The Journal of Plant Protection Sciences, **4**(2) : 37-42, December, 2012

Evaluation of new and conventional insecticides for the management of mustard aphid, *Lipaphis erysimi* Kalt. (Homoptera: Aphididae) on rapeseed (*Brassica juncea* L.)

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A B S T R A C T

Field experiment was conducted during *rabi* season at Raipur, Bankura, West Bengal to study the effect of few insecticides against mustard aphid, *Lipaphis erysimi* K. on rapeseed (*Brassica juncea* L.). Experiment was laid out in Randomized Block Design with eight treatments. Insecticides used in the experiments were imidacloprid 17.8% SL at 27g a.i/ha, lambda-cyhalothrin 5% EC at 25g a.i/ha, chlorpyriphos 20% EC at 375g a.i/ha, dichlorvos 75% EC at 375g a.i/ha, thiamethoxam 25% WG at 27g a.i/ha, dimethoate 30% EC at 375g a.i/ha and chlorpyriphos 50% + cypermethrin 5% EC (Canon) at 375g a.i/ha. Chlorpyriphos (93.50%) found to be most effective treatment followed by chlorpyriphos + cypermethrin (92.76%), thiamethoxam (90.70%) and imidacloprid (90.46%) and dichlorvos (82.81%) showed least effective. Highest yield was recorded from chlorpyriphos + cypermethrin (18.45 q/ha) treated plot followed by thiamethoxam (17.86 q/ha), chlorpyriphos (17.50 q/ha) and imidacloprid (16.75 q/ha) and lowest in dichlorvos treated plot (1: 10.27). Incremental cost benefit ratio indicated that highest return was obtained from imidacloprid (1:16.12) followed by lambda-cyhalothrin (1: 15.68) treated plot.

Keyword: Rapeseed, mustard aphid, lambda-cyhalothrin, canon, imidacloprid

Introduction

Rapeseed-mustard occupies a prime position as a source of edible oil for human. This oilseed crop is grown over an area of 6.51 million hectare with a production of 7.67 million tones with productivity of 1179 kg/ha in 2010 -11 in India (Anon 2011). The production of rapeseed-mustard is low in India as compared to other countries mainly due to damage caused by insect pest and diseases including other factors (Bakhetia & Sekhon 1989). More than 43 species of insect pests infest rapeseed-mustard crop in India, out of which about a dozen of species are considered as major pest (Purwar *et al*. 2004). Mustard aphid, *Lipaphis erysimi* K. (Homoptera: Aphididae) is one of the most serious pests and considered to be a major limiting factor for successful cultivation of the crop; causing up to 96 percent yield losses (Bakhetia & Arora 1986; Rohilla *et al.* 1987; Bakhetia & Sekhon 1989; Singh & Sachan 1994; Singh & Premchand 1995; Sharma & Kashyap 1998; Singh & Sharma 2002). Mustard aphid may cause 66 to 99% loss in *Brassica campestris* L. and 27-28 percent in *Brassica juncea* L. (Bakhetia 1979) and oil content of 15% (Verma & Singh 1987). Considering yield losses due to this pest, chemical control measures are suggested and in many cases seed yield loss have been minimized. The present investigation was carried out with the objective to study on the efficacy of some insecticides against mustard aphid, *Lipaphis erysimi* K. under field conditions.

Materials and Methods

The experiment was conducted at farmer's field at Raipur, Bankura, West Bengal (India), during *rabi* season of 2010-11. The soil of the experimental site was clay loam in texture and acidic in nature with subtropical climate. The weather conditions during the period of investigation was characterized by the temperature ranging from 9.04-15.38^{0}C and relative humidity 38.20- 97.13% and total rainfall 19.50mm during crop growth period. Attempts were made to evaluate the effect of seven insecticides *viz*. imidacloprid 17.8% SL at 27g a.i/ha, lambda-cyhalothrin 5% EC at 25g a.i/ha, chlorpyriphos 20% EC at 375g a.i/ha, dichlorvos 75% EC at 375g a.i/ha thiamethoxam 25%WG at 27g a.i/ha, dimethoate 30% EC at 375g a.i/ha and chlorpyriphos 50% + cypermethrin 5% EC) at 375g a.i/ha with untreated plot against mustard aphid of rapeseed (*Brassica juncea* L. cultivar-Bhagirathi). The experiment was laid out in Randomized Block Design with three replications. Individual size of the plot was 4m x 3m and the crop was sown by broadcasting method. All the sprayings were done by using Knapsack sprayer at an interval of 15 days. The population of aphid was recorded based on three randomly selected plants and the population was counted from 10cm upper main shoot of each plant, that were done at one day and before, 1, 7 and 14 days after each spray on rapeseed crop. The seed yield was recorded from net plot area and converted into q/ha. Incremental Cost Benefit Ratio (ICBR) for each treatment was calculated. Agronomic practices for growing of the crop were followed as per recommendations of the region.

Results and Discussion

The pre-treatment population of aphid varied from 45.56-33.89 per 10cm upper portion of mid shoots of rapeseed. All the treatments significantly controlled aphid in rapeseed after each spray. The highest percentage of reduction was recorded in fourteen days after first spray in chlorpyriphos (89.18%) treated plot followed by imidacloprid (88.62%). After second spray, 100% mortality was recorded in imidacloprid, chlorpyriphos, thiamethoxam and chlorpyriphos+cypermethrin treated plots. The efficacy of dimethoate (84.09%) was comparatively lower. After 7 days of first spray, the population of aphid was commenced to increase gradually in all plots. Regarding the overall mean percent reduction after final spray, chlorpyriphos (93.50%) provided to be most effective followed by chlorpyriphos+cypermethrin (92.76%). Dichlorvos (82.81%) showed the least effective against aphid on rapeseed in this regard (Table 1).

All the treatments showed significant increase in yield of rapeseed. The highest seed yield was recorded in chlorpyriphos + cypermethrin (18.45q/ha) treated plot followed by thiamethoxam (17.86q/ha) whereas, the lowest yield was noted in dichlorvos treated plot. Maximum net profit/ha was noted in thiamethoxam (Rs.30940/-) treated plot followed by chlorpyriphos+cypermethrin (Rs. 30815/-), chlorpyriphos (Rs. 30090/-), imidacloprid (28695/-), lambda-cyhalothrin (28060/-), dimethoate

(19410/-) and lower net profit was recorded in dichlorvos (Rs.19410/-) treated plot. All the treatments included in this experiment showed effectiveness for controlling mustard aphid as spraying of insecticides resulted in enhancement of seed yield. This was evident from the ICBR calculated for the treatments (Table 2). The highest ICBR was noted in imidacloprid (1:16.12) followed by lambda-cyhalothrin (1:15.68), thiamethoxam (1:13.39), chlorpyriphos (1:13.31), dimethoate (1:10.33), dichlorvos (1:10.27) and chlorpyriphos + cypermethrin (1:7.88) treated plot.

Among these insecticides, chlorpyriphos was most effective followed by chlorpyriphos+ cypermethrin, thiamethoxam and imidacloprid for aphid management and highest yield was recorded from chlorpyriphos+cypermethrin (canon) followed by thiamethoxam, chlorpyriphos and imidacloprid treated plot. But incremental cost benefit ratio indicated that most favorable return was obtained from imidacloprid followed by lambda-cyhalothrin, thiamethoxam and chlorpyriphos treated plot.

Efficacy and incremental cost benefit ratio of imidacloprid, thiamethoxam and dimethoate against mustard aphid was similar with the observation of Sahoo (2012). Imidacloprid and thiamethoxam was most effective against mustard aphid in field, reported by Rohilla *et al.* (2004). Prasad (1978); Phadke & Prasad (1989); Kumar *et al.* (1996); Sinha *et al.* (2001) found that chlorpyriphos was effectively controlled mustard aphid causing increase in yield and giving the maximum net profit. Rouf & Kabir (1997) observed dichlorovos as moderately toxic against mustard aphid in field conditions. Tripathi *et al.* (1988); Dubey *et al.* (2001) reported that dimethoate was moderately toxic to aphid in laboratory condition. Hazarika & Saharia (1981); Baral *et al.* (1986); Sikha-Deka & Borah (1999); Sinha *et al.* (2001) also reported dimethoate was moderately toxic to mustard aphid in field condition and increasing the yield of mustard Sonkar & Desai (1998). Khurana & Batra (1989) postulated that cypermethrin was most effective against mustard aphid infesting on mustard under late sown condition. Imidacloprid was most effective in reducing the aphid population over control and achieved maximum marketable fruits of brinjal as well as highest net profit (Konar *et al*. 2011).

From the above discussion it may be concluded that among the tested insecticides, imidacloprid, lambda-cyhalothrin and thiamethoxam may be recommended for most economic and effective management of mustard aphid, *Lipaphis erysimi* K. on rapeseed crop.

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Table 1.

Effect of few insecticides against mustard aphid (*Lipaphis erysimi* Kalt.) on rapeseed

Treatment	Dose (g a.i / ha)	Pre - treatment	Percentage reduction/increase (+) after first spray over pre-treatment count			Percentage reduction/ increase (+) after second spray over pre-treatment count			Over all mean
			1 DAS*	7DAS*	14 DAS*	1 DAS*	7DAS*	14 DAS*	
Imidacloprid 17.8% SL	27	44.89	100.00 (90.00)	91.61 (73.16)	88.62 (70.29)	100.00 (90.00)	90.73 (72.28)	71.77 (57.91)	90.46
Lambda- cyhalothrin 5% EC	25	33.89	95.59 (77.88)	87.87 (69.61)	66.84 (54.84)	100.00 (90.00)	82.57 (65.32)	84.64 (66.93)	86.25
Chlorpyriphos 20% EC	375	45.56	99.50 (85.96)	92.08 (73.65)	89.18 (70.80)	100.00 (90.00)	100.00 (90.00)	80.24 (63.61)	93.50
Dichlorvos 75% EC	375	34.78	87.78 (69.50)	89.41 (71.01)	78.63 (62.47)	82.64 (65.38)	80.70 (63.94)	77.70 (61.82)	82.81
Thiamethoxam 25% WG	27	41.89	100.00 (90.00)	92.26 (73.84)	79.80 (63.29)	100.00 (90.00)	91.99 (73.56)	80.17 (63.56)	90.70
Dimethoate 30% EC	350	42.00	91.79 (73.35)	90.31 (71.86)	86.16 (68.16)	96.32 (78.94)	91.29 (72.83)	83.03 (65.68)	89.82
Chlorpyriphos 50% + Cypermethrin5% EC	375	34.33	99.66 (86.66)	93.41 (75.12)	77.38 (61.60)	100.00 (90.00)	93.49 (75.21)	92.60 (74.21)	92.76
Untreated		45.33	+8.39	+118.82	+246.40	+16.14	-51.24	-69.40	-
S.Em(±)			2.26	1.26	3.18	2.02	0.97	2.10	
CD at (P=0.05)			7.57	4.20	10.64	6.75	3.23	7.01	

DAS-Days After Spraying, *Significant at P(=0.05)

Table 2.
Cost benefit ratio of few insecticides against mustard aphid (*Lipaphis erysimi* Kalt.) on rapeseed

Treatments	Dose (g a.i / ha)	Formulation g/ha	Seed Yield (q/ha)	Increased yield over control (q/ ha)	*Value of increased seed yield / ha (Rs)	Cost of treatments /ha			Net re-turn /ha	ICBR
						Cost of insecti-cide for two sprays/ha	**Labour charge/ ha	Incre-mental cost		
Imidacloprid 17.8% SL	27	150	16.75	12.19	30475.00	570.00	1210.00	1780.00	28695.00	1: 16.12
Lambda- cyhalothrin 5% EC	25	500	16.50	11.94	29850.00	580.00	1210.00	1790.00	28060.00	1: 15.68
Chlorpyriphos 20% EC	375	1875	17.50	12.94	32350.00	1050.00	1210.00	2260.00	30090.00	1: 13.31
Dichlorvos 75% EC	375	500	13.08	8.52	21300.00	680.00	1210.00	1890.00	19410.00	1: 10.27
Thiamethoxam 25% WG	27	110	17.86	13.30	33250.00	1100.00	1210.00	2310.00	30940.00	1: 13.39
Dimethoate 30% EC	350	750	13.10	8.54	21350.00	675.00	1210.00	1885.00	19465.00	1: 10.33
Chlorpyriphos 50% + Cypermethrin 5% EC	375	1500	18.45	13.89	34725.00	2700.00	1210.00	3910.00	30815.00	1: 7.88
Untreated		-	4.56	-	-	-	-	-	-	-

Imidacloprid 17.8% SL- Rs. 1900/L, Thiamethoxam 25%WG- Rs. 25/5g, Lambda-cyhalothrin 5% EC- Rs. 580/ L, Chlorpyriphos 20% EC- Rs. 280/L, Dichlorvos 75% EC- Rs. 680/L, Dimethoate 30% EC- Rs. 450/ Lit, Chlorpyriphos 50%+ Cypermethrin 5% EC- Rs 900/ L, * Price of mustard Rs. 2700/q, ** Labour charges- Rs. 121/ man-day.