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**Gajendra Chandrakar**Department of Entomology,  
Indira Gandhi Krishi  
Vishwavidyalaya, Raipur,  
Chhattisgarh, India**Renuka**Department of Entomology,  
Indira Gandhi Krishi  
Vishwavidyalaya, Raipur,  
Chhattisgarh, India**Manmohan Singh Bisen**Department of Entomology,  
Indira Gandhi Krishi  
Vishwavidyalaya, Raipur,  
Chhattisgarh, India**Harshal Kumar Chandrakar**Department of Entomology,  
Indira Gandhi Krishi  
Vishwavidyalaya, Raipur,  
Chhattisgarh, India**Corresponding Author:****Renuka**Department of Entomology,  
Indira Gandhi Krishi  
Vishwavidyalaya, Raipur,  
Chhattisgarh, India

## Bio-efficacy of Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP against sucking insect pests of chilli during *Rabi* season 2017-18 and 2018-19

**Gajendra Chandrakar, Renuka, Manmohan Singh Bisen and Harshal Kumar Chandrakar**

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### Abstract

The field experiment was conducted to evaluate the “Effect of soil and foliar supplementation of nitrogen, boron and salicylic acid on growth and yield of cucumber (*Cucumis sativus* L.) in alfisols of Konkan (M.S.)” at Research and Education Farm, Department of Agricultural Botany, College of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri (M.S.) during the Summer season of 2018. The experiment was laid out in Randomized Block Design (RBD) comprising ten treatment combinations replicated thrice, where the effect of soil and foliar supplementation of nitrogen, boron and salicylic acid either alone or in combinations applied along with the recommended dose of fertilizers (135:60:30 NPK kg ha<sup>-1</sup>) and an absolute control (to judge the fate of native nutrients) were studied. The study further revealed that the treatment receiving the application of recommended dose of fertilizer (135:60:30 kg ha<sup>-1</sup>) + Foliar spray of nitrogen through urea (1%) + Soil application of boron through borax @ 2 kg ha<sup>-1</sup> + Foliar spray of salicylic acid (0.2%) was recorded the highest fruit yield (231.22 q ha<sup>-1</sup>) and yield attributing characters like number of fruits per vine (7.00) and weight of fruit i.e., 1.98 kg per vine as well as growth parameters *viz.* vine length (407.00 cm) and number of branches per vine (14.22) of Cucumber in alfisols of Konkan (M.S.).

**Keywords:** Emamectin Benzoate, salicylic acid, alfisols

### Introduction

Chilli (*Capsicum annum* L.) popularly known as ‘mirch’ in Hindi. It belongs to the family Solanaceae. Chilli is one of the important vegetable and commercial spice crops (Mondal *et al.*, 2012) [13]. The red color of chillies is due to the presence of pigment ‘Capsanthin’ (Choudhary *et al.*, 2009) [3]. It is grown throughout the year as a cash crop and used in green and red ripe dried stage for their pungency, colour and other ingredients in all culinary preparations of rich and poor alike to impart taste, flavour and colour. Nutritionally, it is a rich source of vitamin A, B and C. Capsaicin an alkaloid responsible for pungency in chillies has medicinal properties and it prevents heart attack by dilating the blood vessels (Gill, 1989) [6]. Important chilli producing countrys are China, India, Indonesia and Sri Lanka in Asian region. Nigeria, Tunisia, Ghana, and Egypt in Africa, Mexico, United States of America in North & Central America, Spain, Yugoslavia, Romania, Italy, Bulgaria, and Hungary in Europe and Peru, Argentina and Brazil in South America (Kraft *et al.*, 2014) [10]. In India, chilli is grown in 2, 87, 050 ha area with a production of 34,06,030 metric tonnes (Anonymous, 2017) [1]. Whereas in Chhattisgarh, the area is 37,320 ha and production is 2, 68, 440 metric tonnes (Anonymous, 2017) [1]. Indian Chilli is principally exported to Bahrain, Israel, Bangladesh, Japan, USA, Malaysia and UAE (Halder and Kodandaram, 2014) [7].

The chilli crop is attacked by a number of insect-pests right from germination to harvest of the crop, out of them thrips is major sucking insect pests, responsible for low productivity, reduce up to 50 per cent yield (Ahmed *et al.*, 1987) [2]. Under severe infestation thrips alone cause 50 percent yield loss (Kandasamy *et al.*, 1990). The yield losses range from 50-90 percent due to insect pests of chilli (Nelson and Natrajan, 1994 and Kumar, 1995) [15, 11]. These sucking pests causes serious damage to chilli crop by direct feeding and transmit deadly chilli leaf

curl disease. Both adults and nymphs of thrips feed by rasping and sucking the oozing cell sap from the ventral side of the leaves, growing shoots, developing flowers and fruits. The affected leaves curl and exhibit characteristic leaf curl symptoms. Over use of pesticides has often led to the development of undesirable problems like destruction of natural enemies, pest resurgence and failure of control strategies leading to outbreak of leaf curling in chilli. In addition the presence of pesticide residues in chillies (Joia *et al.*, 2001) [8] has been of more concern for export of chillies to developed countries. In this context, it is therefore necessary to develop effective non-chemical pest management strategies against sucking pests for sustained crop management and production of healthy food. In view of this indiscriminate use of chemical pesticides and public concerns, the rise of new generation insecticides provides an alternative to reduce the ill effects of conventional insecticides. The pesticides molecules of new generation have been claimed to be effective as well as safer for non-target organism. Realizing serious pest status of the thrips, few promising, and widely recommended insecticides were incorporated in the present investigation.

### Materials and Methods

The Experiments was carried out under field conditions at the Horticulture farm, Indira Gandhi Krishi Vishwavidyalaya,

Raipur, during *Rabi* 2017-18 & 2018-19. Bio - efficacy of five insecticidal treatments comprising Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP at three different doses viz., 11.00, 16.00 and 21.25 g a.i./ha respectively has been tested against thrips along with single dose of Emamectin Benzoate 5 % SG (10 g a.i./ ha) and lambda cyhalothrin 5% EC (15 g a.i./ ha) were sprayed with an untreated control check was shown in Randomized Block Design. There were three replications with 5m x 4 m plot size. The plant spacing between row to row and plant to plant was maintained 60 cm x 60 cm, respectively.

The observations on total number of thrips, mite and aphid were recorded on top, middle and bottom leaves of five randomly selected plants from each treatment at one day before insecticide application while post-treatment observation made after 1, 3, 7, 10 and 15 days after spraying five plants randomly selected from each plot to work out the mean reduction in the insect population over control using statistical analysis.

Two sprays of each treatment were applied. Fruits were harvested from each plot separately and yield per plant each picking was recorded in kg. Total yield was worked out by adding the yield of each picking. The yield per plot was converted to quintals per hectare.

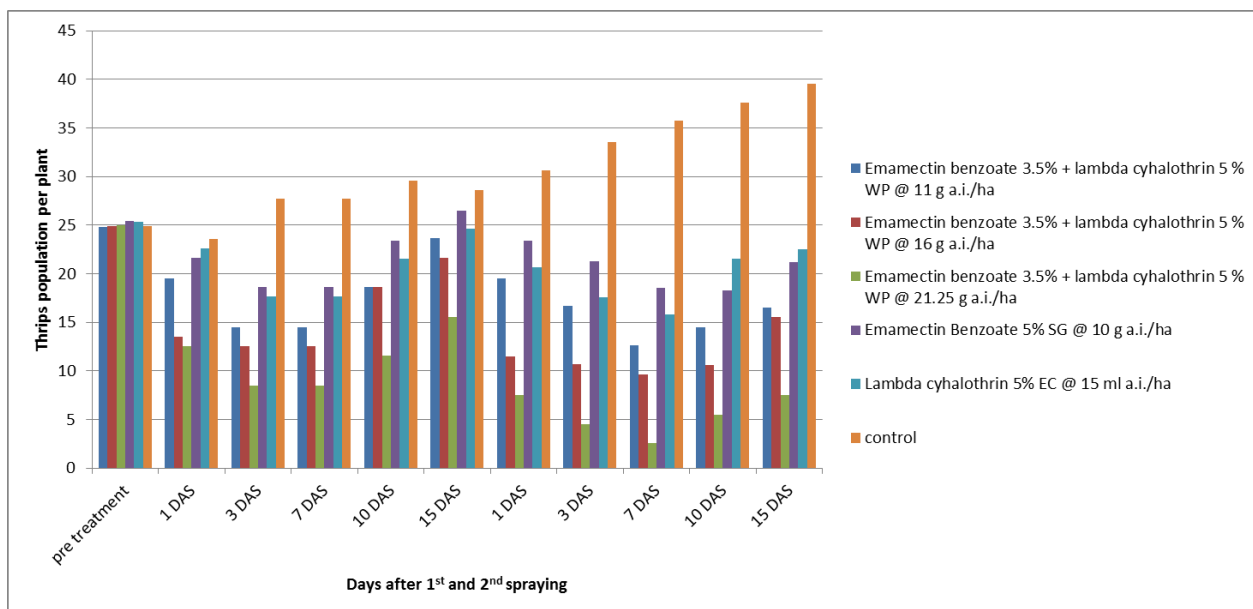
### Treatments detail

S. No.	Treatments	Dose
T <sub>1</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	11 g a.i./ha
T <sub>2</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	16 g a.i./ha
T <sub>3</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	21.25 g a.i./ha
T <sub>4</sub>	Emamectin Benzoate 5% SG	10 g a.i./ha
T <sub>5</sub>	Lambda cyhalothrin 5% EC	15 g a.i./ha
T <sub>6</sub>	Control (Untreated)	-

**Table 1:** Bio-efficacy of Emamectin benzoate 3.5%+Lambda cyhalothrin 5% WP against thrips on chilli pooled data during *Rabi* 2017-18 & 2018-19

Treatment	Insecticide	Dose	Pre treatment	Average no. of thrips/ plant										Over all mean
				I Spray					II Spray					
				1 DAS	3 DAS	7 DAS	10 DAS	15 DAS	1 DAS	3 DAS	7 DAS	10 DAS	15 DAS	
T <sub>1</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	11 ga.i./ha	24.81 (5.55)	19.54 (4.97)	16.58 (4.07)	14.52 (3.81)	18.63 (4.31)	23.63 (4.86)	19.53 (4.41)	16.68 (4.08)	12.63 (3.55)	14.52 (3.81)	16.51 (4.06)	17.96
T <sub>2</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	16 ga.i./ha	24.89 (5.53)	13.54 (4.24)	10.58 (3.25)	12.52 (3.53)	18.61 (4.31)	21.63 (4.65)	11.53 (3.39)	10.68 (3.26)	9.63 (3.10)	10.58 (3.25)	15.51 (3.93)	13.48
T <sub>3</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	21.25 ga.i./ha	24.97 (5.54)	12.59 (3.54)	11.55 (3.39)	8.53 (2.92)	11.55 (3.39)	15.52 (3.94)	7.53 (2.74)	4.51 (2.12)	2.55 (1.59)	5.53 (2.35)	7.55 (2.74)	10.21
T <sub>4</sub>	Emamectin Benzoate 5% SG	10 ga.i./ha	25.45 (5.59)	21.63 (4.65)	19.58 (4.42)	18.62 (4.31)	23.38 (4.83)	26.48 (5.14)	23.37 (4.83)	21.27 (4.61)	18.51 (4.30)	18.27 (4.27)	21.23 (4.60)	21.61
T <sub>5</sub>	Lambda cyhalothrin 5% EC	15 ml a.i./ha	25.36 (5.58)	22.60 (4.75)	18.51 (4.30)	17.68 (4.20)	21.54 (4.64)	24.62 (4.96)	20.64 (4.54)	17.57 (4.19)	15.78 (3.97)	21.56 (4.64)	22.55 (4.74)	20.76
T <sub>6</sub>	Control (Untreated)	-	24.86 (5.53)	23.60 (4.85)	25.51 (5.05)	27.68 (5.26)	29.54 (5.43)	28.62 (5.35)	30.64 (5.53)	33.57 (5.79)	35.78 (5.98)	37.56 (6.12)	39.55 (6.28)	30.62
SEm <sub>±</sub>			0.047	0.015	0.005	0.002	0.025	0.002	0.002	0.006	0.004	0.002	0.007	
CD at 5%			NS	0.045	0.015	0.006	0.079	0.006	0.007	0.018	0.012	0.007	0.021	

DAS= days after spray, ( ) figures in parentheses are square root transformed, NS= Non significant, S= significant.

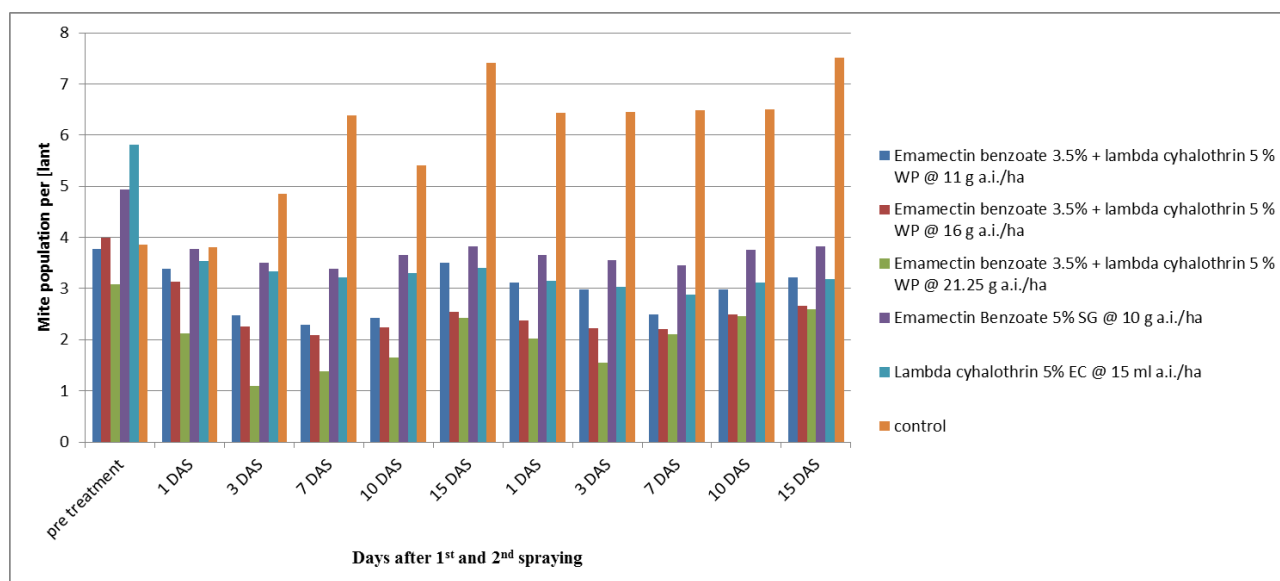


**Fig 1:** Bio-efficacy of Emamectin benzoate 3.5% + Lambda cyhalothrin 5% WP against thrips on chilli after 1<sup>st</sup> & 2<sup>nd</sup> spray.

**Table 2:** Bio-efficacy of Emamectin benzoate 3.5% + Lambda cyhalothrin 5% WP against mite on chilli pooled data during *Rabi* 2017-18 & 2018-19

Treat ment	Insecticide	dose	Pre treatment	I Spray					II Spray					Over all mean
				1DAS	3DAS	7DAS	10DAS	15DAS	1DAS	3DAS	7DAS	10DAS	15DAS	
T <sub>1</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	11 g a.i./ha	3.78 (1.94)	3.38 (1.83)	2.48 (1.57)	2.29 (1.51)	2.42 (1.55)	3.51 (1.87)	3.12 (1.76)	2.99 (1.72)	2.49 (1.57)	2.99 (1.72)	3.22 (1.79)	2.97
T <sub>2</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	16g a.i./ha	4.00 (2.00)	3.13 (1.76)	2.26 (1.50)	2.09 (1.44)	2.24 (1.49)	2.54 (1.59)	2.38 (1.54)	2.22 (1.48)	2.20 (1.48)	2.50 (1.58)	2.67 (1.63)	2.53
T <sub>3</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	21.25 g a.i./ha	3.08 (1.75)	2.13 (1.45)	1.09 (1.04)	1.39 (1.17)	1.65 (1.28)	2.43 (1.55)	2.03 (1.42)	1.55 (1.24)	2.10 (1.44)	2.46 (1.56)	2.60 (1.61)	2.04
T <sub>4</sub>	Emamectin Benzoate 5% SG	10 g a.i./ha	4.94 (2.22)	3.77 (1.94)	3.51 (1.87)	3.39 (1.84)	3.65 (1.91)	3.82 (1.95)	3.65 (1.91)	3.56 (1.88)	3.46 (1.86)	3.75 (1.93)	3.83 (1.95)	3.66
T <sub>5</sub>	Lambda cyhalothrin 5% EC	15 ml a.i./ha	5.82 (2.41)	3.54 (1.88)	3.34 (1.82)	3.21 (1.79)	3.31 (1.81)	3.41 (1.84)	3.15 (1.77)	3.03 (1.74)	2.88 (1.69)	3.12 (1.76)	3.19 (1.78)	3.27
T <sub>6</sub>	Control (Untreated)	-	3.85 (1.96)	3.81 (1.95)	4.85 (2.20)	6.38 (2.52)	5.40 (2.32)	7.42 (2.72)	6.44 (2.53)	6.46 (2.54)	6.48 (2.54)	6.50 (2.55)	7.52 (2.74)	5.92
SEM <sub>±</sub>		-	1.08	1.01	1.03	1.03	1.03	1.01	1.03	1.04	1.03	1.06	1.06	
CD at 5%		-	NS	1.13	1.12	1.13	1.15	1.07	1.13	1.14	1.13	1.23	1.23	

DAS= days after spray, ( ) figures in parentheses are square root transformed, NS= Non significant, S= significant.

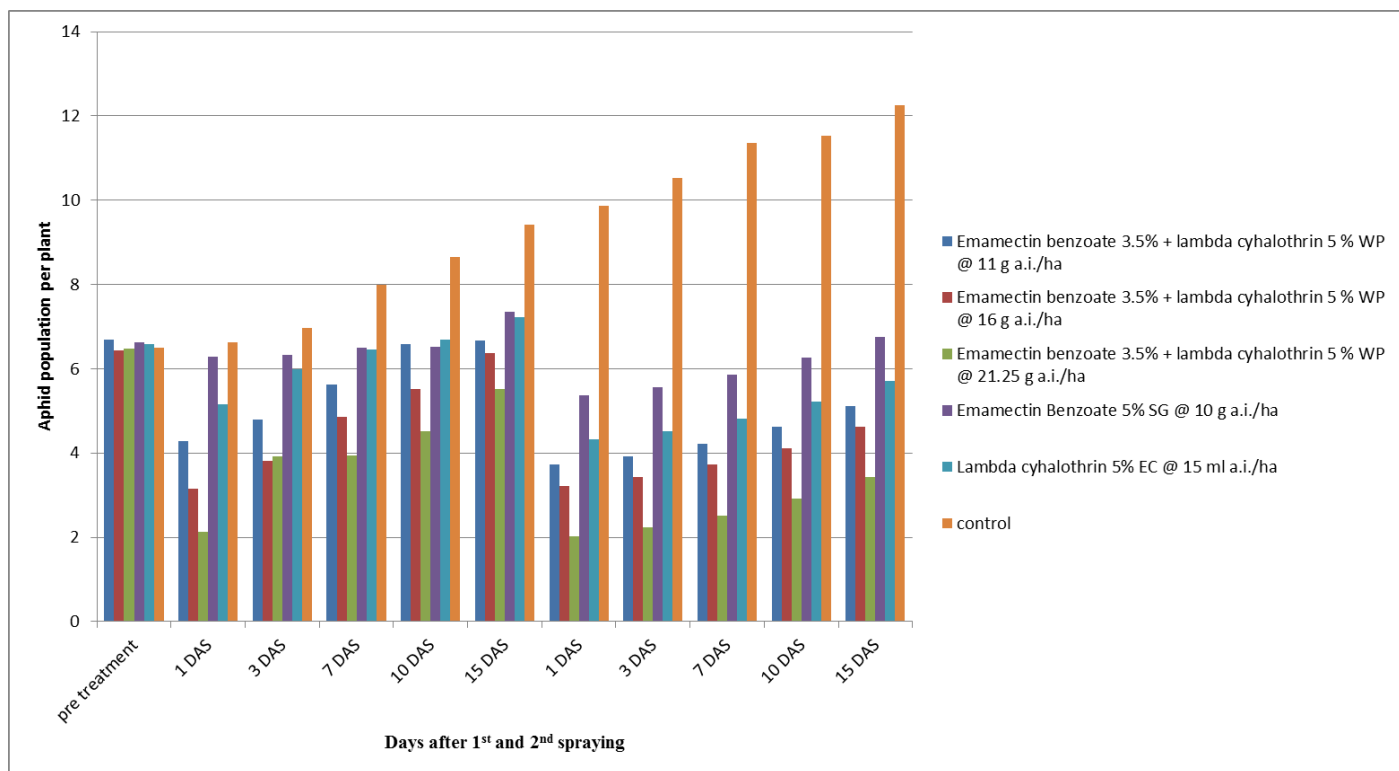


**Fig 2:** Bio-efficacy of Emamectin benzoate 3.5% + Lambda cyhalothrin 5% WP against mite on chilli after 1<sup>st</sup> & 2<sup>nd</sup> spray.

**Table 3:** Bio-efficacy of Emamectin benzoate 3.5% + Lambda cyhalothrin 5% WP against aphid on chilli pooled data during *Rabi* 2017-18 and 2018-19

Treatment	Insecticide	Dose	Pre treatment	1 <sup>st</sup> Spray					2 <sup>nd</sup> Spray					Overall Mean
				1DAS	3DAS	7DAS	10DAS	15DAS	1DAS	3DAS	7DAS	10DAS	15DAS	
T1	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	11 g a.i./ha	6.69 (3.18)	4.28 (2.68)	4.79 (2.80)	5.62 (2.97)	6.59 (3.16)	6.66 (3.17)	3.72 (5.1)	3.92 (2.60)	4.22 (2.67)	4.62 (2.75)	5.12 (2.86)	5.11
T2	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	16 g a.i./ha	6.43 (3.12)	3.15 (2.41)	3.82 (2.57)	4.85 (2.81)	5.52 (2.95)	6.38 (3.12)	3.22 (2.42)	3.42 (2.47)	3.72 (2.54)	4.12 (2.64)	4.62 (2.94)	4.47
T3	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	21.25 g a.i./ha	6.47 (3.13)	2.14 (2.12)	2.92 (2.32)	3.95 (2.60)	4.52 (2.73)	5.52 (3.95)	2.02 (1.98)	2.23 (2.14)	2.52 (2.23)	2.92 (2.34)	3.42 (2.46)	3.51
T4	Emamectin Benzoate 5% SG	10 g a.i./ha	6.62 (3.17)	6.29 (3.10)	6.33 (3.11)	6.49 (3.14)	6.53 (3.15)	7.36 (3.30)	5.36 (3.30)	5.56 (2.96)	5.86 (3.02)	6.26 (3.10)	6.76 (3.19)	6.31
T5	Lambda cyhalothrin 5% EC	15 ml a.i./ha	6.59 (3.16)	5.16 (2.87)	5.99 (3.04)	6.46 (3.12)	6.69 (3.18)	7.22 (3.28)	4.32 (2.69)	4.52 (2.74)	4.82 (2.8)	5.22 (2.89)	5.72 (2.99)	5.70
T6	Control (Untreated)	-	6.49 (3.12)	6.63 (3.16)	6.96 (3.23)	7.99 (3.41)	8.66 (3.52)	9.43 (3.65)	9.86 (3.71)	10.53 (3.82)	11.36 (3.94)	11.53 (3.95)	12.26 (4.06)	9.24
SEm±			0.029	0.032	0.026	0.033	0.040	0.041	0.032	0.023	0.018	0.036	0.018	
CD at 5%			NS	0.102	0.082	0.106	0.127	0.132	0.103	0.073	0.058	0.114	0.058	

DAS= days after spray, ( ) figures in parentheses are square root transformed, NS= Non significant, S= significant.



**Fig. 3:** Bio-efficacy of Emamectin benzoate 3.5% + Lambda cyhalothrin 5% WP against aphids on chilli after 1<sup>st</sup> & 2<sup>nd</sup> spray

**Table 4:** Effect of Emamectin benzoate 3.5%+Lambda cyhalothrin 5% WP against Coccinellids on chilli pooled data during *Rabi* 2017-18 & 2018-19

Treatment	Insecticide	dose	Pre treatment	I Spray					II Spray					Over all mean
				1 DAS	3DAS	7DAS	10DAS	15DAS	1 DAS	3DAS	7DAS	10DAS	15DAS	
T <sub>1</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	11 g a.i./ha	0.46 (1.36)	0.3 (1.25)	0.46 (1.36)	0.28 (1.18)	0.42 (1.32)	0.43 (1.33)	0.51 (1.41)	0.43 (1.33)	0.45 (1.35)	0.46 (1.36)	0.40 (1.30)	0.43
T <sub>2</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	16g a.i./ha	0.44 (1.31)	0.41 (1.31)	0.22 (1.12)	0.46 (1.36)	0.45 (1.35)	0.44 (1.34)	0.42 (1.32)	0.40 (1.30)	0.44 (1.38)	0.40 (1.30)	0.43 (1.33)	0.41
T <sub>3</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	21.25 g a.i./ha	0.47 (1.37)	0.35 (1.25)	0.27 (1.17)	0.35 (1.25)	0.44 (1.34)	0.42 (1.32)	0.40 (1.30)	0.44 (1.34)	0.48 (1.38)	0.40 (1.30)	0.42 (1.32)	0.42
T <sub>4</sub>	Emamectin Benzoate 5% SG	10 g a.i./ha	0.42 (1.32)	0.33 (1.23)	0.26 (1.16)	0.34 (1.24)	0.42 (1.32)	0.43 (1.33)	0.46 (1.36)	0.41 (1.31)	0.45 (1.31)	0.38 (1.28)	0.40 (1.30)	0.39

T <sub>5</sub>	Lambda cyhalothrin 5% EC	15 ml a.i./ha	0.45 (1.35)	0.38 (1.28)	0.24 (1.14)	0.40 (1.30)	0.46 (1.36)	0.44 (1.34)	0.45 (1.35)	0.42 (1.32)	0.43 (1.33)	0.40 (1.30)	0.42 (1.32)	0.40
T <sub>6</sub>	Control (Untreated)	-	0.46 (1.36)	0.47 (1.37)	0.46 (1.36)	0.49 (1.39)	0.44 (1.34)	0.45 (1.35)	0.46 (1.36)	0.47 (1.37)	0.48 (1.38)	0.47 (1.37)	0.46 (1.36)	0.46
	SEm±		0.21	0.21	0.01	0.21	0.21	0.21	0.21	0.21	0.21	0.21	0.21	
	CD at 5%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	

DAS = days after spray, ( ) figures in parentheses are square root transformed, NS = Non significant, S= significant.

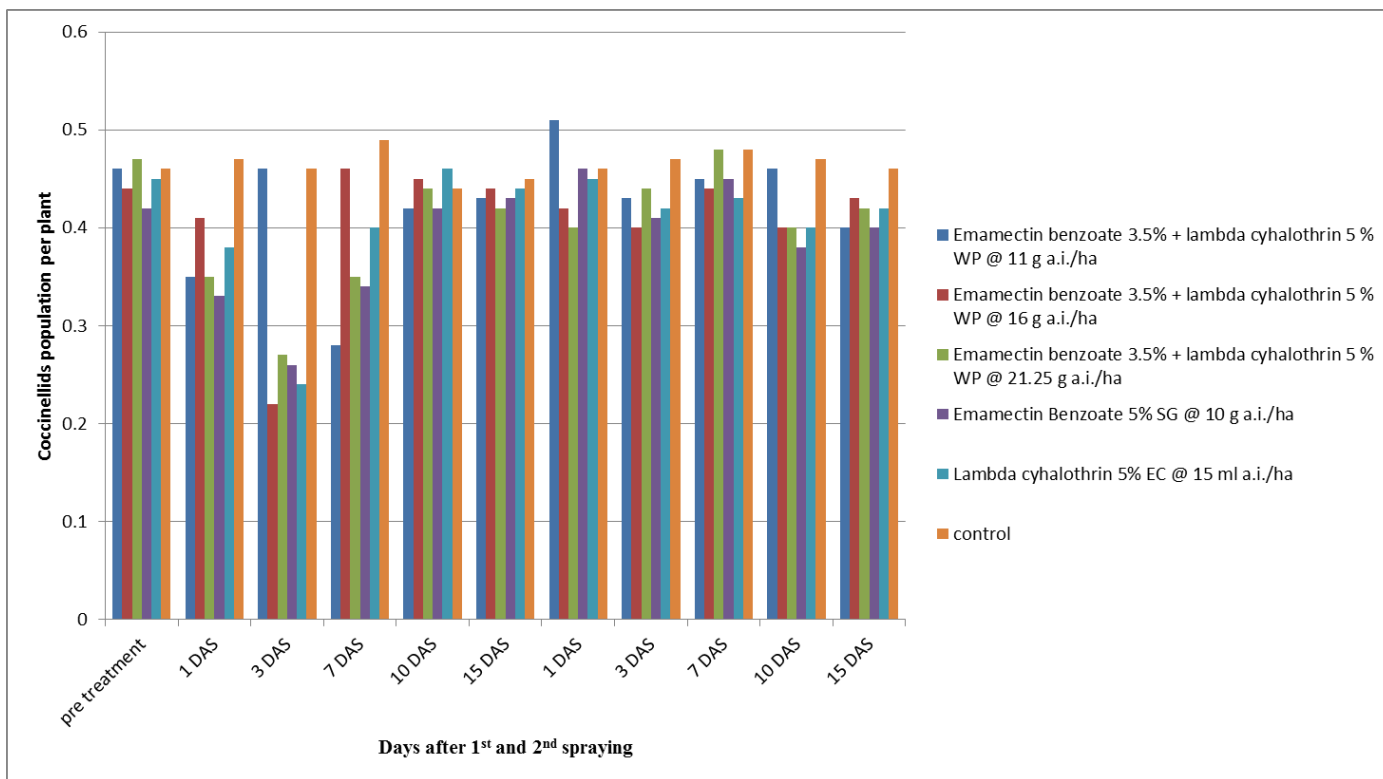
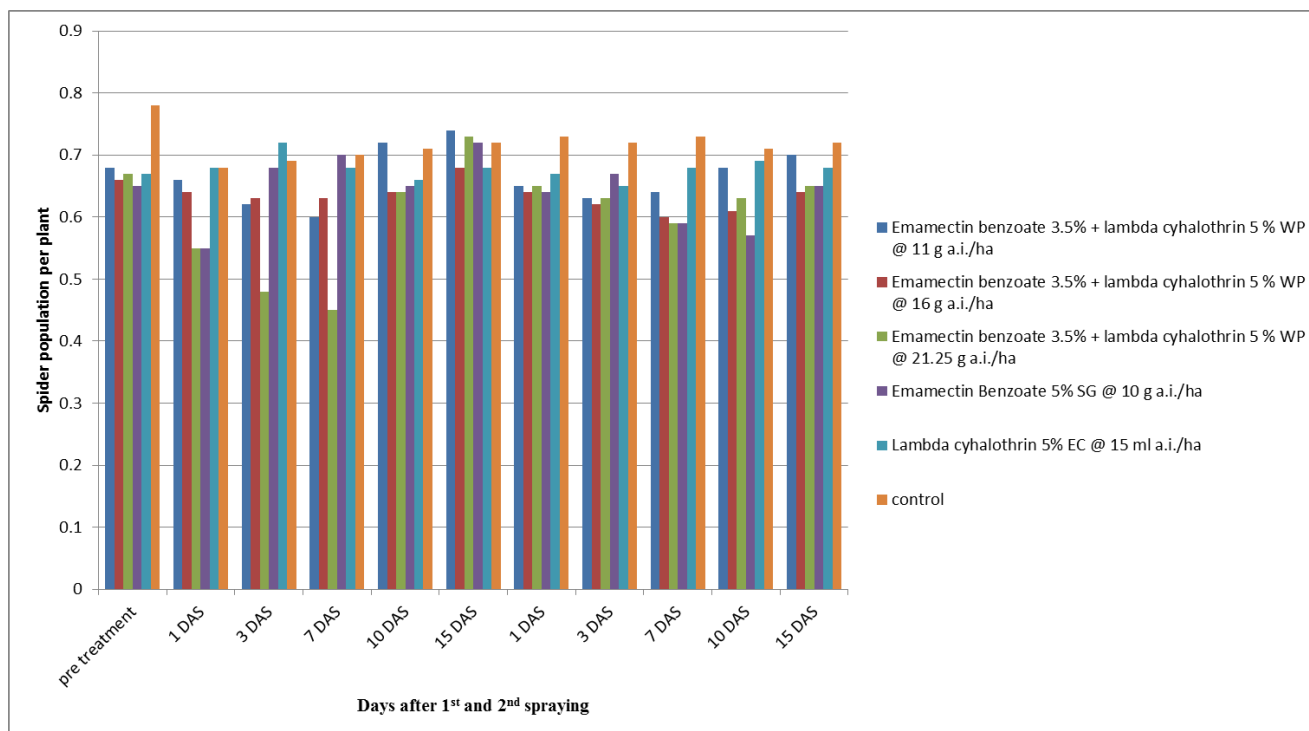


Fig. 4: Influence of Emamectin benzoate 3.5 % + Lambda cyhalothrin 5% WP on the occurrence of coccinellids on chilli

Table 5: Effect of Emamectin benzoate 3.5%+Lambda cyhalothrin 5% WP against Spider on chilli pooled data during Rabi 2017-18 & 2018-19

Treatment	Insecticide	dose	Pre treatment	I Spray					II Spray					Over all mean
				1 DAS	3DAS	7DAS	10DAS	15DAS	1 DAS	3DAS	7DAS	10DAS	15DAS	
T <sub>1</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	11 g a.i./ha	0.78 (1.68)	0.68 (1.58)	0.72 (1.62)	0.68 (1.58)	0.65 (1.55)	0.68 (1.58)	0.67 (1.57)	0.65 (1.55)	0.68 (1.58)	0.69 (1.59)	0.68 (1.58)	0.67
T <sub>2</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	16g a.i./ha	0.68 (1.58)	0.66 (1.56)	0.62 (1.52)	0.60 (1.50)	0.72 (1.62)	0.74 (1.64)	0.65 (1.55)	0.63 (1.53)	0.64 (1.54)	0.68 (1.58)	0.70 (1.60)	0.65
T <sub>3</sub>	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	21.25 g a.i./ha	0.66 (1.56)	0.55 (1.45)	0.68 (1.58)	0.70 (1.60)	0.64 (1.54)	0.72 (1.62)	0.64 (1.54)	0.67 (1.57)	0.59 (1.49)	0.57 (1.47)	0.65 (1.55)	0.64
T <sub>4</sub>	Emamectin Benzoate 5% SG	10 g a.i./ha	0.66 (1.56)	0.64 (1.54)	0.62 (1.52)	0.63 (1.53)	0.64 (1.54)	0.68 (1.58)	0.64 (1.54)	0.62 (1.52)	0.60 (1.50)	0.61 (1.51)	0.64 (1.54)	0.63
T <sub>5</sub>	Lambda cyhalothrin 5% EC	15 mla.i./ha	0.66 (1.56)	0.55 (1.45)	0.48 (1.38)	0.45 (1.35)	0.64 (1.54)	0.72 (1.62)	0.64 (1.54)	0.62 (1.52)	0.59 (1.49)	0.63 (1.53)	0.65 (1.55)	0.60
T <sub>6</sub>	Control (Untreated)	-	0.65 (1.55)	0.68 (1.58)	0.69 (1.59)	0.70 (1.60)	0.71 (1.61)	0.72 (1.62)	0.73 (1.63)	0.72 (1.62)	0.73 (1.63)	0.71 (1.61)	0.72 (1.61)	0.70
	SEm±		0.42	0.44	0.42	0.42	0.41	0.41	0.41	0.41	0.42	0.42	0.42	
	CD at 5%		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	

DAS= days after spray, ( ) figures in parentheses are square root transformed, NS= Non significant, S= significant.



**Fig. 5:** Influence of Emamectin benzoate 3.5 % + Lambda cyhalothrin 5% WP on the occurrence of spiders on chilli

**Table 6:** Mean yield data of chilli to application of different insecticides against different insect pest of chilli crops during *Rabi* 2017-18

S. No.	Name of treatment	Dose	Green Chilli Yield (q/ha)
T1	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	11 g a.i./ha	95.79
T2	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	16g a.i./ha	99.13
T3	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	21.25 g a.i./ha	104.51
T4	Emamectin Benzoate 5% SG	10 g a.i./ha	83.02
T5	Lambda cyhalothrin 5% EC	15ml a.i./ha	89.23
T6	Control (Untreated)	-	43.72

**Table 7:** Mean yield data of chilli to application of different insecticides against different insect pest of chilli crops during *Rabi* 2018-19

S. No.	Name of treatment	Dose	Green Chilli Yield (q/ha)
T1	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	11g a.i./ha	98.83
T2	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	16g a.i./ha	102.12
T3	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	21.25g a.i./ha	107.53
T4	Emamectin Benzoate 5% SG	10g a.i./ha	86.00
T5	Lambda cyhalothrin 5% EC	15ml a.i./ha	92.25
T6	Control (Untreated)	-	54.62

**Table 8:** Pooled mean yield data of chilli to application of different insecticides against different insect pest of chilli crops during *Rabi* 2017-18 and 2018-19

S. No.	Name of treatment	Dose	Green Chilli Yield (q/ha)
T1	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	11g a.i./ha	97.31
T2	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	16g a.i./ha	100.57
T3	Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP	21.25g a.i./ha	106.02
T4	Emamectin Benzoate 5% SG	10g a.i./ha	84.51
T5	Lambda cyhalothrin 5% EC	15ml a.i./ha	90.75
T6	Control (Untreated)	-	49.17

## Results and Discussion

The insecticide molecules Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 11 g a.i./ha, Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 16 g a.i./ha, Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 21.25 g a.i./ha, Emamectin Benzoate 5% SG @ 10 g a.i./ha, Lambda cyhalothrin 5% EC @ 15 g a.i./ha and untreated control were evaluated for their efficacy manage the pest complex of chilli.

## Bio efficacy of Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP against sucking pest on chilli Thrips

The non - significant difference was observed in different plots during the pretreatment observation. A day after application of insecticides, the minimum thrips population per plant observed in Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 21.25 g a.i./ha (10.21 thrips/plant) followed by Emamectin Benzoate 3.5% + lambda cyhalothrin



5% WP @ 16 g a.i./ha (13.48 thrips/plant), Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 11 g a.i./ha (17.96 thrips/plant), Lambda cyhalothrin 5% EC @ 15 g a.i./ha (20.76 thrips/plant) and in Emamectin Benzoate 5% SG @ 10 g a.i./ha (21.61 thrips/plant). However, the maximum thrips population (30.62 thrips/plant) was noticed in untreated control. Sathyan *et al.* (2017) <sup>[18]</sup> revealed that significantly lowest population of thrips was recorded in fipronil 5 SC @ 0.15% (8.05 thrips/3 bud) and Imidacloprid 17.8 SL @ 0.02% (9.0 thrips/3 bud) in chilli. Nagaraj *et al.* (2007) <sup>[14]</sup> revealed that the mean thrips population recorded were minimum in thiomethaxam 25 WG @ 35 g a.i./ha (2.95 thrips/leaf).

### Mite

Mite population was recorded before and after one, three, seventh, tenth and fifteenth days after spraying of insecticides. Pretreatment mite population was observed to be statistically non-significant. The observation recorded on one day after spraying of insecticides displayed that, all the insecticidal treatments were significantly superior over control in reducing the infestation of mite population. Among all the five insecticidal treatments, the foliar application of Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 21.25 g a.i./ha had the lowest 2.04 mite/plant. (T2) and (T1) i.e. Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 16 g a.i./ha, Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 11 g a.i./ha was found statistically on at par with each other. Samanta *et al.* (2017) <sup>[17]</sup> stated that the treatments, spiromesifen 24 SC @ 120 g a.i./ha were observed to be very much effective against yellow mite. Shahaji (2007) <sup>[19]</sup> stated that the abamectin 0.0009% was significantly superior in reducing mite population with 2.66 mites/plant.

### Aphid

The application of Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 21.25 g a.i./ha, (3.51 aphid/plant) recorded the least aphid population per plant, followed by (T2) Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 16 g a.i./ha, (4.47 aphid/plant) and (T1) Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 11 g a.i./ha, (5.11 aphid/plant). Ditya *et al.* (2010) <sup>[5]</sup> stated that chlorfenapyr belongs to pyrrole group of insecticides and is used as a broad spectrum insecticide cum acaricide for the control of whiteflies, thrips, caterpillar, mites, leaf miners, aphids etc. Furthermore, effectiveness of imidacloprid was reported by various workers against aphid on chilli. Kumar *et al.* (2001) <sup>[12]</sup> stated that imidacloprid (70 g/ha) was the best treatment in controlling aphids (99.76% reduction) against the major pest complex aphids, thrips, gram pod borer, tobacco caterpillar of chilli. Das (2013) <sup>[4]</sup> concluded that imidacloprid had good knock down effect on aphids population in chilli. Sujay *et al.* (2015) <sup>[21]</sup> noted lesser effectiveness of imidacloprid against chilli pests. *Viz.* green peach aphid (*Myzus persicae* Sulzer, *Aphis gossypii* Glover) and other sucking pests.

### Effect of insecticide on the natural enemies of insect pest on chilli

#### Coccinellid

The observations on coccinellids were recorded after first spray revealed that, a non-significant difference among various treatments indicating that the predator was spread in all the treatments. The overall mean population of coccinellids after first spray, each spray indicated that

untreated control (0.46 coccinellids/plant) and Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 21.25 g a.i./ha, Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 16 g a.i./ha and Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 11 g a.i./ha (0.42, 0.41 and 0.43 coccinellids/plant) recorded relatively higher population of coccinellids. Emamectin Benzoate 5% SG @ 10 g a.i./ha and Lambda cyhalothrin 5% EC @ 15 ml a.i./ha has pored lower predator population compare to other treatments. The data pertaining to the impact of Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP on the occurrence of natural enemies are presented in Table 4. Shinde *et al.* (2007) <sup>[20]</sup> reported that spinosad 45 SC @ 75 g a.i./ha was most safer insecticide to the predators on okra.

#### Spiders

Although Emamectin Benzoate 5% SG @ 10 g a.i./ha (0.63 spider/plant) and lambda cyhalothrin 5% EC @ 15 ml a.i./ha (0.60 spider/plant) recorded lower population compared to other treatments in second sprays. In general, untreated control T6 (0.70 spider/plant), T3 (0.64 spider/plant), T2 (0.65 spider/plant) and T1 (0.67 spider/plant) treatments registered higher population as compared to other treatments.

#### Fruit yield and economic assessment

The data of two years mean total healthy green chilli fruit yield of all the treatment was significant higher over untreated control. At the end of the experiment, the marketable fruit yield (Table 8) of all the picking was added and transformed into quintals on hectare basis. Among all the treatments (T3), Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 21.25 g a.i./ha. proved to be the best in producing highest marketable yield (106.02 q/ha.) followed by (T2) Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 16 g a.i./ha (100.57 q/ha.) at par with (T1) Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 11 g a.i./ha (97.31 q/ha) and single dose (T5) lambda cyhalothrin 5% EC @ 15 ml a.i./ ha (90.75 q/ha). Comparatively low yield was recorded in Emamectin Benzoate 5% SG @ 10 g a.i./ ha (T4) (84.51 q/ha). The lowest fruit yield was recorded in control (49.17 q/ha). (T3) Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP @ 21.25 g a.i./ha was found significantly superior (at 5%) over all other treatments in giving the highest yield. Patra *et al.* (2016) <sup>[16]</sup> observed that the chlorantraniliprole was the best treatment in reducing the shoot infestation and gave highest marketable brinjal fruit yield (155.01 q/ha).

#### Conclusion

The new chemical insecticide Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP was evaluated for its bio-efficacy against sucking pest of chilli in the department of entomology, IGKV, Raipur during *Rabi* 2017-18 and 2018-19. During the bio-efficacy trial, the effect of all tested doses of Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP effectively control the population of sucking insect pest of chilli. It was also observed that Emamectin Benzoate 3.5% + lambda cyhalothrin 5% WP at all dosages levels tested for bio efficacy has non-significant lower population of natural enemies under field condition.

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