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Effect of Pyriproxifen 10% EW against sucking insect pest population in cotton

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Abstract
An investigation was carried out at AICRP on cotton scheme, Chamarajanagar, Karnataka during *kharif* season of 2016-17 and 2017-18 to evaluate the bio-efficacy of pyriproxifen 10% EW against sucking insect pests of cotton *viz.*, whitefly (*Bemisia tabaci* Genn.), aphids (*Aphis gossypii* Glover), thrips (*Thrips tabaci* Lind), and leafhopper (*Amrasca bigutulla bigutulla* Ishida). The study indicated that spraying of pyriproxifen 10% EW @ 200 *g.a.i*/ha has recorded significantly higher seed cotton yield (19.43 q/ha) with maximum per cent reduction in whiteflies (95.28%), aphids (90.04%), thrips (98.78%) and leafhoppers (94.40%), respectively. Followed by spraying pyriproxifen 10% EW at 125 *g.a.i*/ha. However, all the insecticide treated plots were superior in reducing the pest load as compared to un treated control.

Keywords: Whiteflies, aphids, thrips, leafhoppers, cotton, pyriproxifen

Introduction
Cotton (*Gossypium* sp.) is one of the most important commercial crop of India and popularly known as "King of Fibre", which is primarily grown during *kharif* season. Though the country has the largest area under cotton cultivation, but the productivity is much lower compared to other important cotton growing countries like Brazil, USA, China etc. With the introduction of *Bt* cotton in the country during 2002 the farmers widely accepted the transgenic cotton due its ability to control bollworm damage. but the incidence of sucking pests has remained as such in both *Bt* and non *Bt* cotton hybrids till now (Sree Rekha *et al.*, 2012) [11]. Proper management of these insect pest is very important in successful cultivation of cotton crop.
About 1326 species of insects have been reported in cotton across world, of which whitefly (*Bemisia tabaci* Gennadius), leafhopper (*Amrasca biguttula bigutulla* Ishida) and thrips (*Scirtothrips dorsalis* Hood) are widely distributed polyphagous pest in tropical and sub tropical regions of India (Puri *et al.*, 1998) [7] and mealy bug (Hanchinal *et al.*, 2009) [4]. Besides causing direct damage, these pests act as vector of cotton leaf curl virus and other diseases which are major constraint for cotton cultivation. For management of these sucking pests several new generation insecticides of neonicotinoides group *viz.*, imidacloprid, thiamethoxam and acetamiprid *etc.*, have been widely used among cotton growing farmers. However, for effective management of sucking pests in cotton, there is need to intervene with newer compounds particularly biorationals. (Richardson and Lagos, 2007) [9]. Pyriproxifen 10 EC is one such biorational and which has proved effective against whitefly (Crowder *et al.*, 2006) [1], California red scale (Eliahu *et al.*, 2007) [2], green house whitefly (*Trialeurodes vaporariorum*), cotton leafworm (Nasr *et al.*, 2010) [6] and tomato leafminer (*Tutaabsoluta*) (Tome *et al.*, 2012) [12]. Keeping all these in view, the present study was designed to evaluate the bio-efficacy of pyriproxyfen 10% EW at field level as foliar treatment in different dosages against sucking insect pest complex of cotton.

Material and Methods
The field experiments were carried out at All India Co-ordinated Research project on Cotton, Chamarajanagara during *kharif*, 2016-17 and 2017-18 under rainfed condition. The experiment was Laidout in randomized block design with 7 treatments and replicated 3 times. The Bt cotton hybrid MRC-7351 was used for sowing, the crop was raised successfully by adopting

the package of practices recommended by the University of Agriculture Sciences, Bangalore. The treatments were imposed as per the plan (Table-1). The insecticides were sprayed at 15 days interval, test chemicals along with standard check were sprayed when the pest attained ETL. Observations on incidence of whitefly (*Bemisia tabaci* Genn.), aphids (*Aphis gossypii* Glover), thrips (*Thrips tabaci* Lind), leafhopper (*Amrasca bigutulla bigutulla* Ishida) were taken a day before and 3,7,10 and 14 days after each spray. Sucking pests of cotton require many sprays to make their population below ETL. Hence, last observation *i.e.*, 14 days after second spray was considered to observe the effectiveness of insecticides. In each plot 5 plants and 3 leaves/plant (top, middle and bottom) were randomly selected for observations. For management of bollworms, blanket sprays were taken in all the treatments. Further, impact of these chemicals on predators (Coccinellids) activity was also recorded at 10 days after last spray. The seed cotton yield from the net plot of each treatment in different pickings were pooled, weighed, along with the total yield obtained from the five tagged plant to get the total seed cotton yield from each plot. Then the total yield is converted to seed cotton yield kg ha^{-1}. The experimental data collected were subjected to statistical analysis.

Table 1: Treatment details

Sl. No.	Treatment	Dose(g.*a i* /ha)	Formulation/ha (g/ ml)
1	Pyriproxyfen 10% EW	75	750
2	Pyriproxyfen 10% EW	100	1000
3	Pyriproxyfen 10% EW	125	1250
4	Pyriproxyfen 10% EC	100	1000
5	Buprofezin 25% SC	250	1000
6	Pyriproxyfen 10% EW	200	2000
7	Untreated control	-	-

The percentage reduction in sucking pest population was assessed by adopting the following formula given by Henderson and Tilton (1955) [5].

Percentage reduction = {1 - (Ta x Cb / Tb x Ca)} X 100%,

Where,
Ta = Pest population in treated plant after treatment.
Tb = Pest population in treated plant before treatment.
Ca = Pest population in control plants after treatment.
Cb =Pest population in control plant before treatment.

Results and Discussion

Population of whiteflies and aphids

It is observed that during 2016-17 the population of whiteflies ranged between 6.47 to 9.0 per three leaves in pre-treatment plots. However, there was significant reduction in whitefly population (0.33/3leaves) in Pyriproxyfen 10% EW @ 200 g *ai*/ha (93.42%) treated plots at 14 days after second spray and which was found to be on par with Pyriproxyfen 10% EW 125 g *ai/* ha (90.64%). While, the rest of the treatments were on par with each other in reducing the whitefly population at 14 days after second spray.

During 2017-18, the population of whiteflies did not vary significantly in all the plots before imposing treatments (5.77 to 6.57/ 3 leaves). Spraying of pyriproxifen 10% EW @ 200 *g. a i.*/ha has significantly reduced the whitefly population to an extent of 97.15% (0.22 whiteflies/3 leaves), followed by pyriproxifen @125 *g. a i*/ha (90.05) with 0.77 whiteflies/3leaves. While, the maximum whitefly population was observed in untreated plot with (8.43/3 leaves). From the pooled data it is observed that, the maximum reduction in population of whiteflies is in spraying of pyriproxifen @200*g a.i.*/ha (95.28%), followed by pyriproxifen @125*g a.i.*/ha (90.34%) during 2016-17 and 2017-18, respectively.

During the first year the population of aphids varied between 74.60 to 112.40 per three leaves in pre-treated plots. Spraying of pyriproxyfen 10% EW @ 200 g *ai*/ha has recorded significantly higher reduction of aphid population (84.23%), followed by pyriproxyfen 10% EW 125 *g ai*/ha (80.75%). While, in other treatments the reduction of aphids population is below 65.89 per cent.

In 2017-18, the population of aphids did not differ among the treatments including untreated control before imposing the treatment. Spraying of Pyriproxyfen 10% EW @ 200 *g.a.i*/ha has recorded the lowest number of aphids (2.50/3 leaves), followed by Pyriproxyfen 10% EW @ 125 g.a.i/ha (5.52/3 leaves). These two dosgas are found to reduce the aphid population to an extent of 90.0%. However, all the treatments including standard checks were significantly superior to untreated control in reducing the aphid population (Table-2).

Population of thrips and leafhoppers

The thrips population varied between 33.60 to 39.40 thrips/3 leaves in the pre- treated plots during 2016-17. Foliar application of Pyriproxyfen 10% EW (@ 200 *g ai*/ha) has reduced the thrips population by 98.20 per cent at 14 days after second spraying and it was found to be on par with Pyriproxyfen 10% EW @ 125 g *ai*/ha (97.24%). While in the other treatments it varied between (90.48% to 92.86%) and found on par with each other. But all the treatments were superior in reducing the aphid population compared to the untreated control (Table-3).

Similarly during 2017-18, the population of thrips did not differ among the treatments including untreated control before imposing the treatment, which ranged between 23.45 to 25.40 per three leaves. Spraying of pyriproxyfen 10% EW @ 200 g.a.i/ha has recorded significantly lowest population of thrips (0.26 thrips/3 leaves), followed pyriproxyfen 10% EW 125 g.a.i/ha (1.20 thrips/3leaves) and the highest number of thrips were observed in untreated plot. The mean data of two years also proved that spraying of Pyriproxyfen 10% EW @ 200 g.a.i/ha and Pyriproxyfen 10% EW @ 125 g.a.i/ha has reduced the thrips population by 98.78 and 97.0 per cent, respectively during 2016-17 and 2017-18.

The population of leafhoppers varied from 2.93-3.47/3 leaves before imposition of treatments. Application of pyriproxifen 10% EW @200 *g a.i.*/ha has recorded significantly lower leaf hoppers (0.07/ 3 leavesz) and rest of the treatments were at par with each other but differed significantly with untreated control (6.63 leafhoppers/3 leaves).

During 2017-18, pre treatment count of leafhoppers was homogenous and ranged between 4.32 and 5.28/3 leaves. After 14 days of second spray all the treatments significantly

reduced the leafhoppers population over untreated control. The lowest population was noticed in pyriproxifen 10% EW @200 g a.i. /ha (0.11/ 3 leaves) and found to be at par with pyriproxifen 10% EW 125 *g.a.i*/ha. The mean data of two years also justifies that the reduction in leafhoppers population was maximum with spraying of pyriproxifen 10% EW @200 *g a.i.*/ha (94.40%) and pyriproxifen10% EW @125 *g a.i.*/ha (89.91%).

Natural enemies

During both the seasons, comparatively higher population of coccinellids (adults and grubs) was observed at the end of last spray in untreated control, which was at par with all the doses of pyriproxifen 10% EW after the imposition of treatments and remained same throughout, indicating its biosafety to natural enemies (Table-4).

Yield

During both years under the study spraying of pyriproxyfen 10% EW (@ 200 *g ai*/ha) has recorded significantly higher seed cotton yield (21.58 and 17.28 q/ha), followed by Pyriproxyfen 10% EW @ 125 g *ai*/ha (20.71and 16.68 q/ha). While the rest of the treatments were on par with each other and superior over untreated control with respect to seed cotton yield (Table-4). Thus from the study it can be concluded that application of Pyriproxifen has found to be effective in management of sucking pests of cotton with maximum reduction in the pest population and increased seed cotton yield. These results are in agreement with several earlier works. Qureshi *et al.,* 2009 [8], observed the effect of pyriproxifen against aphids whitefly and a number of sap sucking pests. These results are supported by Eliahu *et al*., (2007) [2] and Ghanim and Kontsedalov (2007) [3] who reported the effectiveness of pyriproxifen against whitefly. Sanjeev Kumar and Vichiter Singh (2016) [10] also observed maximum reduction in whiteflies and thrips population with Pyriproxyfen 10 EC @ 1000 ml/ha.

Table 2: Population of whiteflies and aphids in cotton as influenced by different treatments

Treatment Details	Dose (g.*ai*/ha)	Whiteflies							Aphids						
		2016-17			2017-18			Mean% reduction	2016-17			2017-18			Mean% reduction
		Pre treatment Whiteflies /3 leaves	14 days after 2 nd Spray Whiteflies /3 leaves	% reduction	Pre treatment Whiteflies /3 leaves	14 days after 2 nd spray Whiteflies /3 leaves	% reduction		Pre treatment Aphids /3 leaves	14 days after 2 nd spray Aphids /3 leaves	% reduction	Pre treatment Aphids /3 leaves	14 days after 2 nd spray Aphids /3 leaves	% reduction	
Pyriproxyfen 10% EW	75	6.47 (2.64)	1.53 (1.43)	74.99	6.14 (2.58)	2.43 (1.70)	71.0	73.00	87.93 (9.40)	31.83 (5.69)	53.56	45.37 (6.76)	11.53 (3.46)	79.25	66.41
Pyriproxyfen 10% EW	100	6.53 (2.65)	1.07 (1.25)	79.90	6.18 (2.58)	1.80 (1.51)	78.25	79.07	84.20 (9.20)	20.83 (4.62)	64.41	47.43 (6.92)	9.50 (3.15)	83.40	73.91
Pyriproxyfen 10% EW	125	7.67 (2.86)	0.50 (1.00)	90.64	5.91 (2.53)	0.77 (1.12)	90.05	90.34	74.60 (8.67)	8.33 (2.97)	80.75	45.33 (6.77)	5.52 (2.43)	90.04	85.40
Pyriproxyfen 10% EC	100	7.53 (2.83)	1.77 (1.51)	67.51	6.22 (2.59)	2.50 (1.73)	70.00	68.75	78.33 (8.88)	17.67 (4.26)	65.89	48.88 (7.02)	8.25 (2.94)	85.89	75.89
Buprofezin 25% SC	250	9.00 (3.08)	1.23 (1.32)	78.50	6.57 (2.65)	2.34 (1.67)	73.75	76.12	110.20 (10.52)	27.33 (5.28)	63.05	46.70 (6.86)	8.20 (2.95)	85.89	74.47
Pyriproxyfen 10% EW	200	8.20 (2.95)	0.33 (0.91)	93.42	5.77 (2.49)	0.22 (0.85)	97.15	95.28	86.93 (9.35)	7.18 (2.77)	84.23	47.38 (6.91)	2.50 (1.72)	95.85	90.04
Untreated control	-	7.53 (2.83)	15.00 (3.94)		6.40 (2.62)	8.43 (2.97)			112.40 (10.63)	135.00 (11.64)		48.77 (7.01)	58.15 (7.65)		
S.Em+		0.07	0.07		0.11	0.14			0.32	0.20		0.24	0.20		
CD @ 0.5%		0.20	0.22		NS	0.42			0.99	0.62		NS	0.63		
CV		4.04	7.58		7.21	14.47			5.87	6.53		6.12	10.15		

Table 3: Population of thrips and leafhoppers in cotton as influenced by different treatments

Treatment Details	Dose (g.*ai*/ha)	Thrips							Leafhoppers						
		2016-17			2017-18			Mean% reduction	2016-17			2017-18			Mean% reduction
		Pre treatment thrips /3 leaves	14 days after 2 nd spray Thrips /3 leaves	% reduction	Pre treatment thrips /3 leaves	14 days after 2 nd spray thrips/ 3 leaves	% reduction		Pre treatment Leafhoppers /3 leaves	14 days after 2 nd spray Leafhoppers /3 leaves	% reduction	Pre treatment Leafhoppers /3 leaves	14 days after 2 nd spray Leafhoppers /3 leaves	% reduction	
Pyriproxyfen 10% EW	75	39.40 (6.32)	1.33 (1.26)	92.86	25.37 (5.08)	4.90 (2.30)	87.65	90.26	3.13 (1.91)	0.29 (0.89)^{b}	78.48	4.50 (2.23)	1.11 (1.27)	86.32	82.40
Pyriproxyfen 10% EW	100	39.27 (6.31)	1.17 (1.19)	92.31	24.46 (4.98)	3.01 (1.87)	92.20	92.26	2.93 (1.85)	0.18 (0.83)^{b}	81.48	5.25 (2.39)	0.55 (1.02)	94.30	87.89
Pyriproxyfen 10% EW	125	35.80 (6.02)	0.33 (0.76)	97.24	23.45 (4.89)	1.20 (1.29)	96.75	97.00	3.47 (1.99)	0.18 (0.83)^{b}	83.70	4.82 (2.30)	0.33 (0.91)	96.12	89.91
Pyriproxyfen 10% EC	100	34.67 (5.93)	1.83 (1.44)	90.48	25.40 (5.08)	4.20 (2.14)	89.60	90.04	3.13 (1.91)	0.42 (0.96)^{b}	61.97	4.45 (2.22)	0.98 (1.21)	87.46	74.72
Buprofezin 25% SC	250	33.87 (5.86)	1.33 (1.26)	91.46	25.16 (5.05)	4.05 (2.13)	89.60	90.53	3.27 (1.94)	0.22 (0.85)^{b}	80.08	4.78 (2.30)	0.66 (1.07)	92.02	86.05
Pyriproxyfen 10% EW	200	37.40 (6.16)	0.20 (0.67)	98.20	25.33 (5.05)	0.26 (0.87)	99.35	98.78	3.33 (1.96)	0.07 (0.76)^{a}	89.94	5.28 (2.40)	0.11 (0.78)	98.86	94.40
Untreated control	-	33.60 (5.84)	60.33 (7.78)		25.33 (5.06)	38.95 (6.27)			3.40 (1.97)	6.63 (2.67)^{c}		4.32 (2.19)	7.50 (2.81)		
S.Em+		0.13	0.16		0.26	0.17			0.05	0.06		0.09	0.11		
CD @ 0.5%		0.41	0.48		NS	0.53			0.14	0.17		NS	0.33		
CV		3.82	12.56		8.87	12.28			4.06	8.77		7.18	14.11		

Table 4: Population of natural enemies and seed cotton yield as influenced by different treatments

Treatment Details	Dose (g.*ai*/ha)	Coccinellids/plant			Yield (q/ha)		
		2016-17	2017-18	Mean	2016-17	2017-18	Mean
Pyriproxyfen 10% EW	75	1.32 (1.35)	0.92 (1.19)	1.12	18.04 (4.31)	14.00 (3.81)	16.02
Pyriproxyfen 10% EW	100	1.24 (1.32)	0.91 (1.18)	1.07	18.51 (4.36)	15.90 4.05)	17.205
Pyriproxyfen 10% EW	125	1.23 (1.32)	0.87 (1.17)	1.05	20.71 (4.61)	16.68 (4.14)	18.695
Pyriproxyfen 10% EC	100	1.04 (1.24)	0.87 (1.16)	1.91	19.84 (4.51)	14.50 (3.87)	17.17
Buprofezin 25% SC	250	1.14 (1.28)	0.94 (1.19)	1.04	20.54 (4.59)	14.30 (3.85)	17.42
Pyriproxyfen 10% EW	200	1.12 (1.27)	0.80 (1.13)	0.96	21.58 (4.70)	17.28 (4.22)	19.43
Untreated control	-	1.58 (1.43)	0.95 (1.20)	1.26	15.21 (3.96)	10.25 (3.28)	12.73
S.Em+		0.07	0.08		0.02	0.18	
CD @ 0.5%		0.23	0.25		0.48	0.54	
CV		9.87	12.13		10.54	7.85	

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