Bio-efficacy of new insecticides against sucking pests of chilli

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Abstract

The experiment was conducted at Experimental Research Farm, Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, during the *Kharif* season of the year 2016-17 to study Bio-efficacy of New Insecticides Against Sucking Pests of Chilli. The experiment was laid out in a randomized block design with 9 treatments replicated three times. The treatments comprised of fipronil 5 SC @ 1000 ml/ha, hexythiaziox 5.45EC @ 500 ml/ha, spinosad 45 SC @ 187.5 ml/ha, acetamiprid 20 SP @ 250 g/ha, fenpyroximate 5 EC @ 600 ml/ha, emamectin benzoate 5 SG @ 250 g/ha, spiromesifen 22.9 SC @ 250 ml/ha, diafenthiuron 50 WP @ 625 g/ha and untreated control. The observations on the effect of these insecticidal treatments on thrips, mites and white fly were recorded. The observations on population dynamics of thrips, mites, white fly and fruit borer also recorded. The insecticides application at 25 & 45 days after transplanting showed that all the treatments were found effective against controlling pest complex of chilli as compared to untreated control. The treatment with spinosad 45 SC @ 187.5 ml/ha was found most effective against thrips, *Scirtothrips dorsalis* Hood followed by fipronil 5 SC @ 1000 ml/ha. Whereas the treatment with spinosad 45 SC @ 187.5 ml/ha.was effective was followed by emamectin benzoate 5 SG @ 250 g/ha which were found at par with each other and recorded 100 per cent control after second application. The treatment with diafenthiuron 50 WP @ 625 g/ha was recorded superior control of whitefly, *Bemisia tabaci* Genn. Followed by spinosad 45 SC @ 187.5 ml/ha. The treatment with fenpyroximate 5 EC @ 600 ml/ha, recorded superior control of mites followed by spiromesifen 22.9 SC @ 250 ml/ha and hexythiaziox 5.45 EC @ 500 ml/ha which were found at par with each other.The treatment with spinosad 45 SC @ 187.5 ml/ha recorded highest yield of green chilli fruits followed by emamectin benzoate 5 SG @ 250 g/ha. The overall results indicated that the treatment with spinosad 45 SC @ 187.5 ml/ha was found superior in controlling chilli thrips whereas the treatment with diafenthiuron 50 WP @ 625 g/ha was found superior in controlling chilli whitefly, Fenpyroximate 5 EC @ 600 ml/ha was found superior in controlling chilli mites.

Keywords: bio-efficacy insecticides, scirtothrips dorsalis, bemisia tabaci, mites

Introduction

Chilli, Capsicum annum L. is one of the important Solanaceous crops. Capsicum annum is widely cultivated throughout the world, specially in tropical and subtropical regions. Capsicin an active component of chilli is responsible for burning sensation and is used for medicinal purposes having analgesic properties. Capsicin extracts are also used for making pepper spray. Red chillies are a rich source of vitamins and minerals. They contain high amount of vitamin C and B6, and a small amount of beta carotene. Chillies have high amount of iron, potassium and magnesium (Anonymous, 2013) [25]. India is the largest producer of chillies in the world accounting for 13.76 million tonnes of production annually. In India, chilli was grown in an area 774.9 thousand hectare and production 1492.10 thousand tonnes and the productivity was 1.93 tonnes per hectare in 2014-15. (Geetha and Selvarani, 2017) [26]. Among many other reasons responsible for the lower yield, damage done by insect pests holds a major share. A survey conducted in Benin for finding production constraints in chilli, ranked the attack of insect pests on leaves, flowers and fruits as first among all other constraints (Orobiyi *et al*., 2013) [27]. Another survey conducted by Asian Vegetable Research and Development Committee in Asia indicated that the key insect pests of chilli are aphids (Myzus persicae Sulzer, Aphis gossypii, Glover), thrips (Scirtothrips dorsalis Hood) and yellow mite (Polyphagotarsonemus latus Banks) which act as limiting factors in chilli production. Fifty one species of insects and two species of mites belonging to 27 families under 9 orders were recorded on chilli transplanted crop. Further, Gonocephalumdorsogranosum Frm. (Vegetable beetle), Melanotus sp. (wire worms), Odontotermesobesus (termite), Holotrichia serrata (white grub), Helicoverpa armigera (fruit borer), thrips (S. dorsalis and Thrips flavus Schrank) and mites (P. latus and Tetranychusneocaledonicus Andre) were considered as important pests (Reddy and Puttaswamy, 1983) [23]. A similar study conducted in the nursery of chilli crop recorded 35 species of insects belonging to 6 orders and a species each of mite and snail and two species of millipeds and ants, cutworms and crickets recognized as important pests (Reddy and Puttaswamy, 1984) [24]. Evaluation of the efficacy of newer insecticides against insect pests in an important and continuous process. Reddy *et al*. (2007) reported that fipronil

5% SC @ 2ml/lit was found to be the best treatment followed by spinosad 45%SC @ 0.3 and 0.2ml/lit. Kalyan *et al*. (2012) [11] found that spinosad, imidacloprid, acephate and fipronil effectively control the population of jassids and whiteflies and gave significantly higher cotton yield over to untreated check and standard check. Pathipati *et al.* (2012) [28] reported that maximum mortality of mites was observed with fenpyroximate 5 EC at the rate of 500 ml/ha (98.6%) followed by abamectin 1.9EC at the rate of 125 ml a.i./ha (95.66%) and propergite 50EC at the rate of 1000 ml/ha (88.99%). Ghosh *et al*. (2010) [29] stated that spinosad was effective against *H. armigera* on tomato at 73 to 84 gm a.i./ha than quinalphos, lambda cyhalothrin and cypermethrin. The treatment with spinosad 45 SC @ 187.5 g.a.i./ha recorded highest yield of chilli fruits followed by emamectin benzoate 5 SG @ 250 g.a.i./ha.

Materials and Methods

A field experiment was conducted during *Kharif* 20016-2017 to study Bio-efficacy of New Insecticides Against Sucking Pests of Chilli at the farm of Department of Agricultural Entomology, VNMKV, Parbhani. The geographical location of the experimental fields the climate of the region is typically sub-tropical which is characterized by slightly extremes of the temperature in summer. During summer temperature may rise as high as 40-42^{0}C and in winter it may fall as low as 15-30^{0}C. The total rainfall is 800-1000 mm which is mostly received from July-September. Parbhani is situated 408.50 m above the mean sea level. It lies between 19^{0}16´ North Latitude and 76^{0}47´ East Longitude. The mean relative humidity ranges from 30 to 90 per cent. The seeds of chilli variety 'Parbhanichilli' were obtained from Department of Horticulture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. In order to raise the seedlings for transplanting, chilli (var. Parbhanichilli) was sown in nursery before one and half month of transplanting chilli in main field. Crop-Chilli, Variety-Parbhanichilli, Design-Randomised Block Design, Replication- Three, Treatments- Nine**,** Plot size-4.20 × 3.15 m^2Spacing- 60 cm × 45 cm, Date of sowing- 1/07/2016**,** Date of transplanting-14/08/2016**,** Seed rate- 500 gm/ha,Fertilizer dose- 100:50:50 N: P_2O_5: K_2O/ha, Spraying dates-1st spray 10.09.16, 2nd spray 30.09.16 and 3rd spray 19.10.16. The recording of Observations of pest count after insecticidal application Thrips, Whitefly, Mite Observations on the population of thrips, whiteflies & mites were recorded as per the method suggested by (Pathipati *et al.* 2012) [28]. The data was recorded from five tagged plants selected randomly. Two leaves from bottom, two from middle and one from top from each selected plant were used to count the number of thrips, whiteflies and mites population. The observations of thrips, whiteflies and mites recorded before spraying as pre-count and at 1, 3, 7 and 14 days after spray as post count. Observations were recorded after 1stand 2ndsprays and not recorded after 3rd spray because population was below ETL level.

Result and Discussion

Bio-efficacy of new insecticides against different pests of chilli

Bio-efficacy of new insecticides against thrips

Bio-efficacy of new insecticides against thrips after first spray (25 days after transplanting)

Data pertaining to the survival population of thrips on chilli one day before and 1st, 3rd, 7th and 14th days after first spraying is presented in Table 1.

The pre-treatment population of thrips was uniform in all the experimental treatment plots, since the average population of thrips was statistically non-significant. The average pre-treatment population was 3.15 to 3.80 thrips/leaf justifying that there was need to protect the crop from thrips infestation (Table 6).

A day after first spray among the all insecticidal treatments spinosad 45 SC @ 187.5 ml /hawas emerged as significantly superior and showed lowest number of thrips population (2.01 thrips/leaf)followed by fipronil 5 SC @ 1000 ml/ ha (2.92 thrips/leaf) which was found at par with acetamiprid 20 SP @ 250 g/ha and difenthiuron 50 WP @ 625 g/ha (3.36 thrips/leaf), hexythiaziox 5.45 EC @ 500 ml/ha (3.51 thrips/leaf), fenpyroximate 5 EC @ 600 ml/ ha (3.57 thrips/leaf), spiromesifen 22.9 SC @ 250 ml/ha (3.65 thrips/leaf). The least effective treatment recorded was emamectin benzoate 5 SG @ 250 g /ha (3.79 thrips/ leaf) was found effective against thrips over untreated control.

The data recorded at 3 DAS revealed that lowest population of thrips was observed in the plots treated with spinosad 45 SC @ 187.5 ml /ha (1.43 thrips/leaf) and found most effective treatment in reducing the population of thrips followed by fipronil 5 SC @ 1000 ml/ ha (2.57 thrips/leaf) which was found at par with difenthiuron 50 WP @ 625 g/ha (2.65 thrips/leaf), acetamiprid 20 SP @ 250 g/ha (2.77 thrips/leaf) and fenpyroximate 5 EC @ 600 ml/ ha (3.08 thrips/leaf). Highest population of thrips (5.57 thrips/leaf) was observed in the untreated control plot and remaining all the treatments were moderately effective against thrips.

On the 7th day after spray mean population of thrips ranged from (0.40- 2.89 thrips/ leaf). All the insecticidal treatments were found significantly superior over untreated control (5.69 thrips/leaf) in reducing the population of thrips. The treatment of spinosad 45 SC @ 187.5 ml /ha (0.40 thrips/leaf) was found superior as compared to the other treatments in reducing the population of thrips. However treatments fipronil 5 SC @ 1000 ml/ ha (2.12 thrips/leaf), difenthiuron 50 WP @ 625 g/ ha (2.17 thrips/ leaf), fenpyroximate 5 EC @ 600 ml/ ha (2.33 thrips/leaf), acetamiprid 20 SP @ 250 g/ha (2.39 thrips/leaf) were found at par with each other.

As compared to 7th DAS the thrips population increased in all the treatments at 14th DAS. The treatment with spinosad 45 SC

@ 187.5 ml/ha was found most effective in reducing thrips population (1.11 thrips/leaf). Whereas the treatment, fenpyroximate 5 EC @ 600 ml/ ha (2.92 thrips/ leaf) was at par with acetamiprid 20 SP @ 250 g/ha (3.00 thrips/leaf), fipronil 5 SC @ 1000 ml/ ha (3.08 thrips/leaf), difenthiuron 50 WP @ 625 g/ha (3.24 thrips/leaf), hexythiaziox 5.45 EC @ 500 ml/ha (3.40 thrips/leaf), emamectin benzoate 5 SG @ 250 g /ha (3.44 thrips/leaf).

Table 1: Bio-efficacy of new insecticides against thrips after first spray (25 days after transplanting)

Sr. No	Treatments	Doseg or ml/ha	Population of thrips/ leaf				
			Precount	1DAS	3DAS	7DAS	14 DAS
1	Fipronil 5 SC	1000	3.15(1.90)	2.92(1.85)	2.57(1.75)	2.12(1.62)	3.08(1.89)
2	Hexythiaziox 5.45 EC	500	3.52(2.00)	3.51(2.00)	3.49(1.99)	2.89(1.84)	3.40(1.97)
3	Spinosad 45 SC	187.5	3.71(2.05)	2.01(1.57)	1.43(1.38)	0.40(0.93)	1.11(1.27)
4	Acetamiprid20 SP	250	3.53(2.00)	3.36(1.96)	2.77(1.81)	2.39(1.70)	3.00(1.87)
5	Fenpyroximate 5 EC	600	3.66(2.04)	3.57(2.01)	3.08(1.88)	2.33(1.66)	2.92(1.85)
6	Emamectin Benzoate 5 SG	250	3.80(2.07)	3.79(2.07)	3.47(1.99)	2.80(1.80)	3.44(1.98)
7	Spiromesifen 22.9 SC	250	3.76(2.06)	3.65(2.03)	3.25(1.93)	2.88(1.81)	3.77(2.06)
8	Difenthiuron 50WP	625	3.43(1.98)	3.36(1.96)	2.65(1.77)	2.17(1.63)	3.24(1.93)
9	Untreated control	-	3.80(2.07)	4.40(2.21)	5.57(2.46)	5.69(2.49)	6.05(2.56)
SE ±			NS	0.086	0.078	0.120	0.073
CD at 5%			NS	0.260	0.235	0.362	0.218

*NS = Non significant, *DAS = Days after spray, *Figures in parentheses are transformed values $\sqrt{x+0.5}$

Bio-efficacy of new insecticides against thrips after second spray (45 days after transplanting)

The data recorded on thrips infestation after second spray is presented in Table 2.A day before second spray, the thrips population ranged from 1.41 to 6.21 thrips/leaf showing no significant difference among the evaluated treatments.

The observations recorded 1st day after second spray revealed that the insecticidal treatment with spinosad 45 SC @ 187.5 ml/ha recorded lowest population of thrips (0.60 thrips/leaf) was found significantly superior treatment in reducing population of thrips. However the treatments fipronil 5 SC @ 1000 ml/ ha (2.09 thrips/leaf), acetamiprid 20 SP @ 250 g/ha (2.19 thrips/leaf), fenpyroximate 5 EC @ 600 ml/ ha (2.41 thrips/leaf), difenthiuron 50 WP @ 625 g/ ha (2.63 thrips/leaf), hexythiaziox 5.45 EC @ 500 ml/ha (2.83 thrips/leaf) were found at par with each other. Untreated control which recorded maximum thrips population (6.92 thrips/leaf).

The population of thrips after 3rd day of second spray ranged from 0.13-3.09 thrips/ leaf. Maximum population of thrips (7.55 thrips/leaf) was observd in untreated control. Among the treated plots lowest population of thrips (0.13 thrips/leaf) was observed in spinosad 45 SC @ 187.5 ml/ha treated plots and found most effective for control of thrips population followed by fipronil 5 SC @ 1000 ml/ ha (1.81 thrips/leaf) which was found at par with fenpyroximate 5 EC @ 600 ml/ ha (1.91 thrips/leaf), acetamiprid 20 SP @ 250 g/ha (2.08 thrips/leaf). Other treatments showed medium range of effectiveness as compared to spinosad.

After 7th day of second spray there was slight decrease in the population of thrips in all the treated plots except untreated control plot (7.88 thrips/leaf) and insecticidal treatment with spinosad 45 SC @ 187.5 ml/ha (0.00 thrips/ leaf) was found most superior in reducing population of thrips and hundred per cent control was observed, followed by fipronil 5 SC @ 1000 ml/ ha (1.47 thrips/leaf) which was found at par with fenpyroximate 5 EC @ 600 ml/ ha (1.57 thrips/leaf), acetamiprid 20 SP @ 250 g/ha (1.64 thrips/leaf) and difenthiuron 50 WP @ 625 g/ ha (1.77 thrips/leaf).

At 14th days after second spray there was slight increase in the population of thrips in all the treatments and the results indicated that treatment with spinosad 45 SC @ 187.5 ml/ha was found significantly superior in reducing thrips population (0.00 thrips/leaf) followed by fipronil 5 SC @ 1000 ml/ ha (2.00 thrips/leaf) which was found at par with acetamiprid 20 SP @ 250 g/ha (2.15 thrips/leaf), fenpyroximate 5 EC @ 600 ml/ha (2.24 thrips/leaf), difenthiuron50 WP @ 625 g/ha (2.40 thrips/leaf), emamectin benzoate 5 SG @ 250 g /ha (2.77 thrips/leaf) and hexythiaziox 5.45 EC @ 500 ml/ha (2.79 thrips/leaf). Maximum population of thrips (8.11 thrips/leaf) was recorded in the untreated control plot.

Table 2: Bio-efficacy of new insecticides against thrips after second spray (45 days after transplanting)

Sr. No	Treatments	Dose g or ml /ha	Population of thrips/leaf				
			Precount	1DAS	3DAS	7DAS	14 DAS
1	Fipronil 5 SC	1000	3.37(1.97)	2.09(1.61)	1.81(1.51)	1.47(1.40)	2.00(1.58)
2	Hexythiaziox 5.45 EC	500	3.52(2.00)	2.83(1.82)	2.59(1.75)	2.25(1.66)	2.79(1.81)
3	Spinosad 45 SC	187.5	1.41(1.44)	0.60(1.02)	0.13(0.79)	0.00(0.71)	0.00(0.71)
4	Acetamiprid 20 SP	250	3.37(1.97)	2.19(1.64)	2.08(1.61)	1.64(1.45)	2.15(1.61)
5	Fenpyroximate 5 EC	600	3.00(1.87)	2.41(1.77)	1.91(1.55)	1.57(1.43)	2.24(1.65)
6	Emamectin Benzoate 5 SG	250	3.69(2.05)	2.88(1.84)	2.81(1.82)	2.21(1.65)	2.77(1.81)
7	Spiromesifen 22.9 SC	250	4.00(2.12)	3.36(1.96)	3.09(1.89)	2.47(1.72)	3.03(1.87)
8	Difenthiuron 50WP	625	3.39(1.97)	2.63(1.77)	2.53(1.74)	1.77(1.50)	2.40(1.70)
9	Untreated control	-	6.21(2.59)	6.92(2.72)	7.55(2.84)	7.88(2.90)	8.11(2.93)
	SE ±			0.0712	0.061	0.068	0.087
	CD at 5%			0.2134	0.182	0.204	0.260

*NS = Non significant, *DAS = Days after spray, *Figures in parentheses are transformed values $\sqrt{x+0.5}$

Overall bio-efficacy of new insecticides against chilli thrips (*Scirtothrips dorsalis*)

Pooled average in respect of efficacy of newer insecticides against chilli thrips are presented in Table 3. The precount of thrips before initiation of the spray treatments was in the range of 2.56 to 5.00 thrips/leaf. The thrips incidence in all insecticidal treatments was significantly low indicating that all the insecticides were significantly effective at 14 DAS. As compare to untreated control the treatment comprised of spinosad 45 SC @ 187.5 ml /ha was emerged as significantly superior and showed lowest number of thrips population (0.55 thrips/leaf). Followed by fipronil 5 SC @ 1000 ml/ ha (2.54 thrips/leaf) which was found at par with acetamiprid 20 SP @ 250 g/ha (2.57 thrips/leaf), fenpyroximate 5 EC @ 600 ml/ha (2.58 thrips/leaf), difenthiuron 50 WP @ 625 g/ ha (2.82 thrips/leaf), hexythiaziox 5.45 EC @ 500 ml/ha (3.09 thrips/leaf), emamectin benzoate 5 SG @ 250 g /ha (3.10 thrips/leaf) at 14 DAS. The remaining insecticides also effectively controlled the thrips but their persistence lasted up to seven days showing more number of thrips/leaf at 14 DAS.

The present results are in confirmity with the findings of Dhanalakshmi and Mallapur (2008) [30] who reported that spinosad45 SC @ 0.1 ml/l was most effective against thrips found on par with acetamiprid 20 SP @ 0.2 g/l. Kay and Herron (2010) [32] reported that spinosad, fipronil and methamidophos were effective against adults and larvae of western flower thrips, *F. occidentalis*.

Shivanna *et al.* (2011) [31] revealed that spinosad 45 SC and standard check acetamiprid 20 SP were found effective against sucking insect pests *viz*., whitefly and thrips in cotton. Rohini *et al.* (2012) [16] reported that fipronil 5 SC @ 2 ml/Land acephate 75 SP @ 1.5g/L were found to be effective against thrips. Vanisree *et al*. (2013) [22] reported that spinosad 0.015 percent was found most effective in reducing the population of *S. dorsalis* as well as in increasing yield.

Table 3: Overall bio-efficacy of new insecticides against chilli thrips

Sr. No.	Treatments	Dose g or ml /ha	Population of thrips /leaf				
			Precount	1 DAS	3 DAS	7 DAS	14 DAS
1	Fipronil 5 SC	1000	3.26(1.93)	2.51(1.73)	2.24(1.65)	1.79(1.51)	2.54(1.74)
2	Hexythiaziox 5.45 EC	500	3.52(2.00)	3.17(1.92)	3.04(1.88)	2.53(1.75)	3.09(1.89)
3	Spinosad 45 SC	187.5	2.56(1.75)	1.31(1.34)	0.78(1.12)	0.20(0.83)	0.55(1.03)
4	Acetamiprid 20 SP	250	3.45(1.99)	2.77(1.81)	2.43(1.71)	2.01(1.59)	2.57(1.75)
5	Fenpyroximate 5 EC	600	3.33(1.96)	2.99(1.87)	2.45(1.72)	1.95(1.56)	2.58(1.75)
6	Emamectin Benzoate 5 SG	250	3.75(2.06)	3.33(1.96)	3.14(1.91)	2.51(1.73)	3.10(1.90)
7	Spiromesifen 22.9 SC	250	3.88(2.09)	3.51(2.00)	3.17(1.92)	2.67(1.78)	3.40(1.97)
8	Difenthiuron 50WP	625	3.41(1.98)	2.99(1.87)	2.59(1.76)	1.97(1.57)	2.82(1.82)
9	Untreated control	-	5.00(2.35)	5.66(2.48)	6.56(2.66)	6.79(2.70)	7.08(2.75)
	SE ±		NS	0.048	0.052	0.070	0.060
	CD at 5%		NS	0.144	0.154	0.211	0.180

*Figures in parentheses are transformed value $\sqrt{x + 0.5}$, *DAS: Days After Spray, *NS: Non Significant

Bio-efficacy of new insecticides against whitefly after first spray (25 days after transplanting)

Data pertaining to the whitefly population on chilli 1 day before and 1st, 3rd, 7th and 14th days after first spray is presented in Table 4.

The mean population of whiteflies 1 day before of 1st spray ranged between 2.71 to 4.00 (whiteflies/leaf) and showed non significant results indicating normal distribution of whitefly population in all treatment plots of the field experiment. The observations recorded 1st DAS indicated that the mean number of whiteflies per leaf was significantly lower (2.49 to 3.56 whiteflies/leaf) in all insecticides treatments plots than those in the untreated control plot (4.04 whiteflies/ leaf). The treatment with spinosad 45 SC @ 187.5 ml /ha was foundmost superior in reducing whiteflies population (2.49 whiteflies/ leaf) which was found at par with treatments difenthiuron 50 WP @ 625 g/ha (2.56 whiteflies/ leaf), acetamiprid 20 SP @ 250 g/ha (2.72 whiteflies/leaf), fipronil 5 SC @ 1000 ml/ha (3.25 whiteflies/leaf), fenpyroximate 5 EC @ 600 ml/ ha (3.28 whiteflies/ leaf), spiromesifen 22.9 SC @ 250 ml/ha (3.31 whiteflies/leaf), emamectin benzoate 5 SG @ 250 g/ha (3.47 whiteflies/leaf) and hexythiaziox 5.45 EC @ 500 ml/ha (3.56 whiteflies/leaf).

At 3rdday after first spray treatment with difenthiuron 50 WP @ 625 g/ha was found superior in reducing whiteflies population (1.57 whiteflies/leaf) which was found at par with spinosad 45 SC @ 187.5 ml/ha (1.73 whiteflies/leaf) and acetamiprid 20 SP @ 250 g/ha (2.24 whiteflies/leaf). Maximum population of whitefly (4.73 whiteflies/leaf) was recorded in the untreated control plot.

Data on 7th DAS indicated that population of whiteflies decreased slightly and ranged from 0.27-4.00 whiteflies/leaf in treated plots and maximum population was observed in untreated plot (4.83 whiteflies/leaf). Lowest population of whiteflies observed in difenthiuron 50 WP @ 625 g/ha (0.27 whiteflies/leaf) found most superior treatment in reducing whiteflies population which was found at par with spinosad 45 SC @ 187.5 ml/ha (0.60 whiteflies/leaf). Next best treatment was acetamiprid 20 SP @ 250 g/ha (1.08 whiteflies/leaf). Fipronil 5 SC @ 1000 ml/ha (3.33 whiteflies/leaf) and spiromesifen 22.9 SC @ 250 ml/ha (3.33 whiteflies/leaf) were found equally effective in reducing population of whiteflies.

After 14th days of first spray population of whiteflies also increased slightly and ranged from 1.05-4.56 whiteflies/leaf in treated plots and maximum population observed in untreated plot (5.35 whiteflies/leaf). The insecticidal treatment with difenthiuron 50 WP @ 625 g/ha (1.05 whiteflies/leaf) was found most superior in reducing whiteflies population which was found at par with spinosad 45 SC @ 187.5 ml/ha (1.19 whiteflies/leaf).

Table 4: Bio-efficacy of new insecticides against whitefly after first spray (25 days after transplanting)

Sr. No	Treatments	Doseg or ml / ha	Population of whiteflies/leaf				
			Precount	1DAS	3DAS	7DAS	14 DAS
1	Fipronil 5 SC	1000	3.28(1.94)	3.25(1.93)	2.88(1.83)	3.33(1.95)	3.80(2.07)
2	Hexythiaziox 5.45 EC	500	4.00(2.12)	3.56(2.01)	3.13(1.90)	3.67(2.04)	4.00(2.12)
3	Spinosad 45 SC	187.5	3.34(1.95)	2.49(1.70)	1.73(1.48)	0.6(1.02)	1.19(1.30)
4	Acetamiprid 20 SP	250	3.78(2.05)	2.72(1.79)	2.24(1.63)	1.08(1.25)	1.60(1.44)
5	Fenpyroximate 5 EC	600	3.68(2.04)	3.28(1.93)	2.96(1.86)	3.67(2.04)	4.23(2.17)
6	Emamectin Benzoate 5 SG	250	3.96(2.11)	3.47(1.99)	3.39(1.97)	4.00(2.12)	4.56(2.24)
7	Spiromesifen 22.9 SC	250	3.57(2.00)	3.31(1.94)	3.05(1.88)	3.33(1.96)	4.01(2.12)
8	Difenthiuron 50 WP	625	2.71(1.79)	2.56(1.74)	1.57(1.43)	0.27(0.85)	1.05(1.25)
9	Untreated control	-	3.51(1.99)	4.04(2.13)	4.73(2.28)	4.83(2.31)	5.35(2.41)
	SE ±		NS	0.130	0.088	0.093	0.059
	CD at 5%		NS	0.389	0.265	0.280	0.176

*NS = Non significant, *DAS = Days after spray, *Figures in parentheses are transformed values $\sqrt{x + 0.5}$

Bio-efficacy of new insecticides against whitefly after second spray (45 days after transplanting)

The data recorded on whitefly infestation after second spray is presented in Table 5.

A day before second spray, the population of whiteflies ranged from 1.37 to 6.00 whiteflies/leaf showing no significant difference among the evaluated treatments.

A day after second spray difenthiuron 50 WP @ 625 g/ha was emerged as significantly superior and showed lowest population of whiteflies (0.40 whiteflies/leaf) followed by spinosad 45 SC @ 187.5 ml/ha (0.99 whiteflies/leaf) which was found at par with acetamiprid 20 SP @ 250 g/ha (1.20 whiteflies/leaf). The other treatments fipronil 5 SC @ 1000 ml/ ha (3.48 whiteflies/leaf), spiromesifen 22.9 SC @ 250 ml/ha (3.59 whiteflies/leaf), hexythiaziox 5.45 EC @ 500 ml/ha (3.75 whiteflies/leaf) and fenpyroximate 5 EC @ 600 ml/ ha (3.99 whiteflies/leaf) were found next best treatments in order of efficacy. Maximum population of whiteflies was recorded in untreated control (6.34 whiteflies/ leaf).

After 3rd days of second spray the treatment difenthiuron 50 WP @ 625 g/ha was found most superior in reducing the population of whiteflies (0.27 whiteflies/leaf) which was found at par with spinosad 45 SC @ 187.5 ml/ha (0.33 whiteflies/leaf) and acetamiprid 20 SP @ 250 g/ha (0.64 whiteflies/leaf). Maximum population of whiteflies was recorded in untreated control (6.49 whiteflies/leaf).

The data on 7th DAS indicated that population of whiteflies was decreased slightly and hundred percent control of whiteflies (0.00 whiteflies/leaf) was observed in the difenthiuron 50 WP @ 625 g/ha treated plot. Population ranged from 0.13-3.03 in treated plots. spinosad 45 SC @ 187.5 ml/ha (0.13 whiteflies/leaf) and acetamiprid 20 SP @ 250 g/ha (0.40 whiteflies/leaf) were found most effective in reducing whiteflies population. Remaining treatments showed similar trend in the efficacy of insecticides were observed as that of 3rd DAS.

Table 5: Bio-efficacy of new insecticides against whitefly after Second spray (45 days after transplanting)

Sr. No	Treatments	Dose g or ml / ha	Population of whiteflies/ leaf				
			Precount	1DAS	3DAS	7DAS	14 DAS
1	Fipronil 5 SC	1000	4.01(2.12)	3.48(1.99)	3.25(1.94)	2.81(1.82)	3.85(2.08)
2	Hexythiaziox 5.45 EC	500	4.40(2.21)	3.75(2.06)	3.53(2.01)	3.03(1.88)	4.09(2.14)
3	Spinosad 45 SC	187.5	1.40(1.38)	0.99(1.22)	0.33(0.88)	0.13(0.79)	0.89(1.18)
4	Acetamiprid20 SP	250	2.13(1.62)	1.20(1.30)	0.64(1.04)	0.40(0.93)	1.04(1.24)
5	Fenpyroximate 5 EC	600	4.35(2.20)	3.99(2.12)	3.32(1.95)	2.87(1.83)	3.80(2.07)
6	Emamectin Benzoate 5 SG	250	4.43(2.22)	4.00(2.12)	3.35(1.96)	2.83(1.82)	3.64(2.03)
7	Spiromesifen 22.9 SC	250	4.25(2.18)	3.59(2.02)	2.75(1.80)	2.04(1.59)	2.72(1.79)
8	Difenthiuron 50WP	625	1.37(1.37)	0.40(0.93)	0.27(0.87)	0.00(0.71)	0.40(0.93)
9	Untreated control	-	6.00(2.55)	6.34(2.61)	6.49(2.64)	6.59(2.66)	7.37(2.80)
	SE ±		NS	0.073	0.109	0.074	0.080
	CD at 5%		NS	0.219	0.327	0.222	0.240

*NS = Non significant, *DAS = Days after spray, *Figures in parentheses are transformed values$\sqrt{x + 0.5}$

As compared to 7th DAS population of whiteflies increased slightly and ranged from 0.40-4.09 whiteflies/leaf in treated plots and maximum population was observed in untreated plot (7.37 whiteflies/leaf) after 14 DAS. The insecticidal treatment with difenthiuron 50 WP @ 625 g/hawas found significantly superior in reducing whiteflies population (0.40 whiteflies/leaf)followed by spinosad 45 SC @ 187.5 ml /ha (0.89 whiteflies/leaf) which was found at par withacetamiprid 20 SP @ 250 g/ha (1.04 whiteflies/leaf).

Overall bio-efficacy of new insecticides against chilli whiteflies (*Bemisiatabaci*)

Pooled average in respect of efficacy of newer insecticides against chilli whiteflies are presented in Table 6. The precount of whiteflies before initiation of the spray treatments was in the range of 2.04 to 4.75 whiteflies/leaf. The whiteflies incidence in all insecticidal treatments was significantly low indicating that all the insecticides were significantly effective at 14 DAS. As compare to untreated control the treatments comprised of difenthiuron 50 WP @ 625 g/ha was found significantly superior in reducing whiteflies population (0.73 whiteflies/leaf) followed by spinosad 45 SC @ 187.5 ml/ha (1.04 whiteflies/leaf) which was found at par acetamiprid 20 SP @ 250 g/ha (1.32 whiteflies/leaf) at 14 DAS. The remaining insecticides spiromesifen 22.9 SC @ 250 ml/ha (3.37 whiteflies/leaf), fipronil 5 SC @ 1000 ml/ha (3.83 whiteflies/leaf),fenpyroximate 5 EC @ 600 ml/ha (4.01 whiteflies/leaf), hexythiaziox 5.45 EC @ 500 ml/ha (4.05 whiteflies/leaf)also effectively controlled the whiteflies but their persistence lasted up to seven days showing more number of whiteflies/leaf at 14 DAS.

Thus, the results obtained in the present investigation are confirmity withthe findings of earlier research workers Razaq *et al*. (2005) [33] found that population of whitefly was below ETL in plots treated with acetamiprid (3.38/leaf) and diafenthiuran (2.69/leaf) seven days after application and diafenthiuron, acetamiprid, imidacloprid and thiamethoxam proved to be the most effective in reducing whiteflies population. Gopalaswamy *et al*. (2012) [34] showed that the whitefly population as well as yellow mosaic virus incidence were less in diafenthiuron 50 WP @ 600 g/ha, imidacloprid 70 WG @ 75 g/ha and thiamethoxam 25 WG @ 100 g/ha.

Table 6: Overall bio-efficacy of new insecticides against chilli whiteflies

Sr. No.	Treatments	Doseg or ml /ha	Population of whitefly/ leaf				
			Precount	**1 DAS**	**3 DAS**	**7 DAS**	**14 DAS**
1	Fipronil 5 SC	1000	3.65(2.03)	3.37(1.97)	3.07(1.89)	3.07(1.89)	3.83(2.08)
2	Hexythiaziox 5.45 EC	500	4.20(2.17)	3.65(2.04)	3.33(1.95)	3.35(1.96)	4.05(2.13)
3	Spinosad 45 SC	187.5	2.50(1.73)	1.74(1.49)	1.03(1.22)	0.37(0.92)	1.04(1.24)
4	Acetamiprid20 SP	250	2.96(1.84)	1.96(1.57)	1.44(1.39)	0.74(1.11)	1.32(1.35)
5	Fenpyroximate 5 EC	600	4.26(2.18)	3.63(2.03)	3.14(1.91)	3.27(1.94)	4.01(2.12)
6	Emamectin Benzoate 5 SG	250	4.19(2.16)	3.73(2.06)	3.37(1.97)	3.41(1.98)	4.1(2.14)
7	Spiromesifen 22.9 SC	250	3.91(2.10)	3.45(1.98)	2.9(1.84)	2.69(1.79)	3.37(1.96)
8	Difenthiuron 50WP	625	2.04(1.59)	1.48(1.40)	0.92(1.18)	0.13(0.79)	0.73(1.11)
9	Untreated control	-	4.75(2.29)	5.19(2.39)	5.61(2.47)	5.71(2.49)	6.36(2.62)
	SE ±		NS	0.073	0.061	0.070	0.041
	CD at 5%		NS	0.219	0.182	0.216	0.122

*Figures in parentheses are transformed values$\sqrt{x + 0.5}$, *DAS: Days After Spray, *NS: Non Significant

Abbas and Farhan (2014) [1] reported that difenthiuron, acetamiprid, spirotetramid were effective against cotton whitefly *Bemisiatabaci* Genn. (Hemiptera: Aleyrodidae). Afzal *et al.* (2014) [3] showed that diafenthiuron, acetamiprid and thiamethoxam were most effective insecticides against whitefly up to seven days after application. While, diafenthiuron gave maximum mortality during first spray (89.52 and 85.80%) and second spray (91.67 and 87.51%) after 72 hrs of application.

Bio-efficacy of new insecticides against mites after first spray (25 days after transplanting)

Data pertaining to the population of mites on chilli 1 day before and 1st, 3rd, 7th and 14th days after first spraying is presented in Table 7. The pre-treatment population of mites was uniform in all the experimental treatment plots, since the average population of mites was statistically non- significant. The average pre-treatment population was 1.20 to 2.19 (mites/leaf) justifying that there was need to protect the crop from mites infestation (Table 12).

At 1st day after spray all the insecticides treatments were found to be significantly superior over untreated control (1.61 mites/leaf). Lowest population of mites (0.77 mites/leaf) was recorded in plots treated with fenpyroximate 5 EC @ 600 ml/ ha which was found at par with spiromesifen 22.9 SC @ 250 ml/ha (0.89 mites/leaf) and hexythiaziox 5.45 EC @ 500 ml/ha (1.04 mites/leaf). Other treatments, difenthiuron 50 WP @ 625 g/ha (1.12 mites/leaf), emamectin benzoate 5 SG @ 250 g /ha (1.37 mites/leaf).and acetamiprid 20 SP @ 250 g/ha (1.41 mites/leaf) were found next in order of efficacy.

Data recorded on 3rd day after first spray revealed that lowest population of mites (0.40 mites/leaf) was observed in the plots treated with fenpyroximate 5 EC @ 600 ml/ha which was found at par with spiromesifen 22.9 SC @ 250 ml/ha (0.53 mites/leaf) and hexythiaziox 5.45 EC @ 500 ml/ha (0.73 mites/leaf), difenthiuron 50 WP @ 625 g/ha (1.16 mites/leaf) respectively. Maximum population of mites was observed in the untreated control plot (1.81 mites/leaf) and remaining all the treatments were showed moderate effectiveness in reducing mites population.

After 7th day of first spray, population of mites decreased slightly ranged from (0.00- 1.04 mites/leaf). In untreated control plot it was recorded highest population (1.85 mites/leaf). Both treatments fenpyroximate 5 EC @ 600 ml/ha and spiromesifen 22.9 SC @ 250 ml/ha (0.00 mites/leaf) were showed hundred percent control of mites and found most effective treatments in reducing mites population.

Table 7: Bio-efficacy of new insecticides against mites after first spray (25 days after transplanting)

Sr. No	Treatments	Dose g or ml / ha	Population of mites/ leaf				
			Precount	1DAS	3DAS	7DAS	14 DAS
1	Fipronil 5 SC	1000	1.67(1.46)	1.36(1.36)	1.12(1.27)	0.97(1.20)	1.45(1.40)
2	Hexythiaziox 5.45 EC	500	1.71(1.48)	1.04(1.24)	0.73(1.11)	0.27(0.85)	0.73(1.11)
3	Spinosad 45 SC	187.5	1.44(1.39)	1.33(1.35)	1.07(1.25)	0.81(1.14)	1.29(1.34)
4	Acetamiprid20 SP	250	1.75(1.49)	1.41(1.38)	1.23(1.31)	1.13(1.28)	1.56(1.43)
5	Fenpyroximate 5 EC	600	2.04(1.59)	0.77(1.12)	0.40(0.93)	0.00(0.71)	0.40(0.93)
6	Emamectin Benzoate 5 SG	250	1.60(1.44)	1.37(1.36)	1.15(1.28)	1.04(1.24)	1.45(1.40)
7	Spiromesifen 22.9 SC	250	2.19(1.62)	0.89(1.18)	0.53(1.01)	0.00(0.71)	0.47(0.96)
8	Difenthiuron 50WP	625	1.56(1.42)	1.12(1.27)	0.87(1.16)	0.53(1.00)	1.12(1.27)
9	Untreated control	-	1.20(1.30)	1.61(1.45)	1.81(1.52)	1.85(1.53)	2.21(1.65)
	SE ±		NS	0.066	0.077	0.098	0.073
	CD at 5%		NS	0.198	0.231	0.295	0.220

*NS = Non significant, *DAS = Days after spray, *Figures in parentheses are transformed values $\sqrt{x+0.5}$

After 14th days of first spray there was again slight increase in the population of mites in all treated plots. The of population mites was ranged from 0.40 to 1.56 (mites/leaf). In untreated control plot it was recorded maximum (2.21 mites/leaf). The treatment with fenpyroximate 5 EC @ 600 ml/ha (0.40 mites/leaf) was found most effective in reducing mites population, which was found at par with spiromesifen 22.9 SC @ 250 ml/ha (0.47 mites/leaf) andhexythiaziox 5.45 EC @ 500 ml/ha (0.73 mites/leaf) followed by difenthiuron 50 WP @ 625 g/ha (1.12 mites/leaf) and spinosad 45 SC @187.5 ml/ha (1.29 mites/leaf). Fipronil 5 SC @ 1000 ml/ ha (1.45 mites/leaf) and emamectin benzoate 5 SG @ 250 g/ha (1.45 mites/leaf) were found equally effective in reducing mites population.

Bio-efficacy of new insecticides against mites after secondspray (45 days after transplanting)

The data recorded on mites infestation after second spray is presented in Table 8.A day before second spray, the mites population ranged from 0.69 to 2.25 mites/leaf showing no significant difference among the evaluated treatments.

The observations recorded 1st day after second spray revealed that the insecticidal treatment with fenpyroximate 5 EC @ 600 ml/ha was found most effective in reducing mites population (0.13 mites/leaf) which was found at par with spiromesifen 22.9 SC @ 250 ml/ha (0.33 mites/leaf) and hexythiaziox 5.45 EC @ 500 ml/ha (0.63 mites/leaf). These were followed by difenthiuron 50 WP @ 625 g/ha(0.75 mites/ leaf) and spinosad 45 SC @ 187.5 ml/ha (0.92 mites/leaf). Maximum number of mites was recorded in untreated control plot (2.27 mites/leaf). The population of mites after third day of second spray ranged from 0.67-1.12 mites/leaf. Maximum mites population (2.40 mites/leaf) was observed in untreated control. The treatments with fenpyroximate 5 EC @ 600 ml/ ha and spiromesifen 22.9 SC @ 250 ml/ha (0.00 mites/leaf) were showed the hundred per cent control and were found most superior treatments in reducing mites population.Other treatments were showed medium range of effectiveness as compared to fenpyroximate and spiromesifen.

After 7th day of second spray there was slight decrease in the population of mites in all the treated plots except untreated control plot (2.48 mites/ leaf) and all treatments were showed similar trends of effectiveness as like 3rd days after spraying. The treatments with fenpyroximate 5 EC @ 600 ml/ha and spiromesifen 22.9 SC @ 250 ml/ha (0.00 mites/leaf) were also showed the hundred per cent control and found most superior treatments for control of mites population.

At 14th days after second spray there was slight increase in the population of mites in all the treatments and the results indicated thattreatment with fenpyroximate 5 EC @ 600 ml/ha (0.53 mites/leaf) was found most effective in reducing mites population which was found at par with spiromesifen 22.9 SC @ 250 ml/ha (0.61 mites/leaf) andhexythiaziox 5.45 EC @ 500 ml/ha (0.81 mites/leaf) followed by difenthiuron 50 WP @ 625 g/ha (1.04 mites/leaf), spinosad 45 SC @ 187.5 ml/ha (1.09 mites/leaf). Maximum population of mites was found in the untreated control plot (2.64 mites/ leaf).

Table 8: Bio-efficacy of new insecticides against mites after Second spray (45 days after transplanting)

Sr. No	Treatments	Doseg or ml / ha	Population of mites/leaf				
			Precount	1DAS	3DAS	7DAS	14 DAS
1	Fipronil 5 SC	1000	1.63(1.46)	1.11(1.27)	0.92(1.18)	0.71(1.07)	1.31(1.34)
2	Hexythiaziox 5.45 EC	500	0.73(1.11)	0.63(1.04)	0.40(0.93)	0.13(0.79)	0.81(1.14)
3	Spinosad 45 SC	187.5	1.39(1.37)	0.92(1.18)	0.73(1.11)	0.47(0.96)	1.09(1.26)
4	Acetamiprid20 SP	250	1.61(1.45)	1.20(1.30)	1.12(1.27)	0.81(1.14)	1.35(1.36)
5	Fenpyroximate 5 EC	600	0.69(1.09)	0.13(0.79)	0.00(0.71)	0.00(0.71)	0.53(1.00)
6	Emamectin Benzoate 5 SG	250	1.63(1.46)	1.12(1.27)	0.96(1.21)	0.73(1.11)	1.28(1.33)
7	Spiromesifen 22.9 SC	250	0.69(1.09)	0.33(0.88)	0.00(0.71)	0.00(0.71)	0.61(1.05)
8	Difenthiuron 50WP	625	1.35(1.36)	0.75(1.11)	0.67(1.08)	0.40(0.93)	1.04(1.24)
9	Untreated control	-	2.25(1.66)	2.27(1.66)	2.40(1.70)	2.48(1.72)	2.64(1.77)
	SE ±	¤	NS	0.100	0.078	0.109	0.073
	CD at 5%		NS	0.300	0.235	0.326	0.219

*NS = Non significant, *DAS = Days after spray, *Figures in parentheses are transformed values$\sqrt{x+0.5}$

Overall bio-efficacy of new insecticides against chilli mites (*Polyphagotarsonemus latus* Banks)

Pooled average in respect of efficacy of new insecticides against chilli mites are presented in Table 9. Theprecount of mites before initiation of the spray treatments was in the range of 1.22 to 1.73 mites/leaf. The mites incidence in all insecticidal treatments was significantly low indicating that all the insecticides were significantly effective. As compare to untreated control the treatments comprised of fenpyroximate 5 EC @ 600 ml/ ha (0.47 mites/leaf) which was foundsignificantly superior in reducing mites population which was found atpar with spiromesifen 22.9 SC @ 250 ml/ha (0.54 mites/leaf) at 14 DAS. The remaining insecticides, hexythiaziox 5.45 EC @ 500 ml/ha (1.12 mites/leaf), difenthiuron 50 WP @ 625 g/ ha (1.26 mites/leaf) and spinosad 45 SC @ 187.5 ml/ha (1.30 mites/leaf), emamectin benzoate 5 SG @ 250 g /ha (1.37 mites/leaf), fipronil 5 SC @ 1000 ml/ ha (1.38 mites/leaf) and also effectively controlled the mites but their persistence lasted up to seven days showing more number of mites/leaf at 14 DAS.

The present results are in confirmity with the findings of Pathipati *et al.* (2012) [28] reported that maximum mortality of mites was observed with fenpyroximate 5EC at the rate of 500 ml/ha (98.6%) followed by abamectin 1.9EC at the rate of 125 ml a.i/ha (95.66%) and propergite 50EC at the rate of 1000 ml/ha (88.99%). Reddy *et al*. (2013) [35] reported that new acaricides (spiromesifen, hexythaizox and fenpyroximate) are most effective against two spotted spider mite, *Tetranychusurticae* Koch in ridge gourd field.

Varghese and Mathew (2013) [36] reported that spiromesifen 45 SC at 100 g a.i. ha^{-1} and propargite 57 EC at 570 g a.i. ha^{-1} were found to be effective in reducing chilli mite population. Kavya *et al*. (2015) [37] revealed that new acaricides like propargite (0.78 mites/leaf) and spiromesifen (1.05 mites/leaf) reduced the overall mite population more significantly than other acaricides.

Table 9: Overall bio-efficacy of new insecticides against chilli mites

Sr. No.	Treatments	Dose g or ml /ha	Population of mites / leaf				
			Precount	1 DAS	3 DAS	7 DAS	14 DAS
1	Fipronil 5 SC	1000	1.65(1.46)	1.23(1.32)	1.02(1.23)	0.84(1.16)	1.38(1.37)
2	Hexythiaziox 5.45 EC	500	1.22(1.31)	0.83(1.15)	0.57(1.03)	0.20(0.83)	0.77(1.12)
3	Spinosad 45 SC	187.5	1.42(1.38)	1.13(1.27)	0.90(1.18)	0.64(1.06)	1.19(1.30)
4	Acetamiprid20 SP	250	1.68(1.46)	1.31(1.34)	1.17(1.29)	0.97(1.21)	1.45(1.40)
5	Fenpyroximate 5 EC	600	1.37(1.36)	0.45(0.97)	0.20(0.83)	0(0.71)	0.47(0.98)
6	Emamectin Benzoate 5 SG	250	1.62(1.44)	1.25(1.32)	1.05(1.25)	0.89(1.18)	1.37(1.37)
7	Spiromesifen 22.9 SC	250	1.44(1.39)	0.61(1.05)	0.27(0.87)	0(0.71)	0.54(1.00)
8	Difenthiuron 50WP	625	1.45(1.40)	0.93(1.20)	0.77(1.12)	0.47(0.97)	1.08(1.26)
9	Untreated control	-	1.73(1.49)	1.94(1.56)	2.11(1.61)	2.17(1.63)	2.43(1.71)
	SE ±		NS	0.066	0.054	0.059	0.053
	CD at 5%		NS	0.198	0.161	0.176	0.159

*Figures in parentheses are transformed values$\sqrt{x + 0.5}$, *DAS: Days After Spray, *NS: Non Significant

Conclusion

Bio-efficacy of New Insecticides Against Sucking Pests of Chilli indicated that spinosad 45 SC @ 187.5 ml/ha and fipronil 5 SC @ 1000 ml/ha proved to be best treatments showing maximum reduction of thrips population. Significant reduction of whitefly population was noticed in difenthiuron 50 WP @ 625 gm/ha, spinosad 45 SC @ 187.5 ml/ha and acetamiprid 20 SP @ 250 gm/ha. Whereas fenpyroximate 5 EC @ 600 ml/ ha, spiromesifen 22.9 SC @ 250 ml/ha and hexythiaziox 5.45 EC @ 500 ml/ha proved to be best treatments showing maximum reduction of mite population.

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