.29	1.17	22.12	1.60	30.25	3.09	58.41	3.53	66.73
Lambda 2.5%WW	5.51	1.33	24.14	1.74	31.58	2.46	44.65	2.92	52.99
Abamectin 1.3% WW	5.78	1.57	27.16	2.07	35.81	2.85	49.31	3.32	57.44
Control	6.22	-0.13	-2.09	-0.06	-0.96	-0.19	-3.05	-0.08	-1.29
S.E.±			*0.8381*		*0.8942*		*0.7598*		*0.8126*
LSD 0.05			*1.6219*		*1.9231*		*1.6464*		*1.4413*
CV%			*7.61*		*11.91*		*17.40*		*12.13*

The efficacy of insecticides increased with the progression in time after spray and after 24 hrs, 48 hrs, 72 hrs and 07 days of 1st spray the efficacy of Acetamiprid 19% WW was 36.03, 59.15, 90.17 and 93.06%, followed by Colarphipare 32% WW (22.12, 30.25, 58.41 and 66.73%), Abamectin 13% WW (27.16, 35.81, 49.31 and 57.44%), Lambda 2.5% WW (24.14, 31.58, 44.65 and 52.99%) and Lambda 25% WW (20.15, 32.12, 34.85 and 51.00%), respectively.

The whitefly vanished from okra crop in plots where the Acetamiprid 19% WW sprayed, showing maximum insect mortality when recorded after one week of spray, and Acetamiprid proved to be maximally effective to combat whitefly infestation from okra fields. Among the evaluated insecticides, Colarphipare 32% WW and Abamectin 13% WW also gave considerable whitefly mortality. Still, Lambda 25% WW and Lambda 2.5% WW remained on the lower side of efficacy against whitefly on okra crop. It concluded that for achieving effective control of whitefly, the pesticide Acetamiprid 19% WW might be sprayed.

2nd Spray

The efficacy of synthetic pesticides against whitefly *Bemisia tabaci* population investigated and the second spray results revealed that there was a non-significant difference in whitefly population between treatments for pre-treatment (F=1.07; DF=17; P>0.4356); and significant difference in whitefly population recorded when the observation made after 24 hours of spray (F=5.66; DF=17; P=0.0099), after 48 hours of spray (F=12.33; DF=17; P<0.0000), after 72 hours of spray (F=36.40; DF=17; P<0.0000) and when recorded after seven days of spray (F=65.66; DF=17; P<0.0000). The second spray efficacy data of certain pesticides against *Bemisia tabaci* at different intervals after treatment up to one week of spray shown in Table-2.

Table 2: Effect of synthetic pesticide on the population of whitefly in 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	4.86	1.75	36.01	2.87	59.05	4.39	90.33	4.64	95.47
Lambda 25% WW	5.78	0.87	15.05	1.60	27.68	2.23	38.58	2.80	48.44
Colarphipare 32% WW	5.28	0.58	10.98	1.10	20.83	2.80	53.03	3.29	62.31
Lambda 2.5%WW	5.51	0.72	13.07	1.34	24.32	1.88	34.12	2.43	44.10
Abamectin 1.3% WW	5.50	0.39	7.09	1.15	20.91	1.90	34.55	2.80	50.91
Control	6.48	0.19	2.93	0.25	3.86	0.17	2.62	0.09	1.39
S.E.±			*0.5634*		*0.5099*		*0.4256*		*0.3466*
LSD 0.05			*1.2553*		*1.1363*		*0.9483*		*0.7722*
CV%			*14.43*		*15.09*		*15.79*		*16.66*

There was a simultaneous improvement in the pesticide efficacy with the advancement of time after spray. After 24 hrs, 48 hrs, 72 hrs and 07 days of 2nd spray the efficacy of Acetamiprid 19% WW against whitefly was 36.01, 59.05, 90.33 and 95.47%, followed by Colarphipare 32% WW (10.98, 20.83, 53.03 and 62.31%), Abamectin 13% WW (7.09, 20.91, 34.55 and 50.91%), Lambda 25% WW (15.05, 27.68, 38.58 and 48.44%) and Lambda 2.5% WW (13.07, 24.32, 34.12 and 44.10%), respectively.

There was a remarkable performance of Acetamiprid 19% WW. With the spray of this pesticide, the whitefly was almost disappeared from okra fields when the observation recorded after one week of spray. All the pesticides showed their relative maximum efficacy after one week of spray. Moreover, Colarphipare 32% WW and Abamectin 13% WW also showed reasonable control of whitefly but not remarkably controlled the insect infestation, while Lambda 25% WW and Lambda 2.5% WW regarded as the pesticides least effective against the whitefly on okra crop. Hence, for combating whitefly from okra fields, the crop may be sprayed with Acetamiprid 19% WW that produced 100 percent mortality of whitefly when recorded after seven days of the second spray

DISCUSSION

Insect resistance to insecticides has become a significant issue, and new insecticides are registered with original composition to combat insect pest infestation. This study aimed at examining the efficacy of some synthetic pesticides including Acetamiprid 19% WW, Lambda 25% WW, Colarphipare 32% WW, Lambda 2.5%WW, and Abamectin 1.3% WW against Jassid, *Amrasca biguttula biguttula* (Ishida), Whitefly, *Bemisia tabaci* (Genn.) and Thrips, *Thrips tabaci* (Lindeman) on okra crop. Colarphipare, 32% WW, was also moderately effective that produced field efficacy of 53.61 and 53.41% against jassid; 66.73 and 62.31% against whitefly, 56.41, and 61.49% against thrips after 7 days of 1st and 2nd spray, respectively. Acetamiprid, 19% WW, showed higher efficacy against sucking complex, followed by Colarphipare 32% WW and Abamectin 1.3% WW, while Lambda 25% WW and Lambda 2.5%WW were least effective. Acetamiprid 19% showed 100% efficacy against whitefly both during 1st and 2nd spray after seven days of spray. Several past researchers partially support the above findings. [23] evaluated several synthetic pesticides for controlling okra insect pests. They found that cypermethrin, carbaryl, abamectin, deltamethrin, diflubenzuron, fenvalerate, fluvalinate, monocrotophos, and quinalphos were effective in controlling the insect pests infesting okra and cotton plantation. Several insecticides are currently available in the local market may be with changed labels. [25] showed that Novastar 56 EC, (Bifenthrien 6% EC and abamectin 0.07%) caused Novastar maximally reduced maximum population reduction of whitefly (70.54%) in okra, jassid (73.08%) and aphid (74.58%) population. Novastar also reduced the maximum thrips population (66.48%). [26] reported a 92.62% reduction in the *Bemisia tabaci* population by pesticidal application against okra insect pests. [27] evaluated several synthetic pesticides for their efficacy against okra insect pests and found that all the synthetic pesticides were effective in controlling okra insect pests. [28] examined fenoxycarb against sucking insect pest complex of cotton and okra and reported that the application of fenoxycarb was less effective against sucking insect pests. [13] reported that okra is heavily attacked by sucking insect pests (thrips, jassid, whitefly, aphid, termite). [29] found chemical control of sucking insects on okra more reliable than any other control measures. [30] revealed that the treatment of okra with endosulfan at 15 days interval brought down the jassids population up to 0.68/5 plants, while [31] found that the highest marketable fruit yields recorded by emamectin benzoate and spinosad (158.51 and 153.23 q/ha, respectively). [32] found that the efficacy of synthetic pesticides was satisfactory when used alone. Still, when combining the synthetic pesticides and plant extracts, the efficacy was increased remarkably in suppressing the insect pests. [33] determined the efficacy of eight insecticides and the highest yield observed with the application of Dimethoate (234.9g) and Lamb-dacyhalothrin (244.9g) by controlling the sucking complex and bollworm complex effectively. The findings of the current study and the results of the researches conducted in different parts of the world are well comparable. However, the chemicals are registered and marketed with varying labels in different countries. Still, the efficacy varied with the crop variety because of genetic resistance. At the same time, the factors related to the resistance of sucking complex to different insecticides have also been reported in the studies. Further studies are required because, in the present investigation, Acetamiprid 19% WW found to be giving desired results, mainly this product gave 100 percent efficacy against whitefly infesting okra crop severely. In contrast, other products were moderate to least effective against the sucking complex.

V. CONCLUSION AND FUTURE SCOPE

The results concluded that; Acetamiprid, 19% WW, showed higher efficacy against *Bemisia tabaci*, followed by Colarphipare 32% WW, Abamectin 1.3% WW, Lambda 25% WW, and Lambda 2.5%WW. Acetamiprid 19% showed more than 90% efficacy against whitefly both during 1st and 2nd spray after seven days of spray. All the insecticides showed their highest efficacy after seven days of spray. The 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 sucking complex. Still, Lambda 25% WW or Lambda 2.5%WW did not produce promising results regarding their effectiveness against the target insect pests. Over time several pesticides have slowly lost their efficiency for the reason that insect pests have developed resistance. A significant reduction in sensitivity to a pesticide, which reduces the field performance of these pesticides. This study will be helpful in future.

RECOMMENDATIONS

On the basis of findings of the present research, it is recommended that Acetamiprid 19% WW may be sprayed against sucking complex and very particularly against the whitefly on okra.

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Conflict of Interest

The author declares no conflict of interest.

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Author's Contributions

Hira Mannan Shaikh: Conducted the experiment, compiled the results, Manuscript Editing (Plagiarism Checking and correction, Grammatical Error Corrections) and Correspondence for Publications.

Razique Ali Nahiyoon: Article Planning, Literature Survey, Final Manuscript Preparation.

Jilian Li: Proofing Reading and Editing.

Maqsood Ali Laghari: Referencing of Article

