



EVALUATION OF IMIDACLOPRID 6%+ LAMBDA CYHALOTHRIN 4% SL AGAINST SUCKING PESTS OF COTTON

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ABSTRACT

Two field experiments were conducted to evaluate the efficacy of imidacloprid 6%+ lambda cyhalothrin 4% SL against sucking insects viz., aphid *Aphis gossypii* Glover, leafhopper *Amrasca biguttula biguttula* (Ishida), thrips *Thrips tabaci* L. and whitefly *Bemisia tabaci* (Gennadius) on cotton during kharif, 2018-19 and 2019-20 at the Agricultural Research Station, Dharwad farm, UAS, Dharwad, Karnataka. Results showed that the higher dose of imidacloprid 6%+ lambda cyhalothrin 4%SL @ 500 ml ha⁻¹ resulted in 89.02, 88.52, 91.91 and 90.17% reduction of aphids, thrips, leafhoppers and whitefly, respectively in first season and 93.03, 87.15, 97.01 and 89.65% in second season compared to the untreated check. It was on par with its lower dose @ 450 ml ha⁻¹. There was no significant difference in the counts of grubs and adults of coccinellids and number of chrysopids. Thus, imidacloprid 6%+ lambda cyhalothrin 4% SL could be used for the management of sucking pests without any effect on non-target insects.

Key words: Cotton, *Aphis gossypii*, *Amrasca biguttula biguttula*, *Thrips tabaci*, *Bemisia tabaci*, imidacloprid, lambda cyhalothrin, natural enemies, coccinellids, chrysopids, yield

Cotton (*Gossypium hirsutum* L.) is an important commercial fibre crop, and India is one of the major producers (ICAC, 2021). It is estimated that >5.8 million farmers cultivate cotton in India and about 40-50 million people are employed directly or indirectly by the cotton industry (Karthik et al., 2017). Nearly 1326 insects and mites are reported on cotton (Hargreaves, 1948) and about 251 arthropods from India (Nagrare et al., 2022), with the yield loss of 87% (Taley et al., 1988). Introduction of Bt cotton has given solution to the bollworm complex to a larger extent but at the same time they are susceptible to most of the sucking pests viz., aphid, leafhopper, thrips, whitefly and mirid bug. Cotton growers in India depend heavily on synthetic pesticides to combat these pests; at least 6-9 sprays are directed against sucking pests at early stage (Lingappa et al., 2001) and it has been estimated that cotton consumes about 21% of the total insecticides used in the country (CICR, 2011). Due to the continuous and indiscriminate use of these systemic insecticides, their efficacy is lost due to buildup of resistance to these insecticides. Hence, combination of two chemicals with different mode of action is the new strategy to reduce the labour, money, time and development of resistance. With this background, this study evaluates the efficacy of new combination product imidacloprid 6%+ lambda

cyhalothrin 4% SL against sucking pests of cotton and its effect on natural enemies.

MATERIALS AND METHODS

Field trials were conducted to evaluate the efficacy of imidacloprid 6%+ lambda cyhalothrin 4% SL at the Agricultural Research Station, Dharwad farm, Dharwad during kharif, 2018-19 and 2019-20 in randomized block design (RBD). There were nine treatments replicated thrice. Cotton hybrid 'First class' was sown in plots of 5.0 x 5.0 sq. m with a spacing of 90 x 60 cm, and the crop was raised following recommended package of practices. Spraying was carried out using hand operated pneumatic knapsack sprayer with 500 l of spray fluid/ ha when the pests crossed economic threshold level (ETL) during 60 DAS (days after sowing) and untreated check plots were maintained with water spray. Three sprays were given at 15 days interval. The incidence of sucking pests viz., nymphs and adults of aphids *Aphis gossypii* Glover, leafhopper *Amrasca biguttula biguttula* (Ishida), thrips *Thrips tabaci* L. and whitefly *Bemisia tabaci* (Gennadius) were recorded from ten randomly selected and tagged plants/replication. In each plant, three leaves (top, middle and bottom) were considered, and observations were made prior to and 3, 7 and 14 days after spraying. Cotton

yield/ plot was recorded from each picking and pooled to arrive at the total yield in q/ ha. The occurrence of natural enemies (chrysopids and coccinellids) was recorded on ten randomly tagged plants/ plot prior to and 3, 7, 10 and 14 days after spray. Based on these observations, means were worked out and statistically analyzed after square root transformation. To assess the phytotoxicity, imidacloprid 6%+ lambda cyhalothrin 4% SL at four doses viz., 400, 450, 900 and 1350 ml ha⁻¹ were used. The treatments evaluated were imidacloprid 6%+ lambda cyhalothrin 4% SL@ 350 ml ha⁻¹, imidacloprid 6%+ lambda cyhalothrin 4% SL@ 400 ml ha⁻¹, imidacloprid 6%+ lambda cyhalothrin 4% SL@ 450 ml ha⁻¹, imidacloprid 6%+ lambda cyhalothrin 4% SL@ 500 ml ha⁻¹, lambda cyhalothrin 5% EC @ 500 ml ha⁻¹, imidacloprid 70% WG @ 35 g ha⁻¹, buprofezin 25% SC @ 1000 ml ha⁻¹, diafenthiuron 50% WP @ 600g ha⁻¹, and an untreated check.

RESULTS AND DISCUSSION

The results revealed that all the treatments were significantly superior over untreated check in reducing the incidence of *A. gossypii*; imidacloprid 6%+ lambda cyhalothrin 4% SL@ 500 ml ha⁻¹, 450 ml ha⁻¹ and 400 ml ha⁻¹ were found to be significantly superior over all other treatments and on par with each other by recording 89.02, 86.81, 85.71 in first season and 93.03, 91.18 and 88.47% reduction of *A. gossypii* incidence over untreated check in second season, respectively. Diafenthiuron 50% WP @ 600 g ha⁻¹ (45.50 & 58.90 %) was found to be the least effective against *A. gossypii*. Imidacloprid 6%+ lambda cyhalothrin 4% SL @ 500 ml ha⁻¹, 450 ml ha⁻¹ and 400 ml ha⁻¹ performed well in reducing the incidence of *T. tabaci* on cotton, which were on par with each other and superior over all other treatments. Buprofezin 25% SC @ 1000 ml ha⁻¹ and imidacloprid 70% WG @ 35 g ha⁻¹ were effective next to the imidacloprid 6%+ lambda cyhalothrin 4% SL @ 500 ml ha⁻¹, 450 ml ha⁻¹ and 400 ml ha⁻¹ (Table 1). The mean data of incidence of *A. biguttula biguttula* revealed that imidacloprid 6%+ lambda cyhalothrin 4% SL @ 500 ml ha⁻¹, 450 ml ha⁻¹ and 400 ml ha⁻¹ was the most effective. It was followed by buprofezin 25% SC @ 1000 ml ha⁻¹ (78.96 %), imidacloprid 6%+ lambda cyhalothrin 4% SL @ 350 ml ha⁻¹ (73.21%), imidacloprid 70% WG @ 35 g ha⁻¹ (64.99 %), lambda cyhalothrin 5% EC @ 500 ml ha⁻¹ (63.17 %) and diafenthiuron 50% WP @ 600 g ha⁻¹ (30.11%) in first season. The similar trend was noticed in second season as well. Against *B. tabaci* all the treatments were significantly superior over untreated

check; imidacloprid 6%+ lambda cyhalothrin 4% SL @ 500 ml ha⁻¹ gave 90.17% reduction in first season followed by imidacloprid 6%+ lambda cyhalothrin 4% SL @ 450 ml ha⁻¹ (89.31 %), imidacloprid 6%+ lambda cyhalothrin 4% SL @ 400 ml ha⁻¹ (89.78 %), imidacloprid 6%+ lambda cyhalothrin 4% SL @ 350 ml ha⁻¹ (81.83%), imidacloprid 70% WG @ 35 g ha⁻¹ (70.30 %). In second season, the similar trend was noticed (Table 1).

All the tested insecticides showed non-significant differences and were statistically on par with each other and found to be safer towards natural enemies viz., coccinellids and chrysopids (Table 2). The present findings are in line with Ameta and Sharma (2005) indicated that imidacloprid 70 WG at 30 and 35 g ha⁻¹ were effective against sucking pests of cotton. Saleem et al. (2001) reported that Confidor 200 SL effectively controlled sucking pests up to seven days after the spray in cotton. Asif et al. (2016) reported that imidacloprid and lambda cyhalothrin were effective against cotton sucking pests. Pal et al. (2020) reported that combination product of imidacloprid 6% + lambda cyhalothrin 4%SL @ 500 ml/ha and 450 ml/ha proved the most effective in Bt cotton. Significantly highest seed cotton yield was recorded in the plots treated with imidacloprid 6%+ lambda cyhalothrin 4% SL @ 500 ml ha⁻¹ and was on par with its lower doses at 450ml/ ha and 400 ml/ ha⁻¹ (Table 2). The effectiveness of imidacloprid on the increase in yield was already reported by Gupta et al. (2005) and Ameta and Sharma (2005) on cotton. Similarly, effectiveness of lambda cyhalothrin on the increase in yield was reported by Asif et al. (2016).

ACKNOWLEDGEMENTS

Authors thank the Directorate of Research, University of Agricultural Sciences, Dharwad, Karnatka, India for permitting to conduct the present experiment and M/S. Willowood chemical Pvt. Ltd., New Delhi, India for sponsoring it.

AUTHOR CONTRIBUTION STATEMENT

SV Hugar conducted the experiments and SS Udikeri prepared the manuscript, all authors read and approved the manuscript.

CONFLICT OF INTEREST

No conflict of interest.

Table 1. Efficacy of Imidacloprid 6%+ Lambda cyhalothrin 4% SL against sucking pest complex in cotton

S. No.	Treatments	Dose (g a.i./ha)	Mean incidence of sucking pests/ three leaves							
			Kharif-2018-19 (First season)				Kharif-2019-20 (Second season)			
			Aphids	Thrips	Leafhoppers	Whitefly	Aphids	Thrips	Leafhoppers	Whitefly
T ₁	Imidacloprid 6%+ Lambda cyhalothrin 4% SL	350 ml	16.26 (4.09)	20.14 (4.54)	6.06 (2.56)	5.06 (2.36)	14.53 (3.88)	21.39 (4.68)	5.86 (2.52)	7.14 (2.76)
T ₂	Imidacloprid 6%+ Lambda cyhalothrin 4% SL	400 ml	11.94 (3.53)	15.66 (4.02)	3.82 (2.08)	3.80 (2.07)	10.13 (3.26)	15.79 (4.04)	3.22 (1.93)	5.06 (2.36)
T ₃	Imidacloprid 6%+ Lambda cyhalothrin 4% SL	450 ml	10.59 (3.33)	14.62 (3.89)	3.44 (1.99)	3.54 (2.01)	8.79 (3.05)	14.35 (3.85)	2.73 (1.80)	3.80 (2.07)
T ₄	Imidacloprid 6%+ Lambda cyhalothrin 4% SL	500 ml	9.34 (3.14)	13.46 (3.74)	3.36 (1.96)	3.42 (1.98)	7.66 (2.86)	13.00 (3.67)	2.04 (1.59)	3.54 (2.01)
T ₅	Lambda cyhalothrin 5% EC	500 ml	19.97 (4.52)	24.36 (4.99)	8.82 (3.05)	6.69 (2.68)	16.90 (4.17)	23.49 (4.90)	6.79 (2.70)	6.58 (2.66)
T ₆	Imidacloprid 70% WG	35 g	17.67 (4.01)	21.79 (4.50)	7.30 (2.54)	7.44 (2.82)	11.77 (3.50)	18.95 (4.41)	4.67 (2.27)	6.69 (2.68)
T ₇	Buprofezin 25% SC	1000 ml	15.61 (4.26)	19.72 (4.72)	5.96 (2.79)	7.14 (2.76)	13.26 (3.71)	17.78 (4.28)	4.67 (2.27)	7.44 (2.82)
T ₈	Diafenthiuron 50% WP	600 g	22.87 (4.83)	27.23 (5.27)	11.49 (3.46)	8.90 (3.07)	19.75 (4.50)	26.98 (5.24)	8.56 (3.01)	8.90 (3.07)
T ₉	Control	--	36.80 (6.11)	43.07 (6.60)	13.77 (3.78)	14.38 (3.86)	33.90 (5.87)	44.88 (6.74)	12.69 (3.63)	14.38 (3.86)
	SEm ±		0.20	0.16	0.08	0.09	0.18	0.19	0.07	0.10
	CD (p=0.05)		0.62	0.48	0.24	0.27	0.54	0.56	0.21	0.30
	CV (%)		8.63	5.92	5.20	5.96	8.17	7.03	5.14	6.57

Mean = Mean of observations 14 days after spray; Figures in parentheses $\sqrt{x + 0.5}$ transformed values.

Table 2. Efficacy of Imidacloprid 6%+ Lambda cyhalothrin 4% SL on natural enemies and yield in cotton

S. No.	Treatments	Dose (g a.i. / ha)	Season I			Season II			Seed cotton yield (Q/ ha)	
			Mean Coccinellids/ 5 plants	Mean Chrysopids/ 5 plants	Mean Coccinellids/ 5 plants	Mean Chrysopids/ 5 plants	Mean Chrysopids/ 5 plants	Mean Chrysopids/ 5 plants	Season I	Season II
T ₁	Imidacloprid 6%+ Lambda cyhalothrin 4% SL	350 ml	3.56 (2.01)	4.04 (2.13)	3.56 (2.01)	3.88 (2.09)	3.56 (2.01)	3.88 (2.09)	13.58	13.02
T ₂	Imidacloprid 6%+ Lambda cyhalothrin 4% SL	400 ml	3.30 (1.95)	3.69 (2.05)	4.04 (2.13)	3.52 (2.00)	4.04 (2.13)	3.52 (2.00)	15.64	15.06
T ₃	Imidacloprid 6%+ Lambda cyhalothrin 4% SL	450 ml	3.13 (1.90)	4.36 (2.20)	3.69 (2.05)	3.59 (2.02)	3.69 (2.05)	3.59 (2.02)	15.95	15.32
T ₄	Imidacloprid 6%+ Lambda cyhalothrin 4% SL	500 ml	3.39 (1.97)	4.07 (2.14)	4.36 (2.20)	4.13 (2.15)	4.36 (2.20)	4.13 (2.15)	16.33	15.62
T ₅	Imidacloprid 6%+ Lambda cyhalothrin 4% SL	500 ml	3.38 (1.97)	4.14 (2.15)	4.07 (2.14)	3.16 (1.91)	4.07 (2.14)	3.16 (1.91)	13.71	13.00
T ₆	Imidacloprid 70% WG	35 g	3.72 (2.05)	4.36 (2.20)	4.14 (2.15)	3.55 (2.01)	4.14 (2.15)	3.55 (2.01)	13.41	13.12
T ₇	Buprofezin 25% SC	1000 ml	3.95 (2.11)	3.70 (2.05)	4.36 (2.20)	3.82 (2.08)	4.36 (2.20)	3.82 (2.08)	14.24	14.07
T ₈	Diafenthuron 50% WP	600 g	3.93 (2.11)	3.76 (2.06)	3.70 (2.05)	3.68 (2.05)	3.70 (2.05)	3.68 (2.05)	13.26	13.02
T ₉	Control	--	4.42 (2.22)	4.54 (2.24)	4.57 (2.25)	6.04 (2.56)	4.57 (2.25)	6.04 (2.56)	11.02	10.60
SEM ±			--	--	--	---	--	---	0.50	0.65
CD (p=0.05)			NS	NS	NS	NS	NS	NS	1.52	1.96
CV (%)			--	--	--	--	--	--	6.59	7.89

Mean = Mean of observations 14 days after spray; Figures in parentheses $\sqrt{x + 0.5}$ transformed values.

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(Manuscript Received: April, 2022; Revised: July, 2022;

Accepted: July, 2022; Online Published: July, 2022)

Online First in www.entosocindia.org and indianentomology.org Ref. No. e22228