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EFFICACY OF SOME BOTANICAL PESTICIDES AGAINST MUSTARD APHID *LIPAPHIS ERYSIMI* (KALT.) IN *BRASSICA NAPUS*

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ABSTRACT

Field experiment on canola type variety of gobhi sarson, GSC 7 was conducted on 20 locations in district SAS Nagar during rabi 2021 and 2022 to evaluate botanical pesticides against mustard aphis *Lipaphis erysimi* (Kalt.). Seven treatments viz., mixing of non-recommended insecticides (Farmer's practice), spray thiamethoxam 25WG @ 100 g/ ha, spray homemade neem extract @ 2.5 l, 3.75 l and 5 l/ ha, spray azadirachtin 0.15 EC (1500 ppm) @ 1.25 l/ ha and untreated control were included and evaluated at farmer's field. Highest crop yield (20.14 q/ ha) was obtained with thiamethoxam followed by azadirachtin spray (19.64 q/ ha) which was on par with homemade neem extract treatment @ 5 l/ ha. Similarly, B:C ratio was found maximum (3.45) in thiamethoxam treatment. The efficacy of all treatments was found maximum on third day after spray which later decreased with time.

Key words: *Lipaphis erysimi*, canola, azadirachtin, efficacy, farmer's practice, homemade neem extract, thiamethoxam, spray yield, cost benefits, incremental yield

India is the world's second largest grower of rapeseed and mustard (Dwivedi et al., 2019), and it is an important edible oilseed crop in Punjab with a production of 50.3 mt during 2020-21, with productivity of 15.95 q/ ha (Anonymous, 2023). Mustard aphid, *Lipaphis erysimi* (L.) Kaltenbach (Homoptera: Aphididae) is one of the most serious insect opposed to crop production success (Raj and Lakhanpal, 1998; Bakhetia and Sekhon, 1989). Under Punjab conditions, gobhi sarson (*Brassica napus* L.) is a rapeseed crop, attacked by *L. erysimi* during January and February months of the year. Mustard aphids reduce crop yield by 35.4 to 96%, oilseed weight by 30.9% and oil production by 2.75% (Bakhetia and Sekhon, 1989; Singh and Prem-chand, 1995; Bakhetia and Arora, 1986). *L. erysimi* infests oilseed plants at all crop stages. The infestation by *L. erysimi* causing curling of pods, the young attacked pods produce immature seeds and most of the plants fail to develop pods resulting into stunted growth of plant, flowers shrink and pod formation being hampered (Morzia and Huq, 1991). Severe aphid attack can sometimes cause total loss of oilseed yield and plants often fail to bear siliqua or end up with defective pods (Das and Islam, 1986). Farmers indiscriminately spray synthetic chemical pesticides to control mustard aphid population which is often considered a quick and easy solution to manage insect pests in agriculture. On the other hand, pesticide contamination cause danger to human health and environment, non-target organisms ranging from beneficial soil microorganisms to insects, plants, fish and birds (Gyawali, 2018). Thus, it is critical to develop an ecologically sound concept for control of *L. erysimi*. The present study evaluates the relative efficacy of some ecofriendly insecticides against *L.erysimi* on gobhi sarson.

MATERIALS AND METHODS

Seed of gobhi sarson variety GSC 7 was obtained from the Punjab Agricultural University, Ludhiana, Punjab, India. Field experiments were carried out on gobhi sarson crop at farmer's field of block Majri, S A S. Nagar during rabi (October 2020 to March 2021) and (October 2021 to March 2022) in twenty plots, of 5 x 4.5 m size with variety GSC 7 sown @ 3.75 kg/ ha on 5th November, 2020 and 2021 maintaining 45 cm row to row and 10 cm plant to plant. Each plot consisted ten rows with 50 plants in each row i.e. 500 plants/ plot. The experiment included seven treatments replicated thrice- 1) T1: Mixing of non-recommended insecticides such as chlorantraniliprole + propiconazole + urea/ DAP (Farmer's practice), 2) T2: spray of thiamethoxam 25WG @ 100g/ ha, T3: homemade neem extract @ 2.5 l/ ha, T4: Spray homemade neem extract @ 3.75 l/ ha, T5: Spray homemade neem extract @ 5 l/ ha, T6: Spray neem formulation azadirachtin 0.15 EC (1500 ppm) @ 1.25 l /ha and T7: Untreated control. Gobhi

sarson yield data was collected separately during March 2021 and 2022 and benefit cost ratio (B:C) was also calculated. To prepare homemade neem extract, 5 kg terminal parts of the shoots of the neem trees including leaves, green branches and fruits were boiled in 10 l of water for 30 min Then filter this material through muslin cloth and use the filtrate for spraying at recommended dose. Observations were made from 10 cm central apical shoot of inflorescence taken from 10 randomly selected plants of each plot. After 1, 3, and 7 days of spraying, post-treatment observations were made. After 10 days of 1st spray, 2nd spray was applied pretreatment observations were taken 24 hr before spray. Population reduction over control was calculated in % by using the modified Abbots formula (Fleming and Retnakaran, 1985). Both data on crop yield and population of mustard aphid were subjected to ANOVA with randomized complete block design (RCBD) by using statistical software SAS (Gomez and Gomez, 1984). In case of mustard aphid population data, square root transformation $\sqrt{(x+0.5)}$ was applied and further data analysis was done using SAS.

RESULTS AND DISCUSSION

Spray of thiamethoxam @ 100 g/ ha showed 35 to 76.18% reduction of aphid incidence over control and was noticed the best among all the treatments during both sprays followed by azadirachtin 0.15EC (33.67 to 71.79%), homemade neem extract @ 5 l, 3.75 l and 2.5 l/ ha, respectively (Table 1). These findings corroborate with the earlier research (Kumar et al., 2020) who concluded that azadirachtin 10000 ppm and azadirachtin 1500 ppm @ 1.0 ml/ l of water showed maximum aphid reduction. Treatments involving biopesticides (*Beauveria bassiana*, *V. lecanii* and azadirachtin), their combinations and dimethoate in terms of % reduction over control after first, second and third spray application observed non-significant differences (Shinde et al., 2021). Pooled mean data in terms of reduction in incidence over control varied from 61.27- 71.51%. The efficacy of all treatments was found maximum on third day after spray which decreased with time on 7th day after spray. These results were in collaboration with the earlier studies by Kafle (2015). After spray application of these treatments, their efficacy decreased with increase in time from 3rd to 9th day of spray. During present studies, maximum aphid incidence was noticed in untreated plots followed by farmers practice whereas minimum aphid incidence was observed in thiamethoxam @ 100g/ ha, azadirachtin @ 1.25 l/ ha and homemade neem extract @ 5 l/ ha.

Significantly higher yield was recorded in all the treatments compared to control. Maximum yield of gobhi sarson (20.14 q/ ha) was noticed with thiamethoxam 25WG followed by neem formulation spray with azadirachtin 0.15 EC (19.64 q/ ha) which was at a par with treatment of homemade neem extract @ 1.25 l/ ha (19.51 q/ ha). Similar results were observed by Kumar et al. (2020) at CCS-HAU, Hisar. Increase in yield over control and highest benefit cost ratio was recorded in treatment with thiamethoxam @ 100g/ ha (26.26% and 3.45, respectively) followed by azadirachtin @ 1.25 l/ ha (23.13% and 3.43, respectively). It may be concluded that the infestation of mustard aphid can be managed by adopting foliar spray of azadirachtin 0.15EC @ 1.25 l/ ha and homemade neem extract @ 5 l/ ha. Although highest yield of gobhi sarson was recorded in treatment with thiamethoxam but there is not much difference between B:C ratio of treatment with thiamethoxam, azadirachtin and homemade neem extract @ 5 l/ ha. Efficacy of imidacloprid 17.8% SL was at par with the different biopesticides, botanicals and their combinations (Halder et al., 2021). Keeping in mind the risk of synthetic insecticides to the human health, environment and non-target organisms, use of such botanicals is a viable and cost effective option for management of mustard aphid. Moreover, neem trees are easily available in the region and its extract can be prepared at home by local farmers.

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AUTHOR CONTRIBUTION STATEMENT

Harmeet Kaur wrote the manuscript and analysed the data. Balbir Singh Khadda read, corrected the manuscript. Parminder Singh conceived and designed the research.

CONFLICT OF INTEREST

Authors declare that there is no conflict of interest.

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Table 1. Mean yield parameters and reduction in mustard aphid incidence with treatments (2020-21 and 2021-22)

Treatments	Mean incidence of aphids/ 10 cm central twig/ plant (No.)														Yield (q/ ha)	Yield increase over control (%)	B:C ratio
	First spray							Second spray									
	1 DBS	1 DAS	PROC	3 DAS	PROC	7 DAS	PROC	1 DBS	1 DAS	PROC	3 DAS	PROC	7 DAS	PROC			
T1	58	44± 0.08^{b} (6.70)	36.78	33± 0.23^{b} (5.81)	59.88	39± 0.21^{b} (6.31)	43.96	46	36± 0.15^{b} (6.07)	27.33	26± 0.12^{b} (5.19)	55.13	29± 0.13^{b} (5.65)	54.19	17.10± 0.01^{e}	7.21	2.85
T2	52	34± 0.24^{bcd} (5.89)	45.51	19± 0.16^{cde} (4.46)	74.24	22± 0.17^{cde} (4.78)	74.14	30	21± 0.17^{bcde} (4.67)	35	9± 0.16^{f} (3.14)	76.18	12± 0.17^{f} (3.57)	72.81	20.14± 0.4^{a}	26.26	3.45
T3	48	41± 0.14^{b} (6.47)	28.82	27± 0.21^{c} (5.27)	60.34	32± 0.20^{c} (5.72)	59.26	43	33± 0.12^{b} (5.82)	28.74	21± 0.18^{c} (4.67)	61.23	25± 0.16^{c} (5.09)	60.48	18.92± 0.26^{d}	18.62	3.32
T4	53	40± 0.24^{b} (6.38)	37.11	24± 0.18^{c} (4.98)	68.07	30± 0.18^{c} (5.55)	65.41	41	31± 0.16^{b} (5.64)	29.79	18± 0.17^{c} (4.34)	65.15	21± 0.13^{c} (4.75)	63.52	19.30± 0.29^{bc}	21.00	3.38
T5	56	38± 0.22^{b} (6.22)	43.45	23± 0.06^{c} (4.90)	71.04	27± 0.16^{c} (5.28)	70.53	38	28± 0.15^{bc} (5.38)	31.58	15± 0.13^{cd} (3.99)	68.66	19± 0.20^{cd} (4.45)	66.01	19.51± 0.29^{b}	22.31	3.41
T6	50	35± 0.21^{bc} (5.98)	41.47	20± 0.15^{cd} (4.57)	71.79	23± 0.15^{cd} (4.90)	70.66	35	25± 0.15^{bcd} (5.08)	33.67	13± 0.14^{cde} (3.73)	70.51	16± 0.18^{cde} (4.10)	68.92	19.64± 0.32^{b}	23.13	3.43
T7	55	66± 0.14^{a} (8.17)	0	78± 0.21^{a} (8.87)	0	90± 0.20^{a} (9.53)	0	104	112± 0.20^{a} (10.62)	0	131± 0.23^{a} (11.48)	0	153± 0.15^{a} (12.40)	0	15.95± 0.30^{f}	-	2.80
LSD		0.53		0.50		0.49			0.45		0.35		0.48		0.32		
CV		6.90		7.59		6.97			6.13		5.70		7.09		1.49		

LSD: Least significant difference (p=0.05); CV: Coefficient of variation; Value with same letter in a column not significantly different at p=0.05 by SAS analysis; Figures after ± indicate Standard Error

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