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Efficacy of insecticides and some bio-rationals against thrips and mites on chilli, (*Capsicum annuum* L)

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Abstract
Study was conducted to determine the bio-efficacy of insecticides and some selected biorationals against chilli thrips (*Scirtothrips dorsalis* Hood) and chilli mites (*Polyphagotarsonemus latus* Banks) during summer and *Rabi*, 2018. Among different insecticides spirotetramat + imidacloprid 240 SC was the effective insecticide against thrips with 90.73% reduction in population followed by fipronil 5 SC (86.22%) and ethion 50 EC (81.60%). Whereas, mites were effectively controlled by spirotetramat + imidacloprid 240 SC (86.80%) followed by spiromesifen 22.9 SC (82.89%) which it was on par. Among biorationals nimbecidine was proved more effective by recording the highest reduction in thrips and mites which was followed by silicon 1000 ppm. The highest incremental cost benefit ratio (1:4.66) was registered in spirotetramat + imidacloprid 240 SC followed by fipronil 5 SC (1:3.30).

Keywords: Insecticides, biorationals, chilli, spirotetramat + imidacloprid

1. Introduction

Chilli (*Capsicum annuum* L.) is one of the important vegetable and condiment crop grown throughout the year in India. It is also known as the ‘hot pepper’, ‘red pepper’ etc. Chilli belongs to Solanaceae family. In India, the chilli was grown in 2, 92,000 ha area, producing 33, 90,000 tonnes with an average productivity of 1.16 tonnes per ha [1]. In Maharashtra, chilli crop is grown over an area of 30,990 ha with production of 3, 59,770 tonnes. Chilli cultivation is facing biotic and abiotic stress that causes severe yield loss [2]. As many as, 51 insects and one mite pest species have been reported to infest chilli crop [3]. Of these, thrips (*Scirtothrips dorsalis* Hood), mites (*Polyphagotarsonemus latus* Banks) and aphids (*Aphis gossypi* Glover) are responsible for approximately 50 percent reduction in yield [4]. Insecticides application can substantially reduce yield losses caused by sucking pests. Bioefficacy of insecticides and some selected biorationals need to be studied for formulating effective and economical management strategies of insect pests. Therefore, the present investigation was conducted to evaluate the bioefficacy of some insecticides and biorationals infesting chilli.

2. Material and Methods

Investigation on “Efficacy of insecticides and some biorationals against thrips and mites on chilli” was carried out at Mahatma Phule Krishi Vidyapeeth (19.3491° N, 74.6461° E), Rahuri, Maharashtra, India during summer and *Rabi* 2018. The experiment was laid out in a Randomized Block Design (RBD), with three replications. The chilli variety “*Teja-4*” was raised as per standard package of practices except the plant protection measures. The measured quantity of test insecticide was mixed with small quantity of water and remaining quantity of water added was to it subsequently to make up the spray volume required for the plot. The spray solution was evenly mixed with a stick before spraying. Test insecticides were applied using a high volume knapsack sprayer. Sprayings were undertaken during morning hours. The first spray was applied when the insect population reached economic threshold levels (ETL) (Thrips, – 2 no./leaf, mite –1 no./cm^2 given by) [5] and second and third sprays were given at when pest pressure develops. A total of three sprays were applied during the entire experimentation against thrips and mites. Observations on insect populations *viz.*, thrips**,** *S. Dorsalis* were recorded in five randomly tagged plants, from 3 leaves (1 from top, 1 from middle and 1 from bottom) per plant. For mites, *P. latus*, numbers of mites present in cm^2 on under surface of leaf were recorded. Pre count (1 day before spray) and post count (1, 3, 7 and 10 days after spray) of the insects was recorded by counting the numbers and analysed as number per leaf for thrips and number of mites per cm^2 of leaf. Per cent reduction over control was calculated for the mean population count of 1, 3, 7 and 10 DAT readings using the following formula [6].

The observations recorded from the different treatments about studied insects were subjected to statistical analysis (RBD) to know the significance of difference among different treatments at 0.05 level of significance. The values in number were transformed into square root values ($\sqrt{x+0.5}$). The DMRT (Dunkan's Multiple Range Test) was applied for the population per cent reduction values to determine the level of effectiveness of the treatments [7].

3. Results

3.1 Thrips and mites

The thrips and mites population which were recorded before spray showed non-significant difference among different treatments indicated that its population was distributed in all the experimental plots in both the seasons.

3.1.1 Thrips

a) Summer

The first spray data indicated that minimum (1.14 thrips/leaf) population of thrips were recorded in plots treated with spirotetramat + imidacloprid 240 SC which was followed by fipronil 5 SC (1.44 thrips/leaf). Ethion 50 EC and flubendamide + Thiacloprid 240 SC stood next to above insecticides and records 1.61 and 1.92 thrips/leaf, respectively. Among biorationals nimbecidine was proved effective (3.16 thrips/leaf) followed by silicon 1000 ppm (3.64 thrips/leaf). The plots treated with treatments were shown significantly less number of thrips as compared to untreated control. The second spray data showed that spirotetramat + imidacloprid 240 SC treated plots recorded least number of thrips (0.53 thrips/leaf) followed by fipronil 5 SC (0.84 thrips/leaf). Among biorationals, nimbecidine(2.32 thrips/leaf) and silicon 1000 ppm (2.39 thrips/leaf) were proved effective in management of thrips. Superiority of spirotetramat + imidacloprid 240 SC(0.22 thrips/leaf) in controlling thrips population was also noticed in third spray followed by fipronil 5 SC (0.54 thrips/leaf).

b) *Rabi*

The first spray data indicated that minimum (1.21thrips/leaf) population of thrips were recorded in plots treated with spirotetramat + imidacloprid 240 SC which was followed by fipronil 5 SC (1.64 thrips/leaf). Ethion 50 EC and flubendamide + Thiacloprid 240 SC stood next to above insecticides and records 2.06 and 2.42thrips/leaf, respectively. Among biorationals nimbecidine was proved effective (3.32 thrips/leaf) followed by silicon 1000 ppm (3.59 thrips/leaf). The plots treated with treatments were shown significantly less number of thrips as compared to untreated control. The second spray data showed that spirotetramat + imidacloprid 240 SC treated plots recorded least number of thrips (0.77thrips/leaf) followed by fipronil 5 SC (1.15 thrips/leaf). Among biorationals, Nimbecidine (2.71 thrips/leaf) and silicon 1000 ppm (3.12thrips/leaf) were proved effective in management of thrips. Superiority of spirotetramat + imidacloprid 240 SC (0.45thrips/leaf) in controlling thrips population was also noticed in third spray followed by fipronil 5 SC (0.82thrips/leaf).

c) Pooled data

Pooled data (Table 1) showed that's pirotetramat + imidacloprid 240 SC showed 90.73% of reduction of thrips which was followed by fipronil 5 SC (86.22%). Ethion50 EC and flubendamide + Thiacloprid 240 SC were recorded 81.60% and 78.38% respectively. Aomg biorationals Nimbecidine was recorded 65.77% of reduction which was followed by silicon 1000 ppm (62.68%).

3.1.2 Mites

a) Summer

The first spray data indicated that minimum (1.09mites/cm^2) population of mites were recorded in plots treated with spirotetramat + imidacloprid 240 SC which was followed by spiromesifen 22.9 SC(1.33mites/cm^2) to which it was on par. Ethion50 EC and fipronil 5 SC stood next to above insecticides and records 1.59 and 2.03mites/cm^2, respectively. Among Biorationals Nimbecidine was proved effective (2.54mites/cm^2) followed by silicon 1000 ppm (2.78mites/cm^2). The plots treated with treatments were shown significantly less number of mitesas compared to untreated control. The second spray data showed that spirotetramat + imidacloprid 240 SC treated plots recorded least number of mites (0.78mites/cm^2) followed by spiromesifen 22.9 SC (0.97mites/cm^2). Among biorationals, Nimbecidine (2.03mites/cm^2) and silicon 1000 ppm (2.05mites/cm^2) were proved effective in management of mites. Superiority of spirotetramat + imidacloprid 240 SC (0.39 mites/cm^2) in controlling mites population was also noticed in third spray followed by spiromesifen (0.60mites/cm^2).

b) Mites

The first spray data indicated that minimum (1.01 mites/cm^2) population of mites were recorded in plots treated with spirotetramat + imidacloprid 240 SC which was followed by spiromesifen 22.9 SC(1.09mites/cm^2) to which it was on par. Ethion 50 EC and fipronil 5 SC stood next to above insecticides and records 1.45 and 1.91mites/cm^2, respectively. Among biorationals Nimbecidine was proved effective (2.39mites/cm^2) followed by silicon 1000 ppm (2.56mites/cm^2). The plots treated with treatments were shown significantly less number of mites as compared to untreated control. The second spray data showed that spirotetramat + imidacloprid 240 SC treated plots recorded least number of mites (0.60mites/cm^2) followed by spiromesifen 22.9 SC (0.84mites/cm^2). Among biorationals, nimbecidine(1.99mites/cm^2) and silicon 1000 ppm (2.22mites/cm^2) were proved effective in management of mites. Superiority of spirotetramat + imidacloprid 240 SC (0.39mites/cm^2) in controlling mites population was also noticed in third spray followed by spiromesifen (0.67mites/cm^2).

c) Pooled data

Pooled data (Table 2) showed thatspirotetramat + imidacloprid 240 SC showed 86.80% of reduction of mites which was followed by spiromesifen 22.9 SC (82.89%) to which it was on par. Ethion 50 EC and Fipronil 5 SC were recorded 77.88% and 69.51% respectively. Aomgbiorationals, nimbecidine was recorded 60.96% of reduction which was followed by silicon 1000 ppm (58.17%).

3.2 Yield

Pooled Data (Table 3) indicated that the plots treated with spirotetramat + imidacloprid 240 SC registered the highest yield (2.10 t/ha) which was followed by fipronil 5 SC (2.02 t/ha). Spiromesifen 22.9 SC and ethion 50 EC stood next in the order which recorded yield of 1.92 and 1.78 t/ha, respectively which was significantly higher than the untreated control. Increase in yield over control was in the range of

10.34% to 81.03%. Maximum (81.03%) increase in yield due to insecticidal application was found in spirotetramat + imidacloprid 240 SC followed by fipronil 5 SC (74.13%). Among biorationalsnimbecidine recorded 31.46% increase in yield which was followed by silicon 1000 ppm (26.72%).

Table 1: Efficacy of insecticides and some bio-rationals against thrips (*S. dorsalis*) on chilli (Pooled data).

	Treatment details	Dose (g or ml a.i.ha-1)	Number of thrips per leaf (Nymphs and adults)								Mean	Percent reduction
			First season				Second season					
			1st spray	2nd spray	3rd spray	Mean	1st spray	2nd spray	3rd spray	Mean		
T_1	Fipronil 5 SC	50	1.44 (1.39)	0.84 (1.16)	0.54 (1.12)	0.94 (1.22)	1.64 (1.46)	1.15 (1.28)	0.82 (1.15)	1.20 (1.30)	1.07 (1.26)	86.22^{b}
T_2	Spiromesifen 22.9 SC	96	2.45 (1.72)	1.69 (1.48)	1.50 (1.41)	1.88 (1.54)	2.74 (1.80)	2.04 (1.59)	1.66 (1.47)	2.15 (1.62)	2.02 (1.58)	74.00^{d}
T_3	Ethion 50 EC	750	1.61 (1.45)	1.23 (1.32)	0.99 (1.22)	1.28 (1.33)	2.06 (1.60)	1.47 (1.40)	1.18 (1.30)	1.57 (1.43)	1.43 (1.38)	81.60^{c}
T_4	Acephate 75 SP	584	2.77 (1.80)	2.01 (1.58)	1.82 (1.48)	2.20 (1.62)	3.02 (1.88)	2.40 (1.70)	1.84 (1.53)	2.42 (1.70)	2.31 (1.66)	70.27^{e}
T_5	Spirotetramat + Imidacloprid 240 SC	60 + 60	1.14 (1.28)	0.53 (1.01)	0.22 (0.99)	0.63 (1.09)	1.21 (1.31)	0.77 (1.13)	0.45 (0.97)	0.81 (1.14)	0.72 (1.12)	90.73^{a}
T_6	Flubendamide + Thiacloprid 240 SC	48 + 48	1.92 (1.56)	1.47 (1.40)	1.19 (1.31)	1.53 (1.42)	2.42 (1.71)	1.71 (1.49)	1.32 (1.35)	1.82 (1.52)	1.68 (1.47)	78.38^{cd}
T_7	Silicon	1000 ppm	3.64 (2.03)	2.39 (1.70)	2.21 (1.61)	2.75 (1.78)	3.59 (2.02)	3.12 (1.90)	2.45 (1.72)	3.05 (1.88)	2.90 (1.83)	62.68^{fg}
T_8	Silicon	750 ppm	4.14 (2.15)	3.08 (1.89)	2.63 (1.77)	3.28 (1.94)	4.26 (2.18)	3.31 (1.95)	2.76 (1.81)	3.44 (1.98)	3.36 (1.96)	56.76^{h}
T_9	Nimbecidine	5ml/l	3.16 (1.91)	2.32 (1.68)	2.22 (1.57)	2.57 (1.72)	3.32 (1.96)	2.71 (1.79)	2.19 (1.64)	2.74 (1.80)	2.66 (1.76)	65.77^{f}
T_{10}	*Lecanicillium lecanii*	2g/l (1×10^8cfu)	4.02 (2.13)	3.64 (2.03)	3.31 (1.95)	3.65 (2.04)	3.50 (2.00)	3.37 (1.97)	2.47 (1.72)	3.11 (1.90)	3.38 (1.97)	56.47^{h}
T_{11}	Untreated control	---	6.60 (2.66)	7.75 (2.87)	7.92 (2.90)	7.74 (2.81)	6.54 (2.65)	8.15 (2.94)	8.72 (3.04)	7.80 (2.88)	7.77 (2.85)	--
S. Em ±			0.027	0.091	0.027	0.05	0.037	0.034	0.017	0.090	0.070	0.271
CD @ 5%			0.079	0.270	0.078	0.14	0.109	0.101	0.051	0.287	0.214	0.796

Note: Figures in parentheses are x+0.5 transformed values,
In a column, per cent followed by the same alphabet do not differ significantly (P=0.05) by DMRT

Table 2: Efficacy of insecticides and some bio-rationals against mites (*P. latus*) on chilli (Pooled data).

	Treatment details	Dose (g or ml a.i.ha-1)	Number of mites per cm^2 of leaf								Mean	Percent Reduction
			First season				Second season					
			1st spray	2nd spray	3rd spray	Mean	1st spray	2nd spray	3rd spray	Mean		
T_1	Fipronil 5 SC	50	2.03 (1.59)	1.62 (1.46)	1.32 (1.35)	1.66 (1.50)	1.91 (1.55)	1.54 (1.43)	1.38 (1.37)	1.61 (1.45)	1.64 (1.48)	69.51^{d}
T_2	Spiromesifen 22.9 SC	96	1.33 (1.35)	0.97 (1.21)	0.60 (1.05)	0.97 (1.46)	1.09 (1.26)	0.84 (1.16)	0.67 (1.08)	0.87 (1.17)	0.92 (1.32)	82.89^{ab}
T_3	Ethion 50 EC	750	1.59 (1.45)	1.22 (1.31)	0.84 (1.16)	1.22 (1.57)	1.45 (1.40)	1.11 (1.27)	0.91 (1.19)	1.16 (1.29)	1.19 (1.43)	77.88^{b}
T_4	Acephate 75 SP	584	2.34 (1.65)	1.79 (1.51)	1.55 (1.43)	1.89 (1.75)	2.14 (1.62)	1.73 (1.49)	1.59 (1.45)	1.82 (1.52)	1.86 (1.64)	65.42^{e}
T_5	Spirotetramat+ Imidacloprid 240 SC	60 + 60	1.09 (1.26)	0.78 (1.13)	0.39 (0.94)	0.75 (1.11)	1.01 (1.23)	0.60 (1.05)	0.39 (0.94)	0.67 (1.07)	0.71 (1.09)	86.80^{a}
T_6	Flubendamide + Thiacloprid 240 SC	48 + 48	1.84 (1.53)	1.44 (1.39)	1.08 (1.26)	1.45 (1.68)	1.65 (1.47)	1.33 (1.35)	1.16 (1.29)	1.38 (1.37)	1.42 (1.53)	73.60^{c}
T_7	Silicon	1000 ppm	2.78 (1.81)	2.05 (1.60)	1.87 (1.54)	2.23 (1.90)	2.56 (1.75)	2.22 (1.65)	1.99 (1.58)	2.26 (1.66)	2.25 (1.78)	58.17^{fg}
T_8	Silicon	750 ppm	3.23 (1.93)	2.58 (1.75)	2.22 (1.65)	2.68 (2.06)	3.16 (1.91)	2.69 (1.79)	2.56 (1.75)	2.80 (1.82)	2.74 (1.94)	49.07^{h}
T_9	Nimbecidine	5ml/l	2.54 (1.74)	2.03 (1.59)	1.77 (1.51)	2.11 (1.61)	2.39 (1.70)	1.99 (1.58)	1.85 (1.53)	2.08 (1.60)	2.10 (1.61)	60.96^{f}
T_{10}	*Lecanicillium lecanii*	2g/l (1×10^8cfu)	3.17 (1.91)	2.68 (1.78)	2.65 (1.77)	2.83 (1.82)	2.71 (1.79)	2.39 (1.70)	2.19 (1.64)	2.43 (1.71)	2.63 (1.77)	57.11^{g}
T_{11}	Untreated control	---	4.71 (2.28)	5.67 (2.48)	6.08 (2.57)	5.49 (2.44)	4.12 (2.17)	5.58 (2.47)	6.08 (2.57)	5.26 (2.40)	5.38 (2.42)	--
S. Em ±			0.024	0.021	0.022	0.022	0.022	0.020	0.028	0.020	0.028	0.021
CD @ 5%			0.072	0.063	0.066	0.067	0.065	0.070	0.076	0.070	0.076	0.070

Note: Figures in parentheses are x+0.5 transformed values,
In a column, per cent followed by the same alphabet do not differ significantly (P=0.05) by DMRT

Table 3: Influence of synthetic insecticides and some bio-rationals on the yield of chilli (pooled)

	Treatment details	Dose (g. or ml a.i. ha^{-1})	Yield (t ha^{-1})			Increase in yield over control (%)
			First season (2018)	Second season (2018)	pooled	
T_1	Fipronil 5 SC	50	1.95	2.10	2.02	74.13
T_2	Spiromesifen 22.9 SC	96	1.84	2.00	1.92	65.51
T_3	Ethion 50 EC	750	1.77	1.79	1.78	53.44
T_4	Acephate 75 SP	584	1.5	1.62	1.56	34.44
T_5	Spirotetramat + Imidacloprid 240 SC	60 + 60	1.89	2.31	2.10	81.03
T_6	Flubendamide + Thiacloprid 240 SC	48 + 48	1.62	1.88	1.75	50.86
T_7	Silicon	1000 ppm	1.26	1.68	1.47	26.72
T_8	Silicon	750 ppm	1.20	1.60	1.40	20.68
T_9	Nimbecidine	5ml/l	1.32	1.73	1.53	31.46
T_{10}	*Lecanicillium lecanii*	2g/l	1.06	1.50	1.33	10.34
T_{11}	Untreated control	---	1.02	1.30	1.16	--
± S Em			0.189	0.324	0.171	1.01
CD @ 5%			0.557	0.956	0.503	2.99

3.3 Cost economics

Data (Table 4) indicated that maximum (1:4.66) ICBR value was found in the treatment of spirotetramat + imidacloprid 240 SC followed by fipronil 5 SC (1:3.30), ethion 50 EC (1:3.24),spiromesifen 22.9 SC (1:2.45). Among biorationals silicon 1000 ppm was recorded ICBR of 1:2.17 followed by silicon 750 ppm (1:1.78) and nimbecidine (1:1.41).

3.4 Discussion

a) Thrips

Vikrant kumar *et al.* (2015) [8] reported that spirotetramat 120 + imidacloprid 120-240 SC @ 90 g + 90 ga.i. ha^{-1} caused higher reduction of thrips on chilli. Similar type of studies were also conducted by Koushik *et al.* (2017)[9] who reported spirotetramat 120 + imidacloprid 120-240 SC @ 75 + 75 ga.i. ha^{-1}as an effective insecticide against thrips. The effectiveness of fipronil against thrips as observed in the present studies is in agreement with Kadam and Dethe (2002) [10] at higher dose @ 60 g a.i. ha^{-1}. Fipronil is a new molecule which belongs to phenol-pyrazole group with a mode of action of blocking gamma-amino-butyric-acid (GABA) and regulating of chloride channels in insect neurons, thus antagonizing the “calming” effect of GABA. (Gavkare *et al.*, 2013) [11]. Effectiveness of fipronil in controlling thrips on chilli was also reported by Vanisree *et al.* (2013) [12], Reddy *et al.* (2007) [13] and Mahalingappa *et al.* (2008) [14]. All these reports lend support to the present findings.In the present studies nimbecidine was effective in controlling thrips on chilli among biorationals. These findings are in corroboration with Jagdishand Purnima (2011) [15].

Table 4: Economics of thrips and mites control through insecticides and bio-rationals.

Sr. no.	Treatments	Quantity of insecticide required for 3 spray (g or ml ha^{-1})	Increased yield over control	Monetary value of the produce	Plant protection cost (Rs. ha^{-1})	Net profit over control	C: B Ratio
1	Fipronil 5 SC	2400	0.86	25800	7800	18000	1: 3.30
2	Spiromesifen 22.9 SC	1200	0.76	22800	9288	13512	1: 2.45
3	Ethion 50 EC	4500	0.62	18600	5730	12870	1: 3.24
4	Acephate 75 SP	2340	0.40	12000	5165	6835	1: 2.32
5	Spirotetramat + imidaclorid 240 SC	750	0.94	28200	6045	22155	1: 4.66
6	Flubendamide + Thiacloprid 240 SC	600	0.59	17700	8880	8820	1: 1.99
7	Silicon 1000 ppm	1800	0.31	9300	4272	5028	1: 2.17
8	Silicon 750 ppm	1250	0.24	7200	4030	3170	1: 1.78
9	Nimbecidine	3000	0.37	11100	7854	3246	1: 1.41
10	*Lecanicillium lecanii*	3000	0.17	6300	4080	2220	1: 1.32
11	Untreated control	---	---	---	---	----	-----

Fipronil 5 SC: Rs 180/100 ml, Spiromesifen 22.9 SC: Rs 484/100 ml, Ethion 50 EC: Rs 50/100 ml, Acephate 75 SP: Rs 72/100 g
Spirotetramat + imidaclorid 240 SC: Rs 342/100 ml, Flubendamide + Thiacloprid 240 SC: Rs 450/ 50 ml, Silicon:Rs 44/100 g
NSE 5%: Rs 1458 ltr, *Lecanicillium lecanii*: Rs.200/kg, Cost of labour: Rs.3000 (500×6), Chilli: Rs.30/kg, and Balasingam *et al.* (2003) [16].

Silicon showed less effectiveness against thrips because pepper acts as a silicon neutral plant i.e., only a limited quantities of silicon was accumulated inside the leaf tissue from foliar application but it was not translocated through-out the plants (Ma and Yamaji 2006) [17]. *L. lecanii* @ 2g/l was found inferior in the present investigation. In contrast *L. lecanii* @ 3g/l was reported to be effective against thrips in chilli as reported by Ghatak*et al.* (2009) [18]. Imidacloprid 200 SL @ 0.05 ml/l was found most effective against thrips on sunflower and recorded highest yield of 726 kg ha^{-1} (Rathod*et al.*, 2010) [19]. All these reports lend support to the present findings.

b) Mites

Vikrant kumar *et al.* (2015) [8] reported that spirotetramat 120 + imidacloprid 120-240 SC @ 90 g + 90 ga.i. ha^{-1} caused higher reduction of mites on chilli. Similar type of studes were conducted by Koushik *et al.* (2017) [9] who reported that spirotetramat 120 + imidacloprid 120-240 SC @ 75 + 75 ga.i. ha^{-1} was an effective insecticide against mites on brinjal. Targe and Kurtadikar (2003) [20] reported that imidacloprid 17.8 SL @ 112 ml ha^{-1} was effective in controlling chilli mites. Spiromesifen, a tetronic acid derivative which blocks the fat synthesis and ultimately causes the target pest to dry out and die i.e., the active ingredient is a lipid biosynthesis inhibitor that prevents insect from maintaining necessary water balance (Gavkare *et al.*, 2013) [11]. It was found effective against numerous mites species and white flies (Bretschneider *et al.*, 2003) [21]. The effectiveness of spiromesifen in controlling mites was also endorsed by Kavitha *et al.* (2006) [22], Varghese and Mathew (2013) [23] and Pathipati *et al.* (2017) [24]. Nagaraju *et al.* (2007) [25]

reported that spiromesifen 24 SC was the best acaricide by registering the highest dry chilli yield of 26.53q ha^{-1}. All the reports lend support to the present findings.

5. Conclusion
From the present study, it is concluded that spirotetramat + imidacloprid 240 SC was proved effective in controlling both thrips and mites and also recorded the highest ICBR (1:4.66) with a yield of 2.10 t/ha which was followed by fipronil for control of thrips and spiromesifen 22.9 SC for control of mites. Among biorationals nimbecidine was proved more effective which was followed by silicon 1000 ppm. Fipronil 5 SC recorded the second highest ICBR of 1:3.30 with a yield of 2.02 t/ha.

6. References

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