

Bioefficacy of different biopesticides and botanicals against mustard aphid (*Lipaphis Erysimi* Kalt.)

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Abstract

The experiment was carried out at Research farm of BTC CARS, Bilaspur during *Rabi* 2019-20. A field experiment was laid down in randomized block design (RBD) and replicated thrice with six bio-pesticides, botanicals, one insecticide and untreated control. The treatment Imidacloprid 17.8 SL @ 0.2ml/liter was found to be most effective treatment against mustard aphid, recorded least over all mean population (15.74 aphid/plant) with maximum per cent reduction in aphid population (88.72%) and benefit cost ratio 3.35:1 followed by Garlic extract 5% with over all mean aphid population (21.24 aphids/plant), per cent reduction (84.87%) and benefit cost ratio 2.68:1. Other treatments in decreasing order of their efficacy were *Lecanicillium lecanii* 10.00% WP, Aak leaf extract 5% *Beauveria bassiana* 10.00% WP, Aak flower extract 5% and *Metarrhizium anisopliae* 10.00% WP. The highest population (142.49 aphids/plant) was recorded in untreated control.

Keywords: *Lipaphis erysimi* bio-pesticide and botanical agents

Introduction

Mustard (*Brassica juncea* L.) is the most important oilseed crop grown in *Rabi* season for its valuable edible oil content. The name 'mustard' is derived from the Latin word *mustum*, or must of old wine mixed with crushed seed makes it one of the most important spice in the world (Hemingway, 1976) [3].

Mustard aphid, *Lipaphis erysimi* (Kalt.) (Homoptera: Aphididae) is the key pest of mustard crop in India. This pest is widely distributed throughout the world on all *Brassica* crops (Yue and liu, 2000) [12]. In India, it is mainly grown in different states like Rajasthan, Uttar Pradesh, Madhya Pradesh, Bihar, Assam, Gujarat, Maharashtra, Haryana and West Bengal etc. In India it is grown in an area of 6123.93 thousand hectare with a production of 9256.66 thousand tonnes and productivity is 1511 kg/ha in 2018-19 (Anonymous, 2019). Mustard aphid (*Lipaphis erysimi* Kalt) causes 35.4 to 96.0% yield losses, 30.9% seed weight loss and 2.75% oil losses (Bakhetia and Sekhon, 1989; Singh and Premchand, 1995) [2, 7]. An eco-friendly pest management approach against mustard aphid is the necessity of present time to safeguard the natural enemies

and pollinators as well as human health. Keeping the above facts in mind the present investigation was undertaken to manage the aphids through bio-pesticides and botanicals.

Material and methods

A field experiment was laid in randomized block design (RBD) with eight treatments including untreated control, replicated three times (Table 1). The crop was sown in second week of November 2019 in plot size of 4.2m x 3m with 30cm row to row distance and 10cm plant to plant distance. The calculated quantity of each bio-pesticide and botanicals was sprayed with the help of hand operated knapsack sprayer. The spraying was done two times.

Six different bio-pesticide and botanicals treatments and one insecticide and untreated control were evaluated for the assessment of their comparative performance against mustard aphid. The observation on the aphid incidence was recorded 1 day before spray as pretreatment and 3, 7, 10, and 15 days after spraying as the post treatment counts. The population of both nymphs and adults of aphid were counted during early morning on 10cm central top twig per plant and population of natural enemies were also recorded.

Table 1: Details of different bio-pesticide and botanicals

Treatment	Treatment detail	Formulation	Does/liter
T1	<i>Lecanicillium lecanii</i>	10.00 % WP (1X 10 ⁹ CFU/g min)	10g
T2	<i>Beauveria bassiana</i>	10.00% WP (1 × 10 ⁹ CFU/g min)	10g
T3	<i>Metarrhizium anisopliae</i>	10.00% WP (1 × 10 ⁹ CFU/g min)	10g
T4	Aak leaves	5% Leaf extract	50ml
T5	Aak flower	5% Flower extract	50ml
T6	Garlic	5% Garlic extract	50ml
T7	Imidachloprid	17.8 SL	0.2ml
T8	Untreated Control	-	-

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M.Sc. Thesis of the first author.

Result and Discussion

Among the biopesticides, botanicals and insecticide

evaluated against mustard aphid, insecticide Imidacloprid 17.8 SL @0.2 ml/lit. was undoubtedly most effective treatment with overall mean 15.74 aphids/plant and maximum 88.72% reduction in aphid population over untreated control followed by Garlic extract 5% @ 50 ml/lit. (21.24aphids/plant) with 84.87%, *Lecanicillium lecanii* 10.00% WP (1x10⁹CFU/gm) @ 10g/lit. (22.80 aphids/plant) with 83.78%, Aak leaf extract 5% @ 50 ml/lit (25.55aphids/plant) with 81.85% and *Beauveria bassiana* 10.00 % WP (1x10⁹CFU/gm) @ 10 g/lit. (25.62aphids/plant) with 81.80% reduction in aphid population over untreated control. Aak flower extract 5% @ 50 ml/lit. (27.60 aphids/plant) and *Metarrhizium anisopliae* 10.00% WP (1 × 10⁹ CFU/gm) @ 10g/lit. (28.47aphids/plant) with 80.42% and 79.81% reduction in population respectively. Both were less effective as compared to other treatments. The highest population (142.49aphids/plant) was recorded in untreated control. The present findings are in accordance with the findings of Konar *et al.* (2013) [5] and Gour and Pareek (2003) who have also reported, Imidacloprid 30 g a.i /ha as

most effective in reducing population of aphids. Sharma *et al.* (2017) [9], Parmar *et al.* (2008) [11], Singh *et al.* (2008) [10] and Kumar and Singh (2009) [6] reported *V. lecanii* as promising entomopathogenic fungi against aphid, confirms the present findings.

The per cent avoidable loss, computed on the basis of the most effective treatment were calculated for rest of the treatments arranged in ascending order were 7.19% in *garlic extract* 5%, 9.84% in *Beauveria bassiana* 10% WP, 17.08% in *Lecanicillium lecanii* 10% WP, 17.25% in Aak leaf extract 5%, 18.46% in *Metarrhizium anisopliae* 10% WP and 22.73% in Aak flower extract 5%.

The benefit cost ratio was calculated maximum 3.35:1 in insecticide treatment Imidacloprid 17.8 SL @ 0.2 ml/litre while considering the biopesticides and botanicals only, *Beauveria bassiana* 10% WP and Garlic extract 5% were recorded best and next best with benefit cost ratio, 2.79:1 and 2.68:1 respectively. The minimum benefit cost ratio 2.30:1 was calculated in untreated control. Rest of the treatment were found intermediary.

Table 2: Efficacy of Different Bio-Pesticides and Botanicals against Mustard Aphid During Rabi 2019-2020 (I spray).

S.No.	Treatment	Dose(g or ml/lit. of water)	Mean aphid population/plant(10 cm twig)					Mean
			PTO	3 DAS	7 DAS	10 DAS	15 DAS	
T ₁	<i>Lecanicillium lecanii</i> 10.00 % WP (1X 10 ⁹ CFU/g min)	10g	94.83 (9.74)	27.33 (5.19) ^{bc}	23.83 (4.87) ^b	20.16 (4.49) ^b	34.16 (5.84) ^{bcd}	26.37 (5.11) ^{cd}
T ₂	<i>Beauveria bassiana</i> 10.00 % WP (1X 10 ⁹ CFU/g min)	10g	109.00 (10.43)	32.16 (5.62) ^{bc}	25.83 (5.07) ^b	22.16 (4.71) ^b	38.16 (6.17) ^{bc}	29.58 (5.41) ^{bcd}
T ₃	<i>Metarrhizium anisopliae</i> 10.00 % WP (1X 10 ⁹ CFU/g min)	10g	114.33 (10.69)	35.50 (5.95) ^{bc}	29.16 (5.40) ^b	27.33 (5.23) ^b	41.83 (6.46) ^b	33.45 (5.76) ^b
T ₄	Aak Leaf extract 5%	50ml	120.00 (10.95)	33.66 (5.77) ^{bc}	26.16 (5.11) ^b	23.83 (4.88) ^b	35.33 (5.94) ^{bc}	29.74 (5.44) ^{bcd}
T ₅	Aak Flower extract 5%	50ml	108.33 (10.40)	39.50 (6.28) ^b	30.16 (5.49) ^b	26.83 (5.18) ^b	30.83 (5.55) ^{cd}	31.83 (5.63) ^{bc}
T ₆	Garlic extract 5%	50ml	116.66 (10.80)	26.66 (5.14) ^c	22.83 (4.72) ^{bc}	19.66 (4.43) ^b	29.16 (5.39) ^{cd}	24.58 (4.94) ^d
T ₇	Imidacloprid 17.8 SL	0.2ml	126.66 (11.23)	24.66 (4.96) ^c	16.33 (4.04) ^c	9.66 (3.11) ^c	26.16 (5.09) ^d	19.20 (4.31) ^e
T ₈	Untreated control	-	130.00 (11.40)	176.66 (13.28) ^a	198.33 (14.06) ^a	173.33 (13.07) ^a	163.33 (12.77) ^a	177.91 (13.33) ^a
SEm ±			0.32	0.37	0.25	0.39	0.26	0.21
CD (0.05)			NS	1.11	0.75	1.17	0.79	0.61

Note: Figure in parentheses are square root transformed values; Average number of nymphs and adult / ten plants; NS = significant; DAS = Days after spraying.

Table 3: Efficacy of Different Bio-Pesticides and Botanicals Against Mustard Aphid Rabi 2019-2020 (II spray).

S.No.	Treatment	Dose (g or ml) /liter of water	Mean aphid population/plant(10 cm twig)					Mean
			PTO	3 DAS	7 DAS	10 DAS	15 DAS	
T ₁	<i>Lecanicillium lecanii</i> 10.00 % WP (1X 10 ⁹ CFU/g min)	10g	48.33 (6.93)	24.66 (4.97) ^{cd}	19.83 (4.45) ^{de}	17.66 (4.26) ^b	14.83 (3.92) ^{de}	19.24 (4.43) ^b
T ₂	<i>Beauveria bassiana</i> 10.00 % WP (1X 10 ⁹ CFU/g min)	10g	53.33 (7.27)	27.16 (5.21) ^{bc}	23.16 (4.81) ^{bc}	20.16 (4.55) ^b	16.16 (4.08) ^{cd}	21.66 (4.69) ^b
T ₃	<i>Metarrhizium anisopliae</i> 10.00 % WP (1X 10 ⁹ CFU/g min)	10g	57.66 (7.58)	28.16 (5.31) ^b	25.33 (5.03) ^b	21.33 (4.67) ^b	19.16 (4.43) ^{bc}	23.49 (4.89) ^b
T ₄	Aak leaf extract 5%	50ml	60.50 (7.77)	25.16 (5.02) ^{bcd}	21.33 (4.62) ^{cd}	20.83 (4.62) ^b	18.16 (4.32) ^{bc}	21.37 (4.67) ^b
T ₅	Aak flower extract 5%	50ml	61.16 (7.82)	25.66 (5.07) ^{bcd}	24.33 (4.92) ^b	22.16 (4.76) ^b	21.33 (4.68) ^b	23.38 (4.88) ^b
T ₆	Garlic extract 5%	50ml	46.66 (6.82)	23.66 (4.86) ^d	18.66 (4.32) ^e	16.16 (4.08) ^b	13.16 (3.68) ^e	17.91 (4.27) ^{bc}
T ₇	Imidacloprid 17.8 SL	0.2ml	39.33 (6.27)	22.66 (4.76) ^d	16.16 (4.02) ^f	10.33 (2.90) ^c	0.00 (0.71) ^f	12.28 (3.22) ^c
T ₈	Untreated control	-	85.16 (9.14)	111.66 (10.57) ^a	133.33 (11.55) ^a	126.66 (11.28) ^a	56.66 (7.55) ^a	107.08 (10.25) ^a
SEm ±			0.48	0.10	0.08	0.38	0.13	0.36
CD (0.05)			NS	0.32	0.25	1.13	0.39	1.07

Table 4: Effect of Bio-Pesticides and Botanicals on Overall Mean Aphid Population of Mustard During Rabi 2019-2020.

S.No.	Treatment	Over all mean aphid population/plant	Per cent reduction in aphid Population over control
T ₁	<i>Lecanicillium lecanii</i> 10.00 % WP (1X 10 ⁹ CFU/g min)	22.80 (4.76) ^{bc}	83.78
T ₂	<i>Beauveria bassiana</i> 10.00 % WP (1X 10 ⁹ CFU/g min)	25.62 (5.04) ^{bc}	81.80
T ₃	<i>Metarhizium anisopliae</i> 10.00 % WP (1X 10 ⁹ CFU/g min)	28.47 (5.32) ^b	79.81
T ₄	Aak leaves 5% Leaf extract	25.55 (5.04) ^{bc}	81.85
T ₅	Aak flower 5% Flower extract	27.60 (5.24) ^b	80.42
T ₆	Garlic 5% Garlic extract	21.24 (4.60) ^{bc}	84.87
T ₇	Imidacloprid 17.8 SL	15.74 (3.94) ^c	88.72
T ₈	Untreated control	142.49 (11.84) ^a	-
SEm ±		0.39	
CD (0.05)		1.17	

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