

## Evaluation of Novel Insecticides against Mustard Aphid *Lipaphis erysimi* Kalt

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**ABSTRACT:** The present investigation entitled “Evaluation of novel insecticides against mustard aphid *Lipaphis erysimi* Kalt.” at Student Instructional Farm (SIF), C.S.A University of Agri. & Tech. Kanpur during Rabi season of 2019-2020 & 2020-2021. The data analysis for management of mustard aphid *Lipaphis erysimi* Kalt. revealed a similar trend in both the years. The treatment Dimethoate 30 EC(1ml/lit) was proved significantly superior over all treatments with highest control over mustard aphid *Lipaphis erysimi* Kalt population in both the years. The treatment *Beauveria bassiana* (2g/lit) was found poorest with minimum control of mustard aphid *Lipaphis erysimi* Kalt population in terms of efficacy in both the years. The trend of efficacy of different treatments against mustard aphid *Lipaphis erysimi* Kalt were in descending order as following Dimethoate 30 EC(1ml/lit) > Imidacloprid 17.8 SL (0.25 ml/lit) > Thiamethoxam 25 WG (0.20g/lit) > Acetamiprid 20 SP (0.1g/lit) > Clothianidine 50 WDG (0.12g/lit) > *Verticillium lecanii* (2g/lit) > Azadirachtin 3000 ppm (5ml/lit) > *Beauveria bassiana* (2g/lit).

**Keywords:** Mustard aphid, efficacy, insecticides, management, Dimethoate 30 EC, Imidacloprid 17.8 SL.

### INTRODUCTION

India's agricultural economy has historically been based on oilseeds. Next to China, Brazil, and the United States of America, India has the fourth-largest vegetable oil economy in the world. Due to their ability to thrive in a variety of agroclimatic settings, oil-seed *Brassica* have gained popularity in India. There are more than 30 pests that have been linked to different phenological stages of rapeseed-mustard crop production (Bakhetia and Sekhon 1989). Among all of the insect pests, mustard aphid, *L. erysimi* (Aphididae: Hemiptera), is by far the most important pest, causing significant yield loss to *Brassica* every year, reducing yield by 50 to 80% (Ellis and Singh 1993; Khan and Munir *et al.*, 1986). The intense attack of aphid results in mustard plant to wither loss of seed yield and oil content. This pest is prevalent worldwide and thrives on all *Brassica* crops (Yue and Liu 2000). Various management strategies were tried, but none were effective due to the aphid's high parthenogenetic reproductive capacity and migratory nature. With demand for oilseed surpassing supply, production trends have been inadequate due to the attack of various insect pests. It causes severe plant stress by sucking plant sap from tender shoots and flowers in the early part and later sucking sap from tender pods. Plants that have been infested become vulnerable and stunted. Chemical control is more precise because it controls approximately

90% of the aphid population, but because of their rapid rate of reproduction, the aphid population returns to pre-treatment levels in 2-3 weeks (Amer *et al.*, 2009; Singh *et al.*, 1983). For the very reason the present study has included a second spray of the treatments after the 15 day period in both the years. As a matter of fact, insecticides must have a longer duration of effective control well over mustard aphid population.

### MATERIAL AND METHODS

The experiment was conducted on the Students Instructional Farm, Chandra Shekhar Azad University of Ag. & Tech. Kanpur during the rabi season of 2019-2020 and 2020-2021. Geographically it is situated between 26°21' east longitude at a height of 125.1 meter above mean sea level. Nine treatments were taken up for the experiment viz. Imidacloprid 17.8 SL, Thiamethoxam 25 WG, Acetamiprid 20 SP, Dimethoate 30 EC, Clothianidine 50 WDG, Azadirachtin 3000 ppm, *Beauveria bassiana*, *Verticillium lecanii* along with a untreated Control. The crop variety Urvashi was sown with a standard plot size of 4.5m × 3m and the distance between rows and plants was 30cm and 10cm respectively. All the recommended agronomic practices were followed. The spraying of insecticides was done twice in one crop season at 15 days interval after making desirable insecticidal spray solution. The population of mustard aphid was recorded from 10 cm top portion of

the central shoot on 10 randomly tagged plants from each plot one day before and 3, 7 and 10 days after the insecticide application.

## RESULTS AND DISCUSSION

### Year 2019-2020

**First spray:** Data presented in (Table 1) showed that first day before of spray the aphid population ranges from 83.00 to 91.29 Aphids/10 cm central top twigs/plant, hence the population was above the threshold level (ETL), so the novel insecticides were applied at this time to minimize aphid population.

**After 3 days of spray.** The novel insecticides data presented in (Table 1) showed that Dimethoate 30 EC(1ml/lit) was found with highest efficacy than other treatments with documentation of population 26.80 Aphids/10 cm top central twigs/plant followed by the efficacy of treatment Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) with recorded population such as 31.78, 33.27, 36.34, 39.45, 41.23, 42.92 and 74.36 Aphids/10 cm top central twigs/plant, respectively.

**After 7 days of spray.** The effect of different treatments after 7 days of application of botanical insecticides on the population of mustard aphid showed in the (Table 1) aphid population of treatment Dimethoate 30 EC(1ml/lit) superior 21.35 Aphids/10 cm top central twigs/plant than other treatments followed by the efficacy of treatments Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) with recorded population such as 21.35, 27.97, 28.43, 30.29, 35.91, 37.19, 38.77 and 42.13 Aphids/10 cm top central twigs/plant, respectively.

**After 10 days of spray.** The treatment Dimethoate 30 EC (1ml/lit) were found (Table 1) highest efficacy in terms of mustard aphid *Lipaphis erysimi* Kalt. population management after 10 days of spray. The lowest population 43.64 recorded from treatment Dimethoate 30 EC (1ml/lit). However, other treatments such as Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) recorded higher population of mustard aphid than Dimethoate 30 EC (1ml/lit) treatment such as 46.19, 48.96, 51.06, 56.12, 85.37, 59.83 and 64.67 aphid/10 cm top central twigs/plant respectively. So, that in above all novel insecticides highest efficacy of Dimethoate 30 EC (1ml/lit) reported after first spray control than remaining novel insecticides. However,

other novel insecticides also deducted the aphid population satisfactorily control treatment.

**Second spray:** The mustard aphid population recorded one day prior to spray founded between 63.92 to 121.20 aphids/10cm top central twigs/plant. So, this range of population goes beyond ETL, for their management applied novel insecticides as foliar spray in different treatments at different days interval.

**After 3 days of spray.** The data after 3 days of application of novel insecticides presented in (Table 2) showed that the treatment Dimethoate 30 EC(1ml/lit) was found with highest efficacy than other treatments with documentation of population 28.12 Aphids/10 cm top central twigs/plant followed by the efficacy of treatment Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) with recorded population such as 31.22, 33.01, 36.32, 37.19, 37.81, 40.27 and 57.64 Aphids/10 cm top central twigs/plant, respectively, after 3 days spraying, all treatment found significant over control.

**After 7 days of spray.** The data after 7 days of application of novel insecticides presented in (Table 2) The treatment Dimethoate 30 EC(1ml/lit) of novel insecticide recorded highest efficacy in terms of mustard aphid population 28.35 aphids/10cm top central twigs/plant management compare to other treatment by the efficacy of treatment Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) with recorded population such as 29.82, 30.46, 31.93, 32.01, 32.07, 34.43 and 37.28 Aphids/10 cm top central twigs/plant, respectively, after 7 days spraying, all treatment found significant over control.

**After 10 days of spray.** The treatment Dimethoate 30 EC(1ml/lit) with novel insecticide were found (Table 2) highest efficacy in terms of mustard aphid *Lipaphis erysimi* Kalt. population management after 10 days of spray. The lowest population 12.37 recorded from treatment Dimethoate 30 EC(1ml/lit). However, other treatments such as Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) with recorded population such as 13.74, 16.87, 19.63, 20.22, 21.15, 23.71 and 28.52 Aphids/10 cm top central twigs/plant, respectively, after 10 days spraying, all treatment found significant over control.

In second spray results recorded that the treatment Dimethoate 30 EC(1ml/lit) found most lethal against mustard aphid *Lipaphis erysimi* Kalt. and all treatments also recorded most effective over control.

**Table 1: Effect of novel insecticides against mustard aphid *Lipaphis erysimi* Kalt./10cm central twig/plant after first spray during rabi 2019-2020.**

Sr. No.	Treatments	1DBS	3DAS	7DAS	10DAS
1.	Imidacloprid 17.8 SL	85.32 (9.26)	31.78 (5.68)	27.97 (5.34)	46.19 (6.83)
2.	Thiamethoxam 25 WG	86.40 (9.32)	33.27 (5.81)	28.43 (5.38)	48.96 (7.03)
3.	Acetamiprid 20 SP	89.37 (9.48)	36.34 (6.07)	30.29 (5.55)	51.06 (7.18)
4.	Dimethoate 30 EC	83.00 (9.14)	26.80 (5.22)	21.35 (4.67)	43.64 (6.64)
5.	Clothianidine 50 WDG	91.29 (9.58)	39.45 (6.32)	35.91 (6.03)	56.12 (7.52)
6.	Azadirachtin 3000 ppm	85.15 (9.25)	42.92 (6.59)	38.77 (6.27)	59.83 (7.77)
7.	Beauveria bassiana	88.49 (9.43)	47.36 (6.92)	42.13 (6.53)	64.67 (8.07)
8.	Verticillium lecanii	88.26 (9.42)	41.23 (6.46)	37.19 (6.14)	58.37 (7.67)
9.	Control	89.00 (9.46)	94.62 (9.75)	100.56 (10.05)	107.89 (10.41)
SE.m. ± CD at 5%		0.21 NS	0.048 0.145	0.055 0.165	0.059 0.179

Transformed figures into  $\sqrt{n+0.5}$

**Table 2 : Effect of novel insecticides against mustard aphid *Lipaphis erysimi* Kalt./10cm central twig/plant after second spray during rabi 2019-2020.**

Sr. No.	Treatments	1DBS	3DAS	7DAS	10DAS
1	Imidacloprid 17.8 SL	63.92 (8.03)	31.22 (5.63)	29.82 (5.51)	13.74 (3.77)
2	Thiamethoxam 25 WG	74.66 (8.67)	33.01 (5.79)	30.46 (5.56)	16.87 (4.17)
3	Acetamiprid 20 SP	66.79 (8.20)	36.32 (6.07)	31.93 (5.69)	19.63 (4.49)
4	Dimethoate 30 EC	72.49 (8.54)	28.12 (5.35)	28.35 (5.37)	12.37 (3.59)
5	Clothianidine 50 WDG	67.85 (8.27)	37.19 (6.14)	32.01 (5.70)	20.22 (4.55)
6	Azadirachtin 3000 ppm	78.67 (8.90)	40.27 (6.39)	34.43 (5.91)	23.71 (4.92)
7	Beauveria bassiana	69.51 (8.37)	57.64 (7.62)	37.28 (6.15)	28.52 (5.39)
8	Verticillium lecanii	68.57 (8.31)	37.81 (6.19)	32.07 (5.71)	21.15 (4.65)
9	Control	121.20 (11.03)	127.94 (11.33)	130.57 (11.45)	139.86 (11.85)
SE.m. ± CD at 5%		0.067 0.204	0.047 0.143	0.044 0.133	0.036 0.108

Transformed figures into  $\sqrt{n+0.5}$

### Year 2020-2021

**First spray:** Data presented in (Table 3) showed that first day before of spray the aphid population ranges from 88.43 to 98.46 Aphids/10 cm central top twigs/plant, hence the population was above the threshold level (ETL), so the novel insecticides were applied at this time to minimized aphid population.

**After 3 days of spray.** 3 days after spray of novel insecticides data presented in table (Table 3) showed that Dimethoate 30 EC (1ml/lit) was found with highest

efficacy than other treatments with documentation of population 27.29 Aphids/10 cm top central twigs/plant followed by the efficacy of treatment Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) with recorded population such as 29.42, 30.94, 32.11, 35.62, 42.87, 47.46 and 49.59 Aphids/10 cm top central twigs/plant, respectively.

**After 7 days of spray.** The effect of different treatments after 7 days of application of botanical insecticides on the population of mustard aphid showed in the (Table 3) The aphid population of treatment Dimethoate 30 EC(1ml/lit) superior 22.08 Aphids/10 cm top central twigs/plant than other treatments followed by the efficacy of treatments Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) with recorded population such as 25.18, 27.36, 28.47, 29.73, 39.14, 43.52 and 46.33 Aphids/10 cm top central twigs/plant, respectively.

**After 10 days of spray.** The treatment Dimethoate 30 EC (1ml/lit) were found (Table 3) highest efficacy in terms of mustard aphid *Lipaphis erysimi* Kalt. population management after 10 days of spray. The lowest population 45.39 recorded from treatment Dimethoate 30 EC (1ml/lit). However, other treatments such as Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) recorded higher population of mustard aphid than Dimethoate 30 EC (1ml/lit) treatment such as 46.72, 46.99, 48.53, 50.78, 56.37, 59.15 and 63.42 aphid/10 cm top central twigs/plant respectively. So, that in above all novel insecticides highest efficacy of Dimethoate 30 EC (1ml/lit) reported after first spray control than remaining novel insecticides. However, other novel insecticides also deducted the aphid population satisfactorily control treatment.

**Second spray:** The mustard aphid population recorded one day prior to spray founded between 65.67 to 115.33 aphids/10cm top central twigs/plant. So, this range of population goes beyond ETL, for their management applied novel insecticides as foliar spray in different treatments at different days interval.

**After 3 days of spray.** The data after 3 days of application of novel insecticides presented in (Table 4) showed that the treatment Dimethoate 30 EC(1ml/lit) was found with highest efficacy than other treatments with documentation of population 29.82 Aphids/10 cm top central twigs/plant followed by the efficacy of treatment Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) with recorded population such as 31.39, 33.62, 35.37, 36.43, 43.12, 47.60 and 54.04 Aphids/10 cm top central twigs/plant, respectively, after 3 days spraying, all treatment found significant over control.

**After 7 days of spray.** The data after 7 days of application of novel insecticides presented in (Table 4). The treatment Dimethoate 30 EC(1ml/lit) of novel insecticide recorded highest efficacy in terms of mustard aphid population 16.34 aphids/10cm top central twigs/plant management compare to other treatment by the efficacy of treatment Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) with recorded population such as 17.86, 20.49, 22.77, 23.52, 29.34, 32.08 and 38.47 Aphids/10 cm top central twigs/plant, respectively, after 7 days spraying, all treatment found significant over control.

**After 10 days of spray.** The treatment Dimethoate 30 EC(1ml/lit) with novel insecticide were found (Table 4) highest efficacy in terms of mustard aphid *Lipaphis erysimi* Kalt. population management after 10 days of spray. The lowest population 14.89 recorded from treatment Dimethoate 30 EC(1ml/lit). However, other treatments such as Imidacloprid 17.8 SL (0.25 ml/lit), Thiamethoxam 25 WG (0.20g/lit), Acetamiprid 20 SP (0.1g/lit), Clothianidine 50 WDG (0.12g/lit), *Verticillium lecanii* (2g/lit), Azadirachtin 3000 ppm (5ml/lit) and *Beauveria bassiana* (2g/lit) with recorded population such as 15.26, 18.34, 19.61, 21.59, 27.68, 29.21 and 36.19 Aphids/10 cm top central twigs/plant, respectively, after 10 days spraying, all treatment found significant over control. In second spray results recorded that the treatment Dimethoate 30 EC(1ml/lit) found most lethal against mustard aphid *Lipaphis erysimi* Kalt. and all treatments also recorded most effective over control. These findings are supported by Choudhury and Pal (2005), thiamethoxam 0.003% was the most effective after one day of spray (20.33 aphids/ 10 cm apical twig). The highest yield was obtained by the spray application of acephate 0.075% (12.31 q/ha) followed by thiamethoxam 0.0125% (12.24 q/ha), dimethoate 0.03% (11.03 q/ha) and cypermethrin 0.004% (10.53 q/ha) of Indian mustard.

Patel (2006), thiamethoxam 0.005% (0.76 AI) was found most effective treatment and it was at par with imidacloprid 0.005% (0.83 AI) and acetamiprid 0.004% (0.92 AI) in controlling the mustard aphid.

Sarwar *et al.* (2011) evaluated the effects of new insecticides, imidacloprid 200 EC, thiomethoxam 25 WG and acetamiprid 20 SL belonging to nitroguanidine group along with conventional insecticides such as, chlorpyrifos 40 EC and dimethoate 30 EC belonging to organophosphate group against aphid population on mustard. The best results were achieved with the application of imidacloprid 200 EC by recording the lowest number of aphids.



**Table 3: Effect of novel insecticides against mustard aphid *Lipaphis erysimi* Kalt./10cm central twig/plant after first spray during rabi 2020-2021.**

Sr. No.	Treatments	1DBS	3DAS	7DAS	10DAS
1.	Imidacloprid 17.8 SL	92.86 (9.66)	29.42 (5.47)	25.18 (5.07)	46.72 (6.87)
2.	Thiamethoxam 25 WG	89.17 (9.47)	30.94 (5.61)	27.36 (5.28)	46.99 (6.89)
3.	Acetamiprid 20 SP	88.43 (9.43)	32.11 (5.71)	28.47 (5.38)	48.53 (7.00)
4.	Dimethoate 30 EC	91.57 (9.60)	27.29 (5.27)	22.08 (4.75)	45.39 (6.77)
5.	Clothianidine 50 WDG	94.74 (9.76)	35.62 (6.01)	29.73 (5.50)	50.78 (7.16)
6.	Azadirachtin 3000 ppm	96.21 (9.83)	47.46 (6.93)	43.52 (6.63)	59.15 (7.72)
7.	Beauveria bassiana	93.87 (9.71)	49.59 (7.08)	46.33 (6.84)	63.42 (7.99)
8.	Verticillium lecanii	98.46 (9.95)	42.87 (6.59)	39.14 (6.30)	56.37 (7.54)
9.	Control	95.64 (9.81)	98.76 (9.96)	104.79 (10.26)	110.27 (10.52)
SE.m. ±		0.091	0.053	0.064	0.048
CD at 5%		NS	0.159	0.195	0.144

Transformed figures into  $\sqrt{n+0.5}$

**Table 4: Effect of novel insecticides against mustard aphid *Lipaphis erysimi* Kalt./10cm central twig/plant after second spray during rabi 2020-2021.**

Sr. No.	Treatments	1DBS	3DAS	7DAS	10DAS
1.	Imidacloprid 17.8 SL	69.16 (8.35)	31.39 (5.65)	17.86 (4.28)	15.26 (3.97)
2.	Thiamethoxam 25 WG	66.73 (8.20)	33.62 (5.84)	20.49 (4.58)	18.34 (4.34)
3.	Acetamiprid 20 SP	69.92 (8.39)	35.37 (5.99)	22.77 (4.82)	19.61 (4.48)
4.	Dimethoate 30 EC	65.67 (8.13)	29.82 (5.51)	16.34 (4.10)	14.89 (3.92)
5.	Clothianidine 50 WDG	68.12 (8.28)	36.43 (6.08)	23.52 (4.90)	21.59 (4.70)
6.	Azadirachtin 3000 ppm	71.19 (8.47)	47.60 (6.94)	32.08 (5.71)	29.21 (5.45)
7.	Beauveria bassiana	74.47 (8.66)	54.04 (7.39)	38.47 (6.24)	36.19 (6.06)
8.	Verticillium lecanii	72.16 (8.52)	43.12 (6.60)	29.34 (5.46)	27.68 (5.31)
9.	Control	115.33 (10.76)	121.58 (11.05)	129.83 (11.42)	138.39 (11.79)
SE.m. ±		0.065	0.054	0.053	0.029
CD at 5%		0.196	0.163	0.161	0.088

Transformed figures into  $\sqrt{n+0.5}$

**Table 5: Effect of novel insecticides against mustard aphid *Lipaphis erysimi* Kalt./10cm central twig/plant after first spray (Pooled data 2019-20 and 2020-21).**

Sr. No.	Treatments	1DBS	3DAS	7DAS	10DAS
1.	Imidacloprid 17.8 SL	89.09 (9.47)	30.60 (5.58)	26.58 (5.20)	46.46 (6.85)
2.	Thiamethoxam 25 WG	87.79 (9.40)	32.11 (5.71)	27.90 (5.33)	47.98 (6.96)
3.	Acetamiprid 20 SP	88.90 (9.46)	34.23 (5.89)	29.38 (5.47)	49.80 (7.09)
4.	Dimethoate 30 EC	87.29 (9.37)	27.05 (5.25)	21.72 (4.71)	44.52 (6.71)
5.	Clothianidine 50 WDG	93.02 (9.67)	37.54 (6.17)	32.82 (5.77)	53.45 (7.35)
6.	Azadirachtin 3000 ppm	90.68 (9.55)	45.19 (6.76)	41.15 (6.45)	59.49 (7.75)
7.	Beauveria bassiana	91.18 (9.57)	48.48 (7.00)	44.23 (6.69)	64.05 (8.03)
8.	Verticillium lecanii	93.36 (9.69)	42.05 (6.52)	38.17 (6.22)	57.37 (7.61)
9.	Control	92.32 (9.63)	96.69 (9.86)	102.68 (10.16)	109.08 (10.47)
SE.m. ±		0.02	0.038	0.049	0.055
CD at 5%		NS	0.116	0.148	0.167

Transformed figures into  $\sqrt{n+0.5}$

**Table 6: Effect of novel insecticides against mustard aphid *Lipaphis erysimi* Kalt. /10cm central twig/plant after second spray (Pooled data 2019-20 and 2020-21).**

Sr. No.	Treatments	1DBS	3DAS	7DAS	10DAS
1.	Imidacloprid 17.8 SL	66.54 (8.19)	31.31 (5.64)	23.84 (4.93)	14.50 (3.87)
2.	Thiamethoxam 25 WG	70.70 (8.44)	33.32 (5.82)	25.48 (5.10)	17.61 (4.25)
3.	Acetamiprid 20 SP	68.36 (8.30)	35.85 (6.03)	27.35 (5.28)	19.62 (4.49)
4.	Dimethoate 30 EC	69.08 (8.34)	28.97 (5.43)	22.35 (4.78)	13.63 (3.76)
5.	Clothianidine 50 WDG	67.99 (8.28)	36.81 (6.11)	27.77 (5.32)	20.91 (4.63)
6.	Azadirachtin 3000 ppm	74.93 (8.69)	43.94 (6.67)	33.26 (5.81)	26.46 (5.19)
7.	<i>Beauveria bassiana</i>	71.99 (8.51)	55.84 (7.51)	37.88 (6.19)	32.36 (5.73)
8.	<i>Verticillium lecanii</i>	70.37 (8.42)	40.47 (6.40)	30.71 (5.59)	24.42 (4.99)
9.	Control	118.27 (10.90)	124.76 (11.19)	130.20 (11.43)	139.13 (11.82)
SE.m. ±		0.049	0.046	0.054	0.045
CD at 5%		0.15	0.138	0.164	0.135

Transformed figures into  $\sqrt{n+0.5}$

## CONCLUSIONS

The results with pooled data analysis for management of mustard aphid *Lipaphis erysimi* Kalt. revealed a similar trend in whole study period for both the years i.e. 2019-2020 & 2020-2021 (Table 5 & 6). Dimethoate 30 EC(1ml/lit) was proved significantly superior over all treatments with highest manage of mustard aphid *Lipaphis erysimi* Kalt population in both the years. *Beauveria bassiana* (2g/lit) was found poorest with minimum control of mustard aphid *Lipaphis erysimi* Kalt population in terms of efficacy in both the years. The trend of efficacy of different treatments against mustard aphid *Lipaphis erysimi* Kalt were in descending order as following Dimethoate 30 EC(1ml/lit) > Imidacloprid 17.8 SL (0.25 ml/lit) > Thiamethoxam 25 WG (0.20g/lit) > Acetamiprid 20 SP (0.1g/lit) > Clothianidine 50 WDG (0.12g/lit) > *Verticillium lecanii* (2g/lit) > Azadirachtin 3000 ppm (5ml/lit) > *Beauveria bassiana* (2g/lit).

## FUTURE SCOPE

With the increase in resistance cases in insect pests different modes of action of insecticides can be explored in further studies.

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**Conflict of Interest.** None.

## REFERENCES

Amer, M., Aslam, M., Razaq, M. and Afzal, M. (2009). Lack of plant resistance against aphids, as indicated by their seasonal abundance in canola, *Brassica napus* L. in

Southern Punjab, Pakistan. *Pakistan Journal of Botany*; 41(3), 1043-1051.

- Bakhetia, D. R. C. and Sekhon, B. S. (1989). Insect-pests and their management in rapeseed-mustard. *Journal of Oilseeds Research*, 6, 269-299.
- Choudhury, S. and Pal, S. (2005). Population dynamics of mustard aphid on different *Brassica* cultivars under terai agro-ecological conditions of West Bengal. *Journal of Plant Protection Science*, 1(1), 83-86.
- Ellis, P. R. and Singh, R. A. (1993). Review of the host plants of the cabbage aphid, *Brevicoryne brassicae* (Homoptera: Aphididae). *IOBS/WPRS bulletin*, 16, 192-201.
- Khan, A. R. and Munir, M. (1986). Rapeseed and mustard family problems and prospects. In Proceedings of National Seminar on Oilseed Research and Development in Pakistan. *Agricultural Research Council, Islamabad, Pakistan*, 95.
- Patel, M. R. (2006). Population dynamics, varietal screening and bio-efficacy of insecticides against pest complex of mustard. M. Sc. (Agri.) thesis submitted to NAU, Navsari, pp 40-43.
- Sarwar, M., Ahmad, N., Moula, B., Nasrullah and Tofique, M. (2011). Comparative field evaluation of some newer versus conventional insecticides for the control of aphids oilseed rape (*Brassica napus* L.). *The Nucleus*, 48(2), 163-167.
- Singh, B., Singh, R. and Mahal, M. S. (1983). Assessment of loss in yield of *Brassica juncea* by mustard aphid *Lipaphis erysimi* Kalt. timing and duration of infestation. *Indian Journal of Ecology*, 11, 139-145.
- Yue, B. and Liu, T. X. (2000). Host selection, development, survival and reproduction of turnip aphid (Homoptera: Aphididae) on green and red cabbage varieties. *Journal of Economic Entomology*, 93, 1308-1314.

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