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Evaluation of synthetic insecticides and botanicals against leafhopper, *Amrasca biguttula biguttula* (ishida) on sunflower

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Abstract
Experiment conducted to study the efficacy of newer molecules against leafhopper during *Kharif*, 2004. The results revealed that, the lowest number of leafhopper noticed in imidacloprid 17.8 SL @ 36.5 g a.i./ha (6.13 leafhopper/ 6 leaves/plant) followed by oxydemeton methyl 25 EC @ 175 g a.i. /ha (8.26 leafhopper/ 6 leaves/plant), thiamethoxam 25 WG @ 25 g a.i./ha (9.66 leafhopper/ 6 leaves/plant) and Acetamiprid 20 SP @ 20 g a.i./ha (11.53 leafhopper/ 6 leaves/plant) compared to rest of the treatments. Similarly the maximum yield of 1100.33 kg/ ha was obtained in imidacloprid 17.8 SL @ 36.5 g a.i./ha followed by oxydemeton methyl 25 EC @ 175 g a.i. /ha (1020.00 kg/ha), thiamethoxam 25 WG @ 25 g a.i./ha (1037.66 kg/ha). Whereas, the lowest seed yield was recorded in untreated control (755.33 kg/ha).

Keywords: Efficacy, leafhopper, seed yield, sunflower

Introduction
Sunflower was cultivated in an area of 1.246 m ha and production of 0.848 mt with an average productivity of 681 kg/ha [1]. As compared to the previous years, the area and production declined by 20 and 15 per cent.
Though there are several seasons for the fall out of the crop in the country, the incidence of few sucking pests like leafhoppers, whiteflies and thrips contributes to its sharp decline. Among these sucking insect pests the leafhopper, *Amrasca biguttula biguttula* (Ishida) appears in serious form causing crop loss up to 46 per cent [2]. Keeping this in mind attempts were made to evaluate the different insecticides as sprays against the leafhopper on sunflower.

Material and Methods
An field experiment were laid out in Randomised Block Design with three replications during *rabi* 2003, to assess the efficacy of insecticides and botanicals against leafhoppers on sunflower. The experiment consisted eight treatments along with an control. Sunflower hybrid KBSH-1 was raised in plots measuring 4.2 x 4.6 m with spacing 60 x 30 cm between rows and plants, respectively. Crop was raised according to package of practices except the plant protection measures [3].
Chemicals and botanicals were sprayed on crop based on ETL of leafhoppers (3 nymphs or adult per leaf), which started from 30 days after emergence and subsequent second spray was given with an interval of 15 days. High volume knapsack sprayers were used for spraying insecticides and botanicals with spray volume of 500 lit/ha.
Observations were recorded on number of leafhoppers before a day of application, three days and seven days after application. Net lot yield was also recorded and computed on hectare basis before subjecting it for statistical analysis.

Results and Discussion
Four insecticides, five per cent Neem Seed Kernel Extract (NSKE), commercial formulation of neem (Rakshak), neem oil (1%) and pongamia oil (1%) were screened for their efficacy against leafhoppers on sunflower. Results are presented hereunder.

First spraying
One day before spraying: Observation on the mean population of leafhoppers (Table 1), a day before spraying revealed that all the treatments including untreated check had leafhopper population ranging from 19.46 to 23.06 leafhoppers per plant and was statistically non-significant indicating the uniform leafhoppers on sunflower.

Three days after spraying: At three days after treatment all the treatments significantly differed from control. The imidacloprid 17.8 SL at 36.5 g a.i. per hectare recorded lowest population of 3.33 leafhoppers per plant which was significantly superior over rest of the treatments. The population of leafhoppers in treatment oxydemeton methyl and acetamiprid were recorded 4.8 and 6.06 leafhoppers per plant respectively and were statistically on par with each other followed by thiamethoxam which was proved to be superior over the botanicals. Among the botanical used NSKE at 5% was found be superior over neem oil, pongamia oil and commercial formulation (Rakshak). However, both insecticides and botanicals were superior over untreated check.

Seven days after spraying: Observation made at seven days after spraying, the lowest population recorded in imidacloprid 17.8 SL at 36.5 g per hectare treated plots (5.4 leafhoppers/ plant) which is followed by oxydemeton methyl 25 EC. Thiamethoxam 25 EC and acetamiprid 20 SP were on par with each other regarding population. Among botanicals again NSKE at 5% was found to be superior recorded lowest population of leafhopper. Highest population of 23.00 leafhoppers per plant were recorded in untreated check.

Second spraying

One day before spraying: Observation made a day before spraying on the population of leafhoppers (Table 1) revealed that all the treatments including untreated check was ranging from 22.33 (Thiamethoxam 25 EC) to 25.80 (Imidacloprid 17.8 SL) leafhoppers per plant which were statistically non significant, indicating uniform incidence of leafhoppers on sunflower.

Three days after spraying: Lowest population was recorded in the treatment imidacloprid (3.40 leafhoppers/ plant) which differed significantly from rest of treatments, while, leafhopper population in oxydemeton methyl and acetamiprid treatments were at par with each other. The next best treatment was thiamethoxam at 25 g a.i. per hectare (7.6 leafhoppers/ plant). NSKE was found to be effective among the botanicals. Untreated check recorded highest population compared to botanicals and synthetic insecticides.

Seven days after spraying: At this period again imidacloprid recorded lowest population of leafhoppers (6.13 leafhoppers/ plant) followed by oxydemeton methyl (8.26 leafhoppers/ plant) which was on par with thiamethoxam. In case of botanicals, NSKE found effective compared to rest of the botanicals which were on par with each other in their efficacy. These present findings are in confirmation with the results of earlier workers [4, 5], who indicated imidacloprid applied as a foliar spray was effective in controlling the leafhoppers. After imidacloprid, oxycemeton methyl was effective in reducing the population which can be compared with the results of earlier workers [6], who reported oxydemeton methyl effective in reducing the pest population below economic threshold level (ETL) compared to other conventional insecticides. However, among botanicals neem seed kernel extract at 5% proved to be effective in reducing the leafhopper population[7] the NSKE was effective in controlling the leafhoppers.

Sunflower seed yield

The efficacy of different synthetic insecticides and neem based insecticides at both first and second application, revealed that all the treatments were superior over the untreated check except Rakshak in recording the higher seed y ield of sunflower. Among insecticidal treatments, imidacloprid 17.8 SL recorded highest yield (1100.3 kg/ha) followed by oxydemetan methyl (1037.6 kg/ha) which was on par with acetamiprid which recorded 1020.0 kg/ha. Thiamethoxam was next best treatment among the synthetic insecticides whereas, it was significantly superior over botanicals. Among botanicals NSKE was superior which recorded 900.66 kg/ha. The present findings are in close agreement with the earlier observation [8], who reported imidacloprid and acetamiprid among the synthetic insecticides and NSKE among the botanicals recorded the highest yield. The botanicals were found to be safer to natural enemies and pollinators in sunflower[7]. Because fall these reasons botanicals may be become ideal components of IPM in sunflower.

Table 1: Comparative efficacy of different insecticidal sprays against leafhoppers in sunflower

Sl. No.	Treatments	Dosage	No. of leafhoppers/6 leaves/plants						Yield (kg/ha)
			I Spray			II Spray			
			1 DBS	3 DAS	7 DAS	1 DBS	3 DAS	7 DAS	
T_1	Acetamiprid 20 SP	20 g.a.i/ha	20.46	6.06 (3.45) ^{b}	12.13 (4.48) ^{c}	23.60	6.73 (3.58) ^{bc}	11.53 (4.39) ^{c}	1020.00 ^{b}
T_2	Imidacloprid 17.8 SL	36.5 g.a.i/ha	22.46	3.33 (2.81) ^{a}	5.40 (3.32) ^{a}	25.80	3.40 (2.83) ^{a}	6.13 (3.46) ^{a}	1100.33 ^{a}
T_3	Oxydemeton methyl 25 EC	175 g.a.i/ha	20.80	4.80 (3.18) ^{b}	7.40 (3.72) ^{b}	24.66	5.53 (3.34) ^{b}	8.26 (3.87) ^{b}	1037.66 ^{b}
T_4	Thiamethoxam 25 WG	25 g.a.i./ha	23.06	8.00 (3.82) ^{c}	11.06 (4.32) ^{c}	22.33	7.60 (3.75) ^{c}	9.66 (4.10) ^{bc}	964.00 ^{c}
T_5	Neem oil	1%	20.06	12.2 (4.49) ^{e}	17.53 (5.18) ^{ef}	22.40	12.46 (4.52) ^{ef}	18.20 (5.26) ^{ef}	846.66 ^{e}
T_6	Pongamia oil	1%	21.00	12.33 (4.54) ^{ef}	16.33 (5.03) ^{de}	24.73	10.53 (4.24) ^{e}	16.20 (5.02) ^{de}	830.00 ^{ef}
T_7	NSKE	5%	22.06	9.86 (4.14) ^{d}	13.33 (4.80) ^{d}	25.66	9.46 (4.07) ^{d}	15.20 (4.89) ^{d}	900.66 ^{d}
T_8	Rakshak (1500 ppm)	3 ml/lit	19.46	14.60 (4.81) ^{f}	18.40 (5.28) f	24.13	14.26 (4.77) ^{f}	18.53 (5.30) ^{ef}	795.33 ^{fg}
T_9	Untreated check	--	21.26	20.40 (5.51) ^{g}	23.00 (5.79) ^{g}	24.00	24.33 (5.92) ^{g}	26.53 (6.14) ^{g}	755.33 ^{g}
	S.Em±		0.106	0.104	0.101	0.081	0.121	0.120	13.293
	C.D. at 5%		NS	0.310	0.300	NS	0.361	0.360	40.312

DBS = Days Before Sowing, DAS = Days after Sowing

* Figures in the parenthesis are ($\sqrt{X}$ + 1) transformed values.

Means carrying same alphabets are statistically insignificant.

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