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Humane Akanksha Narayan
MSc Student, Department of Agril. Entomology, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Dr. PR Zanwar
Ph.D, M.Sc. (Agri.) Associate Professor, Department of Agril. Entomology, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

N Vinay
Ph.D. Scholar, Department of Entomology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Parades, India

Ajabe Santosh Shubhash
MSc Student, Department of Agril. Entomology, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Correspondence
Humane Akanksha Narayan
MSc Student, Department of Agril. Entomology, College of Agriculture, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, Maharashtra, India

Bioefficacy of novel insecticides against brinjal shoot and fruit borer, *Leucinodes orbonalis* Guenee

Humane Akanksha Narayan, Dr. PR Zanwar, N Vinay and Ajabe Santosh Shubhash

Abstract
The "Bio-efficacy of novel insecticides against *Leucinodes orbonalis of* Brinjal" was carried out at the Research Farm of Department of Agricultural Entomology, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani, India during *Kharif* 2018-19 using variety "Ajay. Three insecticidal spray was given during this experiment. Among all the treatments chlorantraniliprole 18.5% SC recorded lowest shoot infestation followed by cyantraniliprole 10.26% OD and emamectin benzoate 5% SG and all treatments were found superior over the control. It is revealed from the experiment that the lowest per cent fruit damage on the number basis and weight basis by chlorantraniliprole 18.5% SC followed by cyantraniliprole 10.26% OD and emamectin benzoate 5% SG. The treatment chlorantraniliprole 18.5% SC recorded higher fruit yield followed by cyantraniliprole 10.26% OD and emamectin benzoate 5% SG over check and lambda cyhalothrin 5% EC found to have highest insecticidal cost benefit ratio.

Keywords: Brinjal, *Leucinodes orbonalis*, newer insecticides, bio-efficacy

Introduction
Brinjal (*Solanum melongena* L.) also called eggplant. It is a species of nightshade grown for its edible fruit. The brinjal is a delicate, tropical perennial, often cultivated as a half-hardy annual in temperate climate. India is the second biggest producer of vegetables in world after China. There are also several constraints in brinjal production which are responsible for reduction in yield. Insect pest is one of the most important factor among them. This economically important commercial crop is infested by more than 142 species of insects, 4 species of mites and 3 species of nematode from planting to harvest (Sohi, 1966). Among the various insect pest attacking the eggplant, shoot and fruit borer, *Leucinodes orbonalis* (Guen.); stem borer, *Euzophera perticella* (Rag.); hadda beetle, *Henosepilachna vigintioctopunctata* (Fab.); leaf hopper, *Amrasca devastans* (Dist.); lacewing bug, *Urentius echinus* (Dist.); aphid, *Aphis gossypii* (Glov.); and white fly, *Bemisia tabaci* (Genn.) were designated as major pests (Singh, 1970) [9]. Out of these *L. orbonalis* is most important pest of brinjal as it damage crop throughout the year. This pest is described in brinjal growing area *viz;* India, Germany, Burma, USA and Shrilanka. Shoot and fruit borer damages occure in all growing stages of brinjal. The yield of brinjal decresed due to the pest is to extend of 70-92% (Eswara Reddy and Srinivas, 2004; Chakrabroti and Sarkar 2011 and Jagginavar *et al.*, 2009) [2, 1, 3]. Even though control given by insecticides is one of the common control measure for shoot and fruit borer, several insecticides applied which not shown satisfactory control for this pest. Brinjal is a vegetable crop, usage of various chemical insecticides contains sone significant toxic residue on the fruits. Also this, single dependency on same types of insecticide has lead to resistance of insecticides by the pest (Natekar *et al.*, 1987) [6]. Hence, usage of novel insecticide molecules is considered as a better for control of this pest. With this background, the experiment was conduct to study the bioefficacy of novel insecticides against *Leucinodes orbonalis*.

Materials and Methods
The present experiment was conducted at the Research Farm of Department of Agricultural Entomology, VNMKV, Parbhani, India during *Kharif* 2018-19. The experiment was layed out in RBD with three replications and eight treatments in a 3.60 × 3.60 m^2 plot with spacing 60 x 60 cm^2 and cultivar Ajay. The insecticides was applied by using battery operated knapsack

Sprayer. The first spray was carried out when ETL crossed after transplanting. All total three insecticidal sprays were given at an interval of 15 days. The observation of the shoot and fruit borer were recorded on five randomly selected plants at one day before spraying and 5, 10 and 14 days after spraying. The fruit yield was recorded plot wise as and when the harvesting was done in the field.

Method of recording observations

For recording shoot infestation of brinjal, healthy and infested shoots were recorded from five randomly selected plants from each plot. The number of infested shoots in each plot were recorded one day before of spraying as well as 5, 10 and 14 days after spraying. The per cent shoot and fruit infestation was find out and converted to angular transformed values, later the data was subjected to statistical analysis.

Observations were also recorded on number of infested fruits and marketable fruits on five randomly selected plants and all the remaining plants from each plot picking wise. Picking wise observations were also recorded on the weight of infested fruits and weight of marketable fruits on five randomly selected plants from each plot. The per cent damage of fruit on weight and number basis was worked out and transform into angular transformed values and the data was subjected to statistical analysis. Healthy fruits were harvested from each plot separately and yield per plant at each and every picking was recorded in kilograms. The all total yield was find out by adding the yield of each and every picking. The net plot of yield was turn into quintals per hectare. The entire data was subjected to the statistical analysis.

The per cent shoot infestation and fruit damage was find out using following the formulae:

$$\% \text{ shoot infestation} = \frac{\text{No of infested shoots}}{\text{Total no of shoots}} \times 100$$

$$\% \text{ Fruit infestation (Number basis)} = \frac{\text{No of infested fruits}}{\text{Total no of fruits}} \times 100$$

$$\% \text{ Fruit infestation (weight basis)} = \frac{\text{No of infested fruits}}{\text{weight of total fruits}} \times 100$$

Results and discussion

The results obtained from this study as well as discussion have been described under following headings:

Bioefficacy of novel insecticides against shoot damage due to *Leucinodes orbonalis* on brinjal

Before the first spray of insecticides, the per cent shoot damage vary from 13.85 to 15.84 per cent/ plants (Table 1 and fig 1). At 5 DAT, the per cent shoot damage ranged from 1.01 to 15.44 per cent/ plants. Treatment chlorantraniliprole 18.5% SC recorded the lowest shoot infestation (1.01%) followed by cyantraniliprole 10.26% OD, emamectin benzoate 5% SG and flubendiamide 39.36% SC and all insecticidal treatments as compared to untreated control plot. At 10 DAT, the per cent shoot damage ranged from 3.08 to 15.51. Treatment chlorantraniliprole 18.5% SC recorded the lowest shoot infestation followed by cyantraniliprole 10.26% OD, emamectin benzoate 5% SG and flubendiamide 39.36% SC. These all treatments found superior as compared to untreated control plot. At 14 DAT, the per cent shoot damage ranged from 6.21 to 17.64. Treatment chlorantraniliprole 18.5% SC recorded minimum shoot infestation (6.21%) followed by cyantraniliprole 10.26% OD, emamectin benzoate 5% SG and flubendiamide 39.36% SC and all seven insecticidal treatments found superior over untreated control.

Before the second spray of insecticides, the per cent shoot damage ranged from 7.24 to 17.67 per cent/ plants (Table 1 and fig 1). At 5 DAT, the per cent shoot damage vary from 1.21 to 18.42 per cent/ plants. Treatment chlorantraniliprole 18.5% SC recorded lowest shoot infestation (1.21%) followed by cyantraniliprole 10.26% OD, emamectin benzoate 5% SG and flubendiamide 39.36% SC as compared to untreated control plot. At 10 DAT, the per cent shoot damage ranged from 2.48 to 18.89. Treatment chlorantraniliprole 18.5% SC recorded the lowest shoot infestation (2.48%) followed by cyantraniliprole 10.26% OD, emamectin benzoate 5% SG and flubendiamide 39.36% SC. These all treatments found superior as compared to untreated control plot. At 14 DAT, the per cent shoot damage ranged from 5.27 to 19.01. Treatment chlorantraniliprole 18.5% SC recorded minimum shoot infestation (5.27%) followed by cyantraniliprole 10.26% OD, emamectin benzoate 5% SG and flubendiamide 39.36% SC and all seven insecticidal treatments found superior over untreated control recorded (19.01%).

Before the third spray of insecticides, the per cent shoot damage vary from 6.38 to 15.38 per cent/ plants (Table 1 and fig 1). At 5 DAT, the per cent shoot damage ranged from 1.10 to 14.87 per cent/ plants. Treatment chlorantraniliprole 18.5% SC recorded the lowest shoot infestation (1.10%) followed by cyantraniliprole 10.26% OD, emamectin benzoate 5% SG and flubendiamide 39.36% SC as compared to untreated control plot. At 10 DAT, the per cent shoot damage ranged from 3.37 to 14.94 per cent/ plants. Treatment chlorantraniliprole 18.5% SC recorded the lowest shoot infestation (3.37%) followed by cyantraniliprole 10.26% OD, emamectin benzoate 5% SG and flubendiamide 39.36% SC. These all treatments found superior as compared to untreated control plot. At 14 DAT, the per cent shoot damage ranged from 5.50 to 15.05. Treatment chlorantraniliprole 18.5% SC recorded lowest shoot infestation (5.50%) followed by cyantraniliprole 10.26% OD, emamectin benzoate 5% SG and flubendiamide 39.36% SC and all seven insecticidal treatments found superior over untreated control

Table 1: Bioefficacy of different insecticides against shoot damage due to *L. orbonalis* in brinjal (Pooled 1st, 2nd & 3rd sprays)

Tr. No.	Treatments	Concentration (%)	Shoot infestation (%) days after 1st Spray				Shoot infestation (%) days after 2nd Spray			Shoot infestation (%) days after 3rd Spray			Overall Mean
			Before spray	5DAS	10DAS	14DAS	5DAS	10DAS	14DAS	5DAS	10DAS	14DAS	
T1	Cynantaniliprole 10.26%OD	0.0143	15.84	1.64	3.51	6.64	1.68	2.82	5.61	1.78	3.73	5.86	3.69
			(23.28)*	(7.36)	(10.71)	(14.49)	(7.45)	(9.55)	(13.64)	(7.67)	(11.01)	(13.42)	(11.07)
T2	Fenpropathrin 30% EC	0.0204	15.71	4.41	6.48	9.61	3.61	4.88	7.67	4.97	7.24	9.37	6.47
			(23.34)	(11.44)	(13.78)	(17.94)	(10.92)	(11.16)	(15.66)	(12.84)	(15.26)	(16.51)	(14.70)
T3	Flubendiamide 39.36	0.0098	14.87	2.84	4.91	8.04	2.15	3.42	6.21	2.96	5.23	7.36	4.79

	SC		(22.02)	(9.67)	(12.74)	(16.37)	(8.27)	(9.73)	(13.33)	(8.50)	(13.16)	(14.06)	(12.61)
T4	Cartaphydrochloride 75% SG	0.075	15.49	3.88	5.95	9.08	3.14	4.41	7.20	3.81	6.08	8.21	5.75
			(23.15)	(10.99)	(13.81)	(17.50)	(10.09)	(11.76)	(15.06)	(10.80)	(13.78)	(16.57)	(13.85)
T5	Emamectin Benzoate 5% SG	0.002	14.39	1.67	4.24	7.37	1.71	3.26	6.05	1.80	4.51	6.64	4.07
			(21.57)	(7.43)	(11.35)	(15.58)	(7.51)	(9.91)	(14.08)	(7.71)	(11.51)	(14.08)	(11.64)
T6	Lambda-Cyhalothrin5%EC	0.003	13.85	3.51	5.58	8.71	2.48	3.75	6.54	3.80	6.07	8.20	5.40
			(20.83)	(10.56)	(13.57)	(17.05)	(8.97)	(11.26)	(14.21)	(11.26)	(14.34)	(16.23)	(13.39)
T7	Chlorantraniliprole 18.5% SC	0.0074	14.66	1.01	3.08	6.21	1.21	2.48	5.27	1.10	3.37	5.50	3.25
			(22.03)	(5.21)	(9.81)	(14.32)	(6.28)	(8.96)	(13.00)	(5.82)	(9.90)	(12.80)	(10.39)
T8	Untreated Control	-	15.78	15.44	15.51	17.64	18.42	18.89	19.01	14.87	14.94	15.05	18.41
			(23.30)	(22.97)	(23.09)	(24.51)	(25.42)	(24.68)	(24.86)	(22.68)	(22.74)	(22.83)	(25.38)
S.E. ±		-	3.307	0.739	0.618	0.824	0.216	0.453	0.314	0.578	0.358	0.799	0.432
C.D. at 5%		-	NS	2.342	1.873	2.486	0.798	1.342	0.959	1.742	1.086	2.411	1.312

*Figures in parentheses are arcsine transformed values
NS- Non Significant

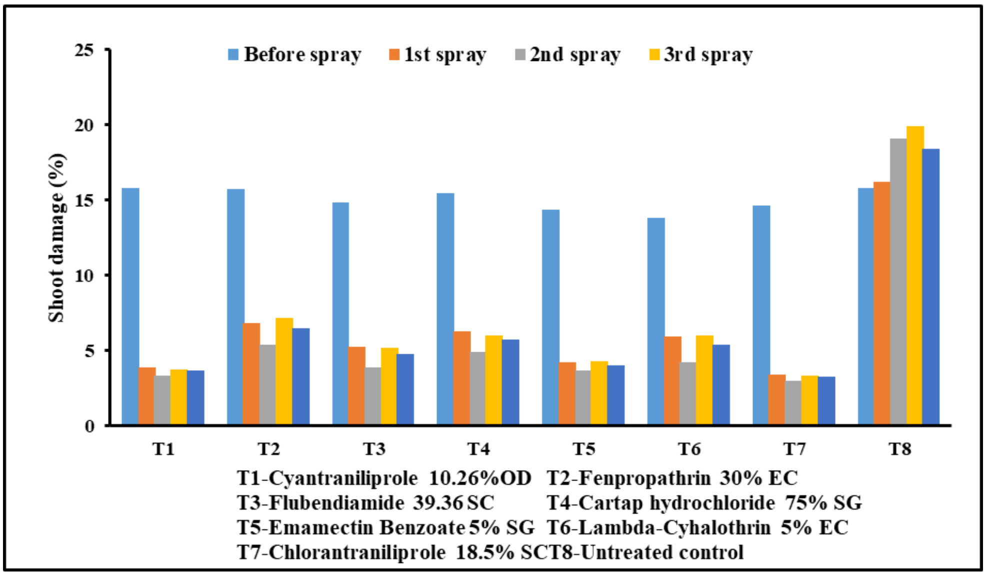

Fig 1: Bio-efficacy of different insecticides against shoot borer damage due to *L. orbonalis in* brinjal (pooled 1st, 2nd & 3rd spray)

Bioefficacy of different insecticides against fruit damage due to *Leucinodes orbonalis* in brinjal

A. Based on Number basis:

The per cent fruit damage on number basis was observed in three pickings. The per cent fruit damage was significantly minimum in chlorantraniliprole 18.5% SC treatment ranged from 10.58 to 14.64 per cent in three pickings followed by cyantraniliprole 10.26% OD, emamectin benzoate 5% SG and remaining all insecticidal treatments as compared to untreated control (Table 2 and fig 2).

Table 2: Bioefficacy of different insecticides against Fruit Damage due to *L. Orbonalis* (Number Basis)

Tr. No.	Treatments	Concentration (%)	Mean per cent fruit infestation after each picking (Number Basis)		
			1st Picking	2nd picking	3rd picking
T1	Cynantaniliprole 10.26%OD	0.0143	14.27	12.37	14.2
			(22.17)	(20.54)	(22.06)
T2	Fenpropathrin 30% EC	0.0204	21.48	22.2	21.61
			(27.60)	(28.03)	(27.67)
T3	Flubendiamide 39.36 SC	0.0098	15.24	14.44	17.18
			(22.94)	(22.20)	(24.32)
T4	Cartaphydrochloride 75% SG	0.075	19.06	19.75	20.06
			(25.86)	(26.21)	(26.56)
T5	Emamectin Benzoate 5% SG	0.002	15.48	14.85	15.05
			(23.09)	(22.57)	(22.70)
T6	Lambda-Cyhalothrin 5% EC	0.003	18.26	18.08	18.9
			(25.22)	(25.09)	(25.72)
T7	Chlorantraniliprole 18.5% SC	0.0074	12.8	10.58	14.64
			(20.90)	(18.86)	(22.18)
T8	Untreated Control	-	37.52	36.12	32.95
			(37.76)	(36.93)	(35.01)
S.E. ±		-	1.067	1.599	1.766
C.D. at 5%		-	3.269	4.898	5.409
C.V. (%)		-	7.196	11.057	11.867

*Figures in parentheses are arcsine transformed values

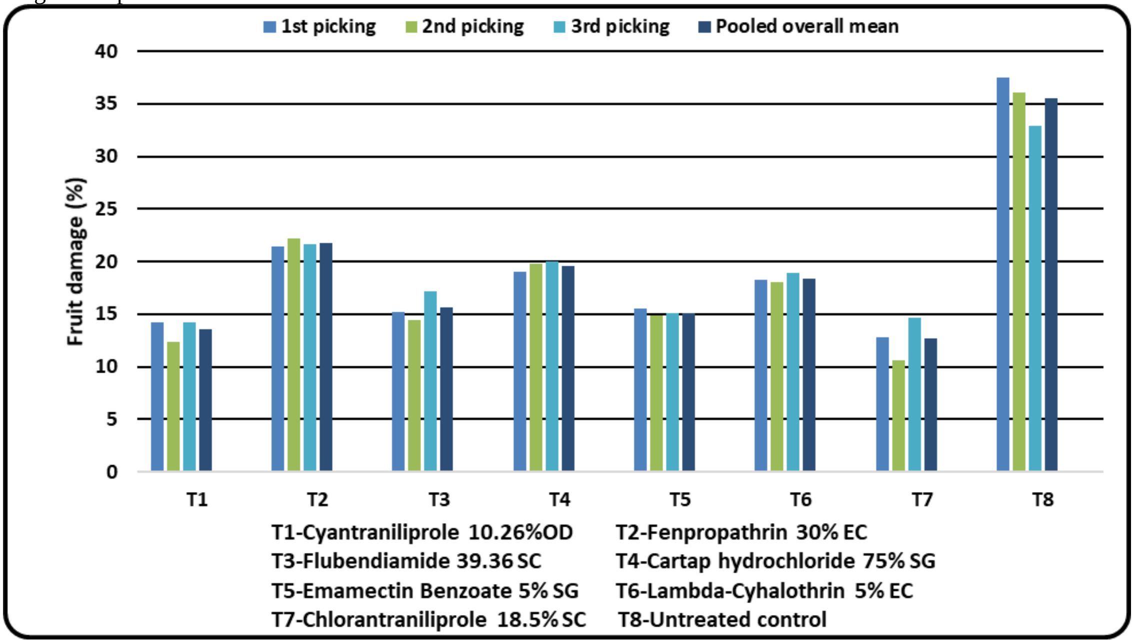

Fig 2: Bio-efficacy of different insecticides against fruit damage due to *L. orbonalis* in brinjal (number basis)

B. Based on weight basis

The per cent fruit infestation ranged from 8.65 to 35.86 per in all three pickings. The minimum per cent fruit infestation was observed in the treatment chlorantraniliprole 18.5% SC ranged from 8.65 to 10.22 per cent followed by cyantraniliprole 10.26% OD and emamectin benzoate 5% SG and all these treatments were superior over untreated control (Table 3 and fig 3).

Table 3: Bioefficacy of different insecticides against fruit damage due to *L. orbonalis* (Weight Basis)

Tr. No.	Treatments	Concentration (%)	Mean per cent fruit infestation after each picking (Number Basis)		
			1st Picking	2nd picking	3rd picking
T1	Cynantaniliprole 10.26%OD	0.0143	11.87 (20.13)*	13.64 (21.65)	12.18 (20.41)
T2	Fenpropathrin 30% EC	0.0204	20.29 (26.72)	18.17 (25.20)	19.43 (26.12)
T3	Flubendiamide 39.36 SC	0.0098	15.70 (23.32)	15.17 (22.88)	16.09 (23.64)
T4	Cartaphydrochloride 75% SG	0.075	18.07 (25.13)	17.89 (24.99)	17.78 (24.92)
T5	Emamectin Benzoate 5% SG	0.002	13.99 (21.94)	15.86 (23.45)	14.33 (22.23)
T6	Lambda-Cyhalothrin 5% EC	0.003	15.57 (23.20)	14.88 (22.67)	17.26 (24.52)
T7	Chlorantraniliprole 18.5% SC	0.0074	8.65 (17.07)	10.22 (18.62)	8.89 (17.32)
T8	Untreated Control	-	35.86 (36.77)	34.48 (35.92)	34.38 (35.88)
S.E. ±		-	0.716	0.770	0.641
C.D. at 5%		-	2.194	2.359	1.963
C.V. (%)		-	5.109	5.464	4.554

*Figures in parentheses are arcsine transformed values.

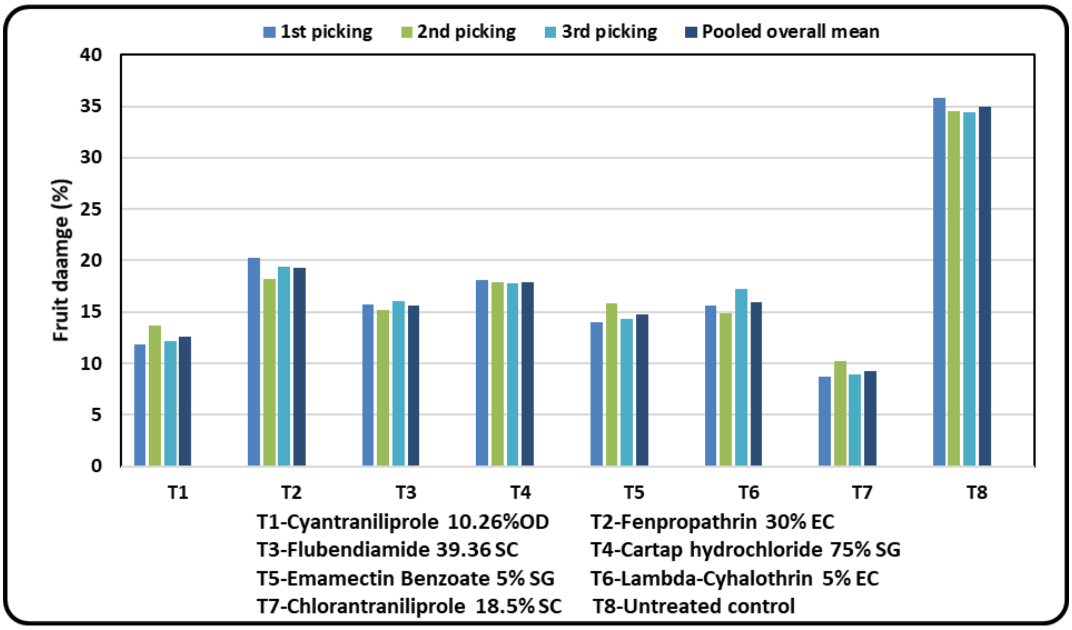

Fig 3: Bio-efficacy of different insecticides against fruit damage due to L. orbonalis in brinjal (weight basis)

Same results were also reported by several researchers. Misra (2008) [5] evaluated the bio efficacy of Rynazypyr 20 SC @ 40 g a.i./ha and Flubendiamide 480 SC @ 100 g a.i./ha against brinjal shoot and fruit borer, *L. orbonalis* and found 90-97 per cent deplation of shoot damage and 87-90 per cent lowering in fruit damage on number basis and 88-90 per cent deplation on weight basis with Rynazypyr 20 SC @ 40 g a.i./ha. Further he was concluded that Rynaxypyr 20 SC @ 40 and 50 g a.i./ha was beneficial against shoot and fruit borer of brinjal. In another study, Shirale *et al*., (2012) [8] concluded that, Chlorantraniliprole 18.5% SC and Flubendiamide 39.35% SC to be the most superior insecticides in lowering the infestation of *L. orbonalis* and increasing yields. Similarly, Kameshwaran and Kumar (2015) [4] also observed the Chlorantraniliprole as the most beneficial insecticide against brinjal shoot and fruit borer followed by Emamectin benzoate.

Yield and Economics

The yield of brinjal fruit from field experiment was recorded and given in table 4 and fig 4. It ranged from 30.17 to 68.38 qt/ha. The highest yield (68.38 qt/ha) was observed in cyantraniliprole 10.26% OD treated plot followed by cyantraniliprole 10.26% OD (63.04 qt/ha) and emamectin benzoate 5% SG (60.49 qt/ha) treated plot which found superior over untreated control (30.17 qt/ha).

Table 4: Yield of brinjal recorded in different insecticidal treatments

Treatments		Yield (kg/plot)			Total yield(kg/plot)	Yield (qt/ha)
		1st picking	2nd picking	3rd picking		
T1	Cyantraniliprole 10.26% OD	2.64	2.74	2.79	8.17	63.04
T2	Fenpropathrin 30% EC	1.78	1.89	1.94	5.16	43.29
T3	Flubendiamide 39.35% SC	2.45	2.46	2.50	7.41	57.17
T4	Cartap hydrochloride75%SG	1.91	1.98	2.03	5.92	45.68
T5	Emamectin Benzoate 5% SG	2.53	2.63	2.68	7.84	60.49
T6	Lambda cyhalothrin 5% EC	2.31	2.45	2.46	7.22	55.71
T7	Chlorantraniliprole18.5% SC	2.87	2.97	3.02	8.86	68.38
T8	Untreated control	1.24	1.28	1.38	3.91	30.17
S.E. ±		0.256	0.278	0.295	0.237	0.264
C.D. at 5%		0.829	0851	0.894	0.725	0.813

The data on the economics of different insecticidal treatments is given in table 5 and fig 4, it revealed that lambda cyhalothrin 5% EC has the maximum insecticidal cost benefit ratio (ICBR) *i.e.* 1:20.02, followed by Emamectin benzoate 5% SG (1:13.44), Fenpropathrin 30% EC (1:8.88), Chlorantraniliprole 18.5% (1:7.47), Flubendiamide 39.35% SC (1:6.01), Cartap hydrochlorode75% SG (1:6.01) and Cyantraniliprole 10.26% OD (1:1.65).

Table 5: Yield and economics of different insecticide treatments in brinjal

Treatments	Conc. (%)	Yield (qt/ha)	Increased yield over (qt/ha)	Total cost of plant protection (Rs/ha)	Gross realization over control (Rs/ha)	Net realization (Rs/ha)	ICBR
Cynantaniliprole 10.26%OD	0.0143	63.04	32.87	24790	65740	40950	1:1.65
Fenpropathrin 30% EC	0.0204	43.29	13.12	2657	26240	23583	1:8.88
Flubendiamide 39.36%SC	0.0098	57.17	27.00	6795	54000	47205	1:6.95
Cartaphydrochloride75%SG	0.075	45.68	15.51	4425	31020	26595	1:6.01
Emamectin Benzoate 5% SG	0.002	60.49	30.32	4200	60640	56440	1:13.44

Lambda-cyhalothrin 5% EC	0.003	55.71	25.54	2430	51080	48650	1:20.02
Chlorantraniliprole18.5%SC	0.0074	68.38	38.21	9000	76420	67420	1:7.47
Untreated control	-	30.17	-	-	-	-	-

* Price of brinjal fruit= Rs 20/kg

Table 6: Details of insecticides application

Treatments	Cost of insecticides (Rs/lit or kg)	Total quantity of insecticides required for 3 spray (lit or kg/ha)	Total cost of insecticides	Labour charges (Rs/ha)	Total cost of treatment (Rs/ha)
Cynantaniliprole 10.26%OD	11000	2.09	22990	1800	24790
Fenpropathrin 30% EC	840	1.02	857	1800	2657
Flubendiamide 39.36%SC	13500	0.37	4995	1800	6795
Cartaphydrochloride75%SG	1750	1.50	2625	1800	4425
Emamectin Benzoate 5% SG	4000	0.60	2400	1800	4200
Lambda-cyhalothrin 5% EC	700	0.90	630	1800	2430
Chlorantraniliprole18.5%SC	12000	0.60	7200	1800	9000

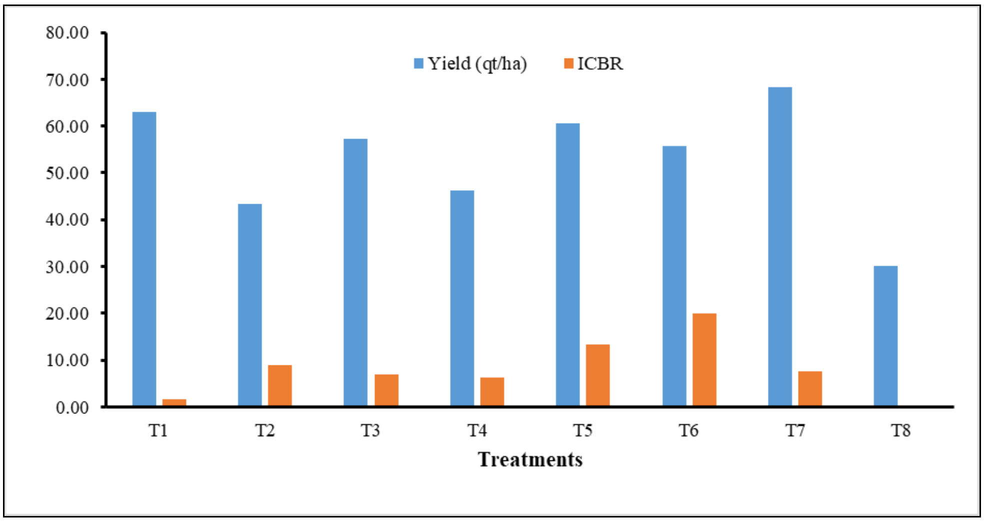

Fig 4: Effect of different insecticides on brinjal yield and ICBR ratio

The few studies were reported the same results as discussed above like Misra (2008) [5] reported that the treatment Rynaxypyr 20 SC @ 40 and 50 g a.i./ha in brinjal recorded a higher yield during winter and summer. Shirale *et al*., (2012) [8] concluded that Chlorantraniliprole 18.5% SC and Flubendiamide 39.35% SC are superior insecticides in gaining the higher yields. Similarly Pawar *et al*., (2016) [7] and Tripura *et al*., (2017) [11] also concluded that the Chlorantraniliprole as a most effective treatment for increasing the fruit yield.

Conclusion

The present investigation was concluded that, all the insecticidal treatments were found effective than control in reducing the infestation of *Leucinodes orbonalis* and chlorantraniliprole 18.5% was extremely effective to control of *Leucinodes orbonalis* on brinjal.

References

1. Chakraborti S, Sarkar P. Management of *Leucinodes orbonalis* Guenee on eggplants during the rainy season in India. Journal of Plant Protection Research. 2011; 51(4):325-328.
2. Eswarareddy SG, Srinivas. Management of shoot and fruit borer (*Luecinodes orbonalis* Guenee) in brinjal using botanicals/oils. Pestology. 2004; 28:50-52.
3. Jagginavar SB *et al*. Bioefficacy of flubendiamide 480 SC against brinjal fruit and shoot borer (*Leucinodes orbonalis* Guenee). Karnataka Journal of Agriculture Science. 2009; 22(3):712-713.
4. Kameshwaran C, Kumar K. Efficacy of newer insecticides against the brinjal (*Solanum melongena* L.) shoot and fruit borer (*Leucinodes orbonalis* Guenee) in Karaikal district, U.T. of Puducherry. Asian Journal of Biological Science.2015: 10(2):119-128.
5. Misra HP. New promising insecticides for the management of brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee). Pest Management in Horticultural Ecosystems. 2008; 14(2):12-15.
6. Natekar MG *et al*. Bioefficacy of synthetic pyrethroids and their residues in brinjal fruit. Pestolog. 1987; 11:18-22.
7. Pawar SA *et al*. Bioefficacy of insecticides against brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee). Bioinfolet. 2016; 13(2A):273-275.
8. Shirale D *et al*. Evaluation of newer insecticides for the management of brinjal fruit and shoot borer (*Leucinodes orbonalis* Guenee). Indian Journal of Plant Protection. 2012; 40(4):273-275.
9. Singh JP. Elements of vegetable pests. Elements of vegetable pests. 1970, 275.
10. Sohi GS. Pest of brinjal. Entomological society of India, New Delhi. 1966, 148.
11. Tripura A *et al*. Bio rational management of brinjal shoot and fruit borer (*Leucinodes orbonalis* Guenee) in mid hills of Meghalaya. Journal of Entomology and Zoology Studies. 2017; 5(4):41-45.