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Bioefficacy of insecticides against leaf miner *chromatomyia horticola* (Goureau) infesting pea

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Abstract

The present investigations entitled bioefficacy of insecticides against leaf miner, (*Chromatomyia horticola* Goureau) (Agromyzidae: Diptera) infesting pea (*Pisum sativum* L.) was carried out at experimental farm of Agricultural Entomology Section, College of Agriculture, Pune under Mahatma Phule Krishi Vidyapeeth, Rahuri during Rabi-2020-2021.

The pooled data on bioefficacy of insecticides used against leaf miner on pea revealed that the spinetoram 11.7% EC was found most superior and significantly effective with minimum infestation (9.78%) over the rest of the treatments. The treatments of chlorantraniliprole 18.5% SC (10.71%) and emamectin benzoate 5% SG (11.35%) was statistically at par with each other in managing the pest of leaf miner on pea while the remaining treatments like azadirachtin 10000 ppm (12.42%), deltamethrin 2.8% EC (13.12%), cartap hydrochloride 50% SP (14.34%), lambda cyhalothrin 5% EC (16.37%) and profenphos 50% EC (18.72%) were also found to effective for controlling of *C. horticola* on pea.

Keywords: leaf miner *Chromatomyia horticola*, pea, infestation, bioefficacy

Introduction

Garden pea (*Pisum sativum* L.) is one of the most important legume crops in temperate climates and its classified by end use into field pea and garden pea. *Pisum sativum* is an herbaceous annual crop in the leguminaceae family. The crop is cultivated for its tender and immature pods for use as vegetable and mature dry pods for use as a pulse. Peas are highly nutritive and is a popular vegetable produced for its fresh shelled green seeds which are high in protein content (7.3 g/100 g), vitamin A (138 I.U.), calcium (21 mg), phosphorus (140 mg), energy (82 kcal), carbohydrates (14.7 g/100 g) and sugars (5.68 g per 100 g) of edible portion (Peter *et al.* 2012) [9]. It has a higher protein content, which includes critical amino acids like lysine. (Nawab *et al.* 2008) [8].

Garden Pea (*Pisum sativum* L.) is one of the most important winter vegetable crops grown on commercial scale around the world and is consumed either as a fresh succulent vegetable or in processed form. India is the world's second-largest producer of peas, accounting for 21% of global output. Garden pea is a significant grain legume crop in India, which is primarily produced in the Rabi season and produces 54.22 thousand tonnes over an area of 5.40 thousand hectares. Maharashtra ranks 15th among all states in India in terms of yearly production with 30.60 thousand tonnes. Over an area of 3.06 thousand ha. (Anonymous 2018) [1].

Materials and Methods**Location of experiment**

The study of bioefficacy of insecticides against leaf miner infesting pea was carried out at the Experimental Farm of Agricultural Entomology Section, College of Agriculture, Pune. During Rabi 2020-21. All the recommended cultivation practices were followed during the period of investigation.

Method of recording observations

An experiment was laid out in a Randomized Block Design (R.B.D.) with nine treatments including untreated check and it was replicated thrice. Observations on per cent damaged leaves were recorded on randomly selected ten plants in each plot. For this purpose ten plants per plot were tagged. The observations were recorded by counting total number of leaves per plant and number of leaf miner infested leaves. Pretreatment count of *C. horticola* damage was recorded one day before the insecticides application and subsequent observations for post treatment counts were recorded on 3, 7 and 10 days after insecticidal application.

Total three sprays were given at 15 days of interval during the entire crop season. The effectiveness of the treatments was judge based on the efficacy of the insecticides against leaf miner on pea crop. The collected data were subjected to statistical analysis after tabulation in to transformed value. The population data were transformed to arc sin value. The per cent damage of leaves was expressed as below.

$$\text{Per cent infestation} = \frac{\text{Number of leaves infested with leaf miner larvae/plant}}{\text{Total number of leaves per plant}} \times 100$$

Statistical analysis

The statistical analysis of data was done by adopting the standard statistical procedure given by Panse and Sukhatme (1985)^[10].

Results

Overall bioefficacy of insecticides against leaf miner on pea crop

The results with regard to bioefficacy of insecticides for

overall three sprays (pooled data) are presented in table 4 the overall infestation of leaf miner after first, second and third spray it was differed significantly.

After 1st spray

The result obtained after the application of first spray was presented in table 1 The mean infestation percentage of leaf miner after the application of first spray was ranged from 14.48 per cent to 26.99 per cent in all treatments. The treatment with spinetoram 11.7% EC gave lowest mean infestation percentage (14.48%) among all the applied treatment and it was found to be at par with chlorantraniliprole 18.5% SC (15.45%) and emamectin benzoate 5% SG (16.24%). The next effective treatment with least infestation percentage were azadirachtin 10000 ppm (17.20%), deltamethrin 2.8% EC (17.64%) followed by cartap hydrochloride 50% SP (18.33%), lambda cyhalothrin 5% EC (19.53%) and profenophos 50% EC (20.29%). The highest infestation was found in control treatment with 26.99 per cent infestation per plant.

Table 1: Bioefficacy of insecticides against leaf miner on pea crop after first spray

Sr. No.	Treatments	Pre-Count (24 hrs before spray)	Per cent infestation of leaf miner after 1 st spray on			Mean Infestation (%)
			3 DAS	7 DAS	10 DAS	
1.	Chlorantraniliprole 18.5% SC	23.76 (29.16)	17.85 (24.98)	14.74 (22.56)	13.77 (21.77)	15.45 (23.13)
2.	Deltamethrin 2.8% EC	22.08 (28.01)	19.11 (25.91)	17.52 (24.73)	16.29 (23.79)	17.64 (24.82)
3.	Lambda cyhalothrin 5% EC	22.88 (28.56)	20.32 (26.78)	18.94 (25.78)	19.34 (26.07)	19.53 (26.21)
4.	Profenophos 50% EC	24.32 (29.53)	21.45 (27.57)	19.67 (26.31)	19.77 (26.38)	20.29 (26.76)
5.	Spinetoram 11.7% EC	23.39 (28.91)	17.13 (24.43)	14.29 (22.20)	12.04 (20.29)	14.48 (22.35)
6.	Emamectin benzoate 5% SG	24.50 (29.65)	18.03 (25.11)	15.73 (23.35)	14.98 (22.76)	16.24 (23.75)
7.	Azadirachtin 10000 ppm	22.12 (28.04)	18.79 (25.67)	16.97 (24.31)	15.84 (23.44)	17.20 (24.49)
8.	Cartap hydrochloride 50% SP	24.63 (29.74)	19.76 (26.38)	18.12 (25.18)	17.11 (24.42)	18.33 (25.33)
9.	Untreated control	23.75 (29.15)	25.39 (30.24)	26.67 (31.08)	28.91 (32.51)	26.99 (31.28)
	SE (m) _±	1.19	0.47	0.69	1.03	0.59
	CD at 5%	NS	1.41	2.07	3.10	1.78

*Figures in parenthesis are arc-sin transformed values & those outside are original value.

DAS- Days After Spraying

After 2nd spray

The mean infestation percentage of leaf miner after second spray application was ranged from 9.14 to 36.29 per cent in all treatments. The significantly lowest leaf miner infestation (9.14%) was recorded in plot sprayed with spinetoram 11.7% EC (9.14%) and it was at par with the treatment of chlorantraniliprole 18.5% SC (9.52%) and emamectin

benzoate 5% SG (9.98%). Next effective treatments were azadirachtin 10000 ppm (10.87%), deltamethrin 2.8% EC (11.68%), cartap hydrochloride 50% SP (13.74%), lambda cyhalothrin 5% EC (16.11%) and profenophos 50% EC (18.42%). The untreated control treatment recorded 36.29 per cent infestation. The result obtained after second spray were represented in table 2

Table 2: Bioefficacy of insecticides against leaf miner on pea crop after second spray

Sr. No.	Treatments	Pre-Count (24 hours before spray)	Per cent infestation of leaf miner after 2 nd spray on			Mean infestation (%)
			3 DAS	7 DAS	10 DAS	
1.	Chlorantraniliprole 18.5% SC	16.44 (23.91)	11.45 (19.77)	8.34 (16.77)	8.77 (17.21)	9.52 (17.96)
2.	Deltamethrin 2.8% EC	19.11 (25.91)	13.59 (21.62)	11.43 (19.75)	10.04 (18.46)	11.68 (19.97)
3.	Lambda cyhalothrin 5% EC	21.17 (27.38)	16.60 (24.03)	15.45 (23.13)	16.29 (23.79)	16.11 (23.65)
4.	Profenophos 50% EC	22.77 (28.48)	19.82 (26.42)	17.02 (24.35)	18.43 (25.41)	18.42 (25.40)
5.	Spinetoram 11.7% EC	16.21 (23.73)	11.19 (19.53)	9.03 (17.48)	7.22 (15.58)	9.14 (17.59)
6.	Emamectin benzoate 5% SG	17.64 (24.82)	11.83 (20.10)	9.21 (17.65)	8.91 (17.36)	9.98 (18.40)
7.	Azadirachtin 10000 ppm	18.78 (25.67)	12.05 (20.30)	10.92 (19.28)	9.64 (18.08)	10.87 (19.24)
8.	Cartap hydrochloride 50% SP	19.74 (26.36)	14.42 (22.30)	13.79 (21.79)	13.02 (21.14)	13.74 (21.74)
9.	Untreated control	31.27 (33.98)	33.36 (35.26)	36.62 (37.22)	38.91 (38.57)	36.29 (37.02)
	SE (m)±	1.34	0.69	0.57	0.82	0.53
	CD at 5%	4.01	2.06	1.74	2.43	1.59

*Figures in parenthesis are arc-sin transformed value & those outside are original value.

DAS- Days After Spray

After 3rd spray

Mean data pertaining to the leaf miner infestation recorded after third spray revealed that, the leaf miner infestation ranged from 5.74 to 46.69 per cent infestation per plant in all treatments. From the mean infestation data it was revealed that the spinetoram 11.7% EC is found to be most effective with minimum infestation (5.74%) and it was at par with the treatment of chlorantraniliprole 18.5% SC (7.18%) and emamectin benzoate 5% SG (7.84%). The next effective

treatments were found to be effective are azadirachtin 10000 ppm (9.21%), deltamethrin 2.8% EC (10.04%), cartap hydrochloride 50% SP (10.96%) and lambda cyhalothrin 5% EC (13.48%). Among all insecticidal treatments the least effective treatment was found to be profenophos 50% EC (17.45%). The maximum infestation was found where no control measure was applied (46.69%). The result obtained after second spray were represented in table 3

Table 3: Bioefficacy of insecticides against leaf miner on pea crop after third spray

Sr. No.	Treatments	Pre-Count (24 hours before spray)	Per cent infestation of leaf miner after 3 rd spray on			Mean infestation (%)
			3 DAS	7 DAS	10 DAS	
1.	Chlorantraniliprole 18.5% SC	13.27 (21.35)	9.34 (17.78)	6.76 (15.06)	5.44 (13.48)	7.18 (15.53)
2.	Deltamethrin 2.8% EC	14.63 (22.47)	11.67 (19.96)	9.43 (17.87)	9.04 (17.49)	10.04 (18.46)
3.	Lambda cyhalothrin 5% EC	19.37 (26.10)	14.01 (21.97)	12.23 (20.46)	14.22 (22.14)	13.48 (21.53)
4.	Profenophos 50% EC	21.62 (27.69)	17.88 (25.00)	16.80 (24.18)	17.69 (24.86)	17.45 (24.68)
5.	Spinetoram 11.7% EC	12.55 (20.73)	8.23 (16.66)	5.19 (13.16)	3.81 (11.25)	5.74 (13.85)
6.	Emamectin benzoate 5% SG	13.89 (21.87)	9.49 (17.93)	7.73 (16.13)	6.32 (14.55)	7.84 (16.25)
7.	Azadirachtin 10000 ppm	14.00 (21.96)	10.39 (18.79)	9.11 (17.56)	8.14 (16.57)	9.21 (17.65)
8.	Cartap hydrochloride 50% SP	16.22 (23.74)	12.44 (20.64)	10.59 (18.98)	9.87 (18.30)	10.96 (19.32)
9.	Untreated control	42.33 (40.57)	44.15 (41.62)	46.28 (42.84)	49.65 (44.78)	46.69 (43.08)
	SE (m)±	1.39	1.09	1.45	1.47	1.23
	CD at 5%	4.18	3.27	4.35	4.41	3.70

*Figures in parenthesis are arc-sin transformed value & those outside are original value.

DAS- Days After Spraying

Overall (pooled) bioefficacy of three sprays

Overall mean infestation percentage of pea leaf miner under different treatments indicated significant differences among the treatments. The data also indicated that all the insecticidal treatments were significantly effective when compared with untreated control after first, second and third spray analysis.

The data obtained from the result were represented in table 4. The analysis it was observed that the spinetoram 11.7% SC found significantly effective with minimum infestation (9.78%) over rest of the treatments. The next effective treatment was found to be chlorantraniliprole 18.5% SC (10.71%) and emamectin benzoate 5% SG (11.35%) however,

both these treatment were found at par with spinetoram 11.7% EC. The treatment of azadirachtin 10000 ppm (12.42%), deltamethrin 2.8% EC (13.12%) and cartap hydrochloride 50% SP (14.34%). Plots sprayed with lambda cyhalothrin 5% EC and profenophos recorded 16.37 per cent and 18.72 per cent infestation respectively. The chronological order of

efficacies of the above treatments in the decreasing order are as follows spinetoram 11.7% SC > chlorantraniliprole 18.5% SC > emamectin benzoate 5% SG > azadirachtin 10000 deltamethrin 2.8% EC > Cartap hydrochloride 50% SP lambda cyhalothrin 5% EC > profenophos 50% EC > untreated control.

Table 4: Overall (Pooled) infestation (%) of leaf miner after the application of three sprays

Sr. No.	Treatments	Overall mean infestation (%) of (3 sprays) after			Overall (pooled) infestation (%)
		1 st spray	2 nd Spray	3 rd Spray	
1.	Chlorantraniliprole 18.5% SC	15.45 (23.13)	9.52 (17.96)	7.18 (15.53)	10.71 (19.09)
2.	Deltamethrin 2.8% EC	17.64 (24.82)	11.68 (19.97)	10.04 (18.46)	13.12 (21.22)
3.	Lambda cyhalothrin 5% EC	19.53 (26.21)	16.11 (23.65)	13.48 (21.53)	16.37 (23.85)
4.	Profenophos 50% EC	20.29 (26.76)	18.42 (25.40)	17.45 (24.68)	18.72 (25.62)
5.	Spinetoram 11.7% EC	14.48 (22.35)	9.14 (17.59)	5.74 (13.85)	9.78 (18.21)
6.	Emamectin benzoate 5% SG	16.24 (23.75)	9.98 (18.40)	7.84 (16.25)	11.35 (19.68)
7.	Azadirachtin 10000 ppm	17.20 (24.49)	10.87 (19.24)	9.21 (17.65)	12.42 (20.62)
8.	Cartap hydrochloride 50% SP	18.33 (25.33)	13.74 (21.74)	10.96 (19.32)	14.34 (22.24)
9.	Untreated control	26.99 (31.28)	36.29 (37.02)	46.69 (43.08)	36.65 (37.24)
	SE (m)±	0.59	0.53	1.23	0.76
	CD at 5%	1.78	1.59	3.70	2.28

*Figures in parenthesis are arc-sin transformed value & those outside are original value

Discussion

From the results, it can be concluded that the minimum infestation of pea leaf miner was recorded where Spinetoram 11.7% EC applied followed by chlorantraniliprole 18.5% SC emamectin benzoate 5% SG, azadirachtin 10000 ppm, deltamethrin 2.8% EC, cartap hydrochloride 50% SP, lambda cyhalothrin 5% EC, and profenophos 50% EC respectively. these findings are in conformity with those of Hafsi *et al.* (2012) [3] they tested bio-insecticides as well as chemical insecticides against pea leaf miner and reported that spintoram was proved most effective among all insecticides. Same kind of results were reported by Hanafy and Sayed (2013) [4] they reported that spinetoram gave the highest toxicity against leaf miner followed by spinosad and emamectin benzoate.

The present finding stated that emamectin benzoate 5% SG was also the best treatment to lowers the infestation of pea leaf miner. The present finding also confirmed with findings of Saito (2004) [11] and Variya and Patel (2012) [14] they reported that application of emamectin benzoate very effective in controlling leaf miner. The effectiveness of cartap hydrochloride was reported by Desai (2013) [2] which is in accordance with present result. Azadirachtin 10000 ppm also gave best result after 7 and 10 days of application against leaf miner. The present finding more or less similar result of neem based product was reported by Joshi (1998) [6] and Krishna kumar (1998) [7] against leaf miner. Cartap hydrochloride 50% SP also found to be most effective treatment against *C.horicola* in present investigation reported that cartap hydrochloride 50% SP proved most effective in suppressing the leaf damage due to the leaf miner similarly Hanumappa (2006) [5] also reported effectiveness of cartap hydrochloride against tomato leaf miner. Two least effective treatments were

lambda cyhalothrin 5% EC and profenophos 50% EC which also gave significant result. This findings collaborated with Sureshkumar *et al.* (2004) [13] concluded that Lambda cyhalothrin is a photostable synthetic pyrethroid, it might have shown maximum residual action against maximum lepidopteran pests. The result obtained from profenophos 50% EC also collaborated with Shehata (2012) [12] who revealed that profenophos 50% EC was effective in reducing the population of leaf miner in tomato.

Conclusion

Among the different insecticidal treatments against leaf miner on pea it was concluded that spinetoram 11.7% EC is found to be significantly superior to lowers the infestation of leaf miner and it was statistically at par with the treatments of chlorantraniliprole 18.5% SC and emamectin benzoate 5% SG.

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