

## Original Research Article

# Bio-efficacy of Botanicals against Aphid, *Lipaphis erysimi* Infesting Cabbage

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## ABSTRACT

A field experiment was conducted at Agronomy farm, B. A. College of Agriculture, Anand Agricultural University, Anand (Gujarat) during *rabi*, 2019 to evaluate the efficacy of different nine botanicals (neem seed kernel extract 5%, neem oil 1%, neem leaf extract 10%, lantana leaf extract 10%, tobacco decoction 2%, garlic bulb extract 5%, asafoetida + ajawain + turmeric 2%, karanj oil 1% and ginger rhizome extract 5%) against cabbage aphid, *Lipaphis erysimi* compared to control. The tobacco decoction 2% and ginger rhizome extract 5% was observed significantly superior followed by neem oil 2%, garlic bulb extract 5% and neem seed kernel extract 5%. The highest yield of cabbage was obtained from the plots treated with ginger rhizome extract 5% (162.33 q/ha) followed by tobacco decoction 2% (160.333 q/ha). The highest increase in yield over control registered from the plot treated with ginger rhizome extract 5% (68.97%) followed by tobacco decoction 2% (66.89%).

## Keywords

Bio-efficacy,  
Botanicals,  
*Lipaphis erysimi*,  
Cabbage

## Introduction

Cabbage (*Brassica oleracea* var. capitata L. 2n=2x=18) is one of the most important cole crops grown under temperate to tropical climatic conditions in more than ninety countries throughout the world (Singh *et al.*, 2010). It is grown in kitchen markets and truck gardens. Cabbage is one among the abundantly consumed vegetables all over the world. In India, West Bengal, Orissa, Bihar, Assam, Gujarat, Maharashtra, Jharkhand, Haryana and Karnataka are the major cabbage growing states. In India the total cultivated area of cabbage is 399 thousand hectares with the production of 90,95,000 MT and average productivity of cabbage is 22,794 kg/ha during 2018-19 (Anonymous, 2019).

Among the different factors responsible for low production of cabbage, insect pests are one of the limiting factors. More than 27 species of insect-pests are reported on cabbage in India (Bhatia and Verma, 1993). Cabbage crop is attacked by a number of insects *viz.*, tobacco caterpillar, *Spodoptera litura* (F.); diamondback moth, *Plutella xylostella* (L.); cabbage leaf webber, *Crocidolomia bionotalis* (Zell); aphids, *Brevicornye brassicae* (L.) and *Lipaphis erysimi* (Kalt); painted bug, *Bagrada cruciferarum* (Kirk.) and flea beetle, *Phyllotreta cruciferae* (Goeze) from sowing to harvest (Rao and Lal, 2005). Among the pest infesting the cabbage crop, aphid, *Lipaphis erysimi* (Kalt) is reported as a serious pest of cabbage (Sharma and Bhalla, 1964). The estimated loss in yield due to the

aphid, *Lipaphis erysimi* (Kalt) in cabbage crop was reported 47.1 to 96.0 per cent. (Suri *et al.* 1988)

In recent years, many scientists have switched to use of botanicals instead of chemical insecticides for the control of insect. The botanicals are more compatible with the environmental components, eco-friendly and non-hazardous to human beings. Therefore, the present study was carried out to evaluate the bio-efficacy of different botanicals as well as economics.

### Materials and Methods

Field experiment was conducted at Agronomy Farm, B. A. College of Agriculture, AAU, Anand during *rabi* season of year 2019. The crop was raised by adopting recommended agronomical practices. To evaluate efficacy, cabbage variety cabbage express was transplanted on plot size 3.60 x 2.70 m.

Various botanicals were given by using high volume sprayer (knapsack) with required concentration. From each treatment plot, 5 plants were selected randomly and on each plant 3 randomly selected leaves were observed. The observations were recorded before spraying as well 3, 5, 7 and 10 days after spray. Observations on number aphids were recorded at weekly interval. First spray was given on appearance of the pest and second spray was given after 10 day of the first spray. Sticker (Teepol, 10 ml/10 litre of water) was added. Data thus obtained were subjected to ANOVA after following the appropriate transformation to see the impact of various botanicals on activity of cabbage aphid (Steel and Torrie, 1980).

The cabbage crop was harvested at maturity and yield (kg/plot) were recorded from each net plot area under each treatment. Yield

recorded from each net plot was converted in to hectare basis for comparison. The increase in yield over control was worked out by following formula given by Khosla (1977).

$$\frac{\text{Yield in treatment} - \text{Yield in control}}{\text{Yield in control}} \times 100$$

Where,

T = Yield from treated (protected) plot (kg/ha)

C = Yield from control (untreated) plot (kg/ha)

### Results and Discussions

The data presented in Table 1 revealed that there was uniform population of nymph and adult of aphid in all the treatments which was found non-significant. The average population ranged from 24.13 to 28.93 nymph and adult aphid/3 leaves.

The data of pooled over periods after first spray presented in Table 1 showed that there was significant difference among various botanicals treatments. The treatment tobacco decoction 2% recorded lowest number (7.67 aphid/3 leaves) and it was at par with ginger rhizome extract 5% (7.90 aphid/3 leaves). Neem oil 1% (12.39 aphid/3 leaves), NSKE 5% (12.59 aphid/3 leaves) and Garlic bulb extract 5% (12.60 aphid/3 leaves) was moderately effective against aphid. While highest (19.87 aphids/3 leaves) aphid population was recorded in lantana leaf extract 10% and it was at par with karanj oil 1% (19.01 aphids/3 leaves), neem leaf extract 10% (18.75 aphids/3 leaves) and asafoetida + ajawain + turmeric 2% (18.49 aphids/3 leaves).

The data of pooled over periods presented in Table 2 conclude that there was significant difference among various botanicals

treatments. The treatment tobacco decoction 2% recorded lowest number (6.25 aphid/3 leaves) and it was at par with ginger rhizome extract 5% (6.35 aphid/3 leaves). Neem oil 2% (10.11 aphid/3 leaves), Garlic bulb extract 5% (10.30 aphid/3 leaves) and NSKE 5% (10.50 aphid/3 leaves) was moderately

effective against aphid. While highest (17.72 aphids/3 leaves) aphid population was recorded in lantana leaf extract and it was at par with karanj oil 2% (15.92 aphids/3 leaves), neem leaf extract 10% (17.06 aphids/3 leaves) and asafoetida + ajawain + turmeric 2% (15.29 aphids/ 3 leaves).

**Table.1** Evaluation of botanicals against cabbage aphid, *L. erysimi* on cabbage after 1<sup>st</sup> spray

Tr. No.	Treatments	Conc. (%)	No. of aphids/3 leaves at indicated days after spray					
			Before spray	3	5	7	10	Pooled
T1	Neem seed kernel extract	5	4.99d (25.00)	3.85b (14.87)	3.52b (12.47)	3.46b (12.07)	3.55b (12.67)	3.59b (12.59)
T2	Neem oil	1	5.27d (27.87)	3.76b (14.20)	3.43b (11.80)	3.40b (11.60)	3.50b (12.27)	3.52b (12.39)
T3	Neem leaf extract	10	5.32d (28.30)	4.63c (21.40)	4.25c (18.13)	4.19c (17.60)	4.28c (18.40)	4.33c (18.75)
T4	Lantana leaf extract	10	4.91d (24.13)	4.66c (21.93)	4.35c (18.93)	4.23c (17.93)	4.35c (18.93)	4.39d (19.87)
T5	Tobacco decoction	2	5.05d (25.67)	2.97a (8.80)	2.70a (7.27)	2.64a (7.00)	2.78a (7.73)	2.77a (7.67)
T6	Garlic bulb extract	5	5.23d (27.33)	3.81b (14.53)	3.47b (12.07)	3.43b (11.80)	3.52b (12.47)	3.55b (12.60)
T7	Asafoetida + Ajawain + Turmeric*	2	5.05d (25.50)	4.59c (21.07)	4.21c (17.80)	4.17c (17.40)	4.24c (18.00)	4.30c (18.49)
T8	Karanj Oil	1	5.28d (27.83)	4.65c (21.60)	4.31c (18.73)	4.21c (17.80)	4.31c (18.73)	4.36c (19.01)
T9	Ginger rhizome extract	5	5.26d (27.90)	3.02a (9.13)	2.73a (7.47)	2.69a (7.27)	2.80a (7.87)	2.81a (7.90)
T10	Control	-	5.26d (28.93)	5.38d (29.80)	5.17d (27.00)	5.13d (26.73)	5.27d (28.33)	5.23d (27.35)
S. Em. ±		T	-	0.30	0.23	0.20	0.22	0.23
		P	-	-	-	-	-	0.06
		T x P	-	-	-	-	-	0.21
F test (T)		-	NS	Sig.	Sig.	Sig.	Sig.	Sig.
C. V. %		-	10.01	9.47	9.01	10.18	10.38	9.63

Notes : 1. Figures in parentheses are retransformed values and those outside are  $\sqrt{x}$  transformed values.

2. Treatment mean(s) with the letter(s) in common are not significant by Duncan's New Multiple Range Test (DNMRT) at 5% level of significance.

**Table.2** Evaluation of botanicals against cabbage aphid, *L. erysimi* on cabbage after 2<sup>nd</sup> spray

Tr. No.	Treatments	Conc. (%)	No. of aphids/3 leaves at indicated days after spray				
			3	5	7	10	Pooled
T1	Neem seed kernel extract	5	3.41b (11.70)	3.19b (10.20)	3.17b (10.07)	3.22b (10.40)	3.24b (10.50)
T2	Neem oil	1	3.35b (11.20)	3.13b (9.80)	3.10b (9.60)	3.18b (10.13)	3.18b (10.11)
T3	Neem leaf extract	10	4.13c (17.13)	3.89c (15.13)	3.84c (14.73)	3.91c (15.33)	4.13c (17.06)
T4	Lantana leaf extract	10	4.19c (17.60)	3.97c (15.79)	3.91c (15.27)	4.04c (16.33)	4.21c (17.72)
T5	Tobacco decoction	2	2.61a (6.80)	2.46a (6.07)	2.42a (5.87)	2.53a (6.40)	2.50a (6.25)
T6	Garlic bulb extract	5	3.38b (11.40)	3.16b (10.00)	3.13b (9.80)	3.20b (10.27)	3.21b (10.30)
T7	Asafoetida + Ajawain + Turmeric*	2	4.10c (16.80)	3.85c (14.87)	3.82c (14.60)	3.87c (15.00)	3.91c (15.29)
T8	Karanj Oil	1	4.16c (17.33)	3.92c (15.40)	3.87c (15.00)	4.01c (16.07)	3.99dc (15.92)
T9	Ginger rhizome extract	5	2.64a (7.00)	2.48a (6.20)	2.44a (6.00)	2.54a (6.47)	2.52a (6.35)
T10	Control	-	5.29d (28.47)	5.16d (27.20)	5.07d (26.40)	4.81d (24.00)	5.08d (25.81)
S. Em. ±	T	-	0.19	0.20	0.21	0.21	0.10
	P	-	-	-	-	-	0.06
	T x P	-	-	-	-	-	0.19
F test (T)		-	Sig.	Sig.	Sig.	Sig.	Sig.
C. V. %		-	8.82	9.65	10.39	10.22	9.69

Notes : 1. Figures in parentheses are retransformed values and those outside are  $\sqrt{x}$  transformed values.

2. Treatment mean(s) with the letter(s) in common are not significant by Duncan's New Multiple Range Test (DNMRT) at 5% level of significance

**Table.3** Evaluation of botanicals against cabbage aphid, *L. erysimi* on cabbage (Pooled over periods and sprays)

Treatments	No. of aphids/3 leaves indicated days after spray			
	After spray		Pooled over periods and sprays	
	First	Second		
Neem seed kernel extract	3.59b (12.59)	3.24b (10.50)	3.42b (11.70)	
Neem oil	3.52b (12.39)	3.18b (10.11)	3.35b (11.22)	
Neem leaf extract	4.33c (18.75)	3.94c (15.52)	3.21c (9.80)	
Lantana leaf extracts	4.39c (19.87)	4.02c (16.16)	4.03c (15.74)	
Tobacco decoction	2.77a (7.67)	2.50a (6.25)	2.63a (6.92)	
Garlic bulb extract	3.55b (12.60)	3.21b (10.30)	3.38b (11.42)	
Asafoetida + Ajawain+ Turmeric	4.30c (18.49)	3.91c (15.29)	4.10c (16.81)	
Karanj Oil	4.36d (19.01)	3.99d (15.92)	4.17c (17.39)	
Ginger rhizome extract	2.81a (7.90)	2.52a (6.35)	2.66a (7.08)	
Control	5.23d (27.35)	5.08d (25.81)	5.15d (26.52)	
S. Em. ±	T	0.10	0.10	0.07
	P	0.06	0.06	0.04
	S	-	-	0.03
	T x P	0.21	0.19	0.05
	T x S	-	-	0.25
	P x S	-	-	0.38
	T x P x S	-	-	0.07
F test (T)		Sig.	Sig.	Sig.
C. V. %		9.63	9.69	9.71

- Notes:
1. Figures in parentheses are retransformed values and those outside are  $\sqrt{x}$  transformed values.
  2. Treatment mean(s) with the letter(s) in common are not significant by Duncan's New Multiple Range Test (DNMRT) at 5% level of significance.

**Table.4** Impact of different botanicals on yield of cabbage

Sr. No.	Treatments	Yield (q/ha)	Increase in yield over control (%)
T <sub>1</sub>	Neem seed kernel extract	138.17ab	43.82
T <sub>2</sub>	Neem oil	141.10a	46.87
T <sub>3</sub>	Neem leaf extract	127.17ab	32.37
T <sub>4</sub>	Lantana leaf extracts	117.70bc	22.51
T <sub>5</sub>	Tobacco decoction	160.33a	66.89
T <sub>6</sub>	Garlic bulb extract	137.60ab	43.23
T <sub>7</sub>	Asafoetida + Ajawain+ Turmeric	130.67ab	36.01
T <sub>8</sub>	Karanj Oil	118.37bc	23.21
T <sub>9</sub>	Ginger rhizome extract	162.33a	68.97
T <sub>10</sub>	Control	96.07d	-
	S.Em. ±	6.70	-
	C.D. at 5%	Sig.	-
	C.V. (%)	8.73	-

Note : Treatment means with letter(s) in common are not significant by Duncan’s New Multiple Range Test (DNMRT) at 5% level of significant

The data of pooled over periods and sprays presented in Table 3 revealed that maximum reduction in aphid population was found in treatment Tobacco decoction 2% (6.92 aphids/3 leaves) which was at par with Ginger rhizome extract 5% (7.08 aphids/ 3 leaves). Neem oil 2% (11.22 aphid/3 leaves), Garlic bulb extract 5% (11.42 aphid/3 leaves)and NSKE 5% (11.70 aphid/3 leaves) was moderately effective in reducing aphids population while, treatments like Lantana leaf extract 10% (15.74 aphids/3 leaves), Karanj oil 1% (17.39 aphid/3 leaves), neem leaf extract 5% (9.80 aphids/3 leaves) and Asafoetida + Ajawain + Turmeric 2% (16.81 aphids/ 3 leaves) were less effective in reducing aphid population while, highest aphid population was found in control (26.52 aphid/3 leaves).

The order of botanicals as per reduction in aphid population is Tobacco decoction 2% ≥ Ginger rhizome extract 5% ≥ Neem oil 2% ≥ Garlic bulb extract 5% ≥ NSKE 5% ≥ Asafoetida + Ajawain + Turmeric 2% ≥ Neem leaf extract 10% ≥ Karanj oil 1% ≥ lantana leaf extract 10% ≥ Control.

The present findings are in accordance with Borad (2018) who reported that effect of different botanical pesticides on the aphid and reported that neem oil, ginger rhizome extract and tobacco decoction found superior over other treatments. The results are also in agreement with Anonymous (2020) who revealed that minimum aphid infestation in cumin was recorded with two foliar application of neem oil, garlic bulb extract and ginger rhizome extract. According to Sharma *et al.* (2012),

minimum aphid infestation was observed on fenugreek with three foliar application of neem oil (1%) which was significantly superior over karanj oil (1%), garlic bulb extract (5%) and NLE (5%). Thus, the present findings are in close agreement with the reports of earlier researchers.

### **Yield**

The effectiveness of various botanicals against aphid was also reflected on yield (Table 4) Plots treated with different bio-pesticides yielded significantly higher yield (162.33 to 117.70 q/ha) than control (96.07 q/ha). The chronological order of various botanicals treatments in comparison to control based on yield (q/ha) given in bracket was: Ginger rhizome extract 5% (162.33) > Tobacco decoction 2% (160.33) > Neem oil 2% (141.10) > NSKE 5% (138.17) Garlic bulb extract 5% (137.60) > Asafoetida + Ajawain + turmeric 2% (130.67) > Neem leaf extract 5% (127.17) > Karanj oil 1% (118.37) > Lantana leaf extract 10% (117.70) > Control (96.07). Significantly highest yield was harvested from the plots treated with ginger rhizome extract and it was at par with tobacco decoction 2%, Neem oil 2%, Garlic bulb extract 5% and NSKE 5% were at par and produced more or less same yield. Rest of the botanicals *i.e.* Neem leaf extract 10%, Asafoetida + Ajawain + Turmeric 2%, Karanj oil 1% and Lantana leaf extract 10% were at par with each other. However, the lowest cabbage yield was obtained from control plots.

### **Increase in yield over control**

The increase in yield over control (%) was worked out in different botanicals treatments Table 4. It was ranged from 68.97 to 22.51 per cent due to the application of botanical treatments. The highest and lowest cabbage

yield over control were registered from the plots treated with ginger rhizome extract 5% (68.97%) and lantana leaf extract 10% (22.51%), respectively. The order of botanical treatments in recording per cent increase in grain yield over control was: Ginger rhizome extract 5% (68.97%) > Tobacco decoction 2% (66.89%) > Neem oil 2% (46.87%) > NSKE 5% (43.82%) > Garlic bulb extract 5% (43.23%) > Asafoetida + Ajawain + Turmeric 2% (36.01%) > Neem leaf extract 10% (32.37%) > Karanj oil 1% (23.21%) > Lantana leaf extract 10% (22.51%).

In conclusion, the Tobacco decoction and Ginger Rhizome Extract was significant superior to other treatments which was followed by Neem oil 2%, NSKE 5%, Garlic Bulb Extract 5% which was moderately effective against aphid and at par with each other. The order of botanicals as per reduction in aphid population is Tobacco decoction 2%  $\geq$  Ginger rhizome extract 5%  $\geq$  Neem oil 2%  $\geq$  Garlic bulb extract 5%  $\geq$  NSKE 5%  $\geq$  Asafoetida + Ajawain + Turmeric 2%  $\geq$  Neem leaf extract 10%  $\geq$  Karanj oil 1%  $\geq$  Lantana leaf extract 10%  $\geq$  Control. Significantly higher cabbage yield was recorded from the plot treated with Ginger rhizome extract 5% and Tobacco decoction 2% than rest of the botanicals treatment. The lowest yield was observed from plot treated with Asafoetida + Ajawain+ Turmeric 2%, Neem leaf extract 10%, Karanj oil 1% and Lantana leaf extract 10%. The order of botanicals treatments in recording per cent increase in cabbage yield over control was highest on Ginger rhizome extract 5% and lowest on Lantana leaf extract 10%.

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