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Comparative efficacy of botanicals, imidacloprid and cow urine against mustard aphid (*Lipaphis erysimi* Kalt.) on mustard (*Brassica juncea* L.)

Chodem Aswitha and Usha Yadav

Abstract
A field trail was conducted at the Central Research Farm (CRF), Department of Entomology, SHUATS, Prayagraj during *Rabi* 2022-2023. With an investigation entitled eight treatments were evaluated against *Lipaphis erysimi*, *i.e.,* NSKE 5% (T_1), Neem oil 5% (T_2), Imidacloprid 17.8% SL+NSKE 5% (T_3), Imidacloprid 17.8% SL (T_4), Castor oil (T_5), Cow urine (T_6), Karanj oil (T_7) and untreated Control (T_8). Results revealed that, among all the two sequential spraying of the treatments, Imidacloprid 17.8% SL+NSKE 5% (29.64%). Imidacloprid 17.8% SL (34.05%) is found to be the next best treatment followed by Neem oil (38.70%). It is followed by Karanj oil (41.80%). NSKE 5% (45.87%) is found to be the next effective treatment. It was followed by Castor oil (50.35%) and Cow urine (55.88%) was the least effective among all treatments. While, the highest yield 17.33 q/ha was obtained from the treatment Imidacloprid 17.8% SL+NSKE 5% as well as C:B ratio (1:4.73) was obtained high from this treatment. It was followed by Imidacloprid 17.8% SL (1:4.52), Neem oil 5% (1:3.99), Karanj oil (1:3.21), NSKE 5% (1:3.07), Castor oil (1:2.70), Cow urine (1:2.28), as compared to Control (1:1.77).

Keywords: Botanicals, imidacloprid 17.8% SL, *Lipaphis erysimi*, mustard aphid

Introduction
Oilseed crops play an important role in agricultural economy of India. It constitutes the second largest agricultural product in the country next to food grains. In India, oilseeds contribute 3 percent and 10 percent to gross national products and the value of all agricultural products respectively (Singh *et al.,* 2017) [9]. Rapeseed-mustard belonging to the family Cruciferae (Brassicaceae) is the third most important oilseed crop growth in the world after soybean (*Glycine max*) and palm (*Elaeis guineensis* Jacq.) oil. India is an important rapeseed-mustard growing country in the world, occupying the fourth position in its area and production after Canada, China and European Union. Out of the seven edible oilseeds cultivated in India, the contribution of rapeseed-mustard (*Brassica* spp.) is 28.6% in the total production of oilseeds. In India, it is the second most important edible oilseeds after groundnut which shares 27.8% in India's oilseed economy. Out of the total cropped area in India, the share of oilseeds is 14.1% with which rapeseed-mustard accounting for 3%. The overall production of rapeseed-mustard and its oil is around 38-42 MT and 12-14 MT, respectively. Contribution of India in world acreage and production introduction is 28.3% and 19.8%, respectively (Bhanu *et al.,* 2014) [2].
The average productivity of rapeseed and mustard crops is quite low in India due to a number of abiotic and biotic stresses, e.g., non-adoption of improved technology and cultivation in rainfed and marginal lands having low fertility. In addition, the insect-pests and diseases also cause heavy damage to the yield potential of these crops. The mustard crop is damaged at various stages of plant growth by a number of insect pests *viz*; mustard sawfly (*Athalia lugens proxima* Klug.), painted bug (*Bagrada cruciferarum* Kirk.), mustard aphid (*Lipaphis erysimi* Kalt.), cabbage leaf Webber (*Crocidolomia binotalis* Zeller), flea beetle (*Phyllotreta Cruciferae* Geoze) and leaf minor (*Phytomyza horticola* Meign) (Gautam *et al.,* 2019) [4]. Among these, the mustard aphid (*Lipaphis erysimi* Kalt.) is of prime significance, which tolls up to 91.30 percent seed yield. This pest alone can devastate the entire mustard crop. Out of many insect pests, the mustard aphid, *Lipaphis erysimi* is considered important which causes considerable yield losses. Both nymph and adult suck the cell sap from various parts of a plant like leaves, inflorescence, tender stem and pods and cause economic damage. Due to the heavy infestation of mustard aphids, the symptoms of yellowing, and curling drying of leaves appear, resulting in the development of feeble and small seeds in the pods.

It also reduces the photosynthetic rate and secretes the honeydew which is responsible for sooty mould growth (Patel *et al.*, 2017) [9].

Mustard aphid causes significant yield losses in many crops in the family Brassicaceae, which includes mustards and crucifers. Continued feeding by aphids causes yellowing, wilting and stunting of plants. Severely infested plants become covered with a mass of small sticky aphids, which can eventually lead to death and decay. Mustard aphids feed on the underside of the leaves and on the centre of the mustard head. Many controlling measures are adopted to manage the mustard aphid population below economic injury level like chemical, mechanical, physical, cultural, host plant resistance and biological control. Among these, at severe attack, chemical control is very important and provides significant control (Choudhary *et al.*, 2020) [3].

Materials and Methods

The experiment was conducted at the experimental research plot of the Department of Entomology, Central Research Farm, Sam Higginbottom University of Agriculture Technology and Sciences, during the *Rabi* season of 2022-2023, in a Randomized Block Design with eight treatments replicated thrice using variety Md rani super gold (Local variety) @ 400 g/ha in a plot size of 2 m×2 m at a spacing of 30 cm×10 cm with a recommended package of practices excluding plant protection. The soil of the experimental site was well-drained and medium-high. The research farm is situated at 250 27" North Latitude 800 05'' East Longitudes and at an Altitude of 98 meters above sea level, the maximum temperature reaches up to 420 °C in summer and cools down to 40C in winter. The treatments used in the experiment are *viz*, T1 NSKE 5% (5 ml/lit), T_2 Neem oil 5% (10 ml/lit), T_3 Imidacloprid 17.8% SL+NSKE 5% (300 ml+3000 ml/ha), T_4 Imidacloprid 17.8% SL (300 ml/ha), T_5 Castor oil (2 ml/lit), T_6 Cow urine 250 ml/lit, T7 Karanj oil (5 ml/lit) and control T_8.

Observations on aphid population of the plant before and after treatment application. Pre-count aphid population was taken one day before spraying on five randomly selected plants in each plot. Post count was taken 3rd, 7th, and 14th treatment applications for two sprayings. The chemicals and botanicals are sprayed at recommended doses when the aphid reaches its ETL level of 10%.

The healthy marketable yield obtained from different treatments was collected separately and weighted. The cost of treatments used in this experiment was recorded during *Rabi* season. The cost of chemicals and botanicals used was obtained from nearby markets. The total cost of plant protection consisted of cost of the treatments, sprayer, rent and labour charges for the spray. There are two sprays throughout the research period and the overall plant protection expenses were calculated. Total income was obtained by multiplying the total yield per hectare by the prevailing market price, while the net benefit is obtained by subtracting the total cost of plant protection from the total income. Benefit over the control for each sprayed treatment was obtained by subtracting the income of the control treatment from that of each sprayed treatment.

Cost Benefit Ratio

Cost effectiveness of each treatment was assessed based on net returns. Net return of each treatment was worked out by deducting the total cost of each treatment from gross returns. The total cost of production included both cultivation as well as plant protection charges.

Gross return = Marketable yield × Market price
Net return = Gross return – Total cost

$$CBR = \frac{Gross\ returns}{Total\ cost\ of\ protection}$$

(Zorempuii and Kumar, 2019) [15]

Results and Discussion

In the experiment, eight different treatments, consisting application of NSKE 5% (T_1), Neem oil 5% (T_2), Imidacloprid 17.8% SL+NSKE 5% (T_3), Imidacloprid 17.8% SL (T_4), Castor oil (T5), Cow urine (T_6), Karanj oil (T_7) 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 the available relevant literature in this chapter as before.

Results revealed that among the different treatments were significantly superior over control in decreasing the count of aphid population and the mean of 3rd, 7th, and 14th DAS after treatments application was in the following order *viz*., Imidacloprid 17.8% SL+NSKE 5% was found significantly superior (29.64), followed by Imidacloprid 17.8% SL (34.05), Neem oil (38.70), Karanj oil (41.80), NSKE 5% (45.87), Castor oil (50.35) and Cow urine (55.88) was the least effective among all the treatments.

In the present research work, lowest population of Mustard aphid was recorded in Imidacloprid 17.8% SL+NSKE 5% (29.64) treated plot. Similar findings were also reported by Lal *et al*. (2018) [6] reported that Imidacloprid 17.8% SL+NSKE 5% treated plot shown lowest population of Mustard aphid. Similarly, next lowest aphid population is recorded in the plot treated with Imidacloprid 17.8% SL (34.05). These findings were also reported by Patel *et al*. (2017) [9], that Imidacloprid 17.8% SL shown lowest population of Mustard aphid. Next lowest population of Mustard aphid was recorded in Neem oil 5% (38.70) treated plot. Similar findings were also reported by Kumar and Kumar (2019) [5] reported that Neem oil 5% treated plot shown lowest aphid population of Mustard aphid. Next lowest population of Mustard aphid was recorded in Karanj oil (41.80) treated plot. Similar findings were also reported by Singh *et al.* (2017) [9]. NSKE 5% (45.87) and Castor oil (50.35) treated plots showed low aphid population survivability which were also reported with the findings of Yadav *et al*. (2021) [13] and Yadav *et al.* (2018) [14]. Cow urine (55.88) treated plot showed minimum aphid population survivability similarly with the findings of Malla *et al.* (2021) [7].

The maximum returns were recorded by treatment Imidacloprid 17.8% SL+NSKE 5% *i.e.*, (1:4.73) with the similar findings of Lal *et al*. (2018) [6] followed by Imidacloprid 17.8% SL *i.e.*, (1:4.52) with the similar findings of Sharma *et al.* (2020) [10] Neem oil i.e., (1:3.99) with the similar findings of Singh and Kumar (2022) [12] and Karanj oil *i.e.*, (1:3.21). Secondly good return also received by application of NSKE 5% and Castor oil *i.e.*, (1:3.07) with the similar findings of Aziz *et al.* (2014) [1] and (1:2.70). Cow urine recorded less return *i.e.*, (1:2.28). The results obtained in

the present experiment was found in accordance with the findings of (Neen*a et al.* (2009) [8]. An experiment was conducted to control of mustard aphid through insecticide and NSKE 5% combination in mustard crops. The result revealed that Imidacloprid 17.8% SL+NSKE 5% combination recorded maximum grain yield (16.5 q/ha) and highest Benefit ratio (1:4.73).

Table 1: To evaluate the efficacy of selected treatments against mustard aphid (*Lipaphis erysimi Kalt*.).

Tr. No	Treatments	Dose (ml org/Lit.)	Population of Mustard aphid/ 5 selected plants								Mean	Yield (q/ha)	C: B Ratio
			ST				ND						
			1 DBS	3 DAS	7 DAS	14 DAS	1 DBS	3 DAS	7 DAS	14 DAS			
T1	NSKE 5%	5 ml/lit	183.80	58.46	54.66	56.80	57.60	40.46	31.06	33.80	45.87	11.56	1:3.07
T2	Neem oil	10 ml/lit	175.00	51.06	47.60	49.46	50.33	30.66	24.60	28.80	38.70	15.17	1:3.99
T3	Imidacloprid 17.8% SL+NSKE 5%	300 ml+3000 ml/ha	162.80	42.40	39.00	40.60	41.46	22.06	15.80	18.00	29.64	17.33	1:4.73
T4	Imidacloprid 17.8% SL	300 ml/ha	165.60	46.80	43.40	45.00	45.86	26.06	20.00	23.06	34.05	16.5	1:4.52
T5	Castor oil	2 ml/lit	179.20	63.00	59.73	61.93	62.80	44.66	35.20	37.60	50.35	11.15	1:2.70
T6	Cow urine	250 ml/lit	175.00	68.73	65.86	67.66	68.46	49.73	40.26	43.06	55.88	8.41	1:2.28
T7	Karanj oil	5 ml/lit	177.26	54.26	49.93	52.33	53.13	35.53	27.80	30.93	41.80	12.17	1:3.21
T8	Untreated plot	-	175.33	186.60	189.73	199.60	201.06	202.46	203.73	204.86	197.83	6.12	1:1.77
	SE(d)±			2.12	2.09	1.98	2.06	3.00	2.84	2.95	50.045	-	-
	CD at 5%			6.43	6.33	6.011	6.25	9.09	8.60	8.95	19.896	-	-
	CV (%)			5.14	5.26	4.78	4.91	9.19	9.86	9.73	13.620	-	-

DBS = Day Before Spray, **DAS = Day After Spray

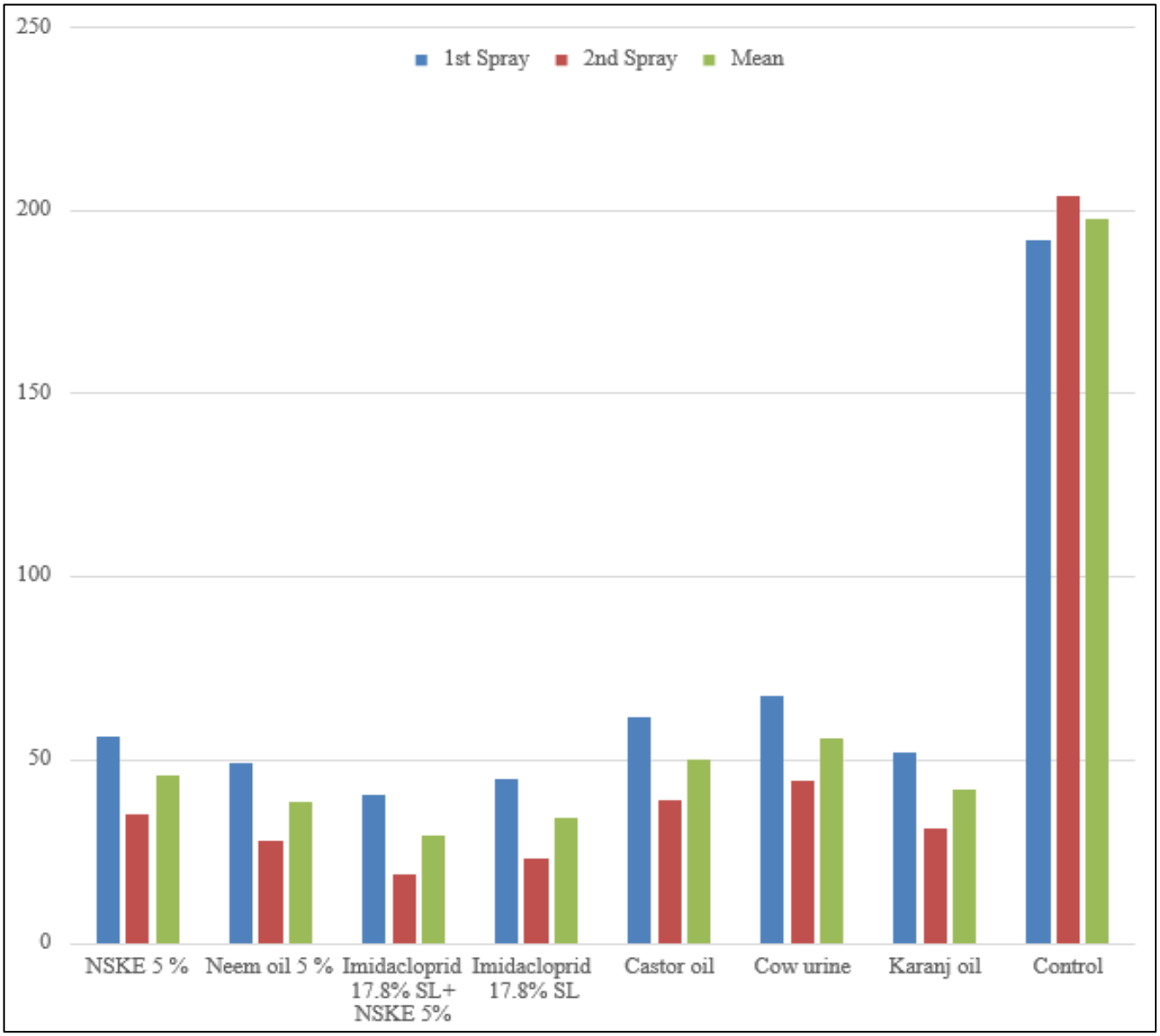

Fig 1: To evaluate the efficacy of selected treatments against mustard aphid (*Lipaphis erysimi* Kalt.) during *Rabi* season 2022-2023

Conclusion

From the experiment discussed above, the results revealed that most superior over the other treatments was found to be Imidacloprid 17.8%+NSKE 5% followed by Imidacloprid 17.8%, Neem oil 5%, Karanj oil, NSKE 5%, Castor oil, Cow urine. Among the treatments studied, Imidacloprid 17.8% + NSKE 5% gave the highest cost benefit ratio (1:4.73) and marketing yield (17.33 q/ha) followed by Imidacloprid 17.8% (1:4.52 and 16.5 q/ha), Neem oil 5% (1:3.99 and 15.17 q/ha), Karanj oil, NSKE 5%, Castor oil, Cow urine respectively. Recommended dose of treatments may be useful in devising integrated pest management strategy against mustard aphid.

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