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BIO-EFFICACY OF SOME NEW INSECTICIDES AGAINST MUSTARD APHID, *LIPAPHIS ERYSIMI* KALT. (HEMIPTERA: APHIDIDAE) ON INDIAN MUSTARD

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ABSTRACT
Field experiment was conducted at CCS Haryana Agricultural University, Hisar, Haryana during *Rabi* seasons of the year 2012-13 and 2013-14 to evaluate the bio-efficacy and economics of some new insecticides against mustard aphid, *Lipaphis erysimi* Kalt. on Indian mustard. The aphid incidence at 10 days after treatment indicated that imidacloprid 17.8 SL @ 20 g a.i. per ha (0.70 aphids /10 cm main apical shoot & 97.88 per cent reduction over control) was most effective among all the tested treatments followed by thiamethoxam 25 WG @ 25 g a.i. per ha (0.90 aphids /10 cm main apical shoot & 97.27 per cent reduction over control) and dimethoate 30 EC @ 300 g a.i. per ha (1.10 aphids /10 cm main apical shoot & 96.67 per cent reduction over control). Thus Imidacloprid spray resulted into 97.88% reduction in aphid population over control followed by thiamethoxam, dimethoate and fipronil with 97.27, 96.67 and 95.45 per cent reduction in aphid population over control respectively. The maximum seed yield of 1630 kg/ha was recorded in imidacloprid, which remained on par with thiamethoxam (1620 kg/ha) and dimethoate (1615 kg/ha). The lowest seed yield was obtained from untreated plots (1370kg/ha).

INTRODUCTION

Oilseeds have been the backbone of agricultural economy of India since long. Indian vegetable oil economy is the fourth largest in the world next to U.S.A., China and Brazil. Oilseed brassicas because of resilience to grow under diverse agro-climatic conditions have gained good momentum in India. These crops are second most important after groundnut in our country contributing about 22.6% of the total oil production (Anonymous, 2013). India accounts for 14.8 % of rapeseed production at global level and occupies prime position in the World (Singh, 2014). Indian mustard [*Brassica juncea* (L.) Czern and Coss.] is the premier oilseed brassica which covers about 85-90% of the total area under cultivation of all these crops.During past few years it has gained substantial importance due to the fact that it possesses inherent high yielding ability and relative tolerance to biotic and abiotic stresses with wider adaptation. At national level it is grown over an area of 6.45 million ha with production and productivity of 7.28 million tons and 1128 kg/ha, respectively (Anonymous, 2015). Haryana is the second most important state in the country with production of 0.88 million tons over an area of 0.54 million ha with average yield of 1639 kg/ha during 2013-2014 (Anonymous, 2015).

More than 43 species of insect pests have been reported to infest rapeseed-mustard crop in India, of which sawfly (*Athalia lugens proxima*), aphid (*Lipaphis erysimi*), painted bug (*Bagrada hilaris*) and leaf miner (*Phytomyza horticola*) are the important ones (Singh, 2009). Among these, mustard aphid, *L. erysimi* (Hemiptera: Aphididae) is the major limiting factor causing up to 96 per cent yield losses and 5-6 per cent reduction in oil content (Shylesha *et al*., 2006). Both nymph and adult stages of this pest cause economic damage by sucking the cell sap from leaves, petioles, tender stems, inflorescence and pods. Due to continuous desaping by large aphid population yellowing, curling and subsequent drying of leaves take place, which ultimately leads to formation of weak pods and undersized seeds in the pods. The aphids also secrete honeydew which provides suitable medium for the development of sooty mould which ultimately hampers the process of photosynthesis.

A number of chemical insecticides have been found effective against this pest in different parts of the country (Singh and Verma, 2008; Singh and Singh, 2009). But the indiscriminate use of the insecticides has resulted into several problems like environmental pollution, health hazards to human beings, toxicity to pollinators & natural enemies etc. (Singh, 2001) but chemical insecticides still remain the key tool for the control of this pest among farmers. New molecules are now emerging as aviable component of IPM strategies on all crops inview 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

The present investigation was carried out at Research Area of Oilseeds Section, Department of Genetics and Plant Breeding, CCS Haryana Agricultural University, Hisar during *Rabi* seasons of the year 2012-13 and 2013-14. Hisar is situated in the semi-arid, subtropics at 29º10′ N latitude and 75º46′ E longitude and at an altitude of 215.2 meters above sea level. For studying the effect of new insecticides on mustard aphid, a field experiment was laid out in randomized block design with three replications. The crop was sown on 5th November, 2012 and 15th November, 2013 during the first and second year of the experiment, respectively. Indian mustard variety 'RH 30' was raised at spacing of 30 cm x 10 cm in plots of size 4.2 x 3m. Recommended agronomic practices except plant protection were followed for raising the crop (Anonymous, 2014). Eight treatments including control were T1: fipronil 5 SC @ 50 g a.i. per ha, T2: thiamethoxam25 WG @ 25 g a.i. per ha, T3: imidacloprid 17.8 SL @ 20 g a.i. per ha, T4: acetamiprid 20 SP @ 10 g a.i. ha, T5: acephate 75 SP @ 350 g a.i. per ha, T6: dimethoate 30 EC @ 300 g a.i. per, T7: clothianidine 50 WDP @ 300 g a.i. per ha and T8: control with no spray. The population of aphids was recorded on the ten randomly selected plants from each plot one day prior to insecticide application and at 3, 7 and 10 days after spray of insecticides. The aphids were counted from top 10 cm apical twigs of these selected plants with the help of a magnifying glass. The numbers of aphids/plant were converted into per cent reduction of aphid population over the control. Yield was recorded from net plot area and converted in to kilogram per ha and data were statistically analyzed as per statistical guidelines given by Gomez and Gomez (1984).

RESULTS AND DISCUSSION

It is mentionable here that aphids were not observed on the mustard crop up to 3rd week of January and were observed initially during 4th week of January at flowering stage. Initial population of aphids was very low but increased gradually and reached to its peak (82.5 aphids/plant) during last week of February and then started declining gradually (Table 1).

Before spray, pooled mean aphid population ranged from 18.2 to 18.7 aphids/10 cm main apical shoot in different treatments. This variation in aphid population was non-significant indicating homogenous distribution of aphid population in the experimental field (Table 2).After spray, aphid population was significantly decreased in all the treated plots, while significantly increased in untreated plots. Data recorded on 3rd day after insecticide application revealed that in all treated plots aphid population decreased and ranged from 2.0 to 5.25/10 cm main apical shoot as compared to control with the highest population density of 24.50 aphids/10 cm twig. Minimum aphid population was recorded in imidacloprid 17.8 SL @ 20 g a.i. per ha (2 aphids/10 cm twig) followed by thiamethoxam25 WG @ 25 g a.i. per ha (2.1 aphids/10 cm twig), dimethoate 30 EC @ 300 g a.i. per ha (2.2 aphids/10 cm twig), clothianidine 50 WDP @ 300 g a.i. per ha (2.4 aphids/10 cm twig), fipronil 5 SC @ 50 g a.i. per ha (2.9 aphids/10 cm twig), acetamiprid 20 SP @ 10 g a.i. per ha (3.55 aphids/10 cm twig) and acephate 75 SP@350 g a.i. per ha (5.25 aphids/10 cm twig). All these treatments were at par with each other. Maximum aphid population reduction was obtained in imidacloprid 17.8 SL @ 20 g (91.84 per cent) followed by thiamethoxam25 WG @ 25 g (91.43 per cent) and dimethoate 30 EC @ 300 g (91.02 per cent).

Similar results were obtained 7 DAT and 10 DAT. Pooled mean aphid population 7 DAT ranged from 27.00 to 1.15/10 cm main apical shoot. Maximum population (27.0 aphids/10 cm twig) was recorded from control. Imidacloprid 17.8 SL @ 20 g a.i. per ha was found to be the best treatment with pooled mean aphid population of 1.15 aphids /10 cm main apical shoot with 95.74 % population reduction over the control. Thiamethoxam 25 WG @ 25 g a.i. per ha was next best treatment (1.40 aphids /10 cm main apical shoot & 94.81 per cent reduction over control) followed by dimethoate 30 EC @ 300 g a.i. per ha (1.80 aphids /10 cm main apical shoot& 93.33 per cent reduction over control)(Table 2).All these treatments were at par with each other.

The aphid incidence at 10 DAT indicated that imidacloprid 17.8 SL @ 20 ga.i. per ha (0.70 aphids /10 cm main apical shoot & 97.88 per cent reduction over control) continues to be most effective among all the tested treatments.The next best treatment was thiamethoxam 25 WG @ 25 g a.i. per ha(0.90 aphids /10 cm main apical shoot & 97.27 per cent reduction over control) followed by dimethoate 30 EC @ 300 g a.i. per ha (1.10 aphids /10 cm main apical shoot & 96.67 per cent reduction over control).

Imidacloprid and thiamethoxam were found most effective against mustard aphid in field by Rohilla *et al*. (2004). Prasad and Dey (2006) and Rathod *et al*. (2003) found imidacloprid was significantly superior even after 14 days of treatment. Kumar *et al*. (2007) also found order of efficacy of different insecticides as imidacloprid0.0178% >oxydemetonmethyl 0.025% >monocrotophos0.036% >dimethoate0.03% >chloropyriphos 0.05% >malathion 0.05% >endosulfan 0.07 % >cypermethrin0.01% >neemarin, respectively on seventh day after spray. But Mandal and Mandal (2010) reported that thiamethoxam 25 WG @ 25 g a.i. ha^{-1} and acetarniprid 25 SP @ 40 g a.i. ha^{-1} were more effective in managing the aphids incidence and realizing higher yield of mustard (10.70 q/ha) as compared to imidacloprid200 SL @ 50 g a.i.ha^{-1} and dimethoate30 EC @ 400 g a.i. ha^{-1}. Sohail *et al*. (2011) recommended the use of Actara for the effective control of *L. erysimi* due to less toxic effects on ladybird beetle

Table 1: Population of mustard aphidon *Brassica juncea* variety RH 30 at Hisar

Std. Week	No. of aphid / 10 cm top twig		
	2012-13	2013-14	Mean
3	0.0	0.0	0.0
4	0.6	0.5	0.6
5	1.4	1.8	1.6
6	14.4	16.4	15.4
7	18.6	19.6	19.1
8	80.0	85.0	82.5
9	73.0	75.0	74.0
10	20.0	22.0	21.0
11	6.0	8.0	7.0
12	1.5	1.0	1.3
13	0.0	0.0	0.0

Table 2: Pooled mean bio-efficacy of newer insecticides againstmustard aphid during 2012-13 and 2013-14

Treatment	(a.i. per ha)	Aphids/ plantBS	Aphids/ plant3 DAS	Per cent reduction over control	Aphids / plant7 DAS	Per cent reduction over control	Aphids / plant 10 DAS	Per cent reduction over control	Yield (kg/ha)	Increase in yield (%) over control
T1	Fipronil 5 SC @ 50 g	18.50	2.90	88.16	2.05	92.41	1.50	95.45	1590	16.06
T2	Thiamethoxam 25 WG @ 25g	18.40	2.10	91.43	1.40	94.81	0.90	97.27	1620	18.25
T3	Imidacloprid 17.8 SL @ 20g	18.20	2.00	91.84	1.15	95.74	0.70	97.88	1630	18.98
T4	Acetamiprid 20 SP @ 10g	18.70	3.55	85.51	3.00	88.89	2.30	93.03	1570	14.60
T5	Acephate 75 SP @ 350g	18.30	5.25	78.57	4.10	84.81	3.10	90.61	1550	13.14
T6	Dimethoate 30 EC @ 300g	18.60	2.20	91.02	1.80	93.33	1.10	96.67	1615	17.88
T7	Clothianidine 50 WDP@300g	18.60	2.40	90.20	2.05	92.41	1.35	95.91	1600	16.79
T8	Control (No spray)	18.50	24.50		27.00		33.00		1370	
CD (p = 0.05)			3.65		2.59		2.39		22.5	

NS = Non significant; BS = Before spray; DAS = Days after spray

though the lowest population of *L. erysimi* was recorded in Fastkil (methomyl) and Confidor (imidacloprid). Kantipudi *et al*. (2013) reported maximum control of mustard aphid with the application of thiamethoxam 25% WDG @100 g/ha followed by imidacloprid 17.8% SL @ 150 ml/ha. Similarly thiamethoxam 25WG @ 0.006% was reported most effective against okra aphid (Patil *et al*., 2014). Contrary to the above results Sahoo (2012) found that among the different chemical insecticides evaluated for their bio-efficacy against *L. erysimi*, dimethoate 30EC and Oxydemeton methyl 25EC were proved to be most effective.

Among the treatments, the maximum seed yield of 1630 kg/ha was recorded in imidacloprid 17.8 SL @ 20 ga.i. per ha, which remained on par with thiamethoxam 25 WG @ 25 g a.i. per ha (1620 kg/ha) and dimethoate 30 EC @ 300 g a.i. per ha (1615 kg/ha). The seed yield from untreated plots was 1370kg/ha (Table 2). Gour and Pareek (2003) reported maximum seed yield in plots treated with imidacloprid 0.05% (14.9 q/ha) followed by dimethoate 0.03% (11.9 q/ha) and acephate 0.05% (11.1 q/ha). Mandal *et al*.(2012) while studying the effect of few insecticides against *L. erysimi*. on *Brassica juncea*, recorded highest yield 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). Singh *et al*. (2014) evaluated seven insecticides in the field against mustard aphid. The plot treated with Imidacloprid resulted into the maximum mortality of mustard aphid with highest yield (1963.5 kg ha-1).

From the above discussion it may be concluded that among the tested insecticides, Imidacloprid 17.8 SL @ 20 g may be recommended for most economic and effective management of mustard aphid, *Lipaphis erysimi* on Indian mustard.

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