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EFFICACY OF NEEM BASED INSECTICIDES FOR THE MANAGEMENT OF LINSEED BUD FLY (*Dasyneura lini* Barnes)

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ABSTRACT
The field experiment was conducted during *Rabi* seasons of 2007-08, 2008-09, 2009-10, 2010-11 and 2011-12 to evaluate the efficacy of neem based insecticides for the management of linseed bud fly (*Dasyneura lini* Barnes) at the Linseed Research Farm, College of Agriculture, Nagpur, Maharashtra (India). The experimental results revealed that all the neem based insecticides showed significant differences in reducing bud fly infestation over control. Lowest bud fly infestation (20.84 %) and highest mean seed yield (1097 kg/ha) of linseed was recorded with two fortnightly sprays of Azadirachtin 500 ppm starting from bud initiation followed by Neem seed kernel extract 5 % treated plots with 25.31 % bud fly infestation and seed yield of 983 kg/ha. Whereas, the highest bud fly infestation (41.62 %) and lowest yield was recorded in untreated control (595 kg/ha). Therefore, two fortnightly sprays of Azadirachtin 500 ppm starting from bud initiation is recommended for effective management of linseed bud fly.

INTRODUCTION

Linseed (*Linum usitatissimum* L.) is an important oilseed crop having vast industrial as well as medicinal values. The crop is being grown under input starve conditions by the resource poor farmers in Indo-Gangetic plane, central and peninsular region of the country. Of late, its value addition has paved the way for its diversified uses in neutraceutical and medicinal purposes. The linseed crop is damaged by 28 pest species throughout its growth stage. Of these, bud fly, *Dasyneura lini* Barnes is the most destructive and specific pest of linseed. Yield losses in linseed due to bud fly have been estimated to the tune of 90 per cent (Malik *et al.*, 2000; Malik and Srivastava, 2012). Sole reliance on chemical insecticides for reducing the bud fly infestation results in insecticide resistance, pesticide residues, resurgence of secondary pests and environmental pollution. As a result of these critical effects of conventional pesticides, growers have to adopt more environmentally friendly integrated pest management or organic farming approaches (Leake, 2000; Cuthbertson and Murchie, 2003). Formulation of new bioinsecticides, particularly those based on neem oil extract, is an exciting option for integrated pest management programs, since such plant-derived insecticides have various benefits, including selectivity, greater safety for non-target organisms, and compatibility with biological control organisms (Tang *et al.*, 2002). The primary active ingredient of most neem-based pesticides is azadirachtin, a liminoid compound, which has multiple biological activities on more than 400 insect species from several orders (Schmutterer and Singh, 1995). Besides azadirachtin, there are other active components in some formulations. Azadirachtin-based compounds obviously have insecticidal, feeding deterrent, repellent, antioviposition, and physiological properties. They have an effect on some important physiological processes in insect such as are survival, longevity, molting and reproduction (Ulrichs *et al.*, 2001; Tang *et al.*, 2002). All the parts of neem like seed, seed coat, kernel and leaf can be used to produce high quality product. Product derived from neem tree also act as powerful Insect Growth Regulator (IGR) (Subbalakshmi *et al.*, 2012). Keeping this in view, present study evaluates the efficacy of neem based insecticides for the management of linseed bud fly.

MATERIALS AND METHODS

Field experiment to evaluate the efficacy of neem based insecticides, prepared from different parts of neem (*Azadiracta indica*) against bud fly (*Dasyneura lini* Barnes) on linseed cv Neelum was executed during 2007-08, 2008-09, 2009-10, 2010-11 and 2011-12 at the Linseed Research Farm, College of Agriculture, Nagpur, Maharashtra (India). The crop was sown during third week November in each year at 30 cm row to row distance with maintaining 5-7 cm plant spacing by thinning of plants. Ten treatments of home made as well as commercial formulations of neem were replicated thrice in 4 x 2.5 m plot size following Randomized Block Design. The aqueous solution of neem leaf (NLE), seed kernel (NSKE), whole seed (NSE) and seed coat (NSCE) were prepared by grinding the 100 g material in a grinder and subsequently soaked in water measuring weight by volume for 24 hours. The suspension was sieved through a fine muslin cloth and the solution was used for spray in required concentrations.

Commercially available neem based formulation *i.e.* Azadirachtin 500 ppm along with four aforesaid home prepared neem based insecticides were sprayed twice on the crop starting from bud initiation and second at 15 days interval. Bud fly infestation was recorded as per the standard method of AICRP on linseed (Anonymous, 2006) at dough stage of the crop and seed yield after harvesting. The data on bud fly infestation as well as seed yield were computed for their critical difference. Average bud fly infestation and seed yield were calculated on simple mean basis. The data thus obtained was subjected to statistical analysis for critical differences.

RESULTS AND DISCUSSION

Results pertaining to the bud fly infestation, seed yield to study the efficacy of the neem based insecticides are presented in Table 1.

Effect on bud fly infestation

On the basis of the pooled results of the five years data revealed that bud fly infestation ranged from 20.84 to 41.62 per cent in different neem based insecticides as against 33.79 per cent bud damage in untreated control. Minimum bud fly infestation being 20.84% was recorded in Azadirachtin 500 ppm sprayed linseed, which statistically superior from 25.31 and 25.87% bud infestation noticed on Neem seed kernel extract 5% and Neem seed extract 5% applied crop, respectively. For the remaining treatments, the order of efficacy was Neem seed coat extract 5% > Neem seed kernel extract 2% > Neem seed extract 2% > Neem seed coat extract 2% > Neem leaf extract 5% > Neem leaf extract 2% with 25.87, 27.86, 30.22, 30.45, 31.67, 34.00 and 36.46 % bud infestation. These results corroborate with the findings of Gurve *et al.*, (2015) who reported that azadirachtin 1500 ppm recorded highest per cent reduction, 52.83, 51.52 after 7 and 14 days of first spray and 55.40, 53.70 after 7 and 14 days of second spray of bud/capsule damage. The present results get support from the observations of Deole *et al.* (2015) who reported the effectiveness of NSKE 5%, among different neem based formulations with percent damage of 10.80 followed by Neem Seed Coat Extract (NSCE) 5% whereas, commercial Neem product (Nimbolin) gave only 13.30% bud infestation in linseed. The effectiveness of Neem Seed Kernel Extract (NSKE) @ 5% against linseed Bud fly followed by Neem Seed Extract (NSE) @ 5% (Gupta and Rao, 2013). Prasad *et al.* (2008) revealed that nimbicidine 0.5 per cent (azadirachtin 1500 ppm) was statistically superior treatment among botanicals but not effective than other chemical insecticides *i.e.* oxydemeton methyl and cypermethrin respectively against linseed bud fly. The present results however, gets partial support on the effectiveness of Azadirachtin against other pests and crops from the observations of Vanlaldiki *et al.* (2013) who reported the maximum protection of cabbage against diamondback moth, *Plutella xylostella* sprayed with neemark (Azadirachtin 0.03%) and nimbecidine @ 1.5 L/ha. Sarkar *et al.*, (2015) reported lowest population of red cotton bugs with azadirachtin 1% with 2.87 red cotton bugs/5 plants and 47.90% reduction over control after imidacloprid treated plots on okra in West Bengal.

Effect on linseed seed yield

All the treatments showed significant increase in seed yield over untreated control. Seed yield of linseed ranged from 719 to 1097 kg/ha in different neem based insecticides as against 595 kg/ha in untreated control. Highest mean seed yield (1097 kg/ha) of linseed was recorded in Azadirachtin 500 ppm followed by Neem seed kernel extract 5% (983 kg/ha)

For the remaining treatments, the order of efficacy in terms of seed yield was Neem seed coat extract 5% > Neem seed extract 5% > Neem seed coat extract 2% > Neem seed extract

Table 1: Effect of neem based insecticides on bud fly infestation and seed yield in linseed

(Pooled data of *Rabi* 2007-08, 2008-09, 2009-10, 2010-11 and 2011-12)

Sr. No.	Treatments	Per cent / Dosage per lit.	Bud fly infestation (%)						Yield (kg/ha)					
			2007 -08	2008 -09	2009 -10	2010 -11	2011 -12	Pooled	2007 -08	2008 -09	2009 -10	2010 -11	2011 -12	Pooled
1	Neem leaf extract	2%	38.42 (38.27)	37.28 (37.64)	36.9 (37.4)	39.1 (38.7)	30.6 (33.58)	36.46 (37.12)	578	540	1046	820	612	719
2	Neem leaf extract	5%	34.8 (36.12)	31.9 (34.08)	33.7 (35.39)	37.2 (37.57)	28.4 (32.17)	34 (35.64)	750	620	1052	845	623	778
3	Neem seed kernel extract	2%	36.65 (37.24)	35 (36.57)	34.17 (36.77)	19.6 (26.24)	24 (29.32)	30.22 (33.19)	766	730	1225	995	804	904
4	Neem seed kernel extract	5%	27.42 (31.56)	30.39 (33.46)	32.84 (34.96)	15.4 (23.07)	20.5 (26.91)	25.31 (30)	797	760	1375	1131	850	983
5	Neem seed extract	2%	35.84 (36.77)	34.43 (35.91)	34.8 (36.12)	23.6 (29.04)	23.6 (29.04)	30.45 (33.39)	781	740	1358	978	725	916
6	Neem seed extract	5%	26.92 (31.26)	28.15 (32.08)	31.73 (34.46)	20.8 (27.11)	21.8 (27.82)	25.87 (30.5)	828	780	1439	1026	741	963
7	Neem seed coat extract	2%	28.16 (32.05)	32.68 (34.88)	34.19 (35.73)	30.6 (33.58)	32.5 (34.74)	31.67 (34.23)	812	770	1378	921	729	922
8	Neem seed coat extract	5%	24.5 (29.66)	26.7 (31.11)	27.46 (31.73)	26.2 (30.78)	34.4 (35.9)	27.86 (31.82)	844	840	1449	952	734	964
9	Azadirachtin	300 ppm @ 5ml/lit	24.11 (29.39)	25.68 (30.46)	27.73 (31.58)	14.2 (22.11)	12.3 (20.5)	20.84 (26.88)	859	950	1544	1138	992	1097
10	Untreated control	—	44.6 (41.9)	42.29 (40.57)	38.9 (38.55)	44.5 (41.7)	37.8 (37.9)	41.62 (40.16)	516	320	766	773	498	595
	S.E. (m) ±		0.66	0.64	0.53	0.97	72	1.27	31.24	76	100	39.63	9.67	32.91
	C.D. at 5%		1.98	1.94	1.59	2.89	2.15	3.65	83	232	300	117.75	28.68	94.44
	C.V. %		6.35	4.21	2.63	5.44	4.07	8.55	6.34	18.81	13.34	7.17	2.29	8.35

Note: A figure in parenthesis indicates *Arc sine* transformed values.

2% > Neem seed kernel extract 2% >Neem leaf extract 5% > Neem leaf extract 2% with 964, 963, 922, 916, 904, 778 and 719 kg/ha. Untreated linseed crop received significantly lowest yield of 595 kg/ha.

These results are in agreement with the findings of Gurve *et al*. (2015) who evaluated the certain botanicals and Azadirachtin against linseed bud fly and reported that the plot treated with azadirachtin 1500 ppm recorded highest yield 8.04 q/ha. Pal and Nagaich (2012) reported that the highest seed yield (1176.2 kg ha-1) was obtained with nimbicidine 0.5 per cent (azadirachtin1500 ppm) which supports the findings on efficacy of neem insecticides and its translation into higher yield.

Based on the overall results, it is concluded that minimum bud fly infestation 20.84 % and yield of 1097 kg/ha was recorded in Azadirachtin 1500 ppm sprayed linseed. Followed by the treatment with Neem Seed Kernel Extract (NSKE) 5% recorded bud fly infestation of 25.31%, yield of 983 kg/ha net monetary returns of 13826 Rs/ha. These treatments can certainly find a place in case of crop with higher infestations of bud fly.

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