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Efficacy of certain chemicals and botanicals against aphid, *Lipaphis erysimi* (Kaltenbach) on cabbage (*Brassica oleracea* L.)

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Abstract
The present study was carried out against aphis (*Lipaphis erysimi* Kalt), entitled "Efficacy of certain chemicals and botanicals on population density of aphid, *Lipaphis erysimi* (Kaltenbach) on cabbage (*Brassica oleracea* L.) at different destructive index" cultivar i.e. Golden acer during *Rabi* season November 2018 to March 2019 at Agriculture research farm, SHUATS, Prayagraj. The insecticides were used per recommended doses along with an untreated control. Each insecticides were sprayed twice at 15 days interval. Spraying was applied as soon as the pest population reached the ETL. The pest count per plant was taken 1 day before spray and 3, 7, 11 and 14 days after spray. The insecticide tested significantly reduced the pest population compare to control. The highest percent reduction of aphid in chemical insecticides was observed in Malathion 50 Ec (68.68) followed by Dimethoate 30 Ec (65.85) and among the botanicals extract highest pest percent reduction is observed in MECH 333 (64.69) followed by NSKE 5% (61.28). And the highest yield was observed in Malathion 50 Ec (66.66 t/ha) followed by Dimethoate 30 Ec (60.41 t/ha). Thus, Malathion 50 Ec (1.80) have the best benefit cost ratio followed by Dimethoate 30 Ec (1.63) having the second best benefit cost ratio.

Keywords: Aphid (*Lipaphis erysimi* Kalt), chemical insecticide, botanicals, cabbage crop (golden acer)

Introduction
Cabbage is one of the most popular winter vegetable grown in India. India is the second largest producer of cabbage in the world after China. India producing 909.2 million tonnes (5.5 percent of total vegetables product) in an area of 400.1 ha. (4.3 percent of total vegetable area) with a productivity of 22.6 Mt/ha. Highest production of cabbage in India is found in West Bengal. Highest cabbage producing state of India are West Bengal and Orissa which are 2197.4 tonnes and 735.0 tonnes respectively Anonymos (2014) [1]. It is evident that every year a large portion of agriculture produce is damage due to insects. Aphids are 'stealthy' pests. In contrast to chewing herbivores, which macerate plant tissue, they are adapted to feed on phloem sap. The aphids have short generation times and an extremely high asexual fecundity which leads in a rapid increase in aphid population density and subsequent elevated consumption levels of phloem sap. Thus, the depletion of nutrients can become a serious problem and may have a severe impact on host plants Gill *et al.* (2013) [6]. Indiscriminate use of several pesticides creates problem in the natural ecosystem, environmental pollution, pest resistance and health hazards etc. Due to this, only selective chemicals and botanicals were used in order to avoid indiscriminate use of pesticides. The maximum protection to the cabbage foliage was provided at 5 per cent of *M. azedarach* (88.3%) and *A. indica* (82.5%) Sharma and Gupta (2009) [14]. The phytotoxicity ratings recorded was zero under all the treatments tobacco, neem, dhatura and onion, respectively and no abnormality was observed in the crop Magsi *et al.* (2017) [11]. For rapid and absolute antifeedance (within 6 hr), 200 ppm of azadirachtin was required in the formulation which persisted for nearly 5 days Koul *et al.* (1997) [8]. Lantana treatments showed significant mortality effect on aphids at all time Mvumi and Maunga (2018) [12]. The use of these plant extracts *A. indica* seeds and *L. camara* can be incorporated into an overall control programme of these pests Baidoo and Adam (2012) [9]. 2nd instar larva showed that response of aphid to the surface treatment was rapid and occurred within 1hr of treatment in application of NSKE 5% Koul *et al.* (1997) [8]. The efficacy to tested newer insecticides like neemoil, Imidalcloprid and fipronil were found promosing against mustard aphids (*L. erysimi)* Dotasara *et al.* (2017) [4].

The main aim was to observed the efficacy of certain chemicals and botanicals on population density of aphid at different destructive level.

Materials and Methods

The present experiment was undertaken to study, "Efficacy of certain chemicals and botanicals on population density of aphid, *Lipaphis erysimi* (Kaltenbach) on cabbage (*Brassica oleracea* L.) at different destructive index", during *Rabi* season 2018-2019 at SHUATS, Central field, Praygraj. Seed of Golden acer variety were sown on 22nd November, for raising seedlings Germination trays filled with cocopit were used for seed bed followed by irrigation and application of NPK along with water two weeks after sowing twice every week. The seedlings of one month old having uniform size were used for transplantation during the year 2018 in 2 x 1 m^2 ($2m^2$) size plot flowing RBD with 3 replications. Fertilization and intellectual operations were done uniformly for raising the crop.

Observation of aphid population

The estimation of aphid population was based on the numerical count method Dotasara *et al.* (2017) [4]. For recording the aphid population leaves were grasped at the petiole by thumb and fore figure and twisted until entire underside of the leaves were clearly visible. The observations on aphid population were recorded at weekly intervals. The mean number of aphids was recorded by taking the aphids population (Both nymph and adult) per leaf present on each leaf (Upper, middle and lower) from each of randomly 5 selected tagged plants per plot.

Pre-treatment and post-treatment observation

Pre-treatment counts of aphid population were taken one day prior in all the plots just before the application of insecticides. Post-treatment counts of aphid population after 3, 7, 11 and 14 days after application of treatment. Similar observations were also taken after 2nd application of treatments.

Treatment combination

Eight treatments, namely T_1= Tobacco leaf extract @ 30gm/2lit, T_2= NSKE 5% @ 4gm/lit, T_3= Neem oil 0.03% @ 3ml/lit, T_4= Lantana leaf extract @ 250ml/9.5lit, T_5= MECH333 @ 1ml/lit, T_6= Malathion 50 Ec @ 300ml/ha, T_7= Dimethoate @ 300ml/ha and T_8= Untreated control were evaluated against aphid against field condition.

Determination of Per cent population reduction

The formula used for the calculation of percentage reduction of pest population over control using following formula giving by Henderson and Tilton (1955) [7] referring it to be modification of Abbott (1925) [2], Fleming and Retnakaran (1985) [5]

$$\text{Per cent population reduction} = \left(1 - \frac{Ta}{Ca} \times \frac{Cb}{Tb}\right) \times 100$$

Where,

Ta = Number of insects on treated plots after insecticidal application

Tb = Number of insects in treated plots before insecticidal application

Ca = Number of insects in untreated plots after insecticidal application

Cb = Number of insects in untreated plots before insecticidal application

Determination of benefit: cost ratio

Gross return was calculated by multiplying total yield with the market price of the produce. Benefit Cost ratio was calculated by following formula.

$$B:C = \frac{\text{Gross returns}}{\text{Total cost of incurred}}$$

Where, B: C = Benefit Cost Ratio

Statistical analysis of the different insecticide treatments

The significance and non-significance of the treatment effect will be judged with the help of "F" variance ratio, test calculated "F" value compared with the table value of "F" at 5% level of significance. If calculated value exceeds the table value, the effect was considered to be significant. The significant differences between the means will be tested against the critical difference at 5% level of significance. For testing the hypothesis, the ANOVA table was used.

Results and Discussion

First application

Initially, aphids appeared on the unsprayed plot of cabbage in the second week of January 2018-2019 on the under and upper surface of the leaf and their infestation continued up to 3rd week of February at the pre maturity stage (70 DAS). Efficacy of certain chemicals and botanical insecticides on the effect of *Lipaphis erysimi* recorded by counting number of aphids are present (Table 1). The results revealed that all the treatment were significantly effective in reducing the infestation of aphids and thus increasing the yield significantly as compared to control. The initial mustard aphid population ranged from 262.86 to 374.86 aphids/plant (Table 2) before the spray and did not differ significantly. The data recorded 3 days after spray, results showed the significant reduction of the aphids population was maximum in the treatment of Malathion 50 Ec (77.85%) followed by MECH333 (73.48%), Dimethoate 30 Ec (73.286%), Lantana leaf extract (68.10%), Tobacco leaf extract (54.57%), Neem oil 0.03% (66.26%) and NSKE 5% (63.16). Observation recorded on the 7 days after spray, aphids population was decreased in every treatments and increase in control plot, results showed significant reduction of the aphids population was maximum in the treatment of Malathion 50 Ec (56.00%) followed by MECH333 (51.62%), Dimethoate 30 Ec (47.75%), Neem oil 0.03% (47.45%), Tobacco leaf extract (56.46%), Lantana leaf extract (43.69%), and NSKE 5% (42.91%). Data recorded on the 11 days after spray showed decrease of aphids in all treatments and increase in control plot, results shows the significant reduction of aphids population was maximum in the treatment of Malathion 50 Ec (49.19%) followed by Dimethoate 30 Ec (48.19%), MECH333 (37.25%), Tobacco leaf extract (35.27%), NSKE 5% (40.77%), Lantana leaf extract (32.12%) and Neem oil 0.03% (31.37%). At 14 DAS decreased pattern in all the treatments was observed while maintain their efficacy and significance over control, MECH333 recorded to be the highest in reducing aphids population (26.73%) followed by Malathion 50 Ec (23.47%), Dimethoate 30 Ec (21.84%), Neem oil 0.03% (21.13%), Lantana leaf extract (21.07%), Tobacco leaf extract (20.14%) and NSKE 5% (20.05%).

Table 1: Mean aphid population

Treatments	Aphid mean population/Five head										
	1st spray					2nd spray					
	DBS	3DAS	7DAS	11DAS	14DAS	DBS	3DAS	7DAS	11DAS	14DAS	Mean
Tobacco leaf extract	297.4	230	161.13	123.8	77.6	81.33	50.26	40.6	23.6	16.06	74.9
NSKE 5%	311.8	224.4	157.06	126.66	82.46	69.93	55.66	32.6	22.26	16.1	89.68
Neem oil 0.03%	264.2	197.46	157.33	105.4	71.93	81.6	65.13	44.86	22	15	84.88
Lantana leaf extrct	293.2	226.73	173.8	100.6	78.06	87.2	50.06	33.33	28.2	15.6	88.29
MECH333	375	313.86	232.4	119.6	90.26	36.7	31	20.6	11.93	6.93	103.32
Malathion 50Ec	300	261.93	192.13	106.26	84.66	30.46	24.73	17.13	11.33	7.4	88.19
Dimethoate 30 Ec	348.6	289.93	197.53	113.26	97	32.93	26.2	19.2	11.73	6.46	95.39
Control	262.86	292.86	301.93	313.06	317.46	261.13	217.26	169.26	102.53	79.6	224.24

Table 2: Effect of chemicals and botanicals in reduction of population of aphids in 1st spray during *rabi* season of 2018 – 2019

Treatments	% Reduction in population of aphids					
	Pre-treatment population/Five head	3 DAS	7 DAS	11 DAS	14 DAS	Mean
T1- Tobacco leaf extract	294.46	66.37(54.57)*	42.46(40.65)*	35.27(36.26)*	20.14(26.80)*	41.06(39.57)*
T2- NSKE 5%	305.8	63.16(52.71)*	42.90(40.86)*	40.77(35.24)*	20.05(24.09)*	41.72(39.95)*
T3- Neem oil 0.03%	264.06	66.25(54.57)*	47.45(43.53)*	31.37(34.01)*	21.13(27.35)*	41.55(39.86)*
T4- Lantana leaf extract	293.2	68.10(55.73)*	43.69(41.29)*	32.12(34.27)*	21.07(27.26)*	41.24(39.70)*
T5- MECH333	374.86	73.48(59.65)*	46.95(43.23)*	37.25(37.29)*	26.73(30.93)*	46.10(42.75)*
T6- Malathion 50 EC	300	77.85(66.44)*	62.66(52.37)*	49.19(44.53)*	23.74(28.99)*	53.36(46.98)*
T7- Dimethoate 30 EC	348.6	73.28(59.06)*	47.74(43.70)*	48.19(44.06)*	21.84(27.84)*	47.76(43.60)*
T0- Control	262.86	0	0	0	0	0
F- test	-	S	S	S	S	S
S.Ed(±)		6.01	8.08	8.25	3.66	7.47
C.D.(P=0.05)		12.88	17.32	17.69	7.85	11.62

*Figure in parenthesis are arc sine transformed values.

Second application

The second insecticide sprayed was applied 3 days after the 1st application i.e. at 99 days crop age and data recorded on the incidence of *Lipaphis erysimi* (Table 3). A similar trend of efficacy of treatments as in first application on reduction of aphids was recorded after the second spray and all the treatment proved better than the control. Observations recorded on the 3rd days after spray application revealed that the significantly reduction of the population of aphids was maximum in the treatment of Malathion 50 Ec (95.85%) followed by MECH333 (96.34%), Dimethoate 30 Ec (95.85%), Neem oil 0.03% (94.75%), NSKE 5% (86.80%), Lantana leaf extract (74.84%) and Tobacco leaf extract (73.26%). Data recorded on the 7th days after spray application shows that all the treatment were found effective over control, results revealed that the significantly reduction of the population of aphids was maximum in the treatment of Dimethoate 30 Ec (88.94%) followed by Malathion 50 Ec (85.74%), MECH333 (84.99%), Neem oil 0.03% (83.41%), Tobacco leaf extract (76.31%), NSKE 5% (70.97%) and Lantana leaf extract (57.94%). After the 11th days of insecticide application, all the treatment were found significantly superior than the control reduction of the population of aphids was maximum in the treatment of Malathion 50 Ec (91.61%) followed by Dimethoate 30 Ec (87.87%), MECH333 (80.15%), Lantana leaf extract (79.45%), NSKE 5% (78.66%), Tobacco leaf extract (72.11%) and Neem oil 0.03% (66.42%). The data recorded on the 14th day after spray application, showed the decrease pattern of aphids population and results revealed that the significantly reduction of the population of aphids was maximum in the treatment of NSKE 5% (74.00%) followed by Malathion 50 Ec (70.69%), MECH333 (66.97%), Dimethoate 30 Ec (63.57%), tobacco leaf extract (63.62%), Neem oil 0.03% (59.22%) and Lntana leaf extract (56.37%). Thus, Malathion significantly reduced the highest aphid population, Biswas (2013) [3] reported a similar result in his study. The treatment recommended chemical insecticide Dimethoate 30 Ec recorded to be the second highest reduction in the aphid population Khedkar *et al.* (2012) [9] reported almost the same by considering dimethoate as the next best chemical.

Table 3: Effect chemicals and botanicals in reduction of population of aphids in 2nd spray during *rabi* season of 2018 – 2019

Treatments	% Reduction in population of aphids					
	Pre-treatment population/Five head	3 DAS	7 DAS	11 DAS	14 DAS	Mean
T1- Tobacco leaf extract	81.33	73.26(58.87)*	76.31(60.93)*	72.11(58.08)*	63.62(52.92)*	71.32(57.69)*
T2- NSKE 5%	69.93	86.80(68.80)*	70.97(57.55)*	78.66(62.66)*	74.00(59.40)*	77.60(61.98)*
T3- Neem oil 0.03%	81.73	94.75(77.21)*	83.41(66.31)*	66.42(54.58)*	59.22(50.32)*	75.95(61.90)*
T4- Lantana leaf extract	87.2	74.84(59.90)*	57.94(49.57)*	79.45(63.10)*	56.37(48.66)*	67.15(55.29)*
T5- MECH333	36.7	96.34(79.00)*	84.99(67.23)*	80.15(63.78)*	66.97(54.85)*	82.11(66.16)*
T6- Malathion 50 EC	30.46	96.39(79.77)*	85.74(68.02)*	91.61(73.23)*	70.69(57.76)*	86.10(69.31)*
T7- Dimethoate 30 EC	32.93	95.85(76.60)*	88.94(70.64)*	87.87(69.80)*	63.57(53.05)*	84.04(67.82)*
T0- Control	261.13	0	0	0	0	0
F- test	-	S	S	S	S	S
S.Ed(±)		2.10	4.14	3.99	6.58	4.79
C.D.(P=0.05)		4.50	8.88	8.57	14.12	10.76

*Figure in parenthesis are arc sine transformed values.

Benefit: Cost ratio

Economics of various treatment (Table 4 and 5)

The yield among the treatment were significant. The highest yield as recorded in Malathion 30 Ec (66.66 t/ha), which was followed by Dimethoate 50 Ec (60.41 kg/ha), MECH 333 (58.33 kg/ha), NSKE 5% (55.41kg/ha), Neem oil 0.03% (48.58 kg/ha), Lantana leaf extract (41.66 kg/ha), Tobacco leaf extract (39.58 kg/ha) and lowest yield was observed in control plots (31.08 kg/ha). When benefit cost ratio was worked out, interesting result was achieved. Among the treatment studied the best and most economical treatment was Dimethoate 30 Ec (1.82) followed by Malathion 50 Ec (1.80), NSKE 5% (1.80), MECH 333 (1.52), Neem oil 0.03% (1.45), Lantana leaf extract (1.19), Tobacco leaf extract (1.09) and least benefit cost ratio on the Control (0.46). The highest yield was observed in Malathion 50 Ec (66.66 t/ha) in which Biswas (2013) [3] also reported the highest seed yield in his experiment and Dimethoate 30 Ec (60.41t/ha) ranks the second highest. Most fovourable cost benefit ratio was obtained in Dimethoate 30 Ec (1.82) Meena *et al*. (2013) [10] reported the same results on her research with the same treatment. Which was followed by Malathion 50 Ec (1.80).

Table 4: Economics of treatments

Treatment	Chemicals and botanicals use	Chemicals and botanicals used for 2 spray	Cost of insecticide	Total cost of insecticide	Labour charge for 2 spray	Totl cost of treatment
Tobacco leaf extract	18 l/ha	32 l/ha	200/kg	6400	600	7000
NSKE 5%	12.5kg/ha	25 kg/ha	90/kg	2250	600	2850
Neem oil	9 l/ha	18 l/ha	240/l	4320	600	4920
Lantana leaf extract	18 l/ha	32 l/ha	150/l	5400	600	6000
MECH 333	5 l/ha	10 l/h	800/l	8000	600	8600
Malathion 50 Ec	5 l/ha	10 l/ha	700/l	7000	600	7600
Dimethoate 30 Ec	5 l/ha	10 l/ha	700/l	7000	600	7600

Table 5: Economics of cultivation

Tr. no	Treatments	Yield t/ha	Cost of yield Rs/q	Total cost of yield (Rs)	Common cost (Rs)	Treatment cost	Total cost (Rs)	B:C Ratio
T_1	Tobacco leaf extract	39.58	750	29685	20170	7000	27170	1:1.09
T_2	NSKE 5%	49.41	750	37507.5	20170	2850	23020	1:1.60
T_3	Neem oil 0.03%	48.58	750	36435	20170	4920	25090	1:1.45
T_4	Lantana leaf extrct	41.66	750	31245	20170	6000	26170	1:1.19
T_5	MECH 333	58.33	750	43747.5	20170	8600	28770	1:1.52
T_6	Malathion 50 Ec	66.66	750	49995	20170	7600	27770	1:1.80
T_7	Dimethoate 30 Ec	60.41	750	45307.5	20170	7600	24830	1:1.63
T_8	Water	31.08	750	23310	50170	0	50170	1:0.46

Summary and Conclusion

The Maximum population reduction per cent of aphids (*Lipaphis erysimi*) was recorded in Malathion 50 Ec (86.10%) at 2nd spray followed by Dimethoate 30 Ec (84.04%), MECH333 (82.11), NSKE 5% (77.60%), Neem oil 0.03% (75.95%), Tobacco leaf extract (71.32%) and Lantana leaf extract (67.15%).

The highest yield as recorded in Malathion 30 Ec (66.66 t/ha), followed by Dimethoate 50 Ec (60.41 kg/ha), MECH 333 (58.33 kg/ha), NSKE 5% (55.41kg/ha), Neem oil 0.03% (48.58 kg/ha), Lantana leaf extract (41.66 kg/ha), Tobacco leaf extract (39.58 kg/ha) and control (31.08 kg/ha). When benefit cost ratio was worked out, intresting result was achieved. Among the treatment studied the best and most economical treatment was Dimethoate 30 Ec (1.82) followed by Malathion 50 Ec (1.80), NSKE 5% (1.80), MECH 333 (1.52), Neem oil 0.03% (1.45), Lantana leaf extract (1.19), Tobacco leaf extract (1.09) and Control (0.46).

From the critical analysis it was concluded that among the treatments used chemicals are considered to have the best treatment in which Malathion 50 Ec proved to be the best treatment followed by Dimethoate 30 Ec, MECH333, NSKE 5% extracts proved to be the best treatment in managing *Lipaphis erysimi* reduction. And the highest yield was observed in Malathion 50 Ec and Dimethoate 30 E having the best benefit ratio. Therefore, insecticides of short residual effect and may be useful in devising proper integrated pest management strategy against aphid. Botanical low cost and risk without adverse effect on environment, human and animals.

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References

1. Anonymous. Ministry of Agriculture, Government of India. National Horticulture Board, 2014.
2. Abbott WS. A method of computing the effectiveness of an insecticide. Ecological Entomology. 1925; 18:265-267
3. Biswas GC. Comparative effectiveness of neem extract and synthetic organic insecticide against musstaed aphids. Bangladesh Journal of Agriculture Research. 2013; 38(2):181-187.
4. Dotasara SK, Agrawal N, Singh N, Swami D. Efficacy of some newer insecticides against mustard aphid *Lipaphis erysimi* Kalt. In cauliflower. Journal of Entomology and Zoology Studies. 2017; 5(2):654-656.
5. Fleming R, Retnakaran A. Evaluating single treatment data using Abbott's formula with reference of insecticide. Journals of Economical Entomology. 1985; 78:1179-1181.
6. Gill HK, Garg H, Kaufman JLG. Cabbage aphid *Brevicoryne brassicae* Linnaeus (Insecta: Hemiptera: Aphididae). IFAS Extension, 2013, 1-5.

7. Henderson CF, Tilton EW. Tests with acaricides against brown wheat mite. Journal of Economic Entomology. 1955; 48(2):157-161.
8. Koul O, Sankar JS, Mehta N. Antifeedent activity of neem extracts and azadirachtin to cabbage aphid, *Brevicoryne Brassicae* (L). Indian Journal of Experimental Biology. 1997; 35:994-997.
9. Khedkar AA, Bharpoda TM, Patel MG, Patel CK. Efficacy of different chemical insecticides against mustard aphids *Lipaphis erysimi* Kalt. Infesting mustard. An Intrenational e-Journal. 2012; 1(1):53-64.
10. Meena H, Singh SP, Nagar R. Evaluation of microbial agents and bioproduct for the management OD mustard aphids *Lipaphis erysimi* (KALT.). The Bioscan. 2013; 8(3):747-750.
11. Magsi FH, Syed TS, Memon AUR, Bhutto ZA, Chang BH, Chandio MA *et al*. Effect of different tobacco extracts on the population build up of sucking complex in okra crop. International Journal of fauna and biological studies. 2017; 4(2):120-123.
12. Mvumi C, Maunga PR. Efficacy of lantana (*Lantana camara*) ectract application against aphid (*Brevicoryne brassicae*) in rape (*Brassica napus*) over varied period of time. African journal of biotechnology. 2018; 17(8):249-259.
13. Patel S, Yadav SK, Singh CP. Bio-efficacy of insecticides against *Lipaphis erysimi* (Kalt.) in mustard ecosystem. Journal of entomology and zoology studies. 2017; 5(2):1247-1250.
14. Sharma A, Gupta R. Biological activity of some plant extracts against *Pieris brassicae* (Linn.). Journals of Biopesticides. 2009; 2(1):26-31.