The Pharma Innovation Journal 2022; 11(5): 1706-1710

www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(5): 1706-1710

www.thepharmajournal.com
Received: 04-02-2022
Accepted: 10-03-2022

Samala Sreeja
M.Sc. Scholar, Department of Entomology, Faculty of Agriculture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Ashwani Kumar
Associate Professor, Department of Entomology, Faculty of Agriculture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Samala Sreeja
M.Sc. Scholar, Department of Entomology, Faculty of Agriculture, Naini Agriculture Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh, India

Field efficacy of selected chemicals and biopesticides against mustard aphid [*Lipaphis erysimi* (Kaltenbach)] on mustard [*Brassica juncea* (L.)] at Prayagraj (U.P.)

Samala Sreeja and Ashwani Kumar

Abstract
The present study was conducted at the Central Research Field (CRF), Department of Entomology, SHUATS, Prayagraj during *Rabi* 2021-2022. Seven treatments were evaluated against *Lipaphis erysimi*, i.e., Imidacloprid 17.8% SL (T1), Cypermethrin 10% EC (T2), Spinosad 45% SC (T3), *Metarhizium anisopliae* (T4), Neem oil 5% (T5), NISCO MECH 333 (T6), NISCO Sixer Plus (T7) and untreated control (T8) were evaluated against mustard aphid (*Lipaphis erysimi*). Results revealed that, among the different treatments, the highest per cent population reduction of mustard aphid was recorded in Imidacloprid 17.8% SL (88.184%) followed by Spinosad 45% SC (81.498%), Cypermethrin 10% EC (76.937%). It is followed by Neem oil 5% (72.976%) and NISCO MECH 333 (68.251%), NISCO Sixer Plus (58.914%) and *Metarhizium anisopliae* (53.123%) was the least effective among all treatments. While, the highest yield 18.15 q/ha was obtained from the treatment Imidacloprid 17.8% SL as well as B:C ratio 1: 5.20 was obtained high from this treatment. It was followed by Spinosad 45% SC (1: 4.87), Cypermethrin 10% EC (1: 4.58), Neem oil 5% (1:4.15), MECH 333 (1: 3.98), Sixer plus (1: 3.46), *Metarhizium anisopliae* (1: 3.42), as compared to Control (1: 2.74).

Keywords: Comparative efficacy, imidacloprid, insecticides, *Lipaphis erysimi*, mustard

Introduction

Mustard, *Brassica juncea* (L.) Czern & Coss is an important oilseed crop belonging to family cruciferaceae (Syn. Brassicaceae). Indian mustard or brown mustard is having chromosome no (2n=36). It is self-pollinated but certain amount (2-15%) pollination occur due to insects and other factors. The origin place of mustard is China, northeastern India from where it has extended up to Afghanistan via Punjab (Kalasariya, 2016) [10]. India ranks world's third important oil crop in terms of production and area. it is one of the three major oilseeds crops along with groundnut and soybean contributing around 25 per cent of the total oilseeds production. (Sen *et al.*, 2017) [23].

The estimated area, production, and yield of rapeseed-mustard in the world was 36.59 million hectares, 72.37 million tones and 1980 kg/ha, respectively, during 2018-19. Globally, India account for 19.8 and 9.8 per cent of the total acreage and production. The productivity of India is the lowest among the major mustard growing countries, the Indian average yield was only 1.4 tonnes/ha during 2019- 20. (Kalia *et al.*, 2021) [11]. Uttar Pradesh accounts for 10.85% and 11.19% of area and production, respectively in the country with the average yield of 11.49 q/ha which is equivalent to the national average (11.17q/ha). (Singh *et al.*, 2007) [26].

Mustard plays an important role in the oil seed economy of the country. It has 38 to 42% oil and 24% protein. (Meena *et al.*, 2015) [18]. Mustard is also rich in minerals like Calcium, Manganese, Copper, Iron, Selenium, Zinc, Vitamin (A, B and C) and proteins. 1000 g mustard seed contains 508 k. cal. energy, 28.09 g carbohydrates, 26.08 g proteins,26.08 g total fat and 12.2 g dietary fiber, 31 I.U. Vitamin A,4.733 mg Niacin, 7.1 mg Vitamin C, 266 mg Calcium, 9.21 mg Iron, 370 mg Magnesium, 13 mg Sodium and 738 mg Potassium (Daravath *et al.*, 2016) [7].

More than 43 species of insect pests infest rapeseed-mustard crop in India, out of which a dozen species are considered as major pests The aphid species, *viz*., *Lipaphis erysimi* (Kaltenbach), *Brevicoryne brassicae* (Linnaeus) and *Myzus persicae* (Sulzer) are the key pests (Lal *et al.*, 2018) [15] resulting in both qualitative and quantitative losses. Among these, mustard Aphid, *Lipaphis erysimi* Kalt. (Hemiptera: Aphididae) is the most destructive insect pest of mustard (Pragya *et al.*, 2017) [21].

Lipaphis erysimi belongs to family Aphididae and is commonly known as mustard aphid. It is a cosmopolitan insect and found on both the leaf surfaces and in leaf folds of developing heads, on leaf stalks, and on leaf axles. They are found primarily on the growing points of the host plants, including tips, flowers and developing pods and cover the whole plant with high density (Nelson and Rosenheim, 2006) [19]. They suck sap from the hosts and infested plants become stunted and distorted. Their infestation causes wilting, yellowing and stunting of plants (Khan *et al.*, 2015) [12]. On the other hand, aphid produces a good amount of honey dew which facilitates the growth of the fungus that makes the leaves and pods appear dirty black and also interferes in the photosynthetic activity of the leaves (Sharma *et al.*, 2020) [24]. It is predominant and capable of causing up to 96per cent yield losses and 5-6per cent reduction in oil content (Lal *et al.*, 2018) [15].

For the control of insects primarily mustard aphids, most of the mustard growing farmers of apply synthetic pesticides and even banned pesticides in some cases in a repeated manner with the higher doses. Due to the repeated doses of insecticide, aphid has gained resistance over pesticides and hazardous use of pesticide has induced Photo-toxicity, destruction of beneficial organism, disruption of agro-ecosystem and human health hazards. So, the alternative of chemical pesticide can be bio-insecticide, which is economically cheaper, environmentally sound and non-hazardous to human, animal and natural predator and pollinator but effective against harmful pest.

In order to preventing the infestation of the mustard aphid and to produce a quality crop production, it is essential to manage the pest population at proper time with suitable and appropriate measures. Keeping the above facts in mind the present investigation was undertaken to manage mustard aphid, *Lipaphis erysimi* (Kaltenbach) through eco-friendly bio-pesticides and its comparison with some chemical insecticides. So that a pest management module may be devised with minimum input and maximum benefit to farmers.

Materials and Methods

The experiment was conducted during *rabi* season 2021-2022 at Central Research Field (CRF) of Sam Higginbottom University of Agriculture, Technology and Sciences, Naini, Prayagraj, Uttar Pradesh, India, in a randomized block design with eight treatments replicated three times using variety, Black gold seeds in a plot size of 2m×2m at a spacing of 30cm ×10cm with a recommended package of practices excluding plant protection. The soil of the experimental site was well drained and medium high. The observations on population of sucking pest were recorded visually using a magnifying lens early on top 10cm central apical twig per plant from five randomly selected and tagged plants in each plot. Aphid count was taken 24 hours before spraying at 5 tagged plants per treatment, which was further converted in to per plant population and subsequent observation was recorded at 3, 7 and 14 days after spraying on same plants. The formula used for the calculation of percentage reduction of pest population over control using following formula giving by Henderson and Tilton (1955) [9] referring it to be modification of Abbott (1925) [1].

$$\text{Percent reduction over control} = \frac{\text{Population in control-Population in treatment}}{\text{Population in control}} \times 100$$

The average percent reduction of pest population of all two sprays was worked out by using Henderson and Tilton formula described as under:

$$\text{Percent reduction} = 1 - \frac{Ta}{Tb} \times \frac{Cb}{Ca} \times 100$$

Where,

Ta = number of insects in treated plot after insecticides application Tb=number of insects in treated plot before insecticides application Ca= number of insects in Untreated check after insecticide application Cb= number of insects in untreated check before insecticide application (Dotasara *et al.*, 2017) [7]

The healthy marketable yield obtained from different treatments was collected separately and weighed. The cost of insecticides used in this experiment was recorded during *Rabi* season of 2021-22. The cost of botanicals used was obtained from nearby market. The total cost of plant protection consisted of cost of treatments, sprayer rent and labor charges for the spray. There were two sprays throughout the research period and the overall plant protection expenses were calculated. The B:C ratio can be calculated by formula…

$$\text{BCR} = \frac{\text{Gross returns}}{\text{Total Cost of protection}}$$

Where,

BCR = Benefit Cost Ratio

Gross returns = Marketable yield × Market price (Zorempuii and Kumar, 2019) [28]

Results and Discussion

In the experiment, eight different treatments, consisting application of Imidacloprid 17.8% SL (T1), Cypermethrin 10% EC (T2), Spinosad 45% SC (T3), *Metarhizium anisopliae* (T4), Neem oil 5% (T5), NISCO MECH 333 (T6), NISCO Sixer plus (T7) and untreated Control (T8) were tested to compare the efficacy against *Lipaphis erysimi* and their influences on yield of mustard. The results obtained are discussed in the light of available relevant literature in this chapter as before.

Results revealed that, Among the different treatments, the highest per cent population reduction of mustard aphid was recorded in Imidacloprid 17.8% SL (88.184%) followed by Spinosad 45% SC (81.498%), Cypermethrin 10% EC (76.937%). It is followed by Neem oil 5% (72.976%) and NISCO MECH 333 (68.251%), NISCO Sixer Plus (58.914%) and *Metarhizium anisopliae* (53.123%) was the least effective among all treatments.

The data on the mean per cent population reduction of first spray and second spray overall mean revealed that all the treatments except untreated control are effective and at par. Among all the treatments highest per cent reduction of mustard aphid as was recorded in Imidacloprid 17.8% SL (88.184%). Similar findings made by Chandra *et al.* (2014) [6], Aziz *et al.* (2014) [4], Sen *et al.* (2017) [23], Maurya *et al.* (2018) [16], Patel *et al.* (2020) [20] and Rashid *et al.* (2021) [22]. Spinosad 45% SC (81.498%) is found to be the next best treatment which is in line with the findings of Akter *et al.* (2021) [3], Khanal *et al.* (2020) [13], Vishvendra *et al.* (2018)

[28] they reported that was found most effective in reducing percent population of *Lipaphis erysimi*.

Cypermethrin 10% EC (76.937%) is found to be the next best treatment which is in line with the findings of Bhatta *et al.* (2019) [5] and Shivaleela and Chowdary (2020) [25] Neem oil 5% (72.976%) is found to be the next effective treatment which is in line with the findings of Yadav *et al.* (2021) [29], Kumar and Kumar. (2016) [14] and MECH 333 (68.251%) is found to be the next effective treatment which is in line with the findings of Zorempuii and Kumar. (2019) [30]. The result of Sixer plus (58.914%) which is at par with *Metarhizium anisopliae* (53.123%) is found to be least effective but comparatively superior over the control, these findings are supported by Meena *et al.* (2013) [17].

The yields among the treatments were significant. The highest yield was recorded in Imidacloprid 17.8% SL (18.15 q/ha) followed by Spinosad 45% SC (17.85 q/ha),

Cypermethrin 10% EC (16.35 q/ha), Neem oil 5% (14.98 q/ha), MECH 333 (14.58q/ha), Sixer plus (13.03 q/ha), *Metarhizium anisopliae* (12.55q/ha), as compared to control plot (9.17q/ha). These findings are supported by Vishal *et al.* (2019) [27], Bhatta *et al.* (2019) [5], Akter *et al.* (2021) [3], Yadav *et al.* (2021) [29], Aziz *et al.* (2014) [4], Meena *et al.* (2013) [17] respectively.

When cost benefit ratio was worked out, interesting result was achieved. Among the treatments studied, the best and most economical treatment was Imidacloprid 17.8% SL (1: 5.20) followed by Spinosad 45% SC (1: 4.87), Cypermethrin 10% EC (1: 4.58), Neem oil 5%

(1: 4.15), MECH 333 (1: 3.98), Sixer plus (1: 3.46), *Metarhizium anisopliae* (1:3.42), as compared to Control (1: 2.74). The highest yield and cost benefit ratio was recorded in Imidacloprid 17.8 SL (18.15 q/ha & 1: 5.20) followed by Spinosad 45% SC (17.85 q/ha & 1: 4.87). These findings are supported by Ahlawat *et al.* (2018) [2] and Akter *et al.* (2021) [3].

Table 1: To evaluate the effect of selected chemicals and biopesticides on the population of mustard aphid, *Lipaphis erysimi* (Kalt.):

S. No	Treatments	Population of *L. erysimi* /top 10 cm central twig of plant	Per cent population reduction of *L. erysimi* /top 10 cm central twig of plant						
			1ST SPRAY			2ND SPRAY			Cumulative Mean
		Before spraying	3DAS	7DAS	14DAS	3DAS	7DAS	14DAS	
T1	Imidacloprid 17.8% SL	209.00	68.967	88.700	78.920	94.870	98.547	99.097	88.184
T2	Cypermethrin 10% EC	192.93	45.313	64.720	71.180	87.700	94.187	95.860	76.937
T3	Spinosad 45% SC	202.93	51.577	80.680	74.717	89.780	94.827	97.407	81.498
T4	*Metarhizium anisopliae* (108 spore load/gm)	195.00	28.010	49.183	40.967	60.047	67.370	73.157	53.123
T5	Neem oil 5%	194.06	42.827	55.943	64.933	87.263	91.203	95.683	72.976
T6	MECH 333	197.80	32.653	55.423	62.123	78.836	85.027	95.173	68.251
T7	Sixer plus	204.13	28.653	49.737	59.547	68.880	73.290	73.237	58.914
T8	Control (Water spray)	219.73	00.000	00.000	00.000	00.000	00.000	00.000	00.000
	F-test	NS	S	S	S	S	S	S	S
	S. Ed. (±)	-	0.449	0.328	0.221	0.296	0.141	0.256	0.658
	C.D. (P = 0.05)	-	0.965	0.703	0.475	0.634	0.305	0.548	1.412

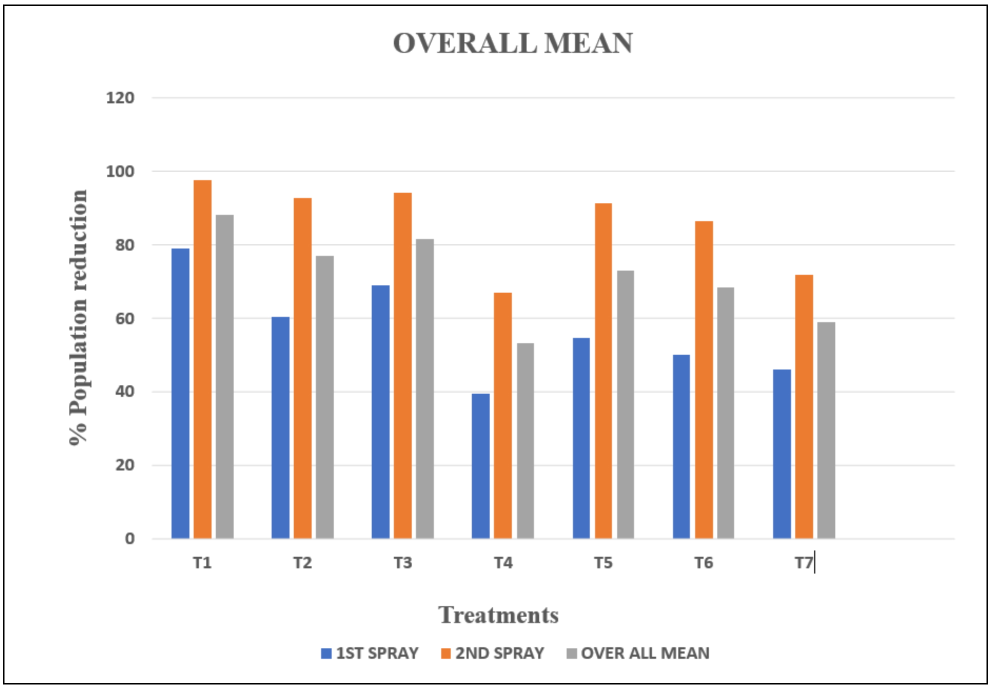

Fig 1: The efficacy of selected chemicals and biopesticides against mustard aphid, *L. erysimi*. (Mean)

Benefit Cost Ratio (BCR):

Table 2: Economics of Cultivation

S. No	Treatments	Yield of q/ha	Cost of yield / ₹/qtl	Total cost of yield (₹)	Common cost (₹)	Treatment cost (₹)	Net return	Total cost (₹)	B:C ratio
1	Imidacloprid 17.8% SL	18.15	6500	117975	21749	960	95266	22709	1: 5.20
2	Cypermethrin 10% EC	16.35	6500	106275	21749	1472	83054	23221	1: 4.58
3	Spinosad 45% SC	17.85	6500	116025	21749	2100	92176	23849	1: 4.87
4	*Metarhizium anisopliae* (108 spore load/gm)	12.55	6500	81575	21749	2088	58126	23837	1: 3.42
5	Neem oil 5%	14.98	6500	97370	21749	1700	73921	23449	1: 4.15
6	MECH 333	14.58	6500	94770	21749	2080	70941	23829	1: 3.98
7	Sixer plus	13.03	6500	84695	21749	2720	60226	24469	1: 3.46
8	Control (Water spray)	9.17	6500	59605	21749		37856	21749	1: 2.74

Conclusion

From the critical analysis it was concluded that among all the treatments T1 Imidacloprid 17.8% SL recorded highest percent reduction of *Lipaphis erysimi* population i.e., (88.14%) with the highest cost benefit ratio (1: 5.20) which was significantly superior over control. While the lowest percent reduction is recorded with *Metarhizium anisopliae* (53.123%) as such more trails are required in future to validate the findings which can be useful for the farmers in a feasible manner for sustainable production and to prevent the losses occuring from the pest infesting the mustard crop.

Acknowledgement

The author expresses his heartful gratitude to, Department of Entomology, Prof, (Dr). Sobita simon, Head of Department of the plant pathology and Entomology and we are grateful thanks to Dean of Director of Research, Dr. Deepak Lal, Dean of Pg studies, Prof. (Dr). Gautam Gosh, Dean, Naini Agricultural Institute who allotting field for this research work at central field of Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, U.P.

References

1. Abbott WS. A method of computing the effectiveness of an insecticide. Ecological Entomology. 1925;18:265-267.
2. Ahlawat P, Singh R, Singh SP, Sachan SK, Singh DV, Spoorthi GS, *et al*. Efficacy of bio pesticides and novel insecticides for control of *Lipaphis erysimi* (Kalt) on mustard crop in western U.P. Journal of Pharmacognosy and Phytochemistry. 2018;1:1814-1820.
3. Akter A, Hossain MI, Amin AKMR, Liza MM. Efficacy of plant derived and synthetic insecticides against mustard aphid for quality seed production. Journal of Entomology and Zoology Studies. 2021;9(4):48-53.
4. Aziz MA, Shahzad AR, Naeem M, Shabbir G. Evaluation of different neem products in comparison with imidacloprid against different morphs of mustard aphid (*Lipaphis erysimi* Kalt.) on canola crop. Asian Journal of Agriculture Biology. 2014;2(3):191-201.
5. Bhatta K, Chaulagain L, Kafle K, Shrestha J. Bio-Efficacy of Plant Extracts against Mustard Aphid (*Lipaphis erysimi* Kalt.) on Rapeseed (*Brassica campestris* Linn.) under Field and Laboratory Conditions. Syrian Journal of Agricultural Research. 2019;6(4):557-566.
6. Chandra A, Malik YP, Kumar A. Efficacy and economics of new insecticides for management of aphid (*Lipaphis erysimi*) in Indian mustard. Current Advances in Agricultural Sciences. 2014;6(1):88-90.
7. Dharavat N, Mehera B, Nath S, Patra SS, Rout S. Effect of sowing dates on population dynamics of mustard aphid (*Lipaphis erysimi*) in mustard (*Brassica juncea*) under Allahabad climatic condition. Advances in Life Sciences. 2016;5(20):2278-3849.
8. 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.
9. Henderson CF, Tilton EW. Tests with acaricides against brown wheat mite. Journal of Economic Entomology. 1955;48(2):157-161.
10. Kalasariya RL. Management of aphid, *Lipaphis erysimi* in mustard with different spray schedules. Indian Journal of Plant Protection. 2016;44(1):16-23.
11. Kalia A, Shukla G, Mishra D, Mishra BP, Patel RR. Comparative trend analysis of mustard in Bundelkhand region, Uttar Pradesh, India. Indian Journal of Extension Education. 2021;57(1):15-19.
12. Khan IA, Ahmad M, Akbar R, Hussain S, Saeed M, Farid A, *et al*. Study on Aphids density and yield components of 12 *brassica* Geno. Journal of Entomology and Zoology Studies. 2015;3(6):11-15.
13. Khanal D, Maharajan S, Lamichhane J, Neupane P, Sharma S, Pandey P. Efficacy of Biorational Compounds against Mustard Aphid (*Lipaphis erysimi* Kalt.) and English Grain Aphid (*Sitobion avenae* Fab.) under Laboratory Conditions in Nepal. Advances in agriculture. 2020;7(10):11-55.
14. Kumar S, Kumar A. Bio-efficacy of biopesticides and certain chemical insecticides against mustard aphid (*Lipaphis erysimi* Kalt.) on mustard crop under field condition. International journal of Plant Protection. 2016;9(1):129-132.
15. Lal B, Nayak MK, Tomar DS, Thakur SR. Efficacy of newer insecticides against mustard aphid, *Lipaphis erysimi* (Kalt.) in Indian mustard under Bundelkhand Agro climatic zone of Madhya Pradesh. Journal of Entomology and Zoology Studies. 2018;6(6):400-403.
16. Maurya NK, Singh R, Singh J, Nigam R, Hasan W, Kumar A. Efficacy of novel insecticides against mustard aphid *Lipaphis erysimi* (Kaltenbach), International Journal of Agricultural Invention. 2018;3(1):62-70.
17. Meena H, Singh SP, Nagar R. Evaluation of microbial agents and bio products for the management of mustard aphid, *Lipaphis erysimi* (Kalt.) The Bioscan. 2013;8(3):747-750.
18. Meena J, Harsha Pant U, Bahjan R. Heterosis analysis for yield and yield attributed traits in Indian mustard

[*Brassica juncea* (L.) Czern & Coss]. Electronic Journal of Plant Breeding. 2015;6(4):1103-1107.

19. Nelson EH, Rosenheim JA. Encounters between aphids and their predators: the relative frequencies of disturbance and consumption. Entomologia Experimentalis et Applicata. 2006;118:211-219.
20. Patel S, Singh CP, Hasan W. Relative efficacy of certain insecticides against mustard aphid in mustard ecosystem. International Journal of Agricultural and Applied Sciences. 2020;1(1):46-48.
21. Pragya Das DK, Sehgal VK, Das TK, Mukherjee J. Impact of Conservation Agriculture on Aphid infestation in Mustard under Rice-Mustard Cropping System. Journal of Agricultural Physics. 2017;17(1):129-136.
22. Rashid S, Hussain S, Mir Yaqoob M, Ashraf S. Efficacy of insecticides against mustard aphid, *Brevicoryne brassicae* and their safety to coccinellid predators. Indian journal of entomology, 2021;67(10):44-55.
23. Sen K, Samanta A, Hansda A, Dhar PP, Samanta A. Bioefficacy and economics of some insecticides against mustard aphid, *Lipaphis erysimi* (Kalt.) infesting mustard. Journal of Crop and Weed. 2017;13(2):235-237.
24. Sharma N, Upadhyaya SN, Singh UC, Dubey M, Ahmad A. Bio efficacy of insecticides against mustard aphid. Journal of Entomology and Zoology Studies. 2020;8(4):97-102.
25. Shivaleela G, Chowdary LR. Field bio efficacy of insecticide premix (Chlorpyriphos 50% + Cypermethrin 5% EC) against major insect pests of cabbage. Journal of Entomology and Zoology Studies. 2020;8(1):835-839.
26. Singh SN, Singh VK, Singh RK, Singh RK. Evaluation of On- Farm Front Line Demonstrations on the Yield of Mustard in Central Plains Zone of Uttar Pradesh. Indian Research Journal of Extension Education. 2007;7(2&3):79-81.
27. Vishal Hem S, Ajay K. Efficacy and economics of some newer insecticides against mustard aphid, *Lipaphis erysimi* (Kalt). Journal of Pharmacognosy and Phytochemistry. 2019;8(3):785-788.
28. Vishvendra SK, Sachan SK, Singh G, Singh R. Bio-Efficacy of insecticides and biorational against *Lipaphis Erysimi* (Kalt.) in mustard crop. Journal of Pharmacognosy and Phytochemistry. 2018;SP5:58-61.
29. Yadav SP, Singh B, Satyajeet, Kumar H. Eco-friendly management of aphid (*Lipaphis erysimi* Kalt) in Indian mustard variety RB-50 under late sown conditions. Journal of Entomology and Zoology Studies. 2021;9(1):1882-1886.
30. Zorempuii R, Kumar A. Efficacy of certain chemicals and botanicals against aphid, *Lipaphis erysimi* (Kaltenbach) on cabbage (*Brassica oleracea* L.). Journal of Entomology and Zoology Studies. 2019;7(5):89-93.