Efficacy of bio-pesticides against leaf miner, *Liriomyza* spp.of field pea

Abstract

Field studies were conducted on the efficacy of bio-pesticides against pea leaf miner, *Liriomyza* spp. at an experimental field, Organic Research Farm Karguwan Ji, Department of Entomology, Institute of Agricultural Sciences, Bundelkhand University, Jhansi (Utter Pradesh) during *Rabi* Season of 2022-2023. Different bio-pesticides viz: Neem oil, Garlic bulb extract, *Bacillus thuringiensis* (5% WP), Castor oil, Panchgavya, Neem Seed Kernel Extract (Crude extract), *Verticilliumlecanii*(2x108 cfu), *Beauveriabassiana*. Experimental results revealed that the plant treated with bio-pesticides registered a significant difference of pea leaf miner*Liriomyza* spp. ~~over the treatment of~~than theuntreated control. Among them, the treatment of *Beauveria bassiana* (8.90 larvae/5 plant) was found in significantly more effective against the pest as compared to other bio-pesticides *Bacillus thuringiensis*, NSKE, Neem oil, and *Verticillium lecanii* were found moderately effective and proved significantly superior over Castor oil, Panchgavya and Garlic bulb extract proved significantly less effective among the bio-pesticides evaluated against pea leaf miner *Liriomyza* spp.

Keywords: Pea, pea leaf miner *Liriomyza* spp., Bio-pesticides

Introduction

The pea (*Pisum sativum* L.), a significant vegetable crop, is cultivated all over the world. In India, it is mostly grown as a summer vegetable in the highlands and as a winter crop in the plains of north India. It is generally used as a fresh vegetable and in the form of canned, processed, or dehydrated foods. The field pea is a type of pea sometimes called *Pisum sativum* sub sp. *arvense* (L.), belonging to the family Leguminosae (Papilonaceae). It is native to India. It is highly nutritive, containing a high percentage of digestible protein, carbohydrates, vitamins, and minerals. The field pea is a cool-season crop. Over 30.37 million acres globally are used to grow it. In India, field pea is cultivated in a 637.60 thousand ha area with 5422 MT of production and 10.04 tonne per ha productivity. In Uttar Pradesh, the total area of field pea is 361 thousand ha, with 562 thousand MT of production and 1557 kg/ha of productivity. In Bundelkhand Region, Jhansi district of Uttar Pradesh, it occupies an area of about 668 thousand ha with 929

MT of production and 1.39 tonne /ha. Productivity **(Ministry of Agriculture and farmer welfare, GOI.2022).**

The major insect pests attacking field pea are stemfly, *Ophiomyia phaseoli*; leaf miner, *Chromatomyia horticola*, thrips, *Caliothrips indicus;* pea pod borer, *Etiella zinckenella;* and gram pod borer, *Helicoverpa armigera*. A 10-15% reduction in the yield of field pea was reported due to insect pest. The pod damage by pod borer, *E. zinckenella,* in field pea ranged from 1.0 to 4.10 percent. Infestation of the *Etiellazinckenella*pest has been reported at up to 17.5 percent.

Material and Methods

A Field study was carried out at the experimental field, Organic Research Farm Karguwan Ji, Department of Entomology, Institute of Agricultural Sciences, Department of Entomology, Bundelkhand University, Jhansi Utter Pradesh During the *Rabi* Season of 2022-2023. From November 2022 to March 2023, to determine the effectiveness of biopesticides against the pea leaf miner (*Liriomyza*spp.). The field pea plant was observed at weekly intervals for infestations of *Liriomyza*spp., and thereupon different products were applied directly as sprays on the plant by using a knapsack sprayer with a flat fan nozzle (Total plot 27, spacing 30cm x 10cm, Number of sprays 2). Various bio-pesticides used were Neem oil (5% EC), Garlic bulb extract,*Bacillus thuringiensis* var. Kurstaki (5% WP), Castor oil (5% EC), Panchgavya, Neem Seed Kernel Extract (Crude extract), *Verticilliumlecanii*(2x108 cfu), *Beauveriabassiana.* ~~Was evaluated based~~The evaluation was basedon the number of *Etiella zinckenella* larvae. The observations were recorded before spraying and 3, 7 and 14 days after spray. The data obtained from various treatments were subjected to convenient variation and statistically analyzed.

Results and Discussion

The efficacy of different Bio-pesticide against pea leaf miner, *Liriomyza* spp.

First spray

Number of damaged leaves (Day before spray): -

The mean data of the results revealed that the number of damaged leaves per treatment ranged from 10.64 to 16.90 and there was no statically significant difference between the treatments (Table-.1, Graph 1).

Three days after spray

All the treatments were found significantly more effective than the untreated control (19.01 damage leaves / 5 plants). A significantly less mean reduction number of damaged leaves (9.47 damaged leaves /5 plants) was observed in Neem oil than in the others, except NSKE (10.20 damaged leaves/5 plants) and Garlic bulb extract (11.92 damaged leaves / 5 plants).

Sevendays after spray

All the treatments were found significantly more effective than the untreated control (20.18 damage / 5 leaves). Among the different treatment, neem oil (9.27 damage leaves / 5 plants) was significantly superior over all the treatments. Followed by NSKE (10.15 damaged leaves/plants) and *Beauveria bassiana*(10.46 damaged leaves /5 plants).

Fourteen days after first spray

All the treatment had found significantly less mean reduction number of damaged leaves than untreated control (20.47 damaged leaves/plants). Among the varied treatment Neem oil (8.50 damage leaves /5 plants) was significantly superior tothe rest of the treatment except NSKE (9.95 damage leaves/plants) and *Beauveria bassiana*(11.72 damage leaves/plants).

Second spray

Number of damaged leaves (Day before spray): -

The mean data of the results revealed that the number of damaged leaves per treatment ranged from 8.50 to 20.47 and there was no statically significant difference between the treatments (Table-.2, Graph 2).

Threedays after second spray

All the treatment had found significantly less mean reduction number of damaged leaves than untreated control (21.10 damaged leaves / 5 plants). It was seen that after two days of application among the varied bio-pesticides, the lowest number of damaged leaves was observed in the treatments of Neem oil (7.22 damaged leaves / 5 plants) and NSKE (8.78 damaged leaves / 5 plants), followed by *Bavaria bassiana* (9.95 damage leaves /5 plants) and *Bt.* Var. kurstaki (10.64 damaged leaves /5 plants) which was the next better treatment.

Seven days after second spray

All the treatment had found significantly less mean reduction number of damaged leaves than untreated control (21.67 damaged leaves / 5 plants). Among the different bio-pesticides treatment, the lowest number of damaged leaves was recorded in the treatment of Neem oil (6.14 damaged leaves / 5 plants) and NSKE (7.81 damaged leaves / 5 plants) followed by *Beauveria bassiana* (8.86 damaged leaves / 5 plants) and *Bt.* var. kurstaki (9.81 damage leaves / 5 plants).

Fourteen days after second spray

All the bio-pesticide treatment had found significantly a smaller number of damaged leaves than the untreated control (21.91 damaged leaves / 5 plants). Among the varied bio-pesticides treatment, the lowest damage of leaves was recorded in the treatment of Neem oil (4.99 damage leaves / 5 plants) followed by NSKE (6.64 damage leaves / 5 plants), *Beauveria bassiana* (7.88 damage leaves / 5 plants) and *Bt.* var. kurstaki (9.91 damage leaves / 5 plants).

Overall mean effect

All the bio-pesticide treatment was found statically significantly more effective than untreated control (21.56 damage leaves / 5 plants). Among the varied bio-pesticide treatment, Neem oil (6.10 damage leaves / 5 plants) and NSKE (7.74 damage leaves / 5 plants) had significantly the lowest number of damaged leaves. Were most effective than other treatments. *Bavaria bassiana* (8.90 damaged leaves / 5 plants) and *Bt* var. kurstaki (9.73 damaged leaves / 5 plants) was the next better treatment. (Table- 3, fig.-1).

Conclusion

Based onthe results and discussion of the present investigation, the following recommendationsand conclusions are proposed. *Beauveria bassiana* proved significantly superior overall to the bio-pesticides in reducing the pea pod borer (*Etiella zinckenella* Treitschke) larval population, providing a significantly higher yield.

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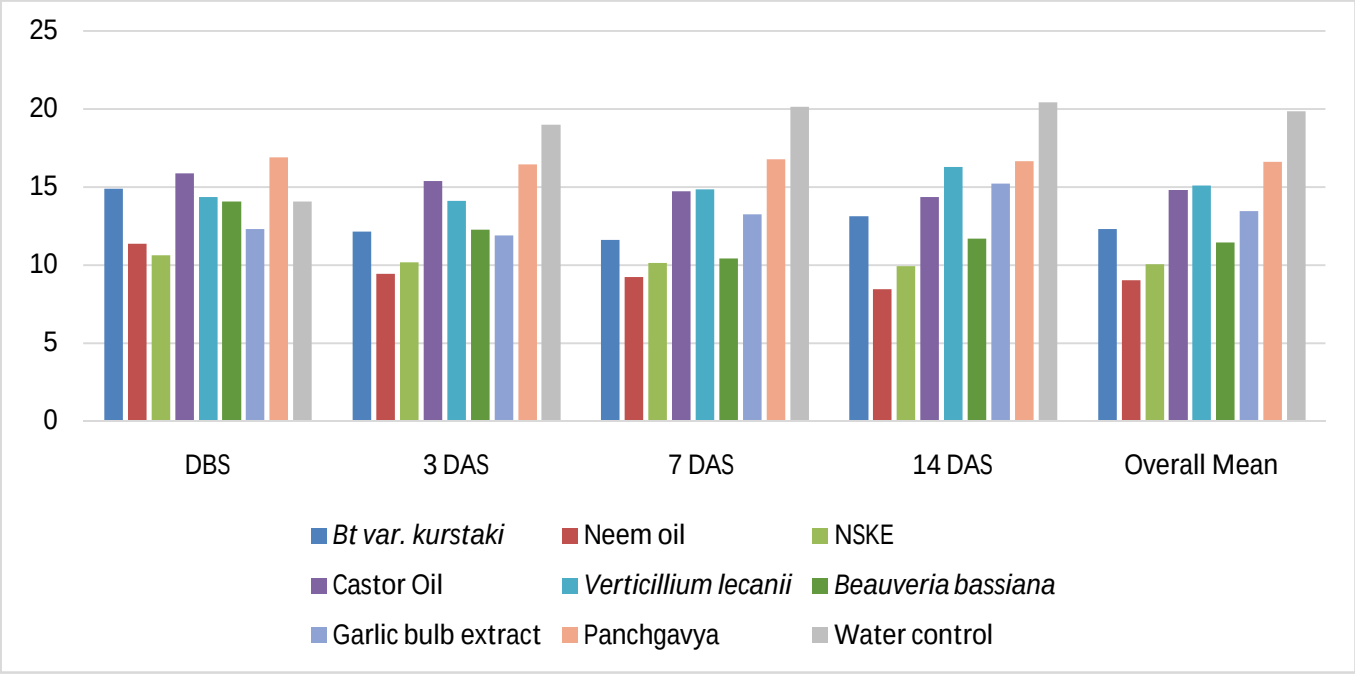
Table: -1. Effect of Bio-pesticides on Leaf miner, *Liriomyza* spp. (First spray)

Mean reduction of damage leaves/ Plant					
Treatment	**DBS**	**3 DAS**	**7 DAS**	**14 DAS**	**Overall Mean**
Bt var. kurstaki	14.92 (3.86)	12.18 (3.48)	11.65 (3.40)	13.17 (3.36)	12.33
Neem oil	11.40 (3.37)	9.47 (3.07)	9.27 (3.04)	8.50 (2.91)	9.08
NSKE	10.64 (3.25)	10.20 (3.18)	10.15 (3.17)	9.95 (3.13)	10.10
Castor Oil	15.91 (3.97)	15.40 (3.91)	14.76 (3.83)	14.37 (3.78)	14.84
Verticillium lecanii	14.38 (3.79)	14.15 (3.76)	14.86 (3.85)	16.30 (4.03)	15.10
Beauveria bassiana	14.09 (3.75)	12.29 (3.50)	10.46 (3.23)	11.72 (3.41)	11.49
Garlic bulb extract	12.31 (3.50)	11.92 (3.44)	13.30 (3.64)	15.23 (3.89)	13.48
Panchgavya	16.90 (4.11)	16.48 (4.05)	16.81 (4.09)	16.66 (4.07)	16.65
Water control	14.09 (3.74)	19.01 (4.36)	20.18 (4.48)	20.47 (4.45)	19.89
C.D.	**2.84**	**2.63**	**2.89**	**3.33**	**1.47**
SE(m)	**0.94**	**0.87**	**0.96**	**1.10**	**0.49**

Figures in the parentheses are transformed values √x+0.5 values.
*DBS-day before spray *DAS-day after spray

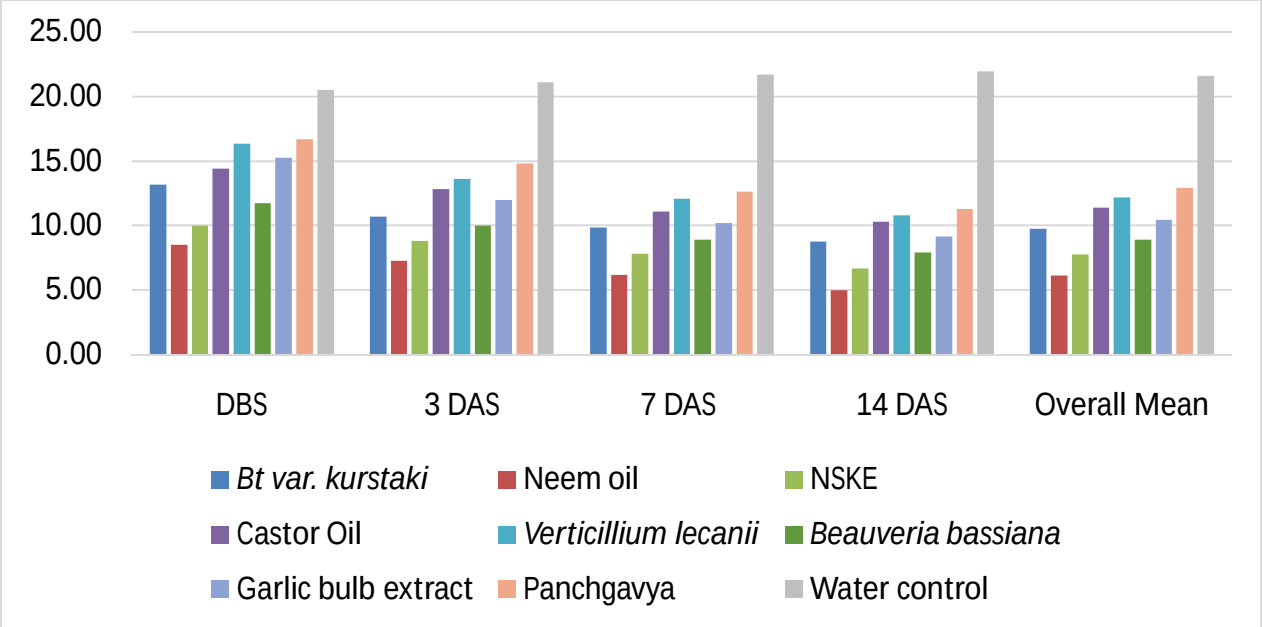


Graph: -.1. Effect of Bio-Pesticides on Leaf miner, *Liriomyza* spp. (First spray)

Table: -.2. Effect of Bio-pesticides on Leaf miner, *Liriomyza* spp. (Second spray)

Mean reduction of damage leaves/ Plant					
Treatment	**DBS**	**3 DAS**	**7 DAS**	**14 DAS**	**Overall Mean**
Bt var. kurstaki	13.17 (3.62)	10.64 (3.26)	9.81 (3.13)	8.74 (2.95)	9.73
Neem oil	8.50 (2.91)	7.22 (2.68)	6.14 (2.47)	4.94 (2.22)	6.10
NSKE	9.95 (3.13)	8.78 (2.29)	7.81 (2.76)	6.64 (2.25)	7.74
Castor oil	14.37 (3.78)	12.81 (3.57)	11.06 (3.31)	10.24 (3.19)	11.37
Verticillium lecanii	16.30 (4.03)	13.58 (3.68)	12.07 (3.47)	10.78 (3.28)	12.14
Bavaria bassiana	11.72 (3.41)	9.95 (3.14)	8.86 (2.96)	7.88 (2.79)	8.90
Garlic bulb extract	15.23 (3.89)	11.96 (3.45)	10.15 (3.18)	9.13 (3.01)	10.42
Panchgavya	16.66 (4.09)	14.76 (3.89)	12.61 (3.54)	11.28 (3.35)	12.88
Water control	20.47 (4.45)	21.10 (4.58)	21.67 (4.65)	21.91 (3.35)	21.56
C.D.	**3.33**	**2.76**	**2.72**	**2.35**	**1.08**
SE(m)	**1.10**	**0.91**	**0.90**	**0.78**	**0.36**

Figures in the parentheses are transformed values √x+0.5 values.
*DBS-day before spray *DAS-day after spray



Graph: -2. Effect of Bio-Pesticides on Leaf miner, *Liriomyza* spp. (Second spray)

Discussion

Based onthe overall mean reduction of damaged leaves, leaf miner (*Liriomyza spp.*), *Beauveria bassiana* and *Bacillus thuringiensis* (7.88 and 8.74 leaves/5 plants) were found significantly superior treatments and overall mean reduction damage leaves of a leaf miner (*Liriomyza spp.*), *Beauveria bassiana* and *Bacillus thuringiensis* had a significantly lowest larval population (8.90 and 9.73 leaves/5 plants) were most effective than other treatments respectively.

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