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Relative Efficacy Of Synthetic And Botanical Insecticides Against Pea Leaf Miner (Phytomyza Horticola) On Pea Crop

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Abstract

The study was carried out to observe the relative efficacy of botanicals and synthetic insecticides viz., Onion bulb (200ml/l), Neem leaves (500ml/l), Garlic bulb (100ml/l), Tobacco leaves (150ml/l), Spintoram 120SE and Lambda cyhalothrin 2.5 EC against pea leaf miner at farmer field in Kalam, District Swat during 2019. Randomized Complete Block Design (RCBD) was used with three replications. Total three spray were applied when the infestation reaches to economic threshold level (ETL). The data were recorded on weekly interval. The least means percent infestation was recorded in plot treated with Lambda cyhalothrin (5.58), followed by Spintoram (9.22). The botanical extracts also reduce the means percent infestation of pea leaf miner viz., Neem leaves (14.06), Onion bulb (13.97), Tobacco leaves (13.76) and Garlic bulb (13.46) as comparatively to control. The highest means percent infestation was recorded in untreated plot (39.69). The highest yield and CBR was recorded in plot treated with Lambda cyhalothrin (3482kg/ha, 1:17.27), followed by Spintoram (2965kg/ha, 1:13.09). All the chemicals and botanicals insecticides reduce infestation and improved yield of the crop. But chemical insecticides Lambda cyhalothrin is recommended for the better management of pea leaf miner.

Keywords. Pea, Leaf miner, Plant extracts, Chemicals, Swat.

INTRODUCTION

Pea is an important and one of the oldest crops domesticated worldwide, belong to the family Leguminosae (Zohary and Hopf, 2000; Ambrose, 1995). It consists of almost all the basic nutrients which fulfil the body requirements like carbohydrates, proteins, dietary fibers, minerals, vitamins and antioxidant compounds (Urbano et al., 2005).

Pea covers around 100,000 ha area in Pakistan with production of less than 1000 kg/ha. The total area of Pakistan under pea cultivation was 24854 ha with production of 170826 tons (MNFSR 2018-19). In KPK, the production of the crop was 15789 tones cultivated on an area of 1959 ha. Regardless of high number of cultivars, the production is not up to international standard due to certain factors including disease, pest attack, less weed control and poor cultural practices (Khan et al., 2013).

Pea leaf miner (Phytomyza horticola Goureau) is the most serious insect pest of pea which cause 90 damage to the crop. The pest harm young leaves by making mines result in stunt growth and less production of flower (Tariq et al., 1991). It causes reduction in the aesthetic value of ornamental plants and crop yield. The spongy tissues, palisade density and thickness of epidermal wall provides barriers to oviposition (Wei et al., 2000).

Many insect pests showed resistance to chemical insecticides due to excessive use. Annually billions of dollars have been invested to reduce pest attack (Pereira et al., 2006). Plant extracts are friendly to the environment, beneficial insect and safe as compared to synthetic insecticides (Hussain et al 2022). About 2400 bioactive plants have been discovered to have insecticidal and anti-pathogenic properties (Karunamoorthi, 2012). These botanicals proved as an excellent alternative to pesticides (Sithisut et al., 2011). It is important to compare the efficacy of insecticides against pests for effective pest management and to reduce the indiscriminate use of insecticides. Thus, the present study was planned to evaluate different products available in the market for their efficacy against leaf miners on pea crop.

MATERIALS AND METHODS

Experiment was conduction at Distract Swat, Kalam during 2019 to evaluate the Relative efficacy of Synthetic and Plant extracts against Pea leaf miner (Phytomyza horticola)

Experimental Design

The experiment was conducted at Randomized complete block design (RCBD) with 7 treatments along with control, triplicated 3 times. Pea variety (Alaska) were sown. Row to row and plant to plant distance was kept 40cm and 15cm respectively. Chemical insecticides Lambda cyhalothrin 2.5EC and Radient 120SE (Spintoram) were purchased from local market. Botanical extracts via Neem oil, garlic bulb, Onion bulb and tobacco dry leaves extracts were prepared in lab.

Preparation of botanical extracts

Garlic bulb extracts were obtained by crushing 20gm of dried garlic bulb and mixed it with 100 ml of water for 24hrs. The solution were filtered through muslin cloth to remove impurities. The solution were then added with 1 liter of water for field use.

For tobacco extracts, 30 gm of dried tobacco leaves were crushed and kept in 150ml of water for 24hrs. The solution were than filtered through muslin cloth and were used in field @ 6ml in 1L water (Sohail et al., 2012).

Neem (Azadirachta indica) extracts were obtained by crushing 50gm dry neem leaves and added with 500ml of water. The solution was then filtered for field use.

To obtained onion bulb extract, 25gm of onion bulb were crushed and mixed with 200ml of water for 48hours. The solution was filtered through muslin cloth and mixed one liter of water for field solution.

Data recorded of pea leaf miner (Phytomyza horticola) **and yield kg/ha**

Data were recorded by randomly selected 3 plants in each treatment. The plants were divided into 3 portions i.e. top, middle and lower to observe the damage done by pea leaf miner. The data were recorded before 24hours and then after weekly interval. The observed damaged leaves and yield were converted into percent damage and kg/ha by using the following formulas:

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

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

CBR and Statistical analysis

CBR was obtained in term of best treatment by using the methods of Hussain et al. (2022). Statistical analysis was done by statistical software (Statistix 8.1). Mean was separated using LSD Test at P≤ 0.05.

RESULTS

Before spray application, all the untreated plots were nonsignificant. After first week of spray application the maximum percent leaves infestation was recorded in untreated plot (35.60) followed by tobacco leaves extracts (19.03) which was statistically similar to onion bulb extracts (18.76), neem leaves extract (18.26) and garlic bulb extracts (17.66) respectively. The minimum percent leaves infestation was recorded in lambda cyhalothrin (3.71) followed by spintoram (9.58).

After second week the highest percent leaves infestation was reported in untreated plot (39.60) followed by garlic bulb (13.83) which was non-significant to tobacco leaves (13.60), Onion bulb (12.76) and Neem leaves (11.43) respectively. The least percent leaves infestation were recorded in plot treated with lambda cyhalothrin (2.41) followed by Spintoram (7.91).

In 3rd week of spray application, the highest percent leaves infestation was recorded in untreated plot (42.12) followed by botanical extracts garlic bulb (10.43) which was statistically non-significant to neem leaves (9.98), tobacco leaves (9.72) and Onion bulb (9.20) respectively. The least percent leaves infestation were recorded in plot treated lambda cyhalothrin (1.37) followed by Spintoram (5.26).

In 4th week of spray application the highest percent infestation was observed in untreated plot (43.83) followed by botanical extracts neem leaves (9.11) which was statistically similar to onion bulb (8.25), garlic bulb (8.23) and tobacco leaves (7.91) respectively. The least percent infestation was reported in plot treated lambda cyhalothrin (1.17) followed spintoram (4.68).

After 5th week of spraying application the maximum percent infestation of leaves was observed in untreated plot (45.06) followed by botanical extracts onion bulb (9.96) which was similar to neem leaves (9.78). The minimum percent infestation was observed in plot treated with lambda cyhalothrin (1.02) followed by Spintoram (4.30).

After 6th week of spray application the highest percent infestation was observed in untreated plot (40.73) followed by onion bulb (9.02), neem leaves (8.89) and garlic bulb (8.05) respectively. The least percent infestation of leaves was recorded in plot treated with lambda cyhalothrin (0.85) followed by Spintoram (4.07).

The highest means percent infestation was reported in untreated plot (39.69) followed by botanical extracts neem leaves (14.06), onion bulb (13.97), tobacco leaves (13.76) and garlic bulb (13.46) respectively. The least percent infestation was recorded in plot treated with lambda cyhalothrin (5.58) followed by Spintoram (9.22) which were statistically better than the rest of the other treatments.

Yield Kgha^{-1} and Cost benefit ratios

Figue1. Showed that highest yield was recorded in plot treated with lambda cyhalothrin 2.5EC (3482kg/ha), followed by Spintoram 120SC (2965 kg/ha. The lowest yield was recorded in untreated plot (1666kg/ha). Table 2 showed that the highest CBR value was reported in lambda cyhalothrin (17.27) followed by spintoram (13.09) while the lowest value was reported in Onion bulb (10.18).

DISCUSSION

The research was conducted at farmer field Kalam, Distract to find the relative efficacy of Synthetic insecticides and Plant extracts against Pea leaf miner (Phytomyza horticola).

The experiment was conducted at Randomize Complete Block Design (RCBD) with 7 treatments replicated 3 times. The treatments used in the experiment were Onion bulb, Neem leaves, Garlic bulb, Tobacco leaves, Spintoram and Lambda cyhalothrin respectively. Total three sprayed were applied at 2 weeks interval. The data were recorded before 24 hours and the after spray application at weekly interval. Three plants were randomly selected in each row, divided into top, middle and lower portions. The data were recorded for infested leaves and converted into percent leaves infestation. The yield was recorded in each picking and then converted into yield kg/ha. The data recorded before spraying application were nonsignificant. The finding was similar to Hussain et al. (2022). All the data were recorded at weekly interval in different treatments. Results revealed that chemical insecticides Lambda cyhalothrin and Spirtoram showed best results as compared to botanical extracts. The chemical Lambda cyhalothrin gave

better to minimize the infestation of pea leaf miner. These findings are agreed with the finding of Bughdady et al, (2020) Nesreen et al. (2016), Kar (2017) and Bala et al. (2019) who recorded lambda cyhlothrin as most effective against leaf miner infestation. Similarly, Neem et al. (2016) also conducted experiment against pea leaf miner and reported that Spirtoram was effective against pea leaf miner.

The botanical extracts and chemical insecticides improved the yield of the crop. The highest yield was recorded in chemical insecticides i.e. lambda cyhalothrin 2.5EC (3482kg/ha) and Spintoram 120SC (2965 kg/ha). The botanical extracts also improved the yield of the crop i.e. Onion bulb (2400kg/ha), Neem leaves (2318kg/ha), Tobacco leaves (2275kg/ha) and Garlic bulb (2240kg/ha) respectively. The lowest yield was recorded in untreated plot (1666kg/ha). These findings are similar to the findings of Floret et al. (2018), Noor et al. (2015), Badii et al. (2015) and Singh et al. (2005) who reported that lambda cyhalothrin treated plot gives highest production. The chemical insecticides showed high CBR at the rest of the other treatments.

Conclusion

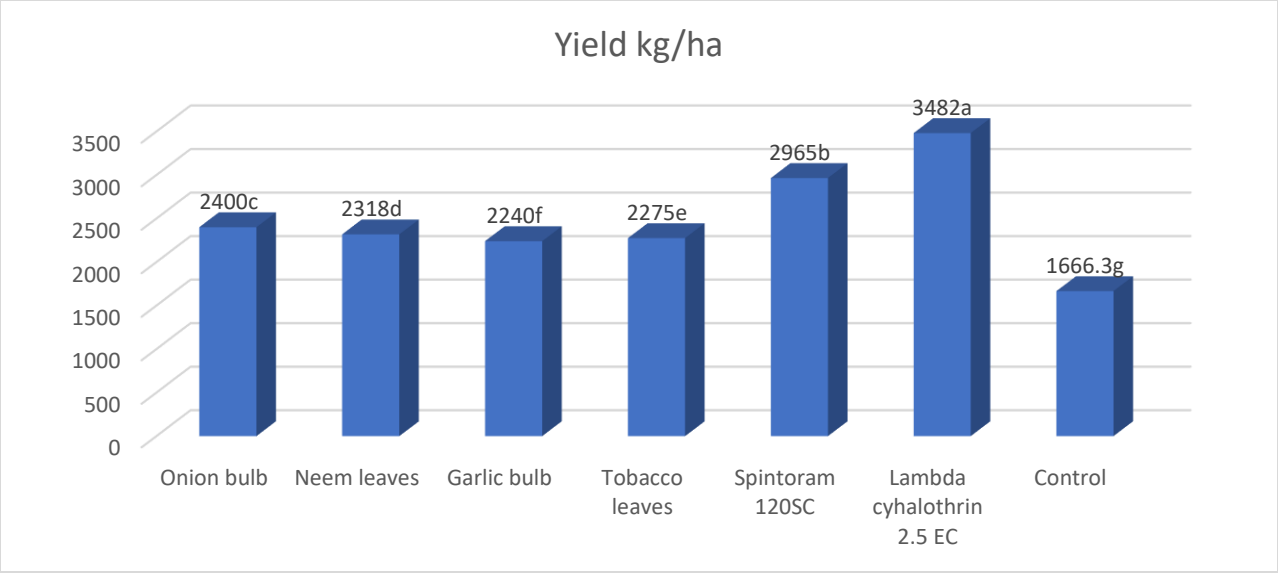
Pea is the most economical crop but sever attack of pea Leaf miner causes significant loss in the yield and effected the quality of pea pods. Above mentioned achievements show the hidden potential of Lambda cyhalothrin 2.5SC and Spintoram 120SE. While keeping in view the problem of leaf miner on pea.

Table 1. Percent leaf damage of tomato leaf miner (Phytomyza horticola) **infestation treated with botanicals extracts and Synthetic insecticide at different weeks interval during 2019 at Swat.**

Treatment	24hrs BSA	% Infestation of pea leaf miner after different weeks interval						
		1week	2weeks	3weeks	4weeks	5week	6week	Means
Onion bulb	29.85a	18.76b	12.76b	9.20bc	8.25b	9.96b	9.05b	13.97b
Neem leaves	30.96a	18.26b	11.43b	9.98b	9.11b	9.78b	8.89b	14.06b
Garlic bulb	29.05a	17.66b	13.83b	10.45b	8.23b	8.20c	8.05bc	13.64b
Tobacco leaves	30.31a	19.03b	13.60b	9.72b	7.91b	8.26c	7.48c	13.76b
Spintoram	28.75a	9.58c	7.91c	5.26cd	4.68c	4.30d	4.07d	9.22c
Lambda cyhalothrin	28.55a	3.71d	2.41d	1.37d	1.17d	1.02e	0.85e	5.58d
Control	30.91a	35.60a	39.60a	42.12a	43.83a	45.06a	40.73a	39.69a
LSD value	5.27	3.14	2.70	3.94	1.80	1.04	1.29	1.27
CV	9.96	10.27	10.47	9.59	8.52	4.77	6.45	4.55

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

Figure 1. Bare graph of yield Kg/ha of different treatments



Same bare showed that treatments are nonsignificant with LSD valve (0.05)

Table 2. Cost benefit ratio of Different Botanical extracts and Chemical Insecticide against pea leaf miner (Phytomyza horticola)

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
Onion bulb	2400	108000	10600	108000	97400	10.18
Neem leaves	2318	104310	10165.9	104310	94144.1	10.26
Garlic bulb	2240	100800	9218.9	100800	91581.1	10.93
Tobacco leaves	2275	102375	9971.2	102375	92403.8	10.26
Spintoram	2965	133425	10192.3	133425	123232.7	13.09
Lambda cyhalothrin	3482	156690	9068.5	156690	147621.5	17.27
Control	1666.3	74983.5				

CONFLICT OF INTEREST

The authors declared that present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

In this study, all authors contributed equally.

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