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Bio-Efficacy of insecticides and biorational against *Lipaphis Erysimi* (KALT.) in mustard crop

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Abstract
A Field study was conducted at Modipurma, Meerut (India) to determine the effectiveness of nine insecticides and biorational viz., thiamethoxam 25 WDG, imidacloprid 17.8 SL, dimetoate 30 EC, nuvaluron 10 EC, spinosad 45 SC, neemrin 1500 ppm, NSKE, *Metarhizium anisopliae* $2x10^9$ CFU and *Beauveria bassiana* $2x10^9$ CFU against mustard aphid, *Lipaphis erysimi* Kalt. The observations were recorded at 3, 7 and 10 days after spraying of insecticides. The results revealed that thiamethoxam 25 WDG was the most effective among the nine insecticides and biorational showing the minimum numbers of *L. erysimi* Kalt followed by imidacloprid 17.8 SL and *Beauveria bassiana* $2x10^9$ CFU was recorded maximum population.

Keywords: Lipaphis erysimi, insecticides, bio-efficacy and mustard

Introduction
Rapeseed-mustard is a group of the major oilseed crops grown in India next only to soybean in terms of production and ranked first in terms of oil yield. In India, rapeseed-mustard crops include traditional indigenous species, namely toria (*Brassica campestris* L. var. toria), brown sarson (*Brassica campestris* L. var. brown sarson), yellow sarson (*Brassica campestris* L. var. yellow sarson), Indian mustard (*Brassica juncea*), black mustard (*Brassica nigra*) and taramira (Eruca sativa), which have been growing since about 3,500 BC together with non-traditional species such as gobhi sarson (*Brassica napus*) and karan rai (*Brassica carinata*). In India, rapeseed–mustard is grown in diverse agro-climatic conditions ranging from north-eastern/north-western hills to down south under irrigated/rainfed, timely/late sown and mixed cropping. The major constrains affecting yield of mustard are insect pests causing injury to different stages right from seedling to maturity of the crop. However, with increase in cropping intensity and the changing patterns under different agro climatic conditions, the pest complex of the crop has changed. Among the several insects infesting the mustard, mustard aphid, *Lipaphis erysimi* (Kalt.) is the most serious insect-pest of rapeseed-mustard. It may cause a yield loses ranging from 35.4 to 96% in favorable conditions and can reduce 5-6% oil content (Sahoo, 2012)[8]. Both nymphs and adults suck the sap from various parts of plant like leaves, inflorescence, tender stem and pods and cause economic damage. Due to heavy infestation, the symptoms of yellowing, curling and then drying of leaves appear, resulting in development of feeble pods and small seeds in the pods. It also secretes the honeydew which is responsible for development of sooty mould and reduces the photosynthetic rate (Kolte, 2009) [4].

Material and Methods
A field experiment was laid out in randomized block design (RBD) to study the efficacy of some insecticides and biorational against mustard aphid, *Lipaphis erysimi* K. on mustard crop during Rabi season, 2016-17at Crop Research Center of S.V.P. University of Agriculture and Technology, Modipuram, Meerut (India)with ten treatments viz., thiamethoxam 25WDG, imidacloprid 17.8 SL, novaluron 10 EC, spinosad 45 SC, NSKE, neemrin1500ppm, *Beauveria bassiana* 2x 10^9CFU, *Metarhizium anisopliae* 2x 10^9CFU, dimetoate 30 ECand untreated control, and replicated three times. The crop variety 'Pusa bold' was sown on 20th Nov. 2016 and 15th Nov. 2016 with plot size of 5.0x5.0m and distance between row to row and plant to

plant was 30cm and 15cm, respectively. The population of mustard aphid was recorded from 10 cm top portion of the terminal shoot on 10 randomly selected plants from each plot one day prior and 3, 7 and 10 days after insecticide application. The yield in each treatment was recorded and expressed in q/ha.

Statistical analysis

The data were subjected to the analysis of variance using simple randomized block design (RBD) programme.

Results and Discussion

First spray

The observations on reduction in mustard aphid population were recorded one day before and 3, 7 and 14 days after each application during *Rabi*, 2016-17. Pre treatment observations recorded one day before spray, the mustard aphid population ranged from 145.00 to 159.67 aphids and it was non significant among all the treatments. aphids per 10 cm terminal shoot (Table 1). Subsequent to spray, aphid population was significantly decreased in all the treated plots, while significantly increased in untreated plots. Data recorded percent reduction over control on 3rd day after spray, the *L. erysimi* population was the minimum (69.67 aphids) with thiamethoxam 25 WDG followed by followed by imidacloprid (70.33 aphids) which were statistically at par with each other and significantly superior over rest of the treatments. The population of aphids 82.33, 87.33 and 93.00 were recorded in dimethoate, novaluron and spinosad, respectively. The maximum number of aphids (143.67) was recorded in *B. bassiana* followed by *M. anisopliae* (139.67) and was also statistically at par with each other. 7th day of application revealed that the minimum number of aphid (25.67) was recorded in thiamethoxam, closely followed by imidacloprid (27.67 aphids) and were statically at par with each other and significantly superior over rest of the treatments. The next effective treatment was dimethoate with 32.33 aphids. The maximum (116.33) number of aphids was found in the treatment of *B. bassiana* followed by *M. anisopliae*, NSKE and neemarin with 109.33, 91.33 and 81.67 aphids, respectively. At 14th day after first application and it ranged between 59.33 to 143.67 aphids. The minimum aphid population (59.33 aphids) was recorded in thiamethoxam, closely followed by imidacloprid (62.67 aphids) which were found at par with each other and significantly superior over rest of the treatments. The next effective treatment was dimethoate followed by novaluron. The least effective treatments were *B. bassiana* and *M. anisopliae* with 143.67 and 140.00 aphids, respectively, and were statistically at par with each other. The next less effective treatments were NSKE and neemarin which reduces aphid population significantly over control. The order of effectiveness of treatments was thiamethoxam > imidacloprid > dimethoate > novaluron > spinosad > neemarin > NSKE > *M. anisopliae* > *B. bassiana* during the year of 2016-17.

Table No.1: Effect of different treatments against mustard aphid, *Lipaphiserysimi* during *Rabi*, 2016-17 and 2017-18

Treatments	Dose/ha	No of aphids/ 10 cm apical shoot													
		Before spray 2016-17	Before spray 2017-18	First spray 2016-17			First spray 2017-18			Second spray 2016-17			Second spray 2017-18		
				3 DAS	7 DAS	14 DAS	3 DAS	7 DAS	14 DAS	3 DAS	7 DAS	14 DAS	3 DAS	7 DAS	14 DAS
Thiomethoxam	100 gm	152.33 (12.34)	141.67 (11.93)	69.67 (8.40)	25.67 (5.16)	59.33 (7.76)	65.33 (8.14)	22.67 (4.86)	59.67 (7.78)	28.67 (5.44)	13.33 (3.78)	8.67 (3.10)	25.33 (5.13)	9.33 (3.20)	5.00 (2.44)
Imidaclorprid	150 ml	147.33 (12.15)	145.00 (12.08)	70.33 (8.44)	27.67 (5.34)	62.67 (7.97)	65.67 (8.16)	23.67 (4.95)	61.33 (7.89)	31.33 (5.68)	14.67 (3.94)	9.33 (3.20)	26.00 (5.19)	10.33 (3.36)	5.67 (2.56)
Novaluron	500 ml	156.33 (12.54)	140.00 (11.86)	87.33 (9.39)	38.00 (6.24)	79.33 (8.96)	84.33 (9.23)	38.00 (6.24)	75.00 (8.71)	85.00 (9.27)	68.67 (8.34)	52.67 (7.32)	81.33 (9.07)	66.00 (8.18)	50.00 (7.14)
Spinosad	200 ml	149.33 (12.24)	148.33 (12.22)	93.00 (9.69)	44.00 (6.75)	86.67 (9.36)	89.00 (9.48)	44.33 (6.73)	85.33 (9.29)	93.67 (9.72)	76.67 (8.81)	64.67 (8.10)	90.67 (9.57)	73.33 (8.62)	59.33 (7.76)
NSKE	2 litre	159.67 (12.66)	151.67 (12.35)	126.67 (11.29)	91.33 (9.60)	125.67 (11.25)	125.33 (11.24)	87.67 (9.41)	122.67 (11.12)	123.67 (11.16)	103.33 (10.21)	105.33 (10.31)	128.00 (11.35)	99.33 (10.01)	100.67 (10.08)
Neemarin	3 litre	158.67 (12.63)	141.00 (11.91)	121.00 (11.04)	81.67 (9.09)	113.33 (10.69)	117.67 (10.89)	79.67 (8.98)	109.33 (10.50)	114.33 (10.73)	95.33 (9.81)	92.33 (9.66)	117.67 (10.89)	91.67 (9.62)	88.33 (9.45)
Beauveriabassiana	2.5 kg	145.00 (12.04)	146.67 (12.15)	143.67 (12.02)	116.33 (10.83)	143.67 (12.02)	140.33 (11.88)	112.67 (10.66)	141.67 (11.94)	140.33 (11.88)	117.67 (10.89)	116.67 (10.84)	143.33 (12.01)	113.67 (10.70)	116.33 (10.83)
Metarhiziumanisopliae	2.5 kg	154.67 (12.47)	149.67 (12.27)	139.67 (11.86)	109.33 (10.50)	140.00 (11.87)	132.67 (11.56)	105.33 (10.31)	135.67 (11.69)	137.33 (11.76)	113.67 (10.70)	113.00 (10.67)	139.33 (11.84)	110.67 (10.56)	112.67 (10.66)
Dimethoate	1000 ml	153.67 (12.43)	142.00 (11.95)	82.33 (9.12)	32.33 (5.76)	72.67 (8.58)	80.33 (9.01)	30.33 (5.59)	70.00 (8.42)	72.33 (8.56)	62.33 (7.95)	45.00 (6.78)	73.67 (8.64)	60.33 (7.83)	42.67 (6.60)
Control	-	156.33 (12.53)	143.33 (12.01)	157.67 (12.59)	186.00 (13.26)	206.67 (14.40)	147.67 (12.19)	168.33 (13.01)	192.00 (13.89)	229.33 (15.17)	240.00 (15.52)	213.67 (14.65)	210.33 (14.53)	221.33 (14.91)	184.67 (13.62)
SE(m) ±	-	0.27	0.16	0.06	0.13	0.11	0.06	0.11	0.08	0.09	0.10	0.07	0.06	0.06	0.08
CD at 5 %	-	N/S	N/S	0.18	0.41	0.32	0.18	0.34	0.23	0.27	0.28	0.21	0.20	0.19	0.26

During the year of 2017-18, at 3rd day of application of treatments. The minimum (65.33) number of aphids was recorded in thiamethoxam followed by imidacloprid (65.67 aphids) which were at par with each other and significantly superior over rest of treatments. The number of aphids 80.33, 84.33 and 89.00 were recorded in dimethoate, novaluron and spinosad. The maximum (140.33) number of aphids was recorded in *B. bassiana* followed by *M. anisopliae* (132.67 aphids) and these treatments were at par with each other. At seventh day after application of the treatments, it was observed that all the treatments were significantly superior over control and aphid populations were varied from 22.67 to 112.67 in different treatments. The minimum (22.67) number of aphids was again observed in thiamethoxam followed by imidacloprid (23.67 aphids) which were at par with each other and significantly superior over rest of treatments. The maximum (112.67) number of aphids was recorded in *B. bassiana* and *M. anisopliae* (105.33 aphids) and was statistically at par with each other. At 14th day after application of treatments, showed that all the treatments

maintained their significant efficacy in reduction of aphid population over control. The minimum (59.67) number of aphids was observed in thiamethoxam, closely followed by imidacloprid (61.33 aphids). They were statistically at par with each other and significantly superior over rest of treatments. The next effective treatment was dimethoate. The order of effectiveness of treatments was thiamethoxam > imidacloprid > dimethoate > novaluron > spinosad > neemarin > NSKE > *M. anisopliae* > *B. bassiana*.

Second spray

Data recorded on 3rd day of second spray, the minimum (28.67) aphids was observed in thiamethoxam and imidacloprid (31.33). These treatments were found at par with each other and followed by dimethoate (72.33 aphids). The maximum population of aphid was recorded in *B. bassiana* (140.33 aphids), *M. anisopliae* (137.33 aphids) and NSKE (123.67 aphids). The other treatments, novaluron (85.00 aphids), spinosad (93.67 aphids) and neemarin (114.33). On 7th day of second spray, the minimum number of aphids (13.33) was observed in thiamethoxam followed by imidacloprid (14.67 aphids). The maximum (117.17) population of mustard aphid was recorded in *B. bassiana* followed by *M. anisopliae* (113.67 aphids) which were found at par with each other and differed significantly from rest of treatments. The order of effectiveness of treatments was thiamethoxam > imidacloprid > dimethoate > novaluron > spinosad > neemarin > NSKE > *M. anisopliae* > *B. bassiana*. At 14th day of second application of treatments, the minimum aphid population (8.67) was recorded in thiamethoxam followed by imidacloprid (9.33 aphids). These treatments were found at par with each other. The maximum number (116.67) of aphids was recorded in *B. bassiana* and *M. anisopliae* (113.00 aphids) which were found at par with each other and differed significantly from rest of treatments. The other treatments, novaluron (52.67 aphids), spinosad (64.67 aphids) and neemarin (92.33 aphids) were found in the middle order of effectiveness during the year of 2016-17.

During the year of 2017-18, On 3rd day of second spray, the minimum (25.33) number of aphids was observed in thiamethoxam followed by imidacloprid (26.00 aphids). These treatments were found at par with each other and significantly superior over rest of treatments. The next effective treatment was dimethoate (73.67 aphids) which differs significantly from other treatments. The maximum (143.00) population of mustard aphid was observed in *B. bassiana* followed by *M. anisopliae* (139.33 aphids). These were found at par with each other. The other treatments, novaluron, spinosad and neemarin were found in the middle order of effectiveness with 81.33, 90.67 and 117.67 aphids respectively. At 7th day of second spray, thiamethoxam was again found most effective with minimum (9.33) aphid population followed by imidacloprid (10.33 aphids). These treatments were followed by dimethoate but differ significantly from other treatments. The next treatments in the order of effectiveness were novaluron, spinosad and neemarin with 66.00, 73.33 and 91.67 aphids. The maximum (113.67) population of aphids was recorded in *B. bassiana* followed by *M. anisopliae* (110.67 aphids). These were found at par with each other and significantly differ from rest of treatments. On 14th days of second application of treatments, thiamethoxam gave the best performance with minimum (5.00) number of aphids followed by imidacloprid (5.67 aphids), which were at par with each other and significant superior over rest of treatments. These treatments were followed by dimethoate but significantly differ from other treatments. The next treatment in the order of effectiveness was novaluron (50.00 aphids), spinosad (59.33 aphids), neemarin (88.33 aphids) and NSKE (100.67 aphids). The maximum (116.33) number of aphids was observed in *B. bassiana*.

The efficacy of various treatments against aphid population showed that the maximum reduction of population was recorded with thiamethoxam 25 WDG followed by imidacloprid 17.8 SL in present study. These findings are conformity with the findings of earlier workers *i.e.* Chaudhary and Pal (2005) [1], Dhaka *et al*. (2009) [3], Mandal *et al*. (2012) [6] and Patel *et al.* (2017) [7] who reported that thiamethoxam 25 WDG was most effective against mustard aphid. The results of Kumar *et al.* (2013) [5] also supported the present findings who reported almost similar impact of thiamethoxam 25 WDG and imidacloprid 17.8 SL against mustard aphid. Dimethoate 30 EC was found effective in present studies, which is in agreement with the results obtained by Sahoo, (2012) [8] and Yadav and Singh, (2015) [10]. NSKE and neemarin were recorded moderate effective against mustard aphid in the present studies, which are conformity with the findings of earlier studies conducted by Sultana *et al.* (2009) [9]. *B. bassiana* was found least effective in present studies which are in accordance with the result of Devee and Baruah, (2012) [2].

Summary and Conclusion

The efficacy of different treatments viz. thiamethoxam, imidacloprid, novaluron, spinosad, NSKE, neemarin, *B. bassiana*, *M. anisopliae* and dimethoate on the population of mustard aphid revealed that all the treatments were found significantly effective in reducing the population of mustard aphid and thus increasing the yield significantly as compare to control. The maximum number of aphids was recorded in the plot treated with *B. bassiana* followed by *M. anisopliae* and NSKE.

References

1. Chaudhary S, Pal S. Efficacy of some newer insecticides against mustard aphid, *Lipaphiserysimi* (Kalt.). New Delhi, India, 2005; 12(2):125-126.
2. Devee A, Baruah AALH. Bio-efficacy of imidacloprid and bifenthrin against mustard aphid *(Lipaphis erysimi)* on *Brassica rapae.* Indian Journal of Agricultural Sciences. 2012; 82(10):845-851.
3. Dhaka SS, Singh G, Malik YPS, Kumar A. Efficacy of new insecticides against mustard aphid, *Lipaphiserysimi* (Kalt.). Journal of Oilseeds Research. 2009; 26(2):112-115.
4. Kolte SJ. Management of major diseases and pests of mustard in India. Bulletins of mustard in India. 2009.
5. Kumar KR, Sachan SK, Singh DV. Bio-efficacy of some new insecticides against mustard aphid, *Lipaphiserysimi* (Kalt.) and their effect on coccinellid population in rapeseed mustard. Journal Article. 2013; 26 (2):159-163.
6. Mandal D, Bhowmik P, Chatterjee ML. Evaluation of new and conventional insecticides for the management of mustard aphid, *Lipaphiserysimi* Kalt. (Homoptera: Aphididae) on rapeseed (*Brassica juncea* L.). The Journal of Plant Protection Sciences. 2012; 4(2):37-42.
7. Patel S, Yadav SK, Singh CP. Bio-efficacy of insecticides against *Lipaphiserysimi* (Kalt.) in mustard ecosystem. Journal of Entomology and Zoology Studies. 2017; 5(2):1247-1250.
8. Sahoo SK. Incidence and management of mustard aphid

(*Lipaphiserysimi* Kaltenbach) in West Bengal. Journal of Plant Protection Sciences. 2012; 4(1):20-26,
9. Sultana NA, Khan MAH, Islam MN, Hasanuzzamam M. Integrated management of aphid (*Lipaphiserysirni* Kalt.) in mustard. World Journal of Zoology. 2009; 4(2):105-108.
10. Yadav S, Singh SP. Bio-intensive integrated management strategy for mustard aphid. Journal of Applied and Natural Science. 2015; **7**(1):192-196.