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Bio-efficacy of insecticides and their combination against sucking pests on chilli (*Capsicum annum* L) in humid region of Rajasthan

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Abstract
The experiment was conducted to found out the bio-efficacy of insecticides against sucking insect pests *viz*., thrips (*Scirtothrips dorsalis* Hood), whitefly (*Bemisia tabaci* Gennadius) and mite (*Polyphagotarsonemus latus* Banks) in chilli. Among the different insecticides combination, Etofenprox 6% + Diafenthiuron 25% WG @ of 1250 g/ ha proved most effective in reducing sucking pest population and found minimum population after third spray (1.22 & 1.47 thrips, 1.30 & 1.37 whitefly and 0.40 & 0.55 mites/ 3 leaves) at 5 & 10 days after spray, respectively followed by Etofenprox 6% + Diafenthiuron 25% WG @ of 1000 g/ha in case of thrips and whitefly, while Propargite 57% EC @ 1500 ml/ha against mite and these were also statistically at par on both duration in all spray. Highest red chilli fruit yield (13.61 q/ha) was harvested from crop treated with Etofenprox 6% + Diafenthiuron 25% WG @ of 1250 g/ ha followed by Diafenthiuron 50% WP @ 600 g/ha and Etofenprox 6% + Diafenthiuron 25% WG @ 1000 g/ha.

Keywords: Efficacy, insecticides, sucking insect pests, chilli

Introduction
Chilli, *Capsicum annum* L. belongs to the family Solanaceae is one of important commercial spice crop grown in India and is widely grown in the tropics and subtropics as well as under glass houses in temperate regions. It is commonly used as condiments, the pungency in chilli is due to a substance "capsaicin" (Kumar *et al*., 2005) [1]. India is a major producer, exporter and consumer of chilli. The major states growing chilli in the country are Andhra Pradesh, Gujarat, Karnataka, Madhya Pradesh, Maharashtra, Orissa, Rajasthan, Tamil Nadu, Uttar Pradesh, West Bengal etc. Andhra Pradesh ranks first both in area and production (Anonymous, 2005) [1]. In Rajasthan area under chilli crop is 8.06 thousand hectare, with total production of 13.34 thousand metric tones and productivity with 1.66 metric tonnes/ha (Anonymous, 2018). The area, production and productivity of chilli is quite low in Rajasthan due to the interference of many biotic and abiotic factors. Although there are number of factors responsible for depressing the yield of chilli but incidence of various insect-pests is one of major bottlenecks of production.

The insect-pests which cause significant damage to the crop are comprises of more than 39 genera and 51 species of insects and mite species in the field as well as storage (Hosamani *et al*., 2005) [7]. Nearly 35 species of insect pests occur on chilli which includes thrips, aphid, whitefly, fruit borer, cutworm, plant bug, mite and other minor pests (Sorensen, 2005) [14]. Among all the major sucking pests complex in *Capsicum* spp. attacking chilli thrips, *Scirtothrips dorsalis* Hood and whitefly, *Bemisia tabaci* (Gennadius) and mites (*Polyphagotarsonemus latus* Banks, *Tetranychus cinnabarinus* Boisd.) are causes crop yield and dominant pests (Berke & Sheih, 2000) [3]. Thrips, *Scirtothrips dorsalis* Hood (Thripidae: Thysanoptera) is alone considered as most destructive pest leading to 30 to 50 percent yield loss under severe infestation (Bhede *et al*., 2008) [5]. Insecticide application is one of the management options that can substantially reduce yield losses caused by sucking insects. Bio-efficacy of newer pesticides needs to be studied for formulating effective and economical management strategies of insect pests. Therefore, the present investigation was conducted to evaluate the bio-efficacy of certain ready mix insecticides against sucking insect pests infesting chilli.

Material and Methods

The field experiment on evaluation of ready mix insecticides against sucking insect pests infesting chilli was carried out at Agricultural Research Station, Ummedganj, (Agriculture University) Kota (Raj.) during *Kharif* 2016 & 2017. The experiment was laid out in a Randomized Block Design with three replication having plot size of 5.0 X 4.2 metres, keeping row to row and plant to plant distance at 45 and 30 cm, respectively. For this purpose Chilli variety Sitara Gold was raised follow all the recommended agronomical practices except plant protection practices. First spray application of respective insecticides was given on appearance of pests and subsequently two sprays were given using manually operated knapsack sprayer having hollow cone nozzle. The observations on the population of thrips, whiteflies and mites were recorded from three leaves of selecting five plants randomly from net plot area of each plot and tagged. From three tender leaves of tagged plants, the number of nymphs as well as adults in case of thrips and adults in case of whiteflies and mites were counted. The sucking insect pest's population were recorded before one day as well as 5 and 10 days after each spray. The red chilli fruit yield was recorded picking wise from each plot. The data thus obtained for sucking insect-pests were analyzed by adopting square root transformation before statistical analysis.

Results and Discussion

Efficacy of insecticides against thrips (*S. dorsalis*) infesting chilli

The population of thrips, *S. dorsalis* (Table 1) recorded before spray showed non-significant difference among different treatments indicated that its population was uniformly distributed in all the experimental plots.

The first spray data indicated that minimum population of thrips (2.32 & 3.04 thrips/ 3 leaves) were found in plots sprayed with Etofenprox 6% + Diafenthiuron 25% WG @ of 1250 g/ ha on 5 & 10 days after spray, respectively, followed by treatment Etofenprox 6% + Diafenthiuron 25% WG @ of 1000 g/ ha (2.63 and 3.24 thrips/ 3 leaves), which are statistically at par in both duration. Fipronil 5% SC @ 800 ml/ha and Diafenthiuron 50% WP @ 600 g/ha stood next to above insecticides and exhibited thrips population as 3.34 & 4.17 and 3.64 & 4.65/ 3 leaves on 5 and 10 days after spray, respectively. Among all insecticides, Emamectin benzoate 5% SG & Propargite 57% SC found inferior and proved effective against thrips and statistically better than untreated check.

The second spray data showed that least numbers (1.97 & 2.49 thrips/ 3 leaves) were found in plots treated with Etofenprox 6%+Diafenthiuron 25% WG @ 1250 g/ha, which is statistically at par with treatment Etofenprox 6% + Diafenthiuron 25% WG @ 1000 g/ha with thrips population (2.12 & 2.50 thrips/ 3 leaves) at 5 & 10 days after spray, respectively. Plots spray with Fipronil 5% SC @ 800 ml, Diafenthiuron 50% WP @ 600 g & Etofenprox 6%+Diafenthiuron 25% WG @ 750 ml/ha were found better in suppressing the thrips population. Treatments Emamectin benzoate 5% SG & Propargite 57% SC proved less effective against thrips but significantly less population of the pest than untreated check (control).

The similar trend of efficacy was observed in third spray & superiority of Etofenprox 6%+Diafenthiuron 25% WG @ 1250 g/ha also maintained with minimum population of thrips (1.22 & 1.47 thrips / 3 leaves) at 5 & 10 days of spray, respectively, which was at par with treatment Etofenprox 6% + Diafenthiuron 25% WG @ 1000 g/ha. The next treatments in order of efficacy were Fipronil 5% SC, Diafenthiuron 50% WP & Etofenprox 6% + Diafenthiuron 25% WG. However, Emamectin benzoate 5% SG & Propargite 57% SC also found inferior but registered significantly less population of the pest then untreated plots.

Reddy *et al*. (2007) [12] observed that among all treatments, fipronil 5 SC at 2 ml/litre was found the best treatment followed by spinosad 45 SC at 0.3 and 0.2 ml/litre against thrips.

Vanisree *et al*. (2013) [15] evaluated certain new insecticides results revealed that spinosad @ 0.015 percent was found most effective in reducing the population of *S. dorsalis* as well as in increasing yields. Khaire (2017) [9] reported that thrips population/3 leaves/plant was minimum (1.59) in the treatment spinosad 45 SC @ 0.016 percent which was at par with treatment acetamiprid 20 SP @ 0.004 percent (1.77). The next effective treatments were emamectin benzoate 5 SG @ 0.0016 percent (1.87) and diafenthiuron 50 WP @ 0.06 percent (1.99).

Table 1: Effect of different insecticides treatments against thrips (*Scirtothrips dorsalis*) in chilli.

Sr. No.	Treatments	Doses/ha (g or ml)	Mean Population of Thrips/3 leaves						
			1st spray			2nd spray		3rd spray	
			PTP	5 DAS	10 DAS	5 DAS	10 DAS	5 DAS	10 DAS
1	Etofenprox 6% + Diafenthiuron 25% WG	750	8.11 (2.85)*	4.97 (2.23)	5.82 (2.41)	4.30 (2.07)	4.83 (2.20)	3.37 (1.84)	3.99 (2.00)
2	Etofenprox 6% + Diafenthiuron 25% WG	1000	8.14 (2.85)	2.63 (1.62)	3.24 (1.80)	2.12 (1.46)	2.50 (1.58)	1.27 (1.13)	1.66 (1.29)
3	Etofenprox 6% + Diafenthiuron 25% WG	1250	8.17 (2.86)	2.32 (1.52)	3.04 (1.74)	1.97 (1.40)	2.49 (1.58)	1.22 (1.10)	1.47 (1.21)
4	Etofenprox 10% EC	500	8.14 (2.85)	5.98(2.44)	6.54 (2.56)	5.57 (2.36)	6.00 (2.45)	5.19 (2.28)	5.55 (2.36)
5	Diafenthiuron 50% WP	*600*	8.27 (2.88)	3.64 (1.91)	4.65 (2.16)	3.27 (1.81)	3.84 (1.96)	2.74 (1.65)	3.13 (1.77)
6	Propargite 57% EC	1500	7.82 (2.80)	7.05 (2.66)	7.78 (2.71)	7.20 (2.68)	7.56 (2.75)	6.70 (2.59)	7.24 (2.69)
7	Fipronil 5% SC	800	7.87 (2.81)	3.34 (1.83)	4.17 (2.04)	2.84 (1.68)	3.28 (1.81)	2.18 (1.48)	2.81 (1.67)
8	Emamectin benzoate 5% SG	200	8.00 (2.83)	6.10 (2.47)	7.06 (2.66)	5.75 (2.40)	6.62 (2.57)	5.52 (2.35)	6.79 (2.61)
9	Control		8.00 (2.83)	8.17 (2.86)	8.68 (2.95)	8.70 (2.95)	8.75 (2.96)	8.83 (2.97)	9.08 (3.01)
S.E(m) ±			(0.05)	(0.07)	(0.06)	(0.06)	(0.05)	(0.08)	(0.05)
CD at 5%			(NS)	(0.21)	(0.17)	(0.18)	(0.16)	(0.24)	(0.15)

*values in parenthesis are square root transformation values.

Efficacy of insecticides against Whitefly (*B. tabaci*) infesting chilli

Data (Table 2) indicated that the population of whitefly, *B. tabaci* recorded before spray showed non-significant difference among different treatments indicated that its population was uniformly distributed in all the experimental plots.

The first spray data showed that minimum population of whitefly (1.90 & 2.10 whitefly/ 3 leaves) were found in plots sprayed with Etofenprox 6% + Diafenthiuron 25% WG @ of

1250 g/ ha at 5 & 10 days after spray, respectively, followed by treatment Etofenprox 6% + Diafenthiuron 25% WG @ of 1000 g/ ha (2.07 and 2.24 thrips/ 3 leaves) and Diafenthiuron 50% WP @ 600 g/ha (2.37 & 2.47), these three were statistically at par at 5 & 10 days after spray. The treatments Etofenprox 6% + Diafenthiuron 25%WG @ 750 g and Etofenprox 10% EC @ 500 ml/ha were stood next to above insecticides and exhibited whitefly 2.23 & 2.57 and 2.84 & 3.03 population/ 3 leaves at 5 and 10 days after spray, respectively. Among all insecticides, Fipronil 5% SC @ 800 ml and Propargite 57% EC @ 1500 ml/ha were found least effective against white fly and statistically at par with untreated control at 5 & 10 days after spray.

It is evident from table-2, the data of second spray indicated that least numbers of whitefly (1.57 & 1.95 whitefly/ 3 leaves) were noticed from plots treated with Etofenprox 6% + Diafenthiuron 25% WG @ 1250 g/ha, which were statistically at par with treatments Etofenprox 6%+Diafenthiuron 25% WG @ 1000 g/ha, Diafenthiuron 50% WP @ 600 g, Etofenprox 6%+Diafenthiuron 25% WG @ 1000 g/ha at 5 & 10 days after spray. The next treatments in order of efficacy were Etofenprox 10% EC @ 500 ml and Emamectin benzoate 5% SG @ 200 g/ha with whitefly population as 2.50 & 2.70 and 2.97 and 3.27/ 3 leaves at 5 and 10 days after spray, respectively and both were statistically at par. However, Fipronil 5% SC @ 800 ml, & and Propargite 57% EC @ 1500 ml/ha showed inferiority at 5 and 10 days after spray and found non-significant to each other but significantly better to untreated control.

The similar trend of effectiveness was observed in third spray & found superiority of Etofenprox 6%+Diafenthiuron 25% WG @ 1250 g/ha with minimum population of whitefly 1.30 & 1.37/ 3 leaves followed by Etofenprox 6%+Diafenthiuron 25% WG @ 1000 g and Diafenthiuron 50% WP @ 600 g/ha and these were statistically at par on 5 & 10 days duration after spray. The treatment stood next in order of efficacy was Etofenprox 6%+Diafenthiuron 25% WG @ 750 g/ha. The treatments Etofenprox 6% EC @ 500 ml and Emamectin benzoate 5% SG were statistically at par after 5 & 10 days of spray. The treatments Fipronil 5% SC @ 800 ml, & and Propargite 57% EC @ 1500 ml/ha again registered least effective at 5 and 10 days after spray and found non-significant to each other but significantly better to untreated control.

Bharpoda *et al*., 2014 evaluated nine synthetic insecticides against sucking pests of cotton and found that imidacloprid 17.8 SL @ 0.008% found most effective to control *B. tabaci* (1.47 whitefly/leaf). The results of earlier findings are more or less similar to present findings. Patil *et al*., 2014 revealed that the average whitefly population count was the lowest in the treatment thiamethoxam 25 WG @ 0.006% (0.48 whiteflies/leaf). Next effective treatments where Lambda-cyhalothrin 5 EC @ 0.004% (0.60 whiteflies/leaf), Lambda-cyhalothrin 5 EC @ 0.005% (0.61 whiteflies/leaf), Thiamethoxam 25 WG @ 0.008% (0.63 whiteflies/leaf) and Triazophos 40 EC @ 0.025% (0.69 whiteflies/leaf) in okra. More or less, it is in conformity with the present findings.

Table 2: Effect of different insecticides treatments against whitefly (*Bemisia tabaci*) in chilli

Sr. No.	Treatments	Doses/ha (g or ml)	Mean population of whitefly /3 leaves						
			PTP	1st spray		2nd spray		3rd spray	
				5 DAS	10 DAS	5 DAS	10 DAS	5 DAS	10 DAS
1	Etofenprox 6% + Diafenthiuron 25% WG	750	3.89 (1.97)*	2.23 (1.49)	2.57 (1.60)	2.00 (1.41)	2.29 (1.51)	1.77 (1.33)	2.07 (1.44)
2	Etofenprox 6% + Diafenthiuron 25% WG	1000	4.32 (2.08)	2.07 (1.44)	2.24 (1.49)	1.67 (1.29)	1.97 (1.40)	1.34 (1.16)	1.44 (1.20)
3	Etofenprox 6% + Diafenthiuron 25% WG	1250	4.16 (2.04)	1.90 (1.38)	2.10 (1.45)	1.57 (1.25)	1.95 (1.39)	1.30 (1.14)	1.37 (1.17)
4	Etofenprox 10% EC	500	4.24 (2.06)	2.84 (1.68)	3.03 (1.74)	2.50 (1.58)	2.70 (1.64)	2.40 (1.55)	2.53 (1.59)
5	Diafenthiuron 50% WP	*600*	4.39 (2.10)	2.37 (1.54)	2.47 (1.57)	1.77 (1.33)	2.07 (1.44)	1.57 (1.25)	1.77 (1.33)
6	Propargite 57% EC	1500	4.01 (2.00)	4.12 (2.03)	4.17 (2.04)	3.90 (1.97)	3.67 (1.91)	3.77 (1.94)	3.90 (1.97)
7	Fipronil 5% SC	800	4.14 (2.03)	3.70 (1.92)	3.84 (1.96)	3.57 (1.89)	4.07 (2.02)	3.33 (1.82)	3.57 (1.89)
8	Emamectin benzoate 5% SG	200	4.44 (2.11)	3.30 (1.82)	3.54 (1.88)	2.97 (1.72)	3.27 (1.81)	2.80 (1.67)	3.03 (1.74)
9	Control		4.42 (2.10)	4.40 (2.10)	4.50 (2.12)	4.70 (2.17)	4.77 (2.18)	4.80 (2.19)	5.13 (2.26)
SE(m) ±			(0.05)	(0.08)	(0.07)	(0.07)	(0.06)	(0.06)	(0.06)
CD at 5%			NS	(0.23)	(0.20)	(0.21)	(0.18)	(0.18)	(0.19)

*values in parenthesis are square root transformation values.

Efficacy of insecticides against mite (*Polyphagotarsonemus latus*) infesting chilli

The data pertaining to the efficacy of different insecticides against mite infesting to chilli crop presented in table-3. The population of mite recorded before spray showed non-significant difference among different treatments indicated that its population was uniformly distributed in all the experimental plots.

It is observed from first spray data that minimum population of mite (1.30 & 1.72/ 3 leaves) were found in plots treated with Etofenprox 6% + Diafenthiuron 25% WG @ of 1250 g/ ha at 5 & 10 days after spray, respectively, followed by treatment Propargite 57% SC @ 1500 ml/ha with mite population 1.34 & 1.76 at 5 & 10 days after spray, respectively and both were statistically at par on both durations. The treatments Etofenprox 6% + Diafenthiuron 25% WG @ of 1000 g/ ha, Diafenthiuron 50% WP @ 600 g/ha and Etofenprox 6% + Diafenthiuron 25% WG @ of 1000 g/ ha were next in order of efficacy at 5 & 10 days after spray and found statistically non-significant. Among all insecticides, Emamectin benzoate 5% SG @ 200 g/ha and Fipronil 5% SC @ 800 ml/ha were least effective with population as 2.97 & 3.22 and 3.05 & 3.23 mites/ 3 leaves and both found statistically non-significant from untreated control.

The second spray data indicated that the superiority of Etofenprox 6%+Diafenthiuron 25% WG @ 1250 g/ha was maintained with population (0.67 & 1.00 mites/ 3 leaves) followed by Propargite 57% SC @ 1500 ml/ha with population (0.70 & 1.09 mites/ 3 leaves) and non significant difference observed between them at 5 & 10 days after spray, respectively. The treatments Etofenprox 6% + Diafenthiuron 25% WG @ of 1000 g/ ha, Diafenthiuron 50% WP @ 600 g/ha and Etofenprox 6% + Diafenthiuron 25% WG @ of 750 g/ ha stood next in order of efficacy at 5& 10 days after spray and found statistically non-significant among each other. However, Emamectin benzoate 5% SG @ 200 g/ha and

Fipronil 5% SC @ 800 ml/ha proved least effective and also found statistically non-significant from untreated control at 5 & 10 days after spray.

The treatment Etofenprox 6%+Diafenthiuron 25% WG @ 1250 g/ha maintained it's superiority with least population of mite (0.40 & 0.55 mites/ 3 leaves) in third spray, which was at par with treatment Propargite 57% SC @ 1500 ml/ha with population (0.53 & 0.60 mites/ 3 leaves) at 5 & 10 days of spray, respectively. Etofenprox 6%+Diafenthiuron 25% WG @ 1000 g/ha, and Diafenthiuron 50% WP @ 600 g/ha were next in order of efficacy at 5 & 10 days after spray and found statistically non-significant among each other. Etofenprox 6%+Diafenthiuron 25% WG@ 750 g/ha, stood next in efficacy and non-significant at 5 days after spray from Etofenprox 6%+Diafenthiuron 25% WG @ 1000 g/ha, and Diafenthiuron 50% WP @ 600 g/ha but significantly different at 10 days after spray. Among all insecticides, Emamectin benzoate 5% SG @ 200 g/ha and Fipronil 5% SC @ 800 ml/ha registered inferior in efficacy but statistically proved better from untreated control at 5 & 10 days after spray.

Our earlier study also revealed that amongst the newer molecules tested, Fipronil 80% WG was found effective against chilli yellow mites and thrips and per cent reduction over control was 57.29 and 75.41, respectively (Halder *et al*. 2015). Sarkar *et al*. (2013) reported that Chlorfenapyr 10% SC@ 100 and 125 g a.i./ha were found to be most effective against the chilli thrips and yellow mite up to 15 days after treatment. Chlorfenapyr 10% SC@ 1 000 ml/ha showed mean 50.22% yellow mite mortality in chilli in Andhra Pradesh Pathipati *et al.* (2012). Incorporation of these newer acaro-insecticide molecules in integrated module might be responsible for its effectiveness than the other molecules.

Table 3: Effect of different insecticides treatments against mite (*Polyphagotarsonemus latus*) in chilli

Sr. No.	Treatments	Doses/ha (g or ml)	Mean population of Mite /3 leaves						
			PTP	1st spray		2nd spray		3rd spray	
				5 DAS	10 DAS	5 DAS	10 DAS	5 DAS	10 DAS
1	Etofenprox 6% + Diafenthiuron 25% WG	750	3.30 (1.82)*	2.63 (1.62)	2.84 (1.68)	1.94 (1.39)	2.13 (1.46)	1.47 (1.21)	1.74 (1.32)
2	Etofenprox 6% + Diafenthiuron 25% WG	1000	3.35 (1.83)	2.12 (1.46)	2.33 (1.53)	1.47 (1.21)	1.75 (1.32)	1.07 (1.03)	1.27 (1.12)
3	Etofenprox 6% + Diafenthiuron 25% WG	1250	3.32 (1.82)	1.30 (1.14)	1.72 (1.31)	0.67 (0.82)	1.00 (1.00)	0.40 (0.63)	0.55 (0.74)
4	Etofenprox 10% EC	500	3.21 (1.79)	2.67 (1.63)	2.76 (1.66)	2.37 (1.54)	2.48 (1.57)	1.74 (1.32)	2.07 (1.44)
5	Diafenthiuron 50% WP	*600*	3.28 (1.81)	2.17 (1.47)	2.37 (1.54)	1.53 (1.24)	1.75 (1.32)	1.07 (1.03)	1.29 (1.14)
6	Propargite 57% EC	1500	3.32 (1.82)	1.34 (1.16)	1.76 (1.33)	0.70 (0.84)	1.09 (1.04)	0.53 (0.73)	0.60 (0.77)
7	Fipronil 5% SC	800	3.30 (1.82)	3.05 (1.75)	3.23 (1.80)	2.97 (1.72)	3.14 (1.77)	2.54 (1.59)	2.88 (1.70)
8	Emamectin benzoate 5% SG	200	3.32 (1.82)	2.97 (1.72)	3.22 (1.79)	2.70 (1.64)	3.00 (1.73)	2.70 (1.64)	2.83 (1.68)
9	Control		3.27 (1.81)	3.32 (1.82)	3.38 (1.84)	3.40 (1.84)	3.57 (1.89)	3.60 (1.90)	3.75 (1.94)
SE(m) ±			(0.04)	(0.07)	(0.05)	(0.06)	(0.07)	(0.06)	(0.05)
CD at 5%			NS	(0.21)	(0.15)	(0.18)	(0.21)	(0.18)	(0.15)

*values in parenthesis are square root transformation values

Yield of Chilli

Data (Table 4) indicated that the plots sprayed with Etofenprox 6% + Diafenthiuron 25% WG @ 1250 g/ha registered highest mean yield (13.61 q/ha) of red chilli fruits followed by Diafenthiuron 50% WP @ 600 g/ha and Etofenprox 6% + Diafenthiuron 25% WG @ 1000 g/ha. These insecticides differed significantly from rest of the tested insecticides. Plots treated with Etofenprox 6% + Diafenthiuron 25% WG @ 750 g/ha, Etofenprox 10% EC @ 500 ml/ha, Propargite 57% EC @1500 ml/ha and Fipronil 5% SC @ 800 ml/ha exhibited 11.47 to 10.44 q /ha red fruit yield. However, minimum mean yield (10.65 q/ha) obtained from treatment Emamectin benzoate 5% SG @ 200 g/ha, which is non-significant to control in both tested years.

Increase in yield over control (Table 4) was in the range of 02.90 to 31.50%. Maximum (31.50%) increase in yield due to insecticidal application was found in Etofenprox 6% + Diafenthiuron 25% WG @ 1250 g/ha followed by Diafenthiuron 50% WP @ 600 g/ha (21.35%) and Etofenprox 6% + Diafenthiuron 25% WG @ 1000 g/ha (20.97%). Emamectin benzoate 5% SG @ 200 g/ha exhibited minimum 02.90% yield increase over control.

From the above study it can be concluded that overall efficacy of all three sprays revealed that insecticides combination, Etofenprox 6% + Diafenthiuron 25% WG @ of 1250 g/ ha proved most effective in reducing sucking pest population and found minimum population after third spray (1.22 & 1.47 thrips, 1.30 & 1.37 whitefly and 0.40 & 0.55 mites/3 leaves) at 5 & 10 days after spray, respectively and the highest red chilli fruit yield (13.61 q/ha) was harvested from this treatment followed by followed by Etofenprox 6% + Diafenthiuron 25% WG @ of 1000 g/ha in case of thrips and whitefly, while Propargite 57% EC @ 1500 ml/ha against mite and these were also statistically at par from Etofenprox 6% + Diafenthiuron 25% WG @ of 1250 g/ ha on both duration in all spray.

Table 4: Effect of different insecticides treatments on fruit yield of red chilli

Sr. No.	Treatments	Doses/ha (g/ml)	Yield (q/ha)			
			2016	2017	Mean	Percent Increase over control
1	Etofenprox 6% + Diafenthiuron 25% WG	750	11.13	11.81	11.47	10.82
2	Etofenprox 6% + Diafenthiuron 25% WG	1000	12.15	12.89	12.52	20.97
3	Etofenprox 6% + Diafenthiuron 25% WG	1250	13.28	13.93	13.61	31.50
4	Etofenprox 10% EC	500	11.12	11.77	11.45	10.63
5	Diafenthiuron 50% WP	600	12.23	12.88	12.56	21.35
6	Propargite 57% EC	1500	10.92	11.45	11.19	08.12
7	Fipronil 5% SC	800	11.05	11.43	11.24	08.60
8	Emamectin benzoate 5% SG	200	10.37	10.92	10.65	02.90
9	Control		10.07	10.62	10.35	-
S.Em ±			0.33	0.33	-	-
CD at 5%			1.01	1.01	-	-

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