Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2018; 6(4): 1120-1123

Received: 24-05-2018
Accepted: 26-06-2018

Rupa Bavisa
M. Sc. (Agri.) Student, College of Agriculture, JAU, Junagadh, Gujarat, India

GM Parmar
Associate Research Scientist, Pearl millet Research Station, J. A. U., Jamnagar, Gujarat, India

Surbhi Kansagara
M. Sc. (Agri.) Student, College of Agriculture, JAU, Junagadh, Gujarat, India

MM Hirapara
M. Sc. (Agri.) Student, College of Agriculture, JAU, Junagadh, Gujarat, India

Correspondence
Rupa Bavisa
M. Sc. (Agri.) Student, College of Agriculture, JAU, Junagadh, Gujarat, India

Field efficacy of different chemical insecticide against *Lipaphis erysimi* (Kalt.) on mustard

Rupa Bavisa, GM Parmar, Surbhi Kansagara and MM Hirapara

Abstract
Studied on bio-efficacy of nine insecticide against aphid *Lipaphis erysimi* (Kalt.) on mustard. Insecticide used in experiment were flonicamid 50% WDG, imidacloprid 40% + fipronil 40% w/w 80% WG, dinotefuran 20% SG**,** clothianidin 50% WDG, fipronil 5% SC, thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015%, thiacloprid 48% SC, dimethoate 30% EC and imidacloprid 17.8% SL. The aphid index data was recorded before 1 day, after 3, 5, 7, and 10 day of both spray. The lowest aphid index was noticed in plots treated with thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% and it was at par with flonicamid 0.002% and imidacloprid 0.005%. The order of effectiveness of synthetic insecticides was thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% > flonicamid 50%WDG 0.002% > imidacloprid 17.8% SL 0.005% > clothianidin 50% WDG 0.003% > dimethoate 30% EC 0.03% > thiacloprid 48% SC 0.024%> imidacloprid 40% + fipronil 40% w/w 80% WG 0.03% > fipronil 5% SC 0.05% > dinotefuran 20% SG 0.008%. Considering the effectiveness yield and economics of insecticides imidacloprid 0.005%, dimethoate 0.03%, flonicamid 0.02%, thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% were found most effective and economical for control of aphid in mustard.

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

Introduction
Rapeseed-mustard crops are cultivated in 53 countries spreading over the 6 continents covering an area of 24.2 million ha with an average yield of 1451 kg/ha ranging from 411 kg/ha (Russian Federation) to 6250 (Algeria) and netted the total production of 35.1 million tonnes. Among various biotic factors responsible for reducing the yield of mustard, insect pests are the major one. Thirty eight insect pests are known to be associated with mustard crop in India (Bakhetia and Sekhon, 1989) [1]. Out of which, Mustard aphid, *Lipaphis erysimi* (Kalt.), Mustard sawfly, *Athalia proxima* Klug., Painted bug *Bagrada hilaris* Kirk., Leaf miner, *Chromatomyia horticola* Goureau and Bihar hairy caterpillar, *Spilarctia obliqua* Walker are the pests of major importance. Among all the insect pests, the mustard aphid, *Lipaphis erysimi* (Kalt.) has gained the status of key pest of rapeseed-mustard in India. It causes 35.4 to 96% yield loss, 30.9% seed weight loss and 2.75% oil loss (Bakhetia, 1984). Considering yield losses due to this pest, chemical control measures are suggested and in many cases seed yield loss have been minimized. New molecules are now emerging as available component of IPM strategies on all crops in view of their good efficacy to pest control and safety to non-target organisms. Therefore, the present investigation was undertaken to evaluate the bio-efficacy of some new insecticides against mustard aphid.

Materials and Methods
A Field experiment was conducted at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh during *Rabi* 2016-17. The experiment was laid out in a randomized block design with three replications and ten treatments, including the control. The seeds of mustard variety, GM-2 were sown on 22th November during 2016-17 in plots measured 5.0 ×1.8 m. Recommended agronomical practices except plant protection measures were followed for raising the crop. The spray solution of insecticides was applied with the help of knapsack sprayer. The care was taken to obtain uniform coverage of insecticides in each plot. Two sprays of insecticides were carried out at an interval of 15 days. The first spray was done at when aphid started to build up and reach to 1.5 aphid index. The spray solution was used according to crop canopy.

In order to evaluate the efficacy of different insecticides, observations on aphid index were recorded visually from 5 plants randomly selected and tagged plants from 10 cm top central shoot in each plot. Aphid population was recorded on the basis of aphid index from randomly selected five plants before first spray and 3, 5, 7 and 10 days after first and second applications as per the methodology. The average values worked out on aphid index were subjected to statistical analysis and the data obtained were subjected to appropriate transformation and analyzed statistically.

Statistical analysis

With a view to evaluate the effect of different chemical insecticides on the mustard yield, the mustard crop was harvested from each net plot of 5.0 m ×1.8 m. The harvested yield was weighted and converted on hectare bases. The per cent increase yield over control calculated by using the following formula (Pradhan, 1969) [3].

$$\text{Yield increased (\%)} = 100 \times \frac{T - C}{C}$$

T = Yield of respective treatment (kg/ha).
C = Yield of control (kg/ha).

Results and discussion

The pre-treatment population of aphid during 2016-17 crop season was 1.38 to 1.60 aphid index/plant. This variation in aphid population was non-significant indicating homogeneous distribution of aphid population in experimental field. All the treatments decrease the aphid population significantly than the control.

First spray

The aphid index of *L. erysimi* after three days of spraying revealed that all the insecticides were found superior over control. The treatment of thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% was found most effective and showed 0.63 aphid index/plant. However, it was at par with flonicamid 0.02% and imidacloprid 0.005% as they showed 0.73 and 0.95 aphid index/plant, respectively. The next best treatment were clothianidin 0.003%, dimethoate 0.03% and thiacloprid 0.024% as they gave 1.05, 1.16 and 1.22 aphid index/plant, respectively. The rest of the treatment *viz.*, imidacloprid 40% + fipronil 40% @ 0.03%, fipronil 0.05% and dinotefuran 0.008% were found less effective as they registered 1.47, 1.55 and 1.75 aphid index/plant, respectively.

The aphid index of *L. erysimi* after five days of spraying showed that significantly lowest aphid index (0.50) was observed in plots treated with thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% and it was at par with flonicamid 0.02% and imidacloprid 0.005% as it recorded 0.69 and 0.67 aphid index/plant, respectively. The treatment of clothianidin 0.003%, dimethoate 0.03% and thiacloprid 0.024% were found moderately effective which registerd 0.96, 1.02 and 1.17 aphid index/plant, respectively. The remaining treatment imidacloprid 40% + fipronil 40% @ 0.03%, fipronil 0.05% and dinotefuran 0.008% were found less effective as they registered 1.33, 1.43 and 1.65 aphid index/plant, respectively. The highest aphid index/plant of 2.53 was recorded in control.

After seven days of spray thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% recorded significantly the lowest 0.73 aphid index/ plant. However, it was at par with flonicamid 0.02%, imidacloprid 0.005%, Clothianidin 0.003% and dimethoate 0.03% as they recorded 0.83, 0.89, 1.07 and 1.09 aphid index/plant, respectively. The remaining treatment *viz.*, thiacloprid 0.024%, imidacloprid 40% + fipronil 40% @ 0.03%, fipronil 0.05% and dinotefuran 0.008% were found moderately effective which registered 1.23, 1.42, 1.52 and 1.69 aphid index/plant, respectively. The highest aphid index/plant of 2.93 was recorded in control.

After ten days of spray, thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% showed the lower aphid index (0.87) and it was at par with flonicamid 0.02%, and imidacloprid 0.005%, clothianidin 0.003% and dimethoate 0.03% which registered 0.99, 1.02, 1.12 and 1.22 aphid index/plant, respectively. The next best effective treatment was thiacloprid 0.024% as they recorded 1.28 aphid index/plant. The remaining treatment *viz.*, imidacloprid 40% + fipronil 40% @ 0.03%, fipronil 0.05% and dinotefuran 0.008% were found moderately effective which registered 1.47, 1.58 and 1.79 aphid index/plant, respectively. The highest aphid index/plant of 2.80 was recorded in control (Table 1).

Second spray

Similar results as first spray were found during second spray.

The studies on bio-efficacy of different insecticides during both the spray revealed that all the evaluated insecticides were significantly superior to untreated control in controlling the aphids up to 10 days of spray. The lowest aphid index was noticed in plots treated with thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% and it was at par with flonicamid 0.002% and imidacloprid 0.005%. The next best treatments were clothianidin 0.003%, dimethoate 0.03% and thiacloprid 0.024%. Among the tested insecticides, the highest aphid index was noted in plots treated with dinotefuran 0.008% and it was less effective treatment among all the evaluated insecticides and was at par with fipronil 0.05% and Imidacloprid 40% + Fipronil 40% w/w 0.03%.

The order of effectiveness of synthetic insecticides was thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% > flonicamid 50%WDG 0.02% > imidacloprid 17.8% SL 0.005% > clothianidin 50% WDG 0.003% > dimethoate 30% EC 0.03% > thiacloprid 48% SC 0.024%> Imidacloprid 40% + Fipronil 40% w/w 80% WG 0.03% >fipronil 5% SC 0.05% > dinotefuran 20% SG 0.008%.

According to Gour and Pareeh (2003) [4] maximum yield was harvested from the treatment of imidacloprid 0.05% (14.9 q/ha) followed by dimethoate 0.03% (11.9 q/ha) and acephate 0.05% (11.1 q/ha). Singh and Kour (2015) [5] showed that maximum mortality of aphids and highest seed yield of celery was reported in the treatment with flonicamid 50 WP @ 200 g/ha followed by imidacloprid 200 SL @ 100 ml/ha. Yadav and Singh (2016) [6] evaluate that the aphid incidence after treatment with imidacloprid 17.8 SL @ 20 g a.i. /ha (0.70 aphids /10 cm main apical shoot) was most effective among all the tested treatments followed by thiamethoxam 25 WG @ 25 g a.i./ha and dimethoate 30 EC @ 300 g a.i. per ha.

Economics

The economics of various synthetic insecticides (Table-2) revealed that the maximum net realization was obtained from the treatment of thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% (39590 Rs/ha) followed by flonicamid 0.002% (30303 Rs/ ha), imidacloprid 0.005% (24383 Rs/ha), clothianidin 0.003% (23643Rs/ha), dimethoate 0.008%

(23495 Rs/ha), thiacloprid 0.024% (19018 Rs/ha), imidacloprid 40% + Fipronil 40% w/w 0.03% (18574 Rs/ha), fipronil 0.05% (18130 Rs/ ha) and dinotefuran 0.008% (8214 Rs/ ha).

The highest (16.93) Incremental Cost Benefit Ratio (ICBR) was calculated from the plots treated with imidacloprid 0.005% followed by dimethoate 0.03% (15.79). Flonicamid 0.02% (12.20), thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% (10.13), clothianidin (09.71) and thiacloprid (08.10). Imidacloprid 40% + fipronil 40% @ 0.03% (02.54), dinotefuran (02.40) and fipronil 0.05% (01.10) recorded lower ICBR and proved to be the least economical insecticidal treatment. According to Mandal *et al.* (2012) [7] Incremental cost benefit ratio indicated that highest return was obtained from imidacloprid (1:16.12) followed by lambda-cyhalothrin (1: 15.68) treated plot. Singh *et al*. (2014) [8] evaluated seven insecticides among them highest cost benefit ratio was obtained from imidacloprid (1:35.5) with a record of maximum monetary benefit of Rs 29,973.3.

Conclusion

Results from the present studies revealed that the lowest aphid index was noticed in plots treated with thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% and it was at par with flonicamid 0.002% and imidacloprid 0.005%. The next best treatments were clothianidin 0.003%, dimethoate 0.03% and thiacloprid 0.024%. Among the tested insecticides, the highest aphid index was noted in plots treated with dinotefuran 0.008% and it was less effective treatment among all the evaluated insecticides. Considering the effectiveness, yield and economics of insecticides imidacloprid 0.005%, dimethoate 0.03%, flonicamid 0.02%, thiamethoxam 12.6% + lambda cyhalothrin 9.50% @ 0.015% were found most effective and economical for control of aphid in mustard. The treatments of remaining insecticide were found comparatively less economical against aphid of mustard ecosystem.

Table 1: Bio-efficacy of different insecticides against aphid, *L. erysimi* on mustard after second spray during *Rabi* season of 2016-17

Insecticides	Aphid Index (0-5) day after spray								
	Before Spray	1st spray				2nd spray			
		3	5	7	10	3	5	7	10
Flonicamid 50%WDG 0.02%	1.18 (1.43)	0.82 (0.70)	0.79 (0.69)	0.91 (0.83)	0.99 (0.99)	0.87 (0.77)	0.79 (0.63)	0.91 (0.83)	1.01 (1.03)
Imidacloprid 40% + Fipronil 40% w/w 80% WG	1.23 (1.52)	1.20 (1.47)	1.15 (1.33)	1.18 (1.42)	1.21 (1.47)	1.19 (1.42)	1.15 (1.32)	1.18 (1.39)	1.21 (1.47)
Dinotefuran 20% SG 0.008%	1.33 (1.77)	1.32 (1.75)	1.28 (1.65)	1.13 (1.69)	1.34 (1.79)	1.32 (1.74)	1.3 (1.68)	1.32 (1.73)	1.34 (1.80)
Clothianidin 50% WDG 0.003%	1.26 (1.60)	1.02 (1.05)	0.98 (0.96)	1.03 (1.07)	1.06 (1.12)	1.02 (1.05)	1.00 (1.00)	1.06 (1.13)	1.16 (1.35)
Fipronil 5% SC 0.05%	1.21 (1.47)	1.24 (1.55)	1.20 (1.43)	1.23 (1.52)	1.26 (1.58)	1.20 (1.45)	1.17 (1.38)	1.22 (1.49)	1.24 (1.53)
Thiamethoxam 12.6% + Lambda cyhalothrin 9.50% @ 0.015%	1.21 (1.47)	0.79 (0.63)	0.71 (0.50)	0.85 (0.73)	0.93 (0.87)	0.81 (0.65)	0.78 (0.61)	0.81 (0.66)	0.96 (0.93)
Thiacloprid 48% SC 0.024%	1.21 (1.47)	1.1 (1.22)	1.06 (1.13)	1.11 (1.23)	1.13 (1.28)	1.10 (1.20)	1.05 (1.10)	1.12 (1.26)	1.17 (1.38)
Dimethoate 30% EC 0.03%	1.17 (1.38)	1.08 (1.16)	1.01 (1.02)	1.04 (1.09)	1.1 (1.22)	1.09 (1.18)	1.04 (1.09)	1.09 (1.18)	1.10 (1.20)
Imidacloprid 17.8% SL 0.005%	1.23 (1.53)	0.97 (0.95)	0.82 (0.67)	0.94 (0.89)	1.01 (1.02)	0.91 (0.82)	0.87 (075)	0.99 (0.98)	1.04 (1.09)
Control	1.23 (1.60)	1.59 (2.60)	1.57 (2.53)	1.69 (2.93)	1.65 (2.80)	1.87 (3.60)	1.88 (3.62)	1.89 (3.67)	1.90 (3.72)
S.Em. ± Treatment (T)	0.08	0.07	0.08	0.07	0.06	0.07	0.07	0.07	0.06
CD. at 5%T	NS	0.20	0.22	020	0.19	0.21	0.22	0.20	0.19
c.v.%	10.71	10.47	12.33	10.49	9.51	10.77	11.55	9.93	9.36

* $\sqrt{x + 0.5}$ Transformation Figures in parentheses are retransformed values DAS = Days after spraying

Table 2: Yield and economics of different insecticidal treatments applied for the control of aphid on mustard crop during *Rabi* 2016-17

Treatments (%)	Cone. (%)	Quantity of insecticides for two sprays (l or kg/ha)	Cost of insecticide (l or kg)	Cost of insecticide for two sprays (Rs/ha)	Total cost of treatment including labour charges (Rs/lit.)	Yield (Kg/ha)	Net gain over control (kg/ha)	Gross realization (Rs/ha)	Net realization over control (Rs/ha)	ICBR
Flonicamid 50% WDG	0.02%	0.6	2940	1764	2484	1439	819	53243	30303	1: 12.20
Imidacloprid 40% + Fipronil 40% w/w 80% WG	0.03%	0.6	11000	6600	7320	1122	502	41514	18574	1: 2.54
Dinotefuran 20%SG	0.008%	0.6	4500	2700	3420	842	222	31154	8214	1: 2.40
Clothianidin 50% WDG	0.003%	0.1	17166	1716	2436	1259	639	46583	23643	1: 9.71
Fipronil 5% SC	0.05%	16	1020	16320	17040	1110	490	41070	18130	1: 1.10
Thiamethoxam 12.6% + Lambda cyhalothrin 9.50%	0.015%	1.1	2900	3190	3910	1690	1070	62530	39590	1: 10.13
Thiacloprid 48% SC	0.024%	0.8	2035	1628	2348	1134	514	41958	19018	1: 8.10
Dimethoate 30% EC	0.03%	1.6	480	768	1488	1255	635	46435	23495	1: 15.79
Imidacloprid 17.8% SL	0.005%	0.4	1800	720	1440	1279	659	47323	24383	1: 16.93
Control	--	--	--	--	--	620	--	--	--	--

Price of mustard 37 Rs/kg, Labour charges@ Rs. 180/ per day × 2 labour = Rs.360/ha/spray

References

1. Bakhetia RC, Sekhon BS. Insect pests and their management in rapeseed mustard. Journal of Oilseed Research. 1989; 8(2):269-299.
2. Bakhetia DRC. Chemical control of *Lipaphis erysimi* (Kalt.) on rapeseed and mustard crop in Punjab. Journal of Research Punjab Agriculture University. 1984; 21(1):63-75.
3. Pradhan S. Insect pests of crops. National Book Trust, New Delhi, India, 1969.
4. Gour IS, Pareek B. Field evaluation of insecticides against mustard aphid, *Lipaphis erysimi* (Kalt.) under semi-arid region of Rajasthan. Indian Journal Plant Protection. 2003; 31(2):25-27.
5. Singh RC, Kour A. Manage the menace of aphids on celery. International Journal of Advanced Research in Biological Science. 2015; 2(10):16-20.
6. Yadav S, Singh SP. Bio-efficacy of some new insecticides against mustard aphid *Lipaphis erysimi* Kalt. (Homoptera: Aphididae) on indian mustard. The bioscan. 2016; 11(1):23-26.
7. Mandal D, Paramita B, Chatterjee ML. Evaluation of new and conventional insecticides for the management of mustard aphid, *Lipaphis erysimi* (Kalt.) (Homoptera: Aphididae) on rapeseed (*Brassica juncea* L.). The Journal of Plant Protection Sciences. 2012; 4(2):37-42.
8. Singh DK, Sundar PD, Pal RK. Efficacy of insecticides against mustard aphid, *Lipaphis erysimi* (Kalt.). Annals of Plant Protection Sciences. 2014; 22(1):39-41.