Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

Journal of Entomology and Zoology Studies

E-ISSN: 2320-7078
P-ISSN: 2349-6800
www.entomoljournal.com
JEZS 2020; 8(3): 255-258

Received: 16-03-2020
Accepted: 18-04-2020

Deepak Singh Pal
Department of Entomology, Chandra Shekhar Azad University of Agricultural and Technology, Kanpur, Uttar Pradesh, India

DK Singh
Department of Entomology, Chandra Shekhar Azad University of Agricultural and Technology, Kanpur, Uttar Pradesh, India

Arun Kumar
Department of Entomology, Sardar Vallabhbhai Patel University of Agricultural and Technology, Meerut, Uttar Pradesh, India

Shinde Pravin Gautam
Mahatma Phule Krishi Vidyapeeth (MPKV), Rahuri Maharashtra, India

Corresponding Author:
Deepak Singh Pal
Department of Entomology, Chandra Shekhar Azad University of Agricultural and Technology, Kanpur, Uttar Pradesh, India

Effect of bio rational approaches for management of mustard aphid, (*Lipaphis erysimi* Kalt.) on seed yield and its economics

Deepak Singh Pal, DK Singh, Arun Kumar and Shinde Pravin Gautam

Abstract
Study on effect of Bio rational approaches for management of mustard aphid, (*Lipaphis erysimi* Kalt.) on seed yield and its economics was conducted on the Oilseed Farm Kalyanpur, Kanpur during rabi, 2018-19. The treatments were : T_1 : Azadirachtin@ 5ml/L followed by its second spray after 15 days, T_2 : Azadirachtin followed by *Beauveria bassiana*@2g/L after 15 days, T_3 : *Beauveria bassiana* followed by its second spray after 15 days, T_4 : Azadirachtin followed by *Verticillium leccani*@2g/L after 15 days, T_5: *Verticillium leccani* followed by its second spray after 15 days, T_6 : Dimethoate 30EC@ 1ml/L followed by its second spray after 15 days and T_7 : Control. Out of which Dimethoate 30EC@ 1ml/L followed by its second spray after 15 days provided highest seed yield which was higher than Azadirachtin followed by *Verticillium leccani* after 15 days. Dimethoate followed by its second spray after 15 days was found most economic with highest IBCR as it gave the maximum benefit (1:37.6) which is very large as compared to remaining treatments and the next effective treatment was Azadirachtin followed by *Verticillium leccani* after 15 days (1:12.5).

Keywords: Mustard aphid, dimethoate 30 EC, Azadirachtin, *Verticillium leccani*, seed yield, IBCR

Introduction
Under Indian conditions Rapeseed mustard is an important oilseed crop. The average productivity of rapeseed and mustard crops in India is very poor due to a range of abiotic and biotic stresses, e.g. the failure to implement improved technology and cultivation in low fertility rainfed and marginal lands. In addition, the insect-pests and diseases also do significant harm to these crops yield capacity (Shukla *et. al.* 1990) [14]. India's average productivity (1176 kg / ha) still represents around two-thirds of the world's average yield of 1695 kg / ha. The yield is reported to be low mainly due to its cultivation in rice under rainfed conditions under substantial area and the infestation of the aphid, *Lipaphis erysimi* (Kalt.). More than three dozen of insect-pests are known to be related with rapeseed mustard crop in India (Bakhetia and Sekhon,1989) [2]. Among them, mustard aphid, *Lipaphis erysimi* (Kalt) is considered the most serious pest of this crop and is considered to be the main limiting factor in the cultivation of mustard causing 35 to 73 per cent reduction in yield (Rai, 1961; Rohilla *et al.*,1987) [11, 12]. Both nymphs and adults suck sap from leaves, inflorescence, and pods; resulting plant growth is sluggish, flowers wither, and the formation of pods is impeded. Severe infestation of the aphid pest can sometimes cause complete loss of oilseed yielding, and plants often fail to bear siliqua or end up with very poor pods (Das and Islam, 1986) [3]. Depending on the season, mustard losses due to aphids ranged from 35-90 per cent. Farmers indiscriminately spray insecticides into their ground. So it causes insect resistance, loss of beneficial species and environmental harm. The economic injury level (EIL) of this pest is 2.04 aphids/ plant (Singh and Malik, 1989) [15] and increases in population above 9.45 aphids per plant and it reduces the seed yield by 59.3 per cent. *Diaeretiella rapaeis* described as one of the most important factor for natural control of mustard aphid (Akhtar *et al*. 2010; Dogra *et al.* 2003) [1, 4]. Twenty aphid species have gained resistance to insecticides (Minks and Harrewinj, 1998) [6] particularly to the organophosphates, carbamates and pyrethroids insecticides (Dress, 1997) [5]. By keeping in mind the negative consequences of chemical pesticides and the growing consensuses in regard of healthcare and environment, sustainable alternative other than the chemical method of pest control is in required. Thus, microbial approaches with antagonistic entomopathogenic fungi (Raj and Lakhanpal, 1998) [9] and

botanicals pesticides have been included as the best alternatives. Modern ecological approaches are needed to be employed to get an effective control over this insect pest which are easily available and match the potency of chemical insecticides.

Materials and Methods

The experiment was conducted during *rabi* season 2018-19 at Oilseed Farm, Kalyanpur, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. Geographically it is situated between 26°21` east longitude at a height of 125.1 meter above mean sea level. The region is subtropical with semi-arid climate. The experiment was conducted by growing variety '*Urvashi*'. The details of the experiments are as follows:

Design	:	RBD
Treatment	:	7
Replication	:	3
Plot size	:	4 m x 3.2 m
Date of sowing	:	25th November, 2018

Treatments for testing their effectiveness against Mustard aphid were:

T_1: Azadirachtin@ 5ml/L followed by its second spray after 15 days

T_2: Azadirachtin followed by *Beauveria bassiana*@2g/L after 15 days

T_3: *Beauveria bassiana* followed by its second spray after 15 days

T_4: Azadirachtin followed by *Verticillium leccani*@2g/L after 15 days

T_5: *Verticillium leccani* followed by its second spray after 15 days

T_6: Dimethoate 30EC@ 1ml/L followed by its second spray after 15 days

T_7: Control

Evaluation of insecticides

The post treatments population of the insects were recorded regularly at ten randomly selected plants of each plot 3,7 and 10 days after treatment application.

$$\text{I Pest Intensity} = \frac{\text{Toatal no.of days adult feed on plants observed}}{\text{No.of plants observed}}$$

$$\text{II Pest Infestation} = \frac{\text{No.of plant infested}}{\text{Total no.of randomly selected plants}} \times 100$$

Total number of nymphs and adults feed on plants observed.

Preparation of spraying solution:

The required amount of toxicant was calculated by the following formula:

$$\text{Amount of insecticide required} = \frac{\text{Concentration of commercial formulation X Volume of commercial formulation}}{\text{Concentration of Spray fluid}}$$

The required amount of solution was sprayed separately in each plots of experiments except control plots.

Results and Discussion

Effect of Treatment on seed yield

The effect of treatments against mustard aphid was determined on the basis of seed yield (Table-1).Significantly higher seed yield (18.25q/ha.) was obtained with T_6: Dimethoate followed by its second spray after 15 days, which did not differ significantly from T_4 : Azadirachtin followed by *Verticillium leccani* after 15 days (16.48q/ha.) and T_2 : Azadirachtin followed by *Beauveria bassiana* after 15 days (15.87q/ha.) but significantly differed from remaining treatments . All the remaining treatments were found superior over control on the basis of Seed Yield and had seed yields viz. 14.02 ,12.7 and 11.67 q/ha. , respectively.

The overall efficacy of treatment on seed yield in mustard was Dimethoate 30EC@ 1ml/L followed by its second spray after 15 days > Azadirachtin followed by *Beauveria bassiana*@2g/L after 15 days > Azadirachtin @ 5ml/L followed by its second spray after 15 days > *Verticillium leccani* followed by its second spray after 15 days > *Beauveria bassiana* followed by its second spray after 15 days > Azadirachtin followed by *Verticillium leccani*@2g/L after 15 days > Control , of which its seed yields were 18.25 > 15.87 > 14.02 > 12.70 > 11.67 > 11.43 > 6.11 Q/Ha. respectively.

Sahoo (2012) [13] found out that the plots treated with Dimethoate and Oxydemeton-methyl recorded minimum aphid infestation , there by produced more yield ranging from 1151.6 to 1310.3 kg seed/ha. Also, Yadav and Singh (2015) [18] ,observed that the spray of Dimethoate 30 EC @ 1 ml/l followed by *Verticillium lecanii* @ 10^8 CS/ml was proved to be the best treatment where the pooled mean seed yield was maximum (1485.0 kg/ha) in this treatment as compared to control (1305.0 kg/ha).

Economics of Treatments

The monetary gain from the treatment was determined by calculating the difference of gross income of a treatment and gross income of control (Table-2).The highest net income was found in T_6 : Dimethoate followed by its second spray after 15 days (Rs 50988/ha.) followed by T_4: Azadirachtin followed by *Verticillium leccani* after 15 days (Rs 43344/ha.). The lowest net income was obtained from T_3: *Beauveria bassiana* followed by its second spray after 15 days (Rs 23352/ha.).Sahoo (2012) [8] evaluated different chemical insecticides for their bio-efficacy against *L. erysimi*, Dimethoate 30EC and Oxydemeton-methyl 25EC proved to be more effective. Incremental cost benefit ratio indicated that most favourable return was obtained under Dimethoate 30EC (1:20.8 & 1:13.3) followed by Oxydemeton-methyl 25EC (1:16.8 & 1:9.1).

The overall profits of treatment on gross income in mustard was Dimethoate 30EC@ 1ml/L followed by its second spray after 15 days > Azadirachtin followed by *Verticillium leccani*@2g/L after 15 days > Azadirachtin followed by *Beauveria bassiana*@2g/L after 15 days > Azadirachtin @ 5ml/L followed by its second spray after 15 days > *Verticillium leccani* followed by its second spray after 15 days > *Beauveria bassiana* followed by its second spray after 15 days, of which its gross incomes were 76650 > 69006 > 66654 > 58884 > 53340 > 49014 > 25662 Rupees respectively.

Singh and Singh (2009) [16] observed a significantly higher yield of mustard seed under dimethoate 30 EC @ 300 g a.i./ha.

Effectiveness of Treatments based on IBCR (Incremental Benefit Cost Ratio)

Based on IBCR as shown in Table-2 , treatment with T_6 : Dimethoate followed by its second spray after 15 days was found most economic as it gave the maximum benefit (1:37.6) which is very much as compared to remaining Treatments.

The next effective treatment was T_4 : Azadirachtin followed by *Verticillium leccani* after 15 days (1:12.5). All treatments were found as cost effective over the control.

The overall effect of treatments on IBCR in mustard was Dimethoate 30EC@ 1ml/L followed by its second spray after 15 days > Azadirachtin followed by *Verticillium leccani*@2g/L after 15 days > Azadirachtin followed by *Beauveria bassiana*@2g/L after 15 days > *Verticillium leccani* followed by its second spray after 15 days > *Beauveria bassiana* followed by its second spray after 15 days > Azadirachtin @ 5ml/L followed by its second spray after 15 days , of which its IBCR were 1:37.6 > 1:12.5 > 1:11.9 > 1:10.6 > 1:08.9 > 1:07.7 respectively.

Imidacloprid 17.8%SL was most effective against mustard aphid where yield increased 881.38kg/ha and cost benefit ratio was 1:18.06 rupees (Sundar Pal *et. al.*, 2018) [17] also approves the fact that chemical insecticide improved more yield with better cost benefit ratio. The additional yield of 18.51 q/ha was also recorded by imidacloprid 17.8 EC (0.008%) treated plots over the control (Mishra *et al.*, 2012) [7].

Mustard plants treated together with Dimethoate and *Azadirechta indica* leaf extract showed highest rapeseed yield (1285kg/acre) with net income Rs.28771 (Parimal Mandal, 2019) [10]

Table 1: Effect of management treatments against mustard aphid *Lipaphis erysimi* Kalt. on seed yield of mustard during *rabi*, 2018-19

Treatments	Mean (Kg/Plot)	Mean (Q/Ha.)
Azadirachtin @ 5ml/L followed by its second spray after 15 days	1.77	14.02
Azadirachtin followed by *Beauveria bassiana*@2g/L after 15 days	2.00	15.87
Beauveria bassiana followed by its second spray after 15 days	1.47	11.67
Azadirachtin followed by *Verticillium leccani*@2g/L after 15 days	2.07	11.43
Verticillium leccani followed by its second spray after 15 days	1.60	12.70
Dimethoate 30EC@ 1ml/L followed by its second spray after 15 days	2.30	18.25
Control	0.77	6.11
SE ±	0.21	1.67
CD@ 5%	0.48	3.65

Table 2: Economics of management treatments against mustard aphid *Lipaphis erysimi* Kalt

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	Azadirachtin @ 5ml/L followed by its second spray after 15 days	3600	4	696	4296	1402	58884	33222	1:07.7
2	Azadirachtin followed by *Beauveria bassiana*@2g/L after 15 days	2760	4	696	3456	1587	66654	40992	1:11.9
3	*Beauveria bassiana* followed by its second spray after 15 days	1920	4	696	2616	1167	49014	23352	1:08.9
4	Azadirachtin followed by *Verticillium leccani*@2g/L after 15 days	2760	4	696	3456	1643	69006	43344	1:12.5
5	*Verticillium leccani* followed by its second spray after 15 days	1920	4	696	2616	1270	53340	27678	1:10.6
6	Dimethoate 30EC@ 1ml/L followed by its second spray after 15 days	660	4	696	1356	1825	76650	50988	1:37.6
7	Control					611	25662		

*Total expenditure includes cost of labour and cost of insecticide

**Income based on produce/ha. and sale price of mustard @Rs. 4200/q

Conclusion

From the findings of present study, it could be concluded that management of mustard aphid through different bio-rational approaches though is better for environment but chemical control with Dimethoate 30EC@ 1ml/L followed by its second spray after 15 days was the most effective treatment which provided higher seed yield but Azadirachtin followed by *Verticillium leccani*@2g/L after 15 days also showed promising results. Also Dimethoate 30EC@ 1ml/L followed by its second spray after 15 days provided higher IBCR return over the remaining treatments. From the above study it could be concluded that bio-rational approaches for the management of mustard aphid can be employed in the Integrated Pest Management of Mustard aphid. which are beneficial both environmentally as well ass economically.

References

1. Akhtar MS, Choudhury RA, Shujauddin. Natural enemies of mustard aphid, *Lipaphis erysimi* (Kaltenbach) in Aligarh (India). Environment and Ecology. 2006; 24(S-3A):781-784.
2. Bakhetia DRC, Sekhon BS. Insect pests and their management in rapeseed mustard. Journal of Oilseed Research. 1989; 6:269-299.
3. Das GP, Islam MA. Seasonal activity of a late mustard aphid (*Lipaphis erysimi* Kalt). Bangladesh Journal of Agriculture 1986; 11:56-61.
4. Dogra Indira, Devi N, Desh raj. Parasitization of mustard aphid, *Lipaphis erysimi* Kalt. by *Diaeretiella rapae* M'‘Intosh in mid hill zone of Himachal Pradesh (India). *Journal of entomological Res*earch, 2003; 27(2):145-149.
5. Dress BM. Aphid management, 1997. (Retrieved on July 30, 2009 from website: http://entowww.tamu.edu/Edu/Extension/Bulletions/uc/uc-031.html).
6. Minks AK, Harrewijn P. Aphids: Their biology, natural enemies and control. Elsevier Publishers, Amsterdam, The Netherlands. 1998, 312.
7. Mishra MK, Singh RP, Ali S. Chemical control and avoidable yield losses of pigeonpea due to insect-pests. Annals of Plant Protection Sciences. 2012; 20:306-309.
8. Yadav, Sunita, Singh SP. Bio-intensive integrated

management strategy for mustard aphid *Lipaphis erysimi* Kalt. (Homoptera: Aphididae). Journal of Applied and Natural Science. 2015; 7(1):192-196.
9. Raj D, Lakhanpal GC. Prevalence and impact of entomogenous fungus, *Entomophthora aphidis* Hoffmann on three important aphid species infesting rapeseed in the Palam Valley of Himachal Pradesh (India). Journal of Entomological Research. 1998; 9:73-76.
10. Parimal Mandal. Botanical based management of mustard aphid (*Lipaphis erysimi* Kalt.) population causing major damage of mustard (*Brassica juncea* L.) plants at West Bengal, India Review of research. 2019; 8(4):41-48
11. Rai B. Three enemies of rape and mustard. Allahabad Farmer, 1961; 35:318-321.
12. Rohilla HR, Singh H, Kalra VGK, Kharub SS. Losses caused by mustard aphid. *Lipaphis erysimi* in different *Brassica genotypes.* Proc. of the VII International Rapeseed Congress, Poland. 1987; (5):1007-1083.
13. Sahoo SK. Incidence and management of mustard aphid (*Lipaphis ery-simi* Kaltenbach) in West Bengal. The Journal of Plant Protection Sciences. 2012; 4(1):20-26.
14. Shukla AN, Singh R, Tripathi CPM. Effect of predation period on the functional response of *Coccinella septempunctata* Linn. (Coleoptera: Coccinellidae) a predator of *Lipaphis erysimi* (Kalt.) (Hemiptera: Aphididae). Journal of Advanced Zoology, 1990. 11(1):27-32
15. Singh SV, Malik YP. Population dynamics and economic threshold of *Lipaphis erysimi* on mustard. Indian Journal of Entomology, 1989, 43-49.
16. Singh SP, Singh YP. Bio-efficacy of pesticides against mustard aphid. Annals of Plant Protection Sciences. 2009; 17:240-242.
17. Sundar Pal, Singh DK, Ram Singh Umrao. Population Dynamics of Insect Pests in Mustard and Eco-friendly Management of *Lipaphis erysimi* (Kaltenbach) in Uttarakhand. International Journal of Current Microbiology and Applied Sciences. 2018; 7(07):324-331.
18. Yadav, Sunita, Singh SP. Bio-intensive integrated management strategy for mustard aphid *Lipaphis erysimi* Kalt. (Homoptera: Aphididae). Journal of Applied and Natural Science. 2015; 7**(**1):192–196.