www.ThePharmaJournal.com

The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2022; 11(10): 1032-1038

www.thepharmajournal.com
Received: 11-07-2022
Accepted: 15-09-2022

Mirala Sruthi
Department of Entomology, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

JB Gopali
Department of Entomology College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

AB Mastiholi,
Department of Agronomy, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Vasant M Ganiger
Department of Vegetable Science, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Shashi Kumar S
Department of Extension, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Mahesh YS
Department of Pathology, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Corresponding Author:
Mirala Sruthi
Department of Entomology, College of Horticulture, University of Horticultural Sciences, Bagalkot, Karnataka, India

Efficacy of new molecules against mites of capsicum under protected condition

Mirala Sruthi, JB Gopali, AB Mastiholi, Vasant M Ganiger, Shashi Kumar S and Mahesh YS

Abstract
The study was undertaken to study the efficacy of new molecules (vertimec, spiromesifen and ecomite) against mites of capsicum under protected condition. The experiment was laid out in a Randomized Block Design (RBD) in a polyhouse with ten treatments including untreated control were replicated thrice. Evaluation of different acaricides indicated that vertimec 1.9 EC at 0.5 ml per litre, was found effective in suppressing the mite population by recording highest yield (47.76 t ha^{-1}), maximum net returns (Rs. 1849600/ha) and highest B:C ratio (2.82). Similarly, spiromesifen 240 SC at 1.0 ml per litre recorded highest fresh fruit yield (45.0 t ha^{-1}) with higher net returns (Rs.1685000/ha) and B:C ratio (2.66) and ecomite registered higher fresh capsicum yield (43.68 t ha^{-1}) suggesting two new molecules (vertimec 1.9 EC and spiromesifen 240 SC) and biopesticides, ecomite were more cost effective and most feasible in suppressing mites.

Keywords: Mites, spiromesifen, vertimec, ecomite, acaricides and biopesticides

Introduction
Capsicum under protected cultivation is gaining popularity especially in urban and peri-urban markets. The yield of capsicum ranges from 100 to 120 tonnes per hectare in polyhouse condition as compared to 20 to 40 tonnes per hectare in open field (Prabhakara *et al*., 2004) [24]. The warm and humid conditions and abundant food under protected conditions provide an excellent stable environment for sucking pest development. Often, the natural enemies that keep pests under control outside are not present under protected environment. For these reasons, pest situations often develop in the indoor environment more rapidly and with greater severity than outdoors.

One of the important limiting factors in the cultivation of capsicum is damage caused by pests. Butani (1976) [3] reported over 20 insect species on chillies (*Capsicum* spp.) from India of which thrips, *Scirtothrips dorsalis* Hood and mite, *Polyphagotarsonemus latus* Banks are the most damaging pests (Moorthy *et al*., 2013) [16]. Quantitative yield loss is to an extent of 11-32 per cent where as quality loss is 88-92% (Kumar, 1995) [12]. It may even cause 100 per cent loss under glass house condition (Liu *et al*., 1991) [14]. Peak activity of chilli mite is noticed in the months of November – February (Srinivasulu *et al*., 2002) [21] and the mite population is favoured by higher temperature, lower humidity and lesser intensity of rainfall (Lingeri *et al*., 1998) [13]. This chilli mite is really a threat to the capsicum cultivation and causing huge economic loss every year.

Both nymphs and adults of mites feed by piercing and sucking action from the leaves, tender shoots and other growing parts leading to downward curling of leaves and elongation of petioles. The mite may raise a generation in one week under optimal conditions (25 °C and high relative humidity) and deposit 40 eggs per female (Gerson, 1992) [7]. Infested leaves become bronzed with down-curling margins, buds are aborted and flowers distorted, shoots grow twisted and fruit may be misshapen and russeted. Injuries, presumably due to toxins, occur even after the broad mite is killed by pesticides.

In the last few decades, awareness of health consciousness led to organically produced food stuffs. The tremendous demand for organically produced food has led to the creation of new export avenues for developing countries. Organic farming is a holistic production management system which involves the use of organic manures, botanical pesticides and biological pest control strategies that can act as an alternative to the costlier, non-ecofriendly and energy intensive chemical inputs.

In this contest, the newer molecules are used at lowest dosage with highest efficacy compared to the conventional insecticides in reducing the pesticide load on the environment and in the fruits.

Material and Methods

Layout of the experiment

The experiment was laid out in a Randomized Block Design (RBD) in a polyhouse with ten treatments including untreated control were replicated thrice. The size of each treatment was 4m x 1m length and breadth, width 22cm. The bed was 16 m length, 100 cm width and 15 - 22 cm height. Between the beds working space of 75 cm was provided. A popular capsicum hybrid, *Indus* (Indus Pvt. Ltd.,) was selected for the study.

Rising of crop

Capsicum seeds were procured from nearby nursery. Before transplanting, FYM @ 10 Kg, neem cake @ 4 Kg, were thoroughly mixed and added to the nursery bed. Line sowing was taken at 10 cm row width. Seeds germinated in about a week's time after sowing. After 15 days Muriate of potash and at 22 days 19:19:19 (3.0 g/l) solutions were drenched. Blitox @ 3.0 g per litre at 12 and 20 Days after Spraying and before transplanting was also applied to control the diseases. The nursery bed was regularly irrigated till the time of transplanting.

Transplanting and spacing

The 25 days age old seedlings were transplanted in the raised beds after providing good irrigation through drip. An inter row spacing of 60 cm and intra row spacing of 45 cm was adopted, so as to maintain optimum plant population in the field. Transplanting was done on 8th September, 2017 during the year of period of investigation.

Drip irrigation and Fertilization

Drip irrigation was given to provide 2- 4 litres of water per square meter per day. Water soluble fertilizers were supplied through fertigation during entire crop growth period, starting from third week after transplanting. Water soluble fertilizers *viz*., 19:19:19 @ 10 kg, potassium nitrate @ 4.5 kg and calcium nitrate @ 4.5 kg per hectare were applied through drip twice a week as recommended by Indian Institute of Horticultural Research (IIHR), Bengaluru.

Inter-cultivation and other operations

The crop was kept free from weeds by hand weeding whenever needed and was kept well managed throughout the period of experimentation by adopting the recommended package of practices of Indian Institute of Horticultural Research (IIHR), Bengaluru. The training of capsicum plants was taken at six weeks after transplanting and each branch was trained with plastic twine starting from six weeks after planting at 20 to 30 days intervals and the fertigation was provided as per the need.

Treatment details on mites

The treatments were imposed immediately after the build-up of mite population particularly when ETL was one mite per leaf (Kumar *et al*., 2007) [25]. During the investigation, two rounds of treatments were imposed against mite and the first spray was imposed when mite population crossed ETL. Four rounds of common sprays comprising fipronil 5 SC 1.0 ml per litre and thiamethoxam 25WG at 0.2 g per litre were imposed to combat thrips population. The treatment details are as follows.

Observations on mite

The mite population as well as Leaf Curl Index (LCI) was recorded on five plants which were selected randomly in each plot and tagged. The top three leaves along with mite population were collected and kept in the perforated polythene bag of size 16 x 18 cm and the samples were brought to laboratory for examination under 20x magnification using binocular microscope. Total number of mites from each leaf were counted and expressed in terms of mean number of mites per leaf.

Results and Discussion

Among the various pests of capsicum, sucking pests *viz*., thrips and mites are the most serious pests which are threatening the cultivation of capsicum and deteriorating the economic status of capsicum growing farmers. The crop loss estimated by these two major pests are 30-50 per cent by thrips, 30-70 per cent by mites (Mallapur and Lingappa, 2005) [15]. The indiscriminate use of chemicals has led to many undesirable effects like pest resurgence, destruction of natural enemies, environmental pollution *etc*. Although insecticidal intervention brought down the pest population but they have led to many problems, especially residues in the fruits which seriously affected the export of capsicum at the international ports (Anon., 2015) [1]. Hence, it is imperative to produce pesticide free capsicum by adapting eco-friendly management practices such as use of indigenous materials, botanicals and bioagents for the management of capsicum pests.

The results depicted in the Table 1, 2 and 3 indicated that mean mite population and LCI (Leaf Curl Index) (Fig.1) after two rounds of spray were minimum in vertimec 1.9 EC at 0.5 ml per litre followed by spiromesifen 240 SC at 1.0 ml per litre which were on par with ecomite at 3.0 ml/l each other. Similarly, per cent reduction over control indicated that vertimec 1.9 EC at 0.5 ml per litre registered more than 90 per cent reduction in mites damage, followed by spiromesifen 240 SC at 1.0 ml per litre and ecomite at 3.0 ml per litre showed more than 75 per cent reduction in mites' damage (Fig.2). Yield data clearly indicated that highest fresh capsicum yield was registered in vertimec 1.9 EC at 0.5 ml per litre (47.76 t ha^{-1}) followed by spiromesifen 240 SC at 1.0 ml per litre (45.0 t ha^{-1}) which was statistically on par with ecomite at 3.0 ml/l (43.68 t ha^{-1}) indicating both the molecules were equally effective in recording highest yield. Similarly, per cent increase in yield over control indicated that vertimec 1.9 EC at 0.5 ml per litre registered 39 per cent increase in yield whereas spiromesifen 24 SC at 1.0 ml per litre and ecomite at 3.0 ml per litre recorded more than 30 per cent increase in yield (Fig.3). Cost economics indicated that among the different treatments, vertimec 1.9 EC at 0.5 ml per litre registered maximum net returns (Rs. 1849600/ha) with the highest B:C ratio (2.82) followed by spiromesifen 240 SC at 1.0 ml per litre with net returns (Rs.1685000) B:C ratio (2.66) and ecomite at 3.0 ml per litre with net returns (Rs.1605050) and B:C ratio (2.58) suggesting vertimec 1.9 EC at 0.5 ml per litre, spiromesifen 240 SC at 1.0 ml per litre and ecomite at 3.0 ml/l were more cost effective and most feasible (Table 4

and Fig 4).

The present investigations on efficacy of new molecules against capsicum mites are in agreement with the results of Kharbade *et al.* (2015) [11], Singh and Rishi (2017) [19] and Ayyanar *et al.* (2018) [2] who opined that the vertimec 1.9 EC significantly reduced the mite population. Abamectin acts mainly by ingestions but also has contact and translaminar activity where the active ingredient passes into the leaf tissue forming a toxic reservoir of abamectin that continues to kill the pests as the feed on the mesophyll tissue. Ingestion of abamectin results in rapid paralysis and subsequent death of insect and mite pests (Corbitt, 1989) [6].

Kavitha *et al.* (2006) [10] who proved that the percent reduction of mite population was highest in spiromesifen 240 SC at 120 g a.i. per ha. It belongs to ketoenols which acts as inhibitors of acetyl CoA carboxylase, besides inhibiting acetyl CoA carboxylase enzyme, it also regulates the lipid biosynthesis of the insects and inhibits the normal growth and development. This unique mode of action might be responsible for the higher toxicity against this phytophagous mite. These findings are in supplemented with results of (Varghese and Mathew (2013); Reddy *et al*., 2013; Vijayalakshmi *et al*., 2015 and Samanta *et al*., 2017) [22-23-17-18] who opined that spiromesifen 240 SC proved to be superior in reducing the mite population in chilli.

Ecomite is a contact miticide effective and alternative to other synthetic contact pesticide. This formulation is primarily based on plant oils and extracts containing alkaloids, salts of fatty acids and natural oils and used to control mite's effectively on vegetables, rose and other crops and can also be used until harvesting. It kills and repels mites and other piercing and sucking insects and destroys their eggs and nymphs. The present findings corroborate with the findings of Choi *et al.* (2004) [5] and Sreenivas *et al.* (2008) [20] who opined that ecomite at 3.0 ml/l was found to be superior in recording the lowest mite incidence in okra. Diafenthiuron acts as an inhibitor of oxidative phosphorylation and disruptor of ATP formation.

Whereas, other new molecules (fenpropathrin 57 EC at 2.0, fenpyroximate 5 EC at 0.5 ml/l) recorded more than 25 per cent increase in yield indicating moderate in their efficacy. Similar findings were reported by Chinniah and Ali (2000) [4]; Hosamani *et al.* (2005) [8] and Jeyarani *et al.* (2006) [9] who opined that fenpropathrin reduced the mite population and recorded the higher green chilli.

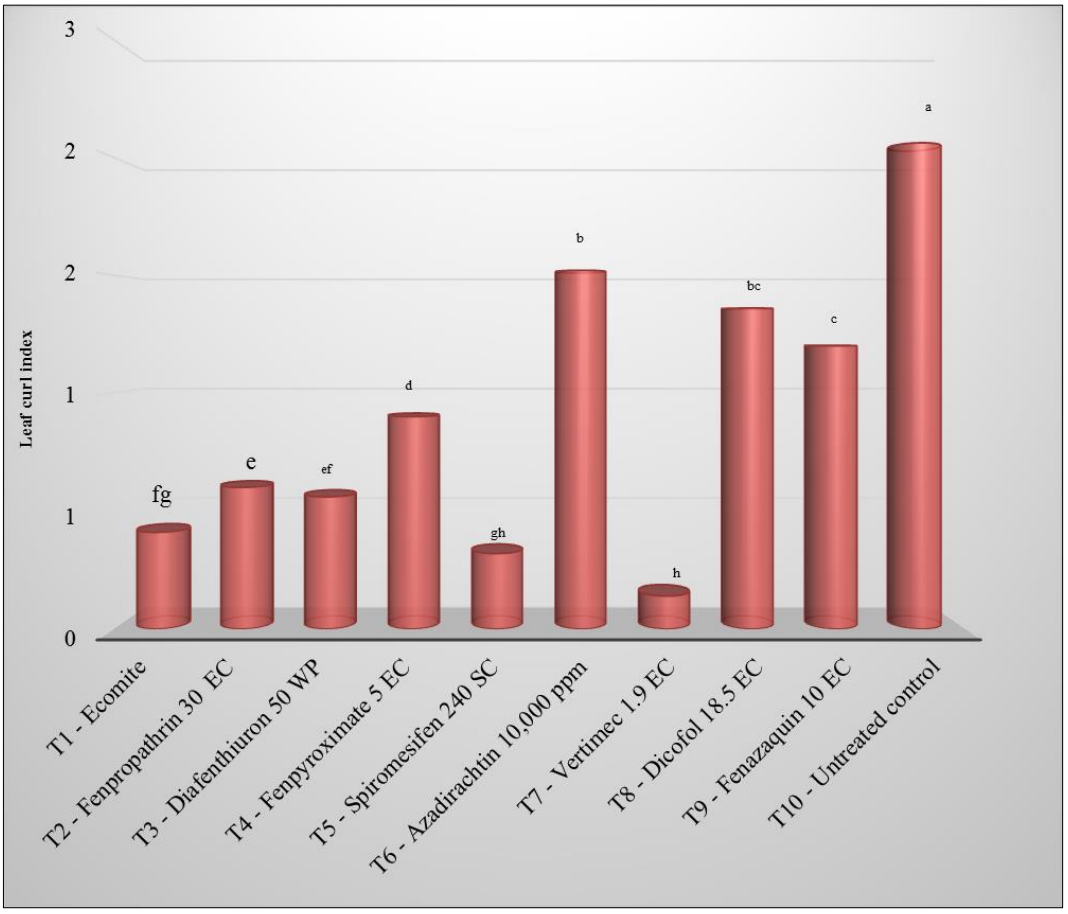

Fig 1: Effect of new molecules on capsicum mites, *Polyphagotarsonemus latus* and leaf curl index

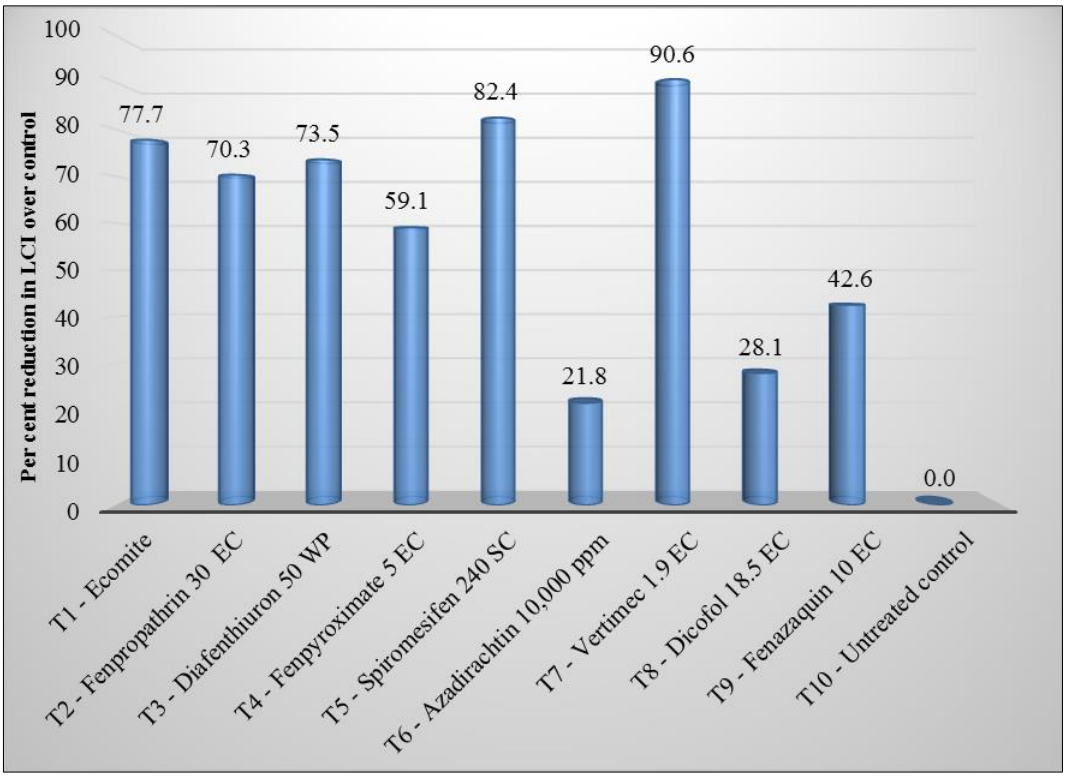

Fig 2: Per cent reduction in Leaf curl index over control due to mites, *Polyphagotarsonemus latus*

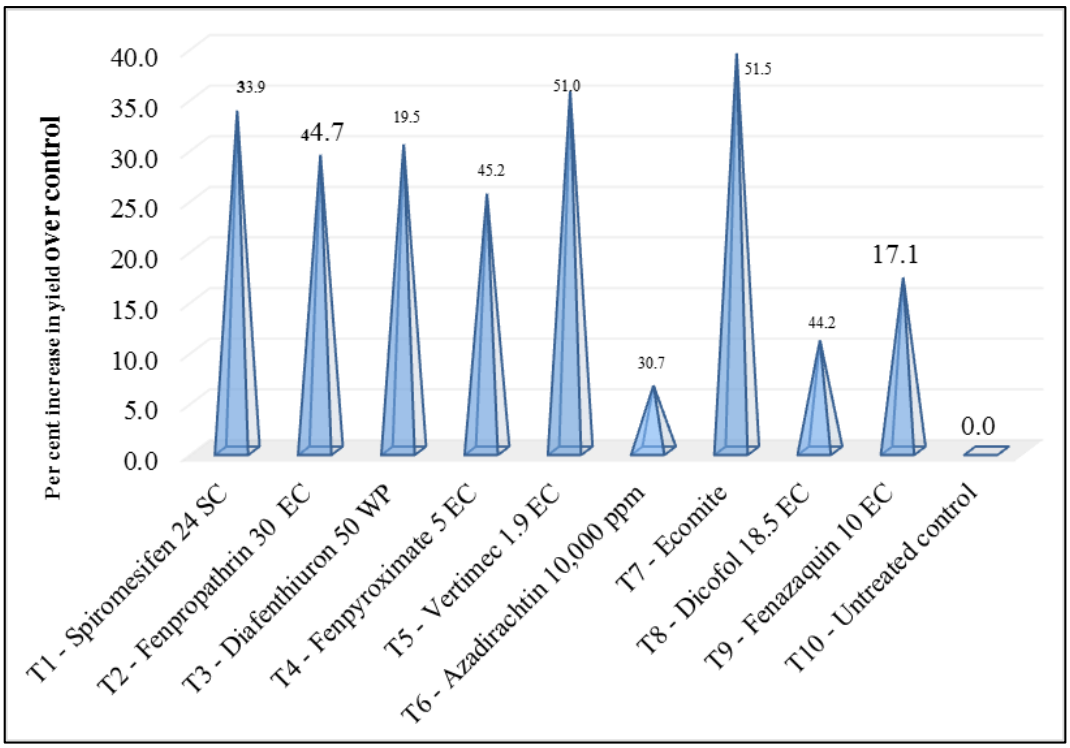

Fig 3: Per cent increase in yield over control against capsicum mites, *Polyphagotarsonemus latus*

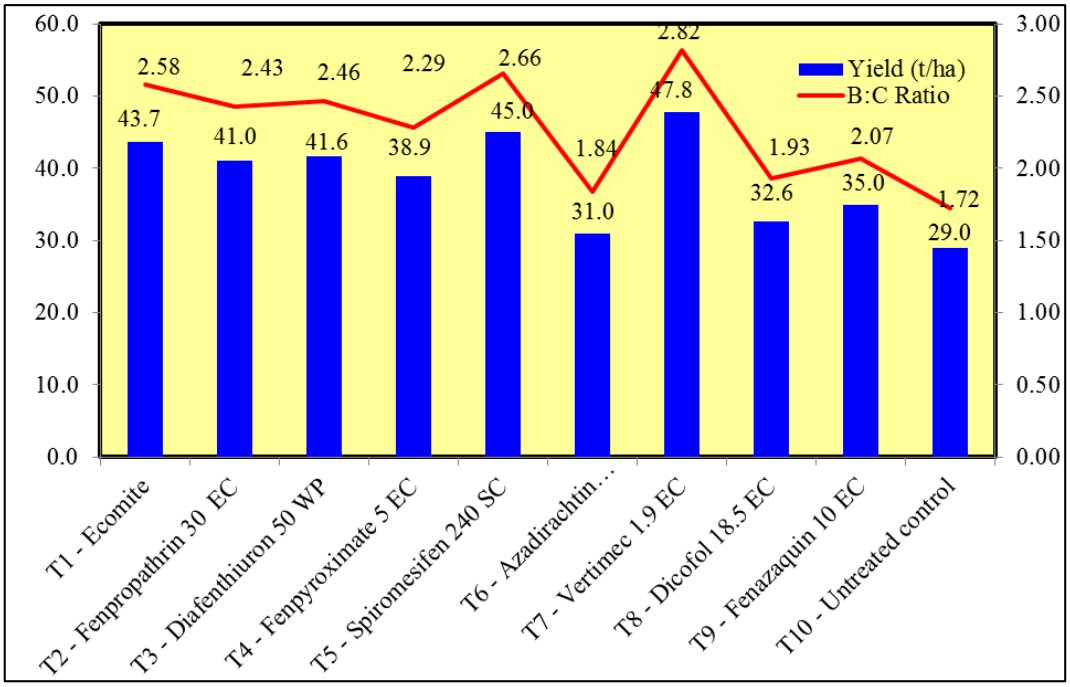

Fig 4: Cost economics of capsicum against mites, *Polyphagotarsonemus latus*

Table 1: Efficacy of new acaricides against capsicum mites, *Polyphagotarsonemus latus* under protected cultivation (First Spray)

Treatments	Dosage (per litre)	Mean number of mites per leaf											
		Precount		1 DAS		3 DAS		7 DAS		14 DAS		Mean	
T_1 – Ecomite	3.0 ml/l	2.40	$(1.70)^a$	1.30	$(1.34)^c$	0.81	$(1.15)^d$	0.60	$(1.05)^{de}$	0.27	$(0.88)^f$	0.75	$(1.10)^e$
T_2 - Fenpropathrin 30 EC	2.0 ml/l	2.10	$(1.61)^a$	1.94	$(1.56)^a$	0.96	$(1.21)^d$	0.79	$(1.13)^{bcd}$	0.67	$(1.08)^c$	1.09	$(1.25)^{bcd}$
T_3 - Diafenthiuron 50 WP	1.0 g/l	2.33	$(1.68)^a$	1.72	$(1.49)^{ab}$	0.75	$(1.12)^d$	0.64	$(1.07)^{cde}$	0.50	$(1.00)^d$	0.90	$(1.17)^{de}$
T_4 - Fenpyroximate 5 EC	0.5 ml/l	2.22	$(1.65)^a$	1.87	$(1.54)^a$	1.36	$(1.36)^c$	0.91	$(1.19)^b$	0.75	$(1.12)^{bc}$	1.22	$(1.30)^{bc}$
T_5 - Spiromesifen 240 SC	1.0 ml/l	2.18	$(1.64)^a$	1.34	$(1.36)^{bc}$	0.77	$(1.13)^d$	0.50	$(1.00)^e$	0.34	$(0.92)^{ef}$	0.74	$(1.10)^e$
T_6 - Azadirachtin 10,000ppm	1.0 ml/l	2.15	$(1.63)^a$	1.91	$(1.55)^a$	1.74	$(1.50)^{ab}$	0.94	$(1.20)^b$	0.86	$(1.16)^b$	1.36	$(1.35)^b$
T_7 - Vertimec 1.9 EC	0.5 ml/l	2.48	$(1.73)^a$	0.88	$(1.17)^d$	0.46	$(0.98)^e$	0.22	$(0.85)^f$	0.10	$(0.77)^g$	0.41	$(0.94)^f$
T_8 - Dicofol 18.5 EC	2.5 ml/l	2.23	$(1.65)^a$	1.90	$(1.55)^a$	1.46	$(1.40)^{bc}$	0.81	$(1.15)^{bc}$	0.68	$(1.09)^c$	1.21	$(1.30)^{bc}$
T_9 - Fenazaquin 10 EC	2.0 ml/l	2.24	$(1.65)^a$	1.72	$(1.49)^{ab}$	1.33	$(1.35)^c$	0.61	$(1.05)^{de}$	0.45	$(0.97)^{de}$	1.03	$(1.22)^{cd}$
T_{10} - Untreated check	-----	2.21	$(1.65)^a$	2.13	$(1.62)^a$	1.98	$(1.58)^a$	1.92	$(1.55)^a$	1.84	$(1.53)^a$	1.97	$(1.57)^a$
S. Em ±		NS		0.05		0.04		0.03		0.03		0.04	
C.D. at 5%		---		0.14		0.11		0.09		0.07		0.10	

DAS: Days after Spraying. Figures in the parenthesis are √x + 0.5 transformed values in a column, means followed by same alphabet do not differ significantly (p= 0.05) by DMRT

Table 2: Efficacy of new acaricides against capsicum mites, *Polyphagotarsonemus latus* under protected cultivation (Second spray)

Treatments	Dosage (per litre)	Mean number of mites per leaf											
		Precount		1* DAS		3 DAS		7 DAS		14 DAS		Mean	
T_1 -Ecomite	3.0 ml/l	1.70	$(1.48)^a$	1.03	$(1.24)^b$	0.65	$(1.07)^{fg}$	0.50	$(1.00)^e$	0.26	$(0.87)^f$	0.61	$(1.05)^f$
T_2 - Fenpropathrin 30 EC	2.0 ml/l	1.52	$(1.42)^a$	1.16	$(1.29)^b$	0.96	$(1.21)^{de}$	0.86	$(1.17)^{cd}$	0.61	$(1.05)^e$	0.90	$(1.18)^{de}$
T_3 - Diafenthiuron 50 WP	1.0 g/l	1.68	$(1.48)^a$	0.98	$(1.22)^b$	0.78	$(1.13)^{ef}$	0.67	$(1.08)^{de}$	0.54	$(1.02)^e$	0.74	$(1.11)^{ef}$
T_4 - Fenpyroximate 5 EC	0.5 ml/l	1.61	$(1.45)^a$	1.50	$(1.41)^a$	1.20	$(1.30)^{cd}$	0.94	$(1.20)^c$	0.88	$(1.18)^d$	1.13	$(1.27)^{cd}$
T_5 - Spiromesifen 240 SC	1.0 ml/l	1.46	$(1.40)^a$	0.88	$(1.18)^b$	0.48	$(0.99)^{gh}$	0.12	$(0.79)^f$	0.03	$(0.72)^g$	0.38	$(0.92)^g$
T_6 - Azadirachtin 10,000ppm	1.0 ml/l	1.63	$(1.46)^a$	1.52	$(1.42)^a$	1.50	$(1.41)^{ab}$	1.45	$(1.40)^{ab}$	1.36	$(1.36)^{ab}$	1.46	$(1.40)^{ab}$
T_7 - Vertimec 1.9 EC	0.5 ml/l	1.59	$(1.44)^a$	0.46	$(0.98)^c$	0.29	$(0.89)^h$	0.09	$(0.77)^f$	0.02	$(0.72)^g$	0.22	$(0.84)^g$
T_8 - Dicofol 18.5 EC	2.5 ml/l	1.62	$(1.46)^a$	1.52	$(1.42)^a$	1.45	$(1.40)^{abc}$	1.20	$(1.30)^b$	1.16	$(1.29)^{bc}$	1.33	$(1.35)^{bc}$
T_9 - Fenazaquin 10 EC	2.0 ml/l	1.57	$(1.44)^a$	1.48	$(1.41)^a$	1.36	$(1.36)^{bc}$	1.28	$(1.33)^{ab}$	0.97	$(1.21)^{cd}$	1.27	$(1.33)^{bc}$
T_{10} - Untreated check	-----	1.84	(1.53)	1.75	$(1.50)^a$	1.67	$(1.47)^a$	1.47	$(1.40)^a$	1.54	(1.43)a	1.61	$(1.45)^a$
S. Em ±		NS		0.04		0.03		0.03		0.03		0.03	
C.D. at 5%		---		0.11		0.10		0.09		0.08		0.10	

DAS: Days after Spraying. Figures in the parenthesis are √x + 0.5 transformed values in a column, means followed by same alphabet do not differ significantly (p= 0.05) by DMRT

Table 3: Efficacy of new acaricides on leaf curl index due to capsicum mites, P*olyphagotarsonemus latus* under protected cultivation

Treatments	Dosage (Per litre)	LCI due to mites after			% Reduction over control	Yield (t/ha)	% Increase in yield over control
		First spray	Second spray	Mean			
T_1 – Ecomite	3.0 ml/l	0.68^{e}	0.41^{fg}	0.55^{ef}	77.73	43.68^{abc}	33.61
T_2 - Fenpropathrin 30 EC	2.0 ml/l	0.82^{e}	0.6^{4e}	0.73^{e}	70.28	41.00^{cd}	29.27
T_3 - Diafenthiuron 50 WP	1.0 g/l	0.74^{e}	0.56^{ef}	0.65^{ef}	73.54	41.60^{bcd}	30.29
T_4 - Fenpyroximate 5 EC	0.5 ml/l	1.10^{d}	0.90^{d}	1.00^{d}	59.14	38.88^{de}	25.41
T_5 - Spiromesifen 240 SC	1.0 ml/l	0.54^{ef}	0.32^{gh}	0.43^{fg}	82.43	45.00^{ab}	35.56
T_6 - Azadirachtin 10,000ppm	1.0 ml/l	2.31^{b}	1.52^{b}	1.92^{b}	21.76	33.00^{fg}	6.45
T_7 - Vertimec 1.9 EC	0.5 ml/l	0.32^{f}	0.14^{h}	0.23^{g}	90.60	47.76^{a}	39.28
T_8 - Dicofol 18.5 EC	2.5 ml/l	2.16^{b}	1.36^{bc}	1.76^{b}	28.09	32.56^{fg}	10.93
T_9 - Fenazaquin 10 EC	2.0 ml/l	1.61^{c}	1.20^{c}	1.41^{c}	42.59	35.00^{ef}	17.14
T_{10} - Untreated check	-----	2.84^{a}	2.06^{a}	2.45^{a}	0.00	29.00^{g}	0.00
S. Em ±		0.09	0.05	0.08	--	1.49	--
C.D. at 5%		0.27	0.20	0.24	--	4.48	--

LCI: Leaf Curl Index, Figures in the parenthesis are √x + 0.5 transformed values in a column, means followed by same alphabet do not differ significantly (p= 0.05) by DMRT

Table 4: Cost economics of new acaricides capsicum against mites, *Polyphagotarsonemus latus* under protected cultivation

Treatments	Dosage (Per litre)	Yield (t/ha)	Cost of plant Protection (Rs/ha)	Other production cost (Rs/ha)	Total cost of production (Rs/ha)	Gross returns (Rs/ha)	Net returns (Rs/ha)	B:C Ratio
T_1 – Ecomite	3.0 ml/l	43.68	4250	1011500	1015750	2620800	1605050	2.58
T_2 - Fenpropathrin 30 EC	2.0 ml/l	41.00	2400	1011500	1013900	2460000	1446100	2.43
T_3 - Diafenthiuron 50 WP	1.0 g/l	41.60	1694	1011500	1013194	2496000	1482806	2.46
T_4 - Fenpyroximate 5 EC	0.5 ml/l	38.88	9250	1011500	1020750	2332800	1312050	2.29
T_5 - Spiromesifen 240 SC	1.0 ml/l	45.00	3500	1011500	1015000	2700000	1685000	2.66
T_6 - Azadirachtin 10,000ppm	1.0 ml/l	31.00	1075	1011500	1012575	1860000	847425	1.84
T_7 - Vertimec 1.9 EC	0.5 ml/l	47.76	4500	1011500	1016000	2865600	1849600	2.82
T_8 - Dicofol 18.5 EC	2.5 ml/l	32.56	825	1011500	1012325	1953600	941275	1.93
T_9 - Fenazaquin 10 EC	2.0 ml/l	35.00	4800	1011500	1016300	2100000	1083700	2.07
T_{10} - Untreated check	-----	29.00	0	*1009500	1009500	1740000	730500	1.72

Gross return = Yield x Market price of capsicum (Rs. 60/kg)
Net Returns = Gross returns - Total cost of production
B:C ratio = Gross returns / Total cost
* Spraying cost excluded

Conclusion

Evaluation of different acaricides indicated that vertimec 1.9 EC at 0.5 ml per litre, was found effective in suppressing the mite population by recording highest yield (47.76 t ha^{-1}), maximum net returns (Rs. 1849600/ha) and highest B:C ratio (2.82). Similarly, spiromesifen 240 SC at 1.0 ml per litre recorded highest fresh fruit yield (45.0 t ha^{-1}) with higher net returns (Rs.1685000/ha) and B:C ratio (2.66) and ecomite registered higher fresh capsicum yield (43.68 t ha^{-1}) suggesting two new molecules (Vertimec 1.9 EC and spiromesifen 240 SC) and biopesticides, ecomite were more cost effective and most feasible in suppressing mites.

Reference

1. Anonymous. Monitoring of pesticide residues at national level. Annual progress report; c2015. p. 115-132.
2. Ayyanar S, Chinniah C, Kalyanasundram M, Balakrishnanan K. Field efficacy of new insecticide molecules against sucking pests of eggplant, *Solanum melongena* L. Annals of Plant Protection Sciences. 2018;26(1):65-68.
3. Butani DK. Pests and diseases of chilli and their control. Pesticides. 1976;10:38-41.
4. Chinniah C, Ali KA. Relative efficacy of insecticides acaricides against sucking pest of okra. Pest Management and Economic Zoology. 2000;8(2):111-116.
5. Choi WI, Lee SG, Park HM, Ahn YJ. Toxicity of plant essential oils to *Tetranychus urticae* (Acari: Tetranychidae) and *Phytoseiulus persimilis* (Acari: Phytoseiidae). Journal of Economic Entomology. 2004;97(2):553-558.
6. Corbitt TS. Toxicity and mode of action of avermectin B1 [abamectin] against insects [Blattaria and Noctuidae]. Index to Theses Accepted for Higher Degrees in the Universities of Great Britain and Ireland (UK); c1989. p. 170-187.
7. Gerson U. Biology and control of the broad mite, *Polyphagotarsonemus latus* (Banks) (Acari: Tarsonemidae. Experimental and Applied Acarology. 1992;13:163-178.
8. Hosamani AC, Thulasiram K, Patil BV, Bheemana M, Hanchinal SG. Fenpropathrin (Meothrin) 30 EC an ideal insecticide for chilli (*Capsicum annum* L) pest management. Pestology. 2005;24(2):21-24.
9. Jeyarani S and Chandrasekaran M. Bioefficacy of certain acaricides against chilli mite, *Polyphagotarsonemus latus* (Banks). Agricultural Science Digest. 2006;26(2):132-134.
10. Kavitha J, Kuttalam S and Chandrasekaran S. Evaluation of spiromesifen 240 SC against chilli mite. Annals of Plant Protection Sciences. 2006;14:52-55.
11. Kharbade SB, Tamboli ND, Chormule AJ. Population dynamics and management of capsicum mite *Polyphagotarsonemus latus* Bank. Annals of Plant Protection Sciences. 2015;23(2):257-260.
12. Kumar NKK. Yield loss in chilli and sweet pepper due to

Scirtothrips dorsalis Hood. Pest Management in Horticultural Ecosystems. 1995;1:61-69.
13. Lingeri MS, Awaknavar JS, Lingappa S, Kulkarni KA. Seasonal occurrence of chilli mite {*Polyphagotarsonemus latus* (Banks)] and Thrips [*Scirtothrips dorsalis* (Hood)]. Karnataka Journal of Agricultural Sciences.1998;11(2):380-385.
14. Liu TS, Wang WJ, Wong YS. Survey on the hosts damaged by the broad mite and its control. Plant Protection Bulletin. 1991;33(4):344-353.
15. Mallapur CP, Lingappa S. Management of chilli pests through indigenous materials. Karnataka Journal of Agricultural Sciences. 2005;18(2):389-392.
16. Moorthy PNK, Saroja S, Shivaramu K. Bio-efficacy of neem products and essential oils against thrips (*Scirtothrips dorsalis* Hood) in capsicum. Pest Management in Horticultural Ecosystems. 2013;19(2):191-193.
17. Reddy SD, Puspalatha M. Efficacy of certain new acaricides against two spotted spider mite, *Tetranychus urticae* Koch. on ridge gourd. Pest Management in Horticultural Ecosystems. 2013;19(2):199-202.
18. Samanta A, Sen K, Basu I. Evaluation of insecticides and acaricides against yellow mite and thrips infesting chilli (*Capsicum annum* L.). Journal of Crop and Weed. 2017;13(2):80-186.
19. Singh, Rishi. Bio-efficacy of some novel insecticides in controlling insect and mite pests of capsicum. M.sc.(Agri.) Thesis, Orissa. Agri. Univ; c2017.
20. Sreenivas AG, Nadaf AM, Mallpur CP, Naragund VB, Patil SB. Bio efficacy of ecomite against *Tetranychus cinnabarinus* Boisduval in okra. Annals of Plant Protection Sciences. 2008;16(1):40-42.
21. Srinivasulu P, Naidu VG, Rao NV. Evaluation of different pesticides for the control of yellow mite, *Polyphagotarsonemus latus* (Banks) on chilli. Journal of Applied Zoological Research. 2002;13(1):71-72.
22. Varghese TS, Mathew TB. Bioefficacy and safety evaluation of newer insecticides and acaricides against chilli thrips and mites. Journal of Tropical Agriculture. 2013;51(1-2):111-115.
23. Vijayalakshmi P, Singh TV, Vemuri SB, Reddy RVSK, Bharathi NB. Evaluation of certain insecticide molecules against mite *Polyphagotarsonemus latus B*anks on Capsicum. Journal of Research ANGRAU. 2015;43(3-4):48- 57.
24. Prabhakara S, Deshpande MD. The no-slip boundary condition in fluid mechanics. Resonance. 2004 May;9(5):61-71.
25. Kumar R, Kumar S, Mehrotra SP. Towards sustainable solutions for fly ash through mechanical activation. Resources, Conservation and Recycling. 2007 Dec 1;52(2):157-79.