www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(2): 397-400

www.thepharmajournal.com
Received: 22-12-2022
Accepted: 31-01-2023

Deepak Singh Pal
Department of Entomology, C.S.A University of Agri. & Tech. Kanpur, Uttar Pradesh, India

DR Singh
Department of Entomology, C.S.A University of Agri. & Tech. Kanpur, Uttar Pradesh, India

DK Singh
Department of Entomology, C.S.A University of Agri. & Tech. Kanpur, Uttar Pradesh, India

Pankaj Rajpoot
Department of Entomology, C.S.A University of Agri. & Tech. Kanpur, Uttar Pradesh, India

Ankit Upadhyay
Department of Entomology, C.S.A University of Agri. & Tech. Kanpur, Uttar Pradesh, India

Corresponding Author:
Deepak Singh Pal
Department of Entomology, C.S.A University of Agri. & Tech. Kanpur, Uttar Pradesh, India

Economics and incremental benefit cost ratio of novel insecticides against mustard aphid *Lipaphis erysimi* Kalt

Deepak Singh Pal, DR Singh, DK Singh, Pankaj Rajpoot and Ankit Upadhyay

DOI: https://doi.org/10.22271/tpi.2023.v12.i2e.19262

Abstract
The effect of different novel insecticides treatment against mustard aphid was determined on the basis of seed yield and Incremental Benefit Cost Ratio. The treatment Dimethoate 30 EC (1 ml/lt) recorded significantly higher seed yield than other all treatments and followed by the treatment Imidacloprid 17.8 SL (0.25 ml/lt), Thiamethoxam 25 WG (0.20 g/lt), Acetamiprid 20 SP (0.1 g/lt), Clothianidine 50 WDG (0.12 g/lt), *Verticillium lecanii* (2 g/lt), Azadirachtin 3000 ppm (5 ml/lt) and *Beauveria bassiana* (2 g/lt). The Incremental Cost Benefit Ratio treatment Dimethoate 30 EC (1 ml/lt) was most economic, it gave the maximum benefit (1:15.4) as compare to remaining treatment all the treatment found as cost effective over the control.

Keywords: Mustard aphid, effect, incremental cost benefit ratio, insecticides, dimethoate 30 EC, economic

Introduction
The yield losses caused by this pest vary with the variety, agricultural practices, and environmental factors. However, it appears to result in yield losses of up to 54.2%. (Bakhetia *et al*. 1989) [2]. Brown sarson (*Brassica campestris* var. brown sarson), Indian mustard (*Brassica juncea*), gobhi sarson (*Brassica napus*), Kiran rai (*Brassica carinata*), toria (*Brassica rapa* var. *toria*), taramira (*Eruca sativa*), and yellow sarson are also the indigenous species of rapeseed mustard grown in India (*Brassica rapa* var. yellow sarson). These crops are grown in roughly 50 countries spread across six continents (Europe, Africa, North America, South America, Oceania, and Asia). It is primarily cultivated in China in Asia (Amer *et al*., 2009) [1]. The Asian continent alone constitutes for 59.1% of the total area of land and 48.6% of overall production. It causes damage whether directly and indirectly by sucking from different parts of the plant. The attack is more severe in areas where the number of cloudy days is higher during the pest activity period. On heavy infestation, aphids congregate on the leaf's underneath, curling and discolouring them, and plants fail to develop pods. If young pods grow, they do not produce healthy seeds, causing the plant to lose growth (Mamun *et al*., 2010) [5]. Rapeseed mustard yield loss varies according to germplasm and agroecological practises. After the rapeseed-mustard crop is harvested, the pest can be found on other Brassica host plants for some time. The wingless form of mustard aphids migrates to hilly areas of the country and spends the unfavourable season on hilly Brassica crops. As soon as the favourable conditions to the aphid prevail in plains aphids gain wings and migrate to the plains of the country. Brassica is vulnerable to a variety of insect pests (Rai, 1976). More than a dozen pests have been linked to various phenological stages of rapeseed and mustard crops in India (Bakhetia *et al*. 1989) [2]. Among the insect pests attacking rapeseed and mustard, the mustard aphid, *Lipaphis erysimi* (Kalt.), is a serious insect pest, infesting the crop right from seedling stage to maturity that ravages the crop during the reproductive phase and acts as a limiting factor in the production. Sap sucking causes curled and discoloured leaves, spots on the foliage, and plants to wilt, turn yellowish or brownish, and die. The mustard aphid is considered a national pest in terms of economic importance.

Materials and Methods
During the rabi seasons of 2019-2020 and 2020-2021 respectively, the experiment was carried out on the Students Instructional Farm at Chandra Shekhar Azad University of Agriculture and

Technology in Kanpur. Randomized Block Design was employed for the experiment with 9 Treatments and 3 replications of each treatment. The gross plot size was 4.5 X 3 with 2 m distance between replications and 1 m distance between plots. The crop variety of rapeseed mustard was Urvashi.

Results and Discussion

Year 2019-20

Effect of treatment on seed yield

The effect of different novel insecticides treatment against mustard aphid was determined on the basis of seed yield presented in (Table 1) The treatment Dimethoate 30 EC (1 ml/lt) recorded significantly higher seed yield 19.45 qha^{-1} than other all treatments and followed by the treatment Imidacloprid 17.8 SL (0.25 ml/lt), Thiamethoxam 25 WG (0.20 g/lt), Acetamiprid 20 SP (0.1 g/lt), Clothianidine 50 WDG (0.12 g/lt), *Verticillium lecanii* (2 g/lt), Azadirachtin 3000 ppm (5 ml/lt) and *Beauveria bassiana* (2 g/lt) recorded with seed yield 18.90 (qha^{-1}), 18.55 (qha^{-1}), 16.70 (qha^{-1}), 16.15 (qha^{-1}), 14.55 (qha^{-1}), 14.75 (qha^{-1}) and 14.40 (qha^{-1}), respectively. All the treatments documented superior over the treatment control on the basis of seed yield.

Economics of treatment

The monetary gain from the treatment was determined by calculating the cost of cultivation and value of saved yield presented in (Table 1) The highest net income reported from treatment Dimethoate 30 EC (1 ml/lt) 55534 ₹/ha followed by the treatment Imidacloprid 17.8 SL (0.25 ml/lt) 53100 ₹/ha, Thiamethoxam 25 WG (0.20 g/lt) 51551 ₹/ha, Acetamiprid 20 SP (0.1 g/lt) 43365 ₹/ha, Clothianidine 50 WDG (0.12 g/lt) 40932 ₹/ha, *Verticillium lecanii* (2 g/lt) 33852 ₹/ha, Azadirachtin 3000 ppm (5 ml/lt) 34737₹/ha and *Beauveria bassiana* (2 g/lt)33188₹/ha.

Effectiveness of treatment based on Incremental Cost Benefit Ratio (ICBR)

Table 1: Economics of management treatments against mustard aphid *Lipaphis erysimi* Kalt. During rabbi 2019-20

S. No.	Treatment and Dose	Cost of insecticide (Rs)	No. of labour	Labour cost (Rs/ha.)	Total expenditure (Rs)	Yield (Kg/Ha)	Gross income	Net return over control (Rs)	IBCR
1	Imidacloprid 17.8 SL	2950	4	824	3774	1890	83632	53100	1:14.07
2	Thiamethoxam 25 WG	2760	4	824	3584	1855	82083	51551	1:14.38
3	Acetamiprid 20 SP	2800	4	824	3624	1670	73897	43365	1:11.97
4	Dimethoate 30 EC	2760	4	824	3584	1945	86066	55534	1:15.5
5	Clothianidine 50 WDG	2850	4	824	3674	1615	71464	40932	1:11.14
6	Azadirachtin 3000 ppm	3050	4	824	3874	1475	65269	34737	1:8.96
7	*Beauveria bassiana*	2750	4	824	3574	1440	63720	33188	1:9.29
8	*Verticillium lecanii*	2600	4	824	3424	1455	64384	33852	1:9.88
9	Control	-	-	-	-	690	30532		

MSP 2020-21 – Mustard = 4425/quintal

Based on Incremental Cost Benefit Ratio and their management in treatment Dimethoate 30 EC (1 ml/lt) recorded most economic, it gave the maximum benefit (1:15.5) as compare to remaining treatment. Second profitable treatment was Imidacloprid 17.8 SL (0.25 ml/lt) with (1:14.07) based on higher ICBR. All the treatment found as cost effective over the control.

Year 2020-21

Effect of treatment on seed yield

The effect of different novel insecticides treatment against mustard aphid was determined on the basis of seed yield presented in (Table 2) The treatment Dimethoate 30 EC (1 ml/lt) recorded significantly higher seed yield 19.20 qha^{-1} than other all treatments and followed by the treatment Imidacloprid 17.8 SL (0.25 ml/lt), Thiamethoxam 25 WG (0.20 g/lt), Acetamiprid 20 SP (0.1 g/lt), Clothianidine 50 WDG (0.12 g/lt), *Verticillium lecanii* (2 g/lt), Azadirachtin 3000 ppm (5 ml/lt) and *Beauveria bassiana* (2 g/lt) recorded with seed yield 18.27 (qha^{-1}), 18.60 (qha^{-1}), 16.45 (qha^{-1}), ^{1}), 16.30 (qha^{-1}), 14.50 (qha^{-1}), 14.25 (qha^{-1}) and 14.10 (qha^{-1}), respectively. All the treatments documented superior over the treatment control on the basis of seed yield.

Economics of treatment

The monetary gain from the treatment was determined by calculating the cost of cultivation and value of saved yield presented in (Table 2) The highest net income reported from treatment Dimethoate 30 EC (1 ml/lt) 54870 ₹/ha followed by the treatment Imidacloprid 17.8 SL (0.25 ml/lt) 52638 ₹/ha, Thiamethoxam 25 WG (0.20 g/lt) 52080 ₹/ha, Acetamiprid 20 SP (0.1 g/lt) 42082 ₹/ha, Clothianidine 50 WDG (0.12 g/lt) 41385 ₹/ha, *Verticillium lecanii* (2 g/lt) 33015 ₹/ha, Azadirachtin 3000 ppm (5 ml/lt) 31852₹/ha and *Beauveria bassiana* (2 g/lt) 31155 ₹/ha.

Effectiveness of treatment based on Incremental Cost Benefit Ratio (ICBR)

Based on Incremental Cost Benefit Ratio and their management in treatment Dimethoate 30 EC (1 ml/lt) recorded most economic, it gave the maximum benefit (1:15.3) as compare to remaining treatment. Second profitable treatment was Thiamethoxam 25 WG (0.20 g/lt) with (1:14.5) based on higher ICBR. All the treatment found as cost effective over the control.

These findings are supported by Gour and Pareek (2003) reported that maximum seed yield was harvested by the spray application of imidacloprid 0.05% (14.9 q/ha) followed by dimethoate 30% EC @ 0.03% (11.9 q/ha) and acephate 0.05% (11.1 q/ha). Gour and Pareek (2003) worked out the field evaluation of insecticides against mustard aphid, *L. erysimi* (Kalt.) in semi-arid region of Rajasthan and observed that treatment of dimethoate 30 EC @ 0.03% proved most effective followed by dimethoate 30 EC @ 0.015%, imidacloprid 17.8 SL @ 0.05%, acephate 75 WP @ 0.05% and cypermethrin 10 EC @ 0.002%. Rohilla *et al*. (2004) noted that imidacloprid 17. 8 SL, thiamethoxam 50 g A.I./ha and monocrotophos 36 SL were found the most effective against mustard aphid. Imidacloprid 17.8% SL @ 0.002% showed the best knock-down effect and the highest

persistency against *L.* erysimi in mustard. However, imidacloprid applied thrice at vegetative, flowering and pod initiation stages, recorded up to 98.30% aphid reduction. The same insecticide also recorded the highest yield (13.82q/ha) and benefit: cost ratio. Reza *et al*. (2004) [7] reported that the spraying with 0.05% oxydemeton-methyl resulted in lowest aphid population and highest aphid mortality in the first spray followed by dimethoate 0.05%. Total control of the aphid was recorded with the second spray. Sen *et al.* (2017) [10] evaluated the economics of certain insecticides against mustard aphid, *Lipaphis erysimi* (Kalt.) infestation on mustard., the incremental cost-benefit ratio was found highest in imidacloprid being, 1:14.62 followed by 1:14.35 in thiamethoxam. Vishal *et al.* (2019) studied seven treatments including control plot. Cost benefit ratio of the treatments showed that imidacloprid 17.8 SL @ 20 g A.I./ha ranked first indicating the maximum B:C Ratio (1: 10.36). Sahoo (2012) [9] evaluated different chemical insecticides for their bio-efficacy against *L. erysimi*, dimethoate 30 EC and methyl-o-demeton 25 EC proved to be more effective. The plots treated with dimethoate and methyl-o-demeton recorded minimum aphid infestation in most of the observations, there by produced more yield ranging from 1151.6 to 1310.3 kg seed/ha. Incremental cost benefit ratio indicated that most favourable return was obtained under dimethoate 30 EC (1:20.8 & 1:13.3) followed by methyl-o-demeton 25 EC. Gupta M P (2005) evaluated insecticides against the mustard aphid, *Lipaphis erysimi* Kalt. Grain yield was maximum in Phosphamidon 0.04% followed by neem oil 1% + Dimethoate 0.03% and NKE 3%. Net profit was also maximum in phosphamidon (Rs. 9246/ha) and NKE 3% (Rs. 5938/ha). Whereas, incremental cost benefit ratio was highest in NKE 2% (15.5) and NKE 3% (15.1).

Table 2: Economics of management treatments against mustard aphid *Lipaphis erysimi* Kalt. During rabbi 2020-21

S. No.	Treatment and Dose	Cost of insecticide (Rs)	No. of labour	Labour cost (Rs/ha.)	Total expenditure (Rs)	Yield (Kg/Ha)	Gross Income	Net return over control (Rs)	IBCR
1	Imidacloprid 17.8 SL	2950	4	824	3774	1872	87048	52638	1:13.9
2	Thiamethoxam 25 WG	2760	4	824	3584	1860	86490	52080	1:14.5
3	Acetamiprid 20 SP	2800	4	824	3624	1645	76492	42082	1:11.6
4	Dimethoate 30 EC	2760	4	824	3584	1920	89280	54870	1:15.3
5	Clothianidine 50 WDG	2850	4	824	3674	1630	75795	41385	1:11.2
6	Azadirachtin 3000 ppm	3050	4	824	3874	1425	66262	31852	1:8.2
7	*Beauveria bassiana*	2750	4	824	3574	1410	65565	31155	1:8.7
8	*Verticillium lecanii*	2600	4	824	3424	1450	67425	33015	1:9.6
9	Control	-	-	-	-	740	34410	-	-

MSP 2021-22 – Mustard = 4650/quintal

Conclusion

For the year 2019-2020 the effect of different novel insecticides treatment against mustard aphid was determined on the basis of seed yield. The treatment Dimethoate 30 EC (1 ml/lt)recorded significantly higher seed yield 19.45 qha-^{1} than other all treatments and followed by the treatment Imidacloprid 17.8 SL (0.25 ml/lt), Thiamethoxam 25 WG (0.20 g/lt), Acetamiprid 20 SP (0.1 g/lt), Clothianidine 50 WDG (0.12 g/lt), *Verticillium lecanii* (2 g/lt), Azadirachtin 3000 ppm (5 ml/lt) and *Beauveria bassiana* (2 g/lt) recorded with seed yield 18.90 (qha-^{1}), 18.55 (qha-^{1}), 16.70 (qha-^{1}), 16.15 (qha-^{1}), 14.55 (qha-^{1}), 14.75 (qha-^{1}) and 14.40 (qha-^{1}), respectively. All the treatments documented superior over the treatment control on the basis of seed yield. The Incremental Cost Benefit Ratio treatment Dimethoate 30 EC (1 ml/lt) was most economic, it gave the maximum benefit (1:15.5) as compare to remaining treatment. Second profitable treatment was Imidacloprid 17.8 SL (0.25 ml/lt) with (1:14.07) based on higher IBCR. All the treatment found as cost effective over the control.

For the year 2020-2021 the effect of different novel insecticides treatment against mustard aphid was determined on the basis of seed yield. The treatment Dimethoate 30 EC (1 ml/lt) recorded significantly higher seed yield 19.20 qha-^{1} than other all treatments and followed by the treatment Imidacloprid 17.8 SL (0.25 ml/lt), Thiamethoxam 25 WG (0.20 g/lt), Acetamiprid 20 SP (0.1 g/lt), Clothianidine 50 WDG (0.12 g/lt), *Verticillium lecanii* (2 g/lt), Azadirachtin 3000 ppm (5 ml/lt) and *Beauveria bassiana* (2 g/lt) recorded with seed yield 18.27 (qha-^{1}), 18.60 (qha-^{1}), 16.45 (qha-^{1}), 16.30 (qha-^{1}), 14.50 (qha-^{1}), 14.25 (qha-^{1}) and 14.10 (qha-^{1}), respectively. All the treatments documented superior over the treatment control on the basis of seed yield. Based on Incremental Cost Benefit Ratio and their management in treatment Dimethoate 30 EC (1 ml/lt) recorded most economic, it gave the maximum benefit (1:15.3) as compare to remaining treatment. Second profitable treatment was Thiamethoxam 25 WG (0.20 g/lt) with (1:14.5) based on higher IBCR. All the treatment found as cost effective over the control.

References

1. Amer M, Aslam M, Razaq M, Afzal M. 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. 2009;41(3):1043-1051.
2. Bakhetia DRC, Sekhon BS. Insect-pests and their management in rapeseed-mustard. Journal of Oilseeds Research. 1989;6(2):269-299.
3. Gour IS, Pareek B. Field evaluation of insecticides against mustard aphid, *Lipaphis erysimi* Kaltenbach under semi-arid region of Rajasthan. Indian Journal Plant Protection. 2003;31(2):25-27.
4. Gupta MP. Efficacy of neem in combination with cow urine against mustard aphid and its effect on coccinellid predators. Natural Product Radiance. 2005;4(2):102-106.
5. Mamun MSA, Ali MH, Ferdous MM, Rahman MA, Hossain MA. Assessment of several mustard varieties resistance to mustard aphid, *Lipaphis erysimi* (Kalt.). Journal of Soil and Nature. 2010;4(1):34-38.
6. Rai BK. Pests of oilseed crops in India and their control (book). Indian Council of Agricultural Research. 1976;12(8):100-121

7. Reza MW, Biswas AK, Roy K. Seasonal abundance of *Lipaphis erysimi* (Kaltenbach) population on mustard. Uttar Pradesh Journal of Zoology. 2004;24(2):129-132.
8. Rohilla HR, Bhatnagar P, Yadav PR. Chemical control of mustard aphid with newer and conventional insecticides. Indian Journal of Entomology. 2004;66(1):30-32.
9. Sahoo SK. Incidence and management of mustard aphid *Lipaphis erysimi* Kaltenbach in West Bengal. The Journal of Plant Protection Sciences. 2012;4(1):20-26.
10. Sen K, Samanta A, Hansda A, Dhar PP, Samanta A. Bioefficacy and economics of some insecticides against mustard aphid *Lipaphis erysimi* Kaltenbach infesting mustard Journal of crop and weed. 2017;13(2):235-237
11. Vishal Singh H, Kumar A. Efficacy and economics of some newer insecticides against mustard aphid, *Lipaphis erysimi* Kaltenbach. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):785-788