

Original Research Article

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Alternation of Insecticidal Sprays for the Management of Thrips (*Thrips tabaci* Lindeman) and Whitefly (*Bemisia tabaci* Gennadius) Pest of Bt Cotton in Malwa Region of Madhya Pradesh

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ABSTRACT

The experiment was carried out during kharif 2014 at College of Agriculture, Indore under All India Coordinated Cotton Improvement Project in Randomized Block Design (RBD) with eight treatments and three replications on Bt cotton hybrid NCS 927, sown on 27th July with 0.6x0.6 m spacing. The recommended agronomical practices were adopted properly. Each treatment was prepared for alternate use of two insecticides during six sprays. The spraying was done at 10 days interval with 500 litre water per hectare, sprayed by knapsack sprayer fitted with a duromist nozzle. These treatments were marked as T₁. Imidacloprid (70%WG) @ 24.5 gai/ha & Oxydemeton methyl (25%EC) @ 250 gai/ha, T₂. Thiacloprid (21.7%SC) @ 30 gai/ha & Dimethoate (30%EC) @ 250 gai/ha, T₃. Imidacloprid (17.8%SL) @ 25 gai/ha & Acephate (75%SP) @ 250 gai/ha, T₄. Imidacloprid (30.5%SC) @ 26.25 gai/ha & Thiamethoxam (25%WG) @ 37.5 gai/ha, T₅. Spiromesifen (22.9%SC) @ 144 gai/ha & Deltamethrin (2.8%EC) @ 15 gai/ha, T₆. Fipronil (5%SC) @ 100 gai/ha & Lambda cyhalothrin (4.9%EC) @ 15 gai/ha, T₇. Acetamiprid (20%SP) @ 30 gai/ha & Difenthiuran (50%WP) @ 300 gai/ha and T₈. Untreated check. Except third spray, in all the sprays T₅ reduced maximum thrips population and found at par with T₆. The highest population reduction was also noted in T₅ (77.78%) followed by T₆- (76.94%). The population of whitefly was lowest after each spray in T₂- and showed no significant difference with T₃ except in 6th spray. The similar trend was observed in population reduction also in T₂ (76.69%) and T₃ (72.20%).

Keywords

Alternation;
Efficacy;
Insecticides; Bt
cotton; Thrips;
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Introduction

Cotton (*Gossypium* sp.) is an important Kharif cash and fibre crop of India known as the “white gold”, grown in almost all parts of the country. Nimar and Malwa Plateau is the major Bt cotton producing region of Madhya Pradesh. Among the sucking insect pests

thrips (*Scirtothrips dorsalis* Hood) and whitefly (*Bemisia tabaci* Gennadius) attack at the early stage of the crop. Whitefly is considered as a most important pest of cotton (Aheer *et al.*, 1999) not only damage the host plant but also cause the spread of disease cotton leaf curl among plants (Gupta *et al.*, 1997). Recently, whitefly menace has been

reported from different parts of cotton fields in Punjab that cripples the growth of cotton plant and this has resulted in reduction of Bt cotton yield. Transgenic cultivars were more susceptible to thrips infestation as compared to conventional genotypes (Saif-ur-Rehman *et al.*, 2013).

The continuous cultivation of Bt cotton increased the activities of sucking pests. In present scenario a numbers of sprays of various insecticides are required to manage these insect pests. The continuous and repeated application of various insecticides has created many fold resistance against insecticides (Singh and Jaglan, 2005 and Sayyed *et al.*, 2011). To avoid the resistance against insecticides present study was planned to assess the efficacy of insecticides use in alternation in each spray.

Sucking pests viz., aphids (*Aphis gossypii* Glover), leaf hopper (*Amrasca biguttula biguttula* Ishida), whiteflies (*Bemisia tabaci* Gennadius) and thrips, (*Thrips tabaci* Lindeman) are deleterious to the cotton crop growth and development (Vennila *et al.*, 2000). The estimated loss due to sucking pest's complex was up to 21.20 per cent (Dhawan *et al.*, 1988). Sucking pests viz., aphids (*Aphis gossypii* Glover), leaf hopper (*Amrasca biguttula biguttula* Ishida), whiteflies (*Bemisia tabaci* Gennadius) and thrips, (*Thrips tabaci* Lindeman) are deleterious to the cotton crop growth and development (Vennila *et al.*, 2000). The estimated loss due to sucking pest's complex was up to 21.20 per cent (Dhawan *et al.*,

1988). Sucking pests viz., aphids (*Aphis gossypii* Glover), leaf hopper (*Amrasca biguttula biguttula* Ishida), whiteflies (*Bemisia tabaci* Gennadius) and thrips (*Thrips tabaci* Lindeman) are deleterious to the cotton crop growth and development (Vennila *et al.*, 2000). The estimated loss due to sucking pest's complex was up to 21.20 per cent (Dhawan *et al.*, 1988).

Materials and Methods

The experiment was conducted during kharif 2014 at College of Agriculture, Indore under All India Coordinated Cotton Improvement Project in Randomized Block Design (RBD) with eight treatments including untreated check and three replications. The Bt cotton hybrid NCS 927 was sown on 27th July with the spacing of 0.6x0.6 m. All the recommended agronomical practices were adopted for the proper growth of crop. Application of continuous six sprays was planned with two insecticides in each treatment for alternate use at 10 days interval with 500 litre water per hectare, sprayed by knapsack sprayer fitted with a duomist nozzle. These treatments were marked as T₁. Imidacloprid (70%WG) @ 24.5 gai/ha & Oxydemeton methyl (25%EC) @ 250 gai/ha, T₂. Thiachlorprid (21.7%SC) @ 30 gai/ha & Dimethoate (30%EC) @ 250 gai/ha, T₃. Imidacloprid (17.8%SL) @ 25 gai/ha & Acephate (75%SP) @ 250 gai/ha, T₄. Imidacloprid (30.5%SC) @ 26.25 gai/ha & Thiamethoxam (25%WG) @ 37.5 gai/ha, T₅. Spiromesifen (22.9%SC) @ 144 gai/ha & Deltamethrin (2.8%EC) @ 15 gai/ha, T₆. Fipronil (5%SC) @ 100 gai/ha & Lambdacyhalothrin (4.9%EC) @ 15 gai/ha, T₇. Acetamiprid (20%SP) @ 30 gai/ha & Difenthiuran (50%WP) @ 300 gai/ha and T₈. Untreated check. Observations were recorded at pre spraying and post spraying after 10 days in each spray on five randomly selected tagged plants per plot. Thrips and whitefly

population were counted on 5 tagged plants per plot with 2 lower, 2 middle and 1 upper leaves per plant and averaged as pest population/5 leaves. The data was averaged and analyzed statistically and presented in table. Finally the overall population reduction was calculated based on pretreatment observation and observation of last spray.

Results and Discussion

Thrips

The findings revealed that initially thrips population (Table 1 and Fig. 1) ranged from 31.62 to 34.57 per 5 leaves. After first and second spray the highest efficacy with least insect population was noted in T5- Spiromesifen (22.9%SC) @ 144 gai/ha & Deltamethrin (2.8%EC) @ 15 gai/ha (18.64 and 17.32) and found at par with T6- Fipronil (5%SC) @ 100 gai/ha & Lambdacyhalothrin (4.9%EC) @ 15 gai/ha (19.74 and 117.44) in both sprays and in T4- Imidacloprid (30.5%SC) @ 26.25 gai/ha & Thiamethoxam (25%WG) @ 37.5 gai/ha (21.13) in first spray. In third spray T6 (13.67) ranked first but found at par with T5 (15.47). In fourth (11.27), fifth (8.63) and sixth spray (7.68) treatment T5 exhibited no significant difference with T6 as 12.15, 8.74 and 7.89 thrips population, respectively. Finally based on overall population reduction treatment T5 showed highest population reduction (77.78%) followed by T6 (76.94%), T2- Thiachlorprid (21.7%SC) @ 30 gai/ha & Dimethoate (30%EC) @ 250 gai/ha (71.63%), T1- Imidacloprid (70%WG) @ 24.5 gai/ha & Oxydmeton methyl (25%EC) @ 250 gai/ha (70.63%), T3- Imidacloprid (17.8%SL) @ 25 gai/ha & Acephate (75%SP) @ 250 gai/ha - (67.32%) (67.32%), T7- Acetamiprid (20%SP) @ 30 gai/ha & Difenthiuran (50%WP) @ 300 gai/ha (64.81%) and T4- Imidacloprid (30.5%SC) @ 26.25 gai/ha & Thiamethoxam (25%WG) @ 37.5 gai/ha

(64.11%). Varghese and Mathew (2013) reported that spiromesifen at 20 g a.i. ha⁻¹ was found to be effective against chilli thrips reduced the leaf curling symptom and safest insecticide against natural enemies. Bretschneider *et al.*, (2003) stated that spiromesifen is effective to suppress some species of thrips such as *Scirtothrips dorsalis*, *Thrips palmi* and *Thrips tabaci* in vegetables and found active against juvenile stages of insect. Stanislav *et al.*, (2007) found the efficacy of deltamethrin against *Thrips tabaci* on white cabbage by one spraying which was sufficient to reduce leaf damage below the higher (more tolerant) threshold, but three sprayings were needed to reduce leaf damage below the lower (more stringent) threshold.

Further, Saner *et al.*, (2013) expressed that thrip population was promisingly suppressed by fipronil 80 WG, followed by fipronil 5 SC in cotton. Similarly Kumar *et al.*, (2013) found the bio-efficacy of fipronil against thrips, *Thrips tabaci* on cotton. Dongarjal, *et al.*, (2018) assessed that fipronil was statistically superior over other treatments against pomegranate thrips. Kadam and Dethé (2002) and Jadhav *et al.*, (2004) reported the highest efficacy of fipronil 5% SC @ 40 to 60 g a.i./ha and 100 g a.i./ha against chilli thrips. Singh *et al.*, (2013) observed that fipronil 5% SC and lambda-cyhalothrin 4.9% SC were the most effective insecticide in reducing the thrips population in onion. Further, Anonymous, (2006) with the application of fipronil @ 1.5 ml/l and Pokharkar *et al.*, (2011) with 0.075 per cent spray of fipronil, found significantly superior effect in suppressing onion thrips population. Kadam (2012) reported the better efficacy of lambda - cyhalothrin against pomegranate thrips incidence with highest yield. The findings of these researchers against thrips in cotton and other crops are in close conformity with the present investigation.

Whitefly

The present study exhibited pretreatment population of whitefly (Table 2 and Fig. 2) in the range of 33.06 to 35.12 per 5 leaves. After

first spray highest population reduction was noted in each treatment but in rest of the sprays population decreased slightly with little margin.

Table.1 Efficacy of insecticides against thrips in *Bt* cotton

Treatments	Dosage g.a.i./ha	Pre-treatment	Thrips population /5 leaves						Overall Population reduction (%)
			10 Days After Spray						
			1 st spray	2 nd spray	3 rd spray	4 th spray	5 th spray	6 th spray	
T1	24.5 and 250	32.83	23.12	18.38	16.69	14.73	11.29	9.64	70.63
		(5.73)	(4.86)	(4.35)	(4.15)	(3.90)	(3.43)	(3.18)	
T2	30.0 and 250	31.62	22.17	19.67	17.67	13.29	10.67	8.97	71.63
		(5.67)	(4.76)	(4.49)	(4.26)	(3.71)	(3.34)	(3.08)	
T3	25.0 and 250	31.73	21.91	19.32	16.53	12.98	11.36	10.37	67.32
		(5.68)	(4.73)	(4.45)	(4.13)	(3.67)	(3.44)	(3.30)	
T4	26.25 and 37.5	33.24	21.13	19.79	18.73	15.69	13.47	11.93	64.11
		(5.81)	(4.65)	(4.50)	(4.39)	(4.02)	(3.74)	(3.53)	
T5	144 and 15.0	34.57	18.64	17.32	15.47	11.27	8.63	7.68	77.78
		(5.92)	(4.37)	(4.22)	(4.00)	(3.43)	(3.02)	(2.86)	
T6	100 and 15.0	34.22	19.74	17.44	13.67	12.15	8.74	7.89	76.94
		(5.85)	(4.50)	(4.24)	(3.76)	(3.56)	(3.04)	(2.90)	
T7	30.0 and 300	33.40	22.62	21.69	19.28	16.74	13.17	11.78	64.73
		(5.78)	(4.81)	(4.71)	(4.45)	(4.15)	(3.70)	(3.50)	
T8	---	33.48	35.09	38.6	39.27	47.43	47.23	49.12	-
		(5.78)	(5.97)	(6.25)	(6.31)	(6.92)	(6.91)	(7.04)	
S Em±		-	0.10	0.06	0.08	0.07	0.08	0.08	
CD at 5 %		NS	0.30	0.17	0.24	0.21	0.24	0.25	
CV %		-	7.51	5.04	6.45	5.64	7.15	7.01	

The values in parentheses are square root transformed values.

DAS = Days after spray.

Treatments:

T₁. Imidacloprid (70% WG) @ 24.5 gai/ha & Oxydemeton methyl (25% EC) @ 250 gai/ha,

T₂. Thiacloprid (21.7% SC) @ 30 gai/ha & Dimethoate (30% EC) @ 250 gai/ha,

T₃. Imidacloprid (17.8% SL) @ 25 gai/ha & Acephate (75% SP) @ 250 gai/ha,

T₄. Imidacloprid (30.5% SC) @ 26.25 gai/ha & Thiamethoxam (25% WG) @ 37.5 gai/ha,

T₅. Spiromesifen (22.9% SC) @ 144 gai/ha & Deltamethrin (2.8% EC) @ 15 gai/ha,

T₆. Fipronil (5% SC) @ 100 gai/ha & Lambda cyhalothrin (4.9% EC) @ 15 gai/ha,

T₇. Acetamiprid (20% SP) @ 30 gai/ha & Difenthiuran (50% WP) @ 300 gai/ha and

T₈. Untreated check.

Table.2 Efficacy of insecticide against whitefly in *Bt* cotton

Treatments	Dosage g.a.i./ha	Pre-treatment	Whitefly population /5 leaves						Overall Population reduction (%)
			10 Days After Spray						
			1 st spray	2 nd spray	3 rd spray	4 th spray	5 th spray	6 th spray	
T1	24.5 and 250	35.12	19.72	15.82	14.81	13.45	12.31	11.62	66.91
		(5.97)	(4.50)	(4.04)	(3.91)	(3.73)	(3.58)	(3.48)	
T2	30.0 and 250	33.21	16.95	15.14	12.13	11.44	9.58	7.74	76.69
		(5.81)	(4.18)	(3.95)	(3.55)	(3.46)	(3.17)	(2.87)	
T3	25.0 and 250	33.06	17.52	15.78	13.08	12.16	11.24	9.19	72.20
		(5.75)	(4.24)	(4.03)	(3.69)	(3.56)	(3.43)	(3.11)	
T4	26.25 and 37.5	35.32	18.12	16.72	16.96	15.08	12.96	10.96	68.97
		(5.98)	(4.32)	(4.27)	(4.18)	(3.95)	(3.67)	(3.39)	
T5	144 and 15.0	35.18	20.15	16.78	14.08	13.23	11.74	9.82	72.08
		(5.97)	(4.54)	(4.16)	(3.82)	(3.71)	(3.50)	(3.21)	
T6	100 and 15.0	34.45	19.12	18.21	16.86	13.44	11.35	10.67	69.02
		(5.87)	(4.43)	(4.33)	(4.17)	(3.73)	(3.44)	(3.34)	
T7	30.0 and 300	33.52	21.18	19.91	18.91	16.09	13.92	11.33	66.19
		(5.79)	(4.66)	(4.52)	(4.41)	(4.07)	(3.80)	(3.44)	
T8	---	35.04	39.45	43.46	44.42	45.58	49.39	54.2	-
		(5.92)	(6.32)	(6.63)	(6.70)	(6.79)	(7.08)	(7.40)	
S Em±		-	0.06	0.09	0.09	0.08	0.09	0.06	
CD at 5%		NS	0.19	0.26	0.28	0.23	0.26	0.18	
CV %		-	5.04	7.14	7.19	6.53	7.62	5.39	

The values in parentheses are square root transformed values.

DAS = Days after spray.

Treatments detail:

- T₁. Imidacloprid (70% WG) @ 24.5 gai/ha & Oxydemeton methyl (25% EC) @ 250 gai/ha,
- T₂. Thiacloprid (21.7% SC) @ 30 gai/ha & Dimethoate (30% EC) @ 250 gai/ha,
- T₃. Imidacloprid (17.8% SL) @ 25 gai/ha & Acephate (75% SP) @ 250 gai/ha,
- T₄. Imidacloprid (30.5% SC) @ 26.25 gai/ha & Thiamethoxam (25% WG) @ 37.5 gai/ha,
- T₅. Spiromesifen (22.9% SC) @ 144 gai/ha & Deltamethrin (2.8% EC) @ 15 gai/ha,
- T₆. Fipronil (5% SC) @ 100 gai/ha & Lambda cyhalothrin (4.9% EC) @ 15 gai/ha,
- T₇. Acetamiprid (20% SP) @ 30 gai/ha & Difenthiuran (50% WP) @ 300 gai/ha and
- T₈. Untreated check.

Fig.1 Efficacy of insecticides against thrips in Bt cotton

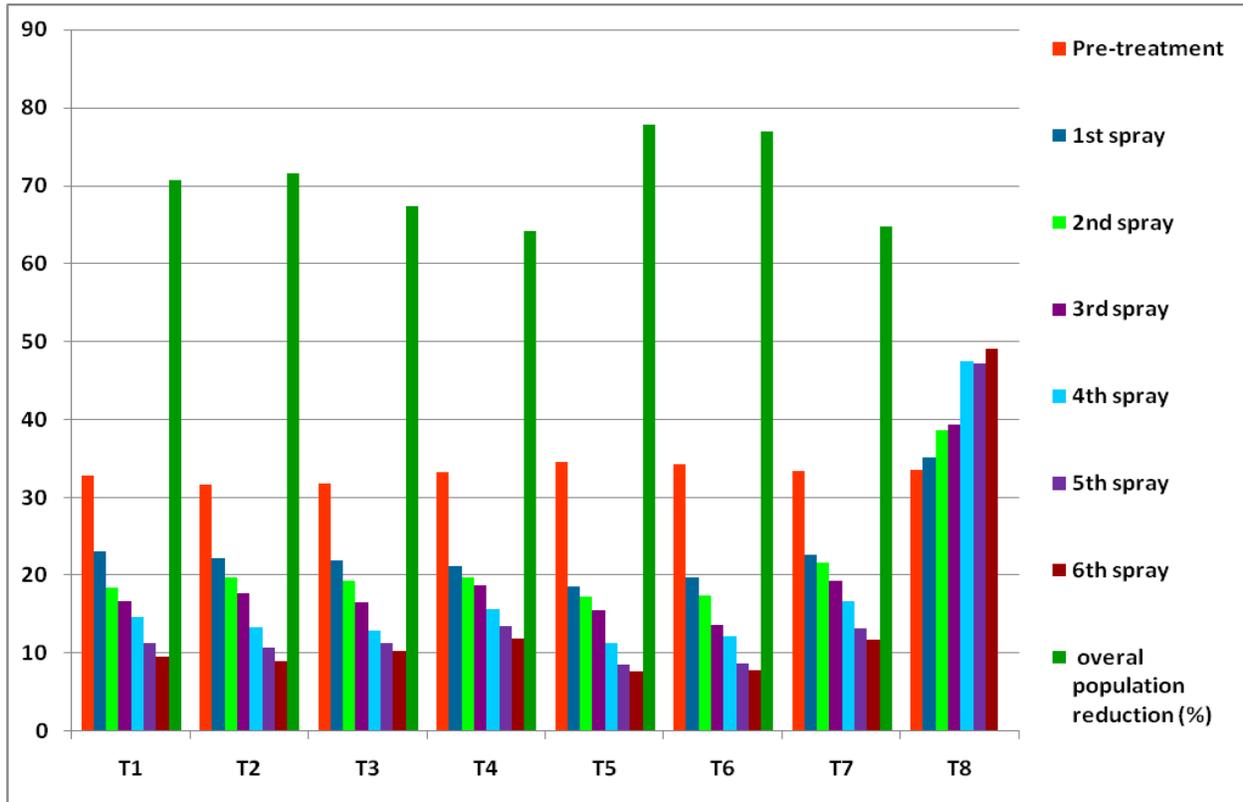
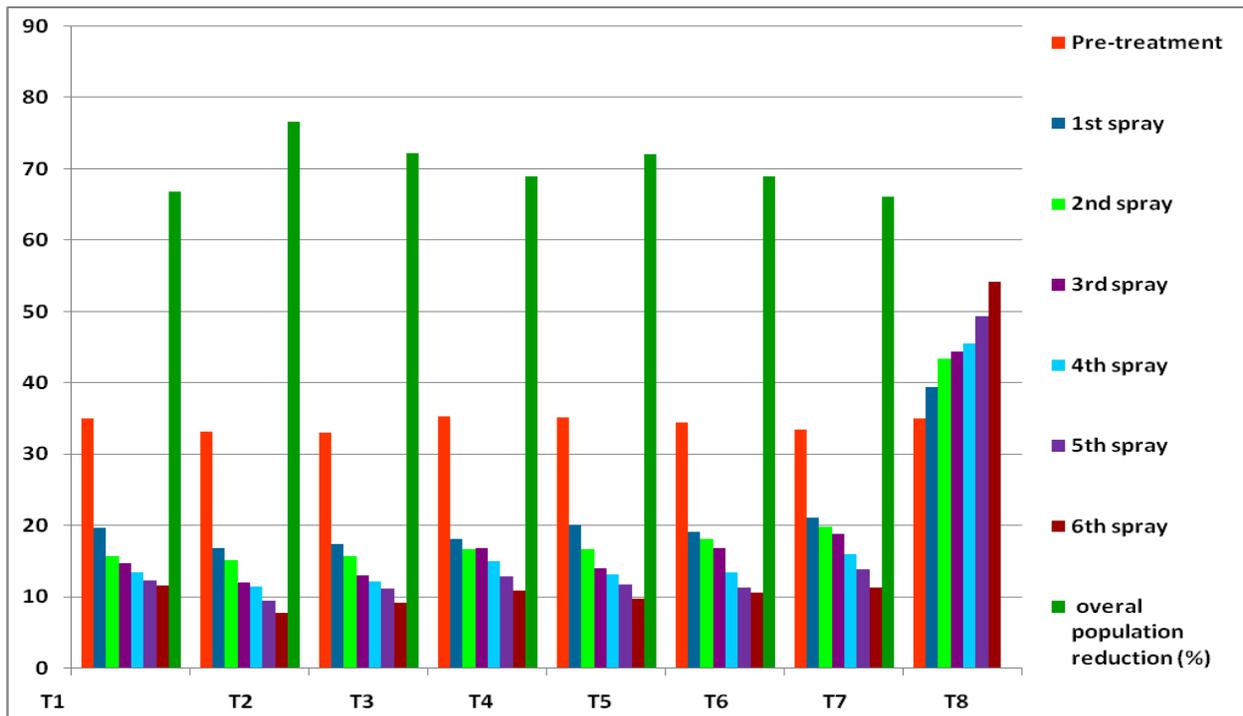


Fig.2 Efficacy of insecticide against whitefly in Bt cotton



In each spray the lowest pest population was noted in T2- Thiacloprid (21.7%SC) @ 30 gai/ha & Dimethoate (30%EC) @ 250 gai/ha as 16.95, 15.14, 12.13, 11.44, 9.54 and 7.74 per 5 leaves, respectively, showed highest efficacy. Treatment T3- Imidacloprid (17.8%SL) @ 25 gai/ha & Acephate (75%SP) @ 250 gai/ha exhibited no significant difference with T2 except in 6th spray.

The overall population reduction was also recorded highest in T2 (76.69%) followed by T3 (72.20%), T5- Spiromesifen (22.9%SC) @ 144 gai/ha & Deltamethrin (2.8%EC) @ 15 gai/ha (69.02%), T6- Fipronil (5%SC) @ 100 gai/ha & Lambdacyhalothrin (4.9%EC) @ 15 gai/ha (76.20%), (69.02%), T4- Imidacloprid (30.5%SC) @ 26.25 gai/ha & Thiamethoxam (25%WG) @ 37.5 gai/ha (68.97%), T1- Imidacloprid (70%WG) @ 24.5 gai/ha & Oxydemeton methyl (25%EC) @ 250 gai/ha (66.91%) and T7- Acetamiprid (20%SP) @ 30 gai/ha & Difenthiuran (50%WP) @ 300 gai/ha (66.19%). The higher efficacy of thiacloprid and imidacloprid compared to conventional insecticides against cotton whitefly was reported by Ahmad *et al.*, (2014). Shivanna *et al.*, (2011) observed that dimethoate alone was most effective against cotton whitefly at three and seven days after spraying. Kumar *et al.*, (2017) revealed that imidacloprid 17.8 SL @ 100 ml/ha, was effective insecticide in reducing the population of whitefly, *Bemisia tabaci* in brinjal with higher cost benefit ratio (1:12.90). Amjad *et al.*, (2009) reported that Confidor (imidacloprid) was the most effective insecticides for whitefly, up to seven days in cotton. Babar *et al.*, (2013) showed mortality of cotton whitefly (76%) 72 hours after spray by Imidacloprid 200SL. Kalyan *et al.*, (2012) stated that imidacloprid 70 WG @ 50 a.i./ha and acephate 75 SP @ 500 a.i./ha effectively controlled the population of whitefly and gave significantly higher seed cotton yield over to untreated check and

standard check. Further, Sahito *et al.*, (2015) found the efficacy of acephate with the reduction of whitefly population up to 60 per cent. The results of these researchers are in the line of agreement and supported the present findings.

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