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Management of sucking pests in cotton with new insecticides

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Abstract: Bioefficacy studies were carried out at Agricultural Research Station, Dharwad, for sucking pests of cotton with BY1 08330 150 OD (spirotetramat 150 OD) and SYN 13623 a combiproduct of thiomethoxam 141 SC+λcyhalothrin 106 SC. The population of thrips, leafhoppers and aphids was brought below ETL with three sprays during 2006 and two sprays in 2007 with different dosages of new chemicals. Significantly highest seed cotton yield of 20.32q/ha (2006) and 29.22 q/ha (2007) was harvested with higher dosage of SYN 13623 @ 300ml/ha and BY1 08330 150 OD @500ml/ha respectively proving them to be on par with acetamiprid 20 SP, a standard check.

Key words : Cotton, spirotetramat, thiomethoxam + λ cyhalothrin, thrips, leafhoppers, aphids

Introduction

Cotton, the most important commercial crop of India, is subjected to the ravages of a number of insect pests. Sucking pests have become quite serious from seedling stage, their heavy infestation at times reduces the crop yield to a great extent. The estimated loss due to sucking pests is up to 21.20% (Dhawan et al., 1988). Among the sap feeders aphids *Aphis gossypii* (Glover), leafhoppers *Amrasca biguttula biguttula* (Ishida), *thrips Thrips* tabaci (Linn) and whitefly *Bemisia tabaci* are deadly pests. Cotton growers in India depend heavily on synthetic pesticides to combat sucking pests. Atleast 2-3 sprays are directed against sucking pests. Due to continuous and indiscriminate use of synthetic insecticides, there is resistance and hence the efficacy has become less reliable. To overcome this problem discovery of novel substances with different biochemical targets are needed. Novel molecules are effective at low doses and have less exposure in the environment. The new insecticide spirotetramat 150 OD (BY1 08330 150 OD) is a broad spectrum insecticide belonging to Ketoenoles class with "spirotetramat" as active ingredient and is said to be suitable to all type of crops (www.newsroom.bsyer vrop science.com). SYN 13623 is a combiproduct of thiomethoxam 141 SC+ λ cyhalothrin 106 SC. In the present investigation these insecticides have been evaluated for their effectiveness against sucking pests of cotton and their impact on natural enemies in comparison with acetamiprid 20 SP and triazophos 40 EC as standard checks.

Material and methods

Field experiments were conducted at ARS Dharwad Farm during Kharif 2006 and 2007 with eight treatments replicated thrice in randomized block design. Cotton hybrid RCH-2Bt was sown in a plot size of 5.4x5.4m^2 with a spacing of 90x60 cm. The crop was maintained well by adapting standard agronomic practices as per the recommendations. The treatments BYI 08330 150 OD @ 400 and 500 ml/ha, SYN 13623 @ 100,200 and 300 ml/ha, acetamiprid 20SP @ 100 g/ha, triazophos 40EC @ 1500 ml/ha (Std checks) were imposed when any one of sucking pests attained economic threshold level, (leafhoppers-nymphs/leaf, thrips or aphids -10/leaf).Thus three and two sprays were given during 2006 and 2007 seasons respectively.

The populations of sucking pests *viz*., thrips, aphids and leafhoppers were recorded from top, middle and bottom leaves of ten randomly tagged plants per plot. The phytotoxic effect of test chemicals and their effect on natural enemies i.e.coccinellids and chrysoperla were recorded and average values of these observations were subjected for statistical analysis to asses the overall impact on pest suppression. Seed cotton yield was harvested on plot basis excluding border lines and expressed as q/ha.

Results and discussion

During 2006-07, the pre treatment population of thrips was uniform and non significant among treatments with a range of 51.58 to 53.39 per three leaves. New chemistry based insecticides showed excellent performance in managing the thrips pests. All three dosages of thiomethoxam + cyhalothrin 247 SC and two dosages of spirotetramat 150 OD found to be superior by registering lowest number of thrips and were as good acetamiprid 20 SP and triazophos 40 EC (Table 1). In subsequent spray also similar trend was noticed. In seasonal mean also new insecticides registered significantly lowest number of thrips population compared to untreated check and were followed after standard check acetamiprid 20 SP and on par with another standard check triazophos 40 EC. However, thiomethoxam + cyhalothrin 247 SC at higher dosage registered lowest number thrips among the new molecule (24.85/3leaves).

The population of aphids did not vary significantly in all the plots before imposing treatments (37.17 to 40.53/three leaves). At 5 days after first spray, all dosages of thiomethoxam +cyhalothrin 247 SC and spirotetramat 150 OD proved to be

Table 1. Bio-efficacy of new insecticides against sucking pests of cotton (2006)

Treatments	Dosage (ml or g/ ha)	Thrips / 3 leaves					Aphids/ 3 leaves					Leafhoppers / 3 leaves				
		DBS	5DAFS	5 DASS	5 DATS	Mean	DBS	5 DAFS	5 DASS	5 DATS	Mean	DBS	5DAFS	5 DASS	5 DATS	Mean
BYI 08330 150 OD	400	52.41	41.24	23.93	22.83	29.33	37.17	19.95	15.43	9.30	14.89	3.25	2.50	1.60	1.06	1.72
(Spirotetramat 150 OD)		(7.31)	(6.50)	(4.99)	(4.88)	(5.51)	(6.21)	(4.61)	(4.05)	(3.24)	(3.98)	(2.06)	(1.87)	(1.61)	(1.43)	(1.63)
BYI 08330 150 OD	500	52.42	39.34	22.30	21.84	27.83	37.70	18.38	15.03	8.77	14.06	3.48	2.44	1.50	1.01	1.65
(Spirotetramat 150 OD)		(7.31)	(6.35)	(4.83)	(4.78)	(5.37)	(6.22)	(4.47)	(4.00)	(3.09)	(3.88)	(2.12)	(1.85)	(1.58)	(1.42)	(1.62)
SYN 13623 (Thiomethoxam	100	51.58	36.56	25.78	20.13	27.49	37.95	17.03	13.71	7.57	12.77	3.27	2.42	1.34	0.93	1.56
141SC+λcyhalothrin 106 SC)		(7.25)	(6.12)	(5.17)	(4.56)	(5.34)	(6.24)	(4.24)	(3.84)	(2.92)	(3.71)	(2.06)	(1.85)	(1.53)	(1.39)	(1.60)
SYN 13623 (Thiomethoxam	200	52.86	35.29	24.71	17.23	25.75	39.10	16.67	12.86	6.93	12.15	3.53	2.39	1.26	0.84	1.50
141SC+ λ cyhalothrin 106 SC)		(7.34)	(6.02)	(5.07)	(4.27)	(5.17)	(6.30)	(4.21)	(3.72)	(2.82)	(3.62)	(2.10)	(1.84)	(1.51)	(1.36)	(1.58)
SYN 13623 (Thiomethoxam	300	53.39	34.49	25.19	14.86	24.85	40.53	16.01	11.72	6.13	11.29	3.72	2.17	1.23	0.87	1.42
141SC+λ cyhalothrin 106 SC)		(7.37)	(5.95)	(5.08)	(3.98)	(5.08)	(6.45)	(4.12)	(3.60)	(2.70)	(3.51)	(2.17)	(1.78)	(1.49)	(1.37)	(1.56)
Acetamiprid 20SP (Std check)	100	52.84	30.40	21.48	12.83	21.57	38.21	15.36	12.13	6.14	11.21	3.80	2.13	1.29	0.72	1.38
		(7.34)	(5.60)	(4.74)	(3.72)	(4.67)	(6.26)	(4.04)	(3.62)	(2.67)	(3.49)	(2.19)	(1.77)	(1.51)	(1.31)	(1.54)
Triazophos 40EC (Std check)	1500	53.07	38.48	25.27	19.32	27.69	38.10	27.08	12.08	5.85	15.00	3.69	2.73	3.02	2.75	2.83
		(7.35)	(6.28)	(5.13)	(4.51)	(5.36)	(6.25)	(5.21)	(3.61)	(2.61)	(4.00)	(2.16)	(1.93)	(2.01)	(1.94)	(1.96)
Untreated control	:	53.01	57.12	63.51	62.32	60.98	39.30	41.43	36.29	40.25	39.32	3.87	3.99	3.36	4.23	3.86
		(7.35)	(7.62)	(8.03)	(7.95)	(7.87)	(6.35)	(6.51)	(6.10)	(6.42)	(6.21)	(2.21)	(2.24)	(2.06)	(2.29)	(2.17)
SEm ±		0.41	0.32	0.32	0.32	0.39	0.37	0.27	0.26	0.25	0.29	0.13	0.08	0.13	0.13	0.12
CD @ 5%		NS	0.94	0.93	0.94	1.16	NS	0.80	0.77	0.74	0.87	NS	0.24	0.37	0.39	0.38
CV (%)		9.78	8.90	10.30	11.94	12.34	10.14	10.24	11.27	13.53	12.67	10.33	9.37	13.21	15.28	13.53

DBS: Days before spray DAFS: Days after first spray DASS: Days after second spray DATS: Days after third spray

Figures in parentheses are $\sqrt{x+1}$ transformed values

effective in registering significantly lowest number of aphid population (Table 1) compared to untreated check and triazophos 40 EC but were at par with acetamiprid 20 SP. However, lower dosages of these chemicals were at par with their respective higher dosages. All treatments were significantly superior over untreated check at 5 days after second and third spray. Similar trend was also followed in seasonal mean also.

Leafhopper population was below economic threshold level (ETL) even before imposition of treatments and reduced further in all plots except untreated check after imposing the treatment. Over all seasonal mean also depicted similar trend as that of 5 days after spray. However, thiomethoxam + cyhalothrin 247 SC at higher dosages registered lowest number of jassid population among treatments (2.17/ three leaves) but was on par with other treatments.

During 2007-08 (Table 1) the pretreatment population of thrips ranged from 45.60 to 57.33 per 3 leaves. At 5 DAFS lowest population of thrips (9.87/3 leaves) was observed in treatment thiomethoxam + cyhalothrin 247 SC @300 ml/ha and was at par with all the remaining treatments except triazophos 40 EC (19.05/3 leaves) and untreated control. The data of 5 DASS indicated similar trend but lower dosage of thiomethoxam + cyhalothrin 247 SC and spirotetramat 150 OD were found to be significantly less effective than their respective higher dosages.

Prior to the treatment imposition uniform distribution of aphid population was noticed and above ETL. However, significant reduction in the aphid population was observed at 5DAFS by application of spirotetramat 150 OD @ 500 ml/ha which registered 5.40 aphids per 3 leaves as against 56.79 aphids in control. It was at par with acetamiprid 20 SP (6.00 aphid/ 3 leaves) but significantly superior over another standard check triazophos 40 EC (15 aphids/3 leaves).The remaining treatments were also showed better efficacy and were next in order. Where as all treatments were equally effective in reducing aphid population at 5 days after second spray. In seasonal mean all treatments were excellent and comparable with standard check acetamiprid 20 SP (Table 2).

Before the application of insecticides leafhoppers population was uniform and varied between 6.06 to 7.80 per three leaves. The data of 5 DAFS indicated the superiority of both the new insecticides by recording lower leafhopper population (0.75 to 2.07/ 3 leaves) and was as effective as

Table 2. Bio-efficacy of new insecticides against sucking pests of cotton (2007)

Treatments	Dosage (ml or g/ ha)	Thrips / 3 leaves DBS	Thrips 5DAFS	Thrips 5 DASS	Thrips Mean	Aphids/ 3 leaves DBS	Aphids 5 DAFS	Aphids 5 DASS	Aphids Mean	Leafhoppers / 3 leaves DBS	Leafhoppers 5DAFS	Leafhoppers 5 DASS	Leafhoppers Mean
BYI 08330 150 OD	400	53.40	15.33	07.68	11.51	6.75	08.25	05.67	07.43	6.75	1.65	0.93	1.29
(Spirotetramat 150 OD)		(7.38)	(4.04)	(2.95)	(3.51)	(2.78)	(3.04)	(2.58)	(2.90)	(2.78)	(1.63)	(1.39)	(1.51)
BYI 08330 150 OD	500	45.60	09.00	05.37	07.19	7.62	05.40	06.60	05.54	7.62	0.75	0.51	0.63
(Spirotetramat150OD)		(6.83)	(3.16)	(2.52)	(2.84)	(2.94)	(2.53)	(2.76)	(2.55)	(2.94)	(1.32)	(1.23)	(1.27)
SYN 13623	100	53.43	12.36	07.92	10.14	6.39	15.72	07.62	11.67	6.39	2.07	2.73	2.40
(Thiomethoxam 141SC+ λcyhalothrin 106 SC)		(7.38)	(3.66)	(2.99)	(3.32)	(2.72)	(4.09)	(2.94)	(3.52)	(2.72)	(1.75)	(1.93)	(1.84)
SYN 13623 (Thiomethoxam	200	53.73	10.20	06.15	08.18	6.06	14.79	06.63	10.71	6.06	1.29	1.95	1.62
141SC+ λ cyhalothrin 106 SC)		(7.40)	(3.35)	(2.67)	(3.01)	(2.66)	(3.94)	(2.76)	(3.35)	(2.66)	(1.51)	(1.72)	(1.61)
SYN 13623 (Thiomethoxam	300	55.11	09.87	05.49	07.68	7.32	11.13	05.40	08.27	7.32	0.90	0.45	0.68
141SC+ λ cyhalothrin 106 SC)		(7.49)	(3.30)	(2.55)	(2.92)	(2.88)	(3.48)	(2.53)	(3.00)	(2.88)	(1.38)	(1.20)	(1.29)
Acetamiprid 20SP (Std check)	100	52.62	09.51	06.39	07.95	6.90	6.00	06.00	06.00	6.90	0.96	0.60	0.78
		(7.32)	(3.24)	(2.72)	(2.98)	(2.81)	(2.65)	(2.65)	(2.65)	(2.81)	(1.40)	(1.26)	(1.33)
Triazophos 40EC (Std check)	1500	57.33	19.05	12.00	15.53	7.26	15.00	14.37	14.69	7.26	3.15	1.89	2.52
		(7.64)	(4.48)	(3.61)	(4.04)	(2.87)	(4.00)	(3.92)	(3.96)	(2.87)	(2.04)	(1.70)	(1.87)
Untreated control	..	53.79	51.39	53.22	52.31	7.80	56.79	59.85	58.32	7.80	8.37	8.07	8.22
		(7.40)	(7.24)	(7.36)	(7.30)	(2.97)	(7.60)	(7.88)	(7.70)	(2.97)	(3.06)	(3.01)	(3.03)
S.E m.±		0.39	0.29	0.22	0.16	0.23	0.23	0.27	0.19	0.23	0.17	0.11	0.10
CD @ 5%		NS	0.85	0.22	0.45	NS	0.66	0.79	0.56	NS	0.49	0.31	0.28
CV(%)		9.44	11.94	11.65	10.38	13.93	10.27	13.56	13.21	13.93	16.14	11.23	14.38

DBS: Days before spray DAFS: Days after first spray DASS: Days after second spray

Figures in parentheses are $\sqrt{x+1}$ transformed values acetamiprid 20 SP (0.96/3 leaves). Efficacy of these insecticides remained effective and followed the similar trend even 5 days after second spray (Table-2).

Insecticide interventions did not affect the predatory activity both the years (table 3) as there was no significant variation among the treatments even before and after application of insecticide, which ranged between 0.48 to 0.56 and 0.26 to 0.60 (2006) and 0.55 to 0.68 and 0.38 to 0.82 (2007) predators per plant respectively.

The data on seed cotton yield revealed that all the treatments were significantly superior over control. Among the treatments, thiomethoxam + cyhalothrin 247 SC at higher dosage registered significantly highest yield of 20.32q/ha and was on par with its lower dosages and spirotetramat 150 OD during 2006. However during the subsequent year higher dose of spirotetramat 150 OD recorded highest seed cotton yield (29.22 q/ha) followed by higher dose of thiomethoxam + cyhalothrin 247 SC (28.85 q/ha). All the chemical treatments except triazophos 40 EC were found to be statistically at par with each other during both the years of experimentation.

Both the novel insecticides proved their effectiveness against all sucking pests of cotton. SYN13623 247 SC is a combi product of thiomethoxam + lambda cyhalothrin. Efficacy of thiomethoxam against sucking pest has been documented by Prasanna (2000) where in the chemical was effective against thrips and leaf hoppers and obtained highest seed cotton yield. Similar reports were also made by Vastard (2003) and Dhawan and Simwat (2002). However, superiority of combi product against sucking pest was proved by Rodriguez *et al*. (2002) on chewing and sucking pests of chilli by application of Leverage (Imidacloprid + Cyfluthrin). Similarly, Ahmad *et al.* (1995) found highest level of control of all pests of cotton with Polytrin C application a combiproduct of profenphosand cypermethrin Tayyib *et al.* (2005) also reported effectiveness of Novastar (bifenthrin+ abamectin) against cotton sucking pest.

Superiority of lambda cyhalothrin against bollworm especially pink bollworm has been well documented. This insecticide proved to be excellent against secondary pest and lepidopteran pests such as bollworms that are capable of surving on transgenic plants and proved to be example for resistant management strategy for Bt cotton. (Harris *et al.,* 1998).Thus combiproducts with excellent molecules against sucking pest and pyrethroide as in case of thiomethoxam + cyhalothrin 247 SC can provide opportunity for managing sucking insects and tissue borers also.

It was proved that the bioefficacy of spirotetramat against aphid cicadas grapes louse, mealy bug white fly, scale and also against larvae by ingestion and also proved its efficacy in all types of crops (www.newroom.bayers crops sciences.com.)

The present findings about both these new molecules were in conformity with proven results elsewhere. These chemicals would be helpful in mitigating sucking pest problem, which are alarming in present situation and could be included in IPM of cotton. Spirotetramat being altogether a new chemistry would be more ideal insecticide.

Table 3. Impact of new insecticides on natural enemies and yield

Sl. No.	Treatments	Dosage (ml or g/ ha)	Predators/plant						Seed cotton yield (q/ha)		
			DBS			7 DAS					
			2006-07	2007-08	Pooled	2006-07	2007-08	Pooled	2006-07	2007-08	Pooled
1	BYI 08330 150 OD (Spirotetramat 150 OD)	400	0.48	0.55	0.51	0.30	0.42	0.36	18.37	26.88	23.12
2	BYI 08330 150 OD (Spirotetramat 150 OD)	500	0.49	0.56	0.52	0.28	0.38	0.33	18.63	29.22	23.92
3	SYN 3623 (Thiomethoxam 141SC+ λ cyhalothrin 106 SC)	100	0.52	0.57	0.54	0.31	0.44	0.375	19.35	26.50	22.92
4	SYN 13623 (Thiomethoxam 141SC+ λ cyhalothrin 106 SC)	200	0.56	0.60	0.58	0.32	0.46	0.39	19.68	27.28	23.48
5	SYN 13623 (Thiomethoxam 141SC+ λ cyhalothrin 106 SC)	300	0.48	0.62	0.55	0.34	0.48	0.41	20.32	28.85	24.58
6	Acetamiprid 20SP (Std check)	100	0.50	0.64	0.57	0.26	0.50	0.38	22.40	27.60	25.00
7	Triazophos 40EC (Std check)	1500	0.46	0.66	0.56	0.27	0.45	0.36	17.70	24.55	21.12
8	Untreated control	—	0.51	0.68	0.59	0.60	0.82	0.71	15.30	21.25	18.27
SEm ±			0.08	0.13	0.06	0.07	0.11	0.10	1.11	1.34	1.26
CD (P=0.05)			NS	NS	NS	NS	NS	NS	3.25	3.89	3.61
CV (%)			11.24	13.74	7.09	10.43	15.80	12.5	10.03	8.81	9.20

DBS: Days before spray DAS: Days after spray

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