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Bio-efficacy of BAS 550 01 I SC against major insect pests of brinjal crop during *Kharif* season

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Abstract
An experiment was conducted to observe the "Bio-efficacy of BAS 550 01 I SC against major insect pests of brinjal crop during *Kharif* season 2019-20" at Horticulture farm, Department of Horticulture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur, Chhattisgarh. In brinjal crop, novel approaches of insect management by using new molecules of insecticides may play important role to manage shoot and fruit borer (BSFB), jassids and safer to non target pest and natural enemies. Two sprays of different insecticides *viz.*, BAS 550 01 I SC, Diafenthuron 50%EC, Cypermethrin 25% EC, at four different concentration of BAS 550 01 I SC @ 120, 108, 96 and 84 g. a.i./ha were made at 1,3,5,7 and 10 days interval. All the treatments registered significantly lower population of shoot and fruit borer and jassids as compared to untreated control. BAS 550 01 I SC @ 120 g.a.i./ha proved the best treatment for the control of shoot and fruit borer and sucking pest *viz.*, jassids. It was followed by T3, BAS 550 01 I SC @ 108 g.a.i./ha in terms of mean mortality of shoot and fruit borer, jassids and also recorded higher marketable yield.

Keywords: bio-efficacy, mortality, insecticides, shoot and fruit borer, jassids

Introduction
Brinjal (*Solanum melongena* L.) is an important vegetable crop grown in all the seasons. It is one of the prominent vegetable crop in India.The eggplant or brinjal (*Solanum melongena* L.) for its purple, white or green pendulous fruit is one of the most common and valuable vegetable crops grown in India and other parts of the world. Vegetable farming has an important place in Indian agriculture due to their nutritional, medicinal and land commercial value (Choudhary, 1977) [3].

"Brinjal is subjected to attack by number of insect and mite pests right from nursery stage till harvesting (Regupathy *et al*. 1997) [12]. The crop is attacked by about 140 species of insect and non insect pests belonging to 50 families. Among the insect pests infesting brinjal, the major ones are shoot and fruit borer, *Leucinodes orbonalis* Guenee; whitefly, *Bemisia tabaci* (Gennadius); leaf hopper, *Amarasca biguttula biguttula* (Ishida); Hadda beetle, *Henosepilachna vigintioctopunctata* (Fabricius) and non insect pest like red spider mites, *Tetranychus macfarlanei* (Baker and Pritchard) and *Tetranychus urticae* Koch. Out of these, *L. orbonalis* is the key pest throughout Asia (Purohit and Khatri 1973, Kuppuswamy and Balasubramanian 1980) [10, 7].

Leucinodes orbonalis (Guenee) is the most injurious and a ubiquitous pest of brinjal, *Solanum melongena* L., which is found to feed on the shoot and fruits and occur throughout the year with varying degrees of infestation intensity. It may cause 100 per cent damage if no control measures are applied (Rahman 2007) [11]. Brinjal shoot and fruit borer (BSFB) is considered a limiting factor in brinjal cultivation and causes losses as high as 70 to 92 per cent (Krishnaiah and Vijay 1975) [6]. This pest is very active and cause significant damage during the rainy and summer season (Ali *et al*. 1980, Kalloo 1988,) [1, 5]. This pest is widely distributed in Malaysia, Myanmar, Sri lanka, India, Pakistan, Germany and East Africa (Dhaliwal *et al.* 2006) [4].

Jassids both nymphs and adults suck the cell sap usually from the ventral surface of the leaves and while feeding inject toxic saliva into plant tissues, affected leaves turn yellowish and curl. The loss caused by sucking pests varies from 10-15 per cent depending on the intensity of infestation (Munde *et al*.

Various methods have been tried for the control of sucking insect-pests. But use of chemical method is an important approach for their control because of its quick action, effectiveness and adaptability to various situations.

Several insecticides have been recommended and used for the effective management of brinjal insect-pests. But according to several reports many of these label claimed insecticides could not achieved effective results. These label claimed insecticides with some new insecticides should have to be evaluated against sucking insect pests of brinjal.

Materials and Methods

The experimental site was conducted at Horticulture farm, Department of Horticulture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya (IGKV) Raipur Chhattisgarh, During *Kharif* season 2019-20. The experiment was laid out in randomized block design (RBD), with seven treatments and three replications. VNR-12 variety of brinjal seedling were transplanted in 20 m^2 area with spacing 60cm (R-R) × 60 cm (P-P). The tested insecticides were first diluted to the desired concentration by using water. Each insecticidal concentration was sprayed through knapsack sprayer after proper dilution of required water quantity. The per cent shoot and fruit infestation per 5 plants was recorded at one day before and 7 and 15 days after application of insecticides. Two sprays of each insecticide were applied. In this experiment, number of infested shoots and number of infested fruits was recorded on randomly selected 5 plants / plot at 10 day's interval in each picking. Pretreatment population was recorded at 24 hours before and post treatment after 1, 3, 5, 7 and 10 days of spray for sucking pests and natural enemies on randomly selected 5 plant/plot.

S. No.	Treatments	Dose
T_1	BAS 550 01 I SC	84 g a.i./ha
T_2	BAS 550 01 I SC	96 g a.i./ha
T_3	BAS 550 01 I SC	108 g a.i./ha
T_4	BAS 550 01 I SC	120 g a.i./ha
T_5	Diafenthuron 50% EC	300 g a.i./ha
T6	Cypermethrin 25 % EC	300 g a.i./ha
T7	Untreated control	-

Statistical analysis

Observations on brinjal shoot and fruit borer infestation was transformed before statistical analysis. Fruit infestation and yield (q/ha) were worked out with the help of following formula:-

$$\text{Per cent fruit damage} = \frac{\text{Number of damaged fruits}}{\text{Total number of fruits (healthy + damaged)}} \times 100$$

$$\text{Percent fruit yield} = \frac{\text{Weight of fruit (kg/plot)}}{\text{Plot area (m}^2\text{)}} \times 100$$

Table 1: Bio-efficacy of different insecticides against shoot and fruit borer (*Leucinodes orbonalis*) on brinjal during *Kharif* 2019-20

S. No.	Insecticides	a.i./ha (gm)	Pre treatment fruit infestation (%)	Post treatment fruit infestation (%)				
				I Spray		II Spray		Overall mean
				7 DAS	15 DAS	7 DAS	15 DAS	
1.	BAS 550 01 I SC	84	31.65 (34.23)	12.09 (20.29)	22.4 (28.32)	13.0 (21.20)	19.32 (26.02)	16.70 (23.95)
2.	BAS 550 01 I SC	96	31.5 (34.19)	11.71 (19.92)	20.3 (26.87)	12.43 (20.54)	18.22 (25.21)	15.66 (23.13)
3.	BAS 550 01 I SC	108	29.92 (30.02)	10.94 (19.28)	17.43 (24.61)	11.62 (19.82)	16.42 (23.86)	14.10 (21.89)
4.	BAS 550 01 I SC	120	30.2 (31.15)	8.92 (17.30)	15.1 (22.97)	10.23 (18.59)	16.12 (23.60)	12.59 (20.61)
5.	Difenthuron 50% EC	300	29.80 (30.00)	13.71 (21.64)	23.1 (28.80)	13.87 (21.78)	20.13 (26.84)	17.70 (24.76)
6.	Cypermethrin 25% EC	300	30.41 (32.44)	14.34 (22.21)	25.92 (30.54)	15.4 (23.23)	22.23 (28.08)	19.47 (26.03)
7.	Control (Untreated)	-	31.00 (34.05)	31.33 (34.01)	33.14 (35.12)	36.40 (37.08)	38.50 (38.32)	34.84 (36.13)
	SEm		-	1.102	1.905	1.127	1.913	-
	CD at 5%		NS	3.42	3.80	3.50	3.83	-

( ) Figures in parentheses are angular transformed, NS= Non significant

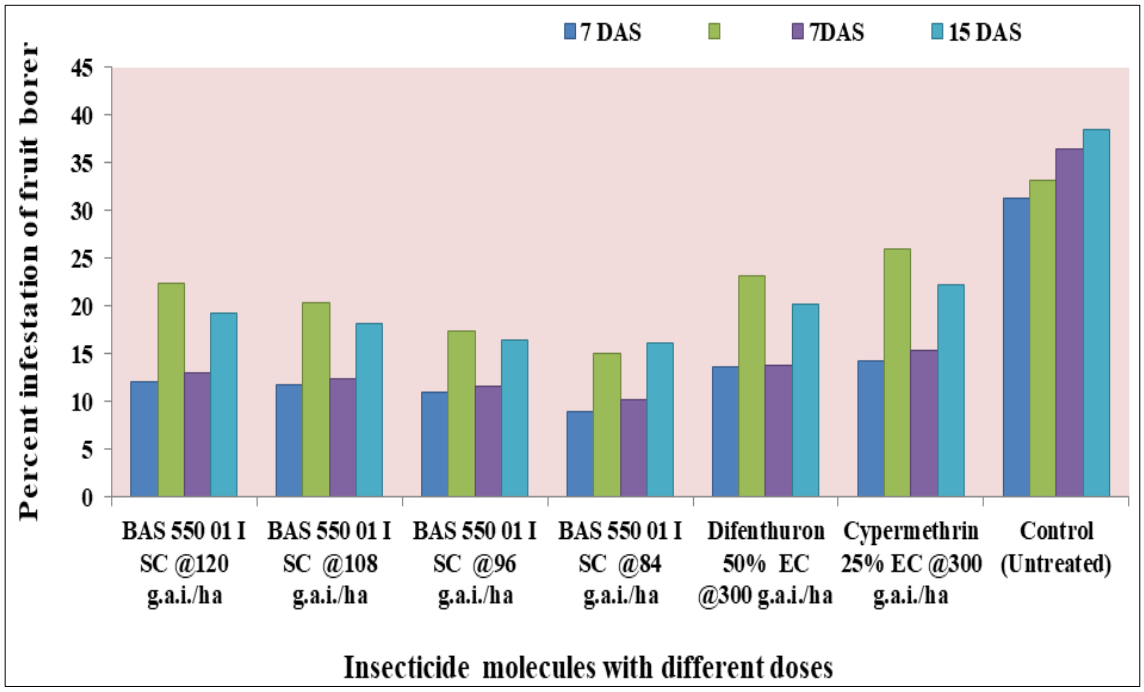

Fig 1: Bio-efficacy of BAS 550 01 I SC against shoot and fruit infestation on brinjal after first and second spray

Table 2: Bio-efficacy of different insecticides against jassids, *Amrasca biguttula biguttula* (Ishida) on brinjal *during kharif* 2019-20

S. No.	Insecticides	a.i./ha (gm)	Pre treatment fruit infestation (%)	Post treatment population of jassids/plant at different days after spray (DAS)										
				I Spray					II Spray					Overall mean
				1 DAS	3 DAS	5 DAS	7 DAS	10 DAS	1 DAS	3 DAS	5 DAS	7 DAS	10 DAS	
1.	BAS 550 01 I SC	84	10.80 (3.42)	5.15 (2.83)	6.69 (2.95)	6.92 (3.23)	7.53 (2.84)	8.06 (2.91)	3.87 (2.06)	4.12 (1.74)	6.56 (2.61)	6.67 (2.65)	7.05 (2.44)	6.26 (2.63)
2.	BAS 550 01 I SC	96	11.09 (3.45)	5.19 (2.90)	6.20 (2.92)	6.88 (3.02)	6.64 (2.65)	7.08 (2.73)	3.33 (1.94)	4.1 (1.90)	5.96 2.54)	6.04 (2.60)	6.51 (2.48)	5.79 (2.57)
3.	BAS 550 01 I SC	108	10.64 (3.39)	4.47 (2.81)	4.99 (2.85)	5.08 (2.99)	6.15 (3.00)	6.45 (3.02)	2.87 (1.76)	3.6 (1.79)	3.89 (1.77)	4.94 (2.52)	5.92 (2.31)	4.83 (2.42)
4.	BAS 550 01 I SC	120	11.11 (3.45)	3.81 (2.45)	4.60 (2.59)	4.74 (2.63)	4.89 (2.30)	5.44 (2.40)	2.5 (1.61)	2.69 (1.70)	2.78 (1.77)	3.1 (1.74)	3.71 (2.23)	3.84 (2.14)
5.	Difenthuron 50% EC	300	10.54 (3.37)	6.63 (3.07)	6.73 (3.10)	6.95 (3.19)	7.75 (3.66)	7.91 (3.69)	3.55 (2.03)	3.8 (2.01)	5.89 (2.69)	6.75 (2.71)	6.95 (2.52)	6.29 (2.70)
6.	Cypermethrin 25% EC	300	10.65 (3.41)	7.93 (3.65)	8.02 (3.69)	8.13 (3.72)	9.1 (3.89)	9.5 (3.90)	4.48 (2.39)	5.25 (2.21)	6.89 (2.73)	7.3 (2.95)	8.33 (2.78)	7.49 (2.92)
7.	Control (Untreated)	-	10.78 (3.48)	10.89 (3.70)	11.26 (3.78)	11.56 (3.84)	11.67 (3.85)	11.88 (3.93)	11.13 (3.75)	11.35 (3.80)	11.41 (3.82)	11.5 (3.84)	11.62 (3.87)	11.42 (3.83)
	SEm		-	0.221	0.219	0.327	0.325	0.320	0.37	0.24	0.215	0.212	0.25	-
	CD at 5%		NS	0.692	0.690	0.713	0.710	0.645	0.862	0.460	0.426	0.423	0.468	-

( ) Figures in parentheses are square root transformed, NS= Non significant

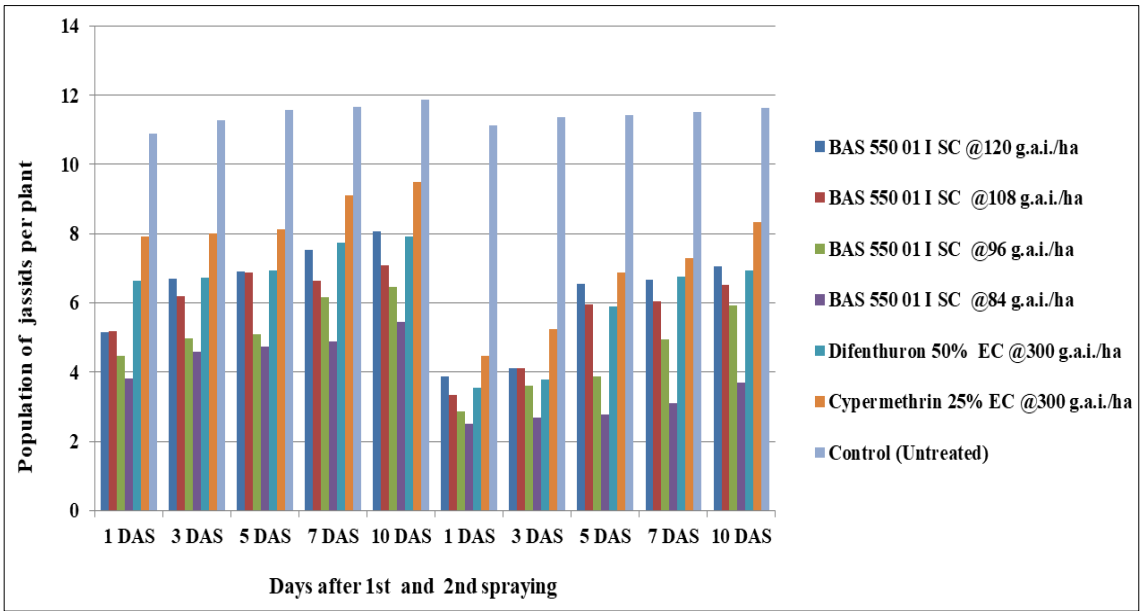

Fig 2: Bio-efficacy of BAS 550 01 I SC against jassids population on brinjal after first and second spray

Table 3: Cumulative yield of brinjal (Q/ha) as influenced by different treatments during the experiment (*Kharif* 2019-20)

Insecticides	Dosages per ha		Total fruit yield (q/ha)	Increase in yield over control (q/ha)
	gm. *a.i.*/ha	Formulation ml/ha		
BAS 550 01 I SC	84	700	179.57	32.25
BAS 550 01 I SC	96	800	182.22	34.97
BAS 550 01 I SC	108	900	194.24	43.05
BAS 550 01 I SC	120	1000	211.24	55.57
Difenthuron 50% EC	300	600	179.02	31.84
Cypermethrin 25% EC	300	750	176.72	30.15
Untreated Control	-	-	135.78	-
SEm	-	-	3.25	-
CD at 5%	-	-	10.03	-

Result and Discussion

The insecticide molecules BAS 550 01 I SC @120g.a.i/ha, BAS 550 01 I SC @108g.a.i/ha, BAS 550 1 I SC @96g.a.i/ha, BAS 550 01 I SC @84g.a.i/ha, Difenthuron 50% EC@300 g.a/ha and Cypermethrin 25%EC@300 g.a.i/ha and untreated control were evaluated for their efficacy manage the pest complex of Brinjal.

Bio-efficacy of BAS 550 01 I SC against shoot and fruit borer, *Leucinodes orbonalis* Guenee on brinjal

None of the shoots of brinjal was damaged due to *L. orbonalis* Guenee. It may be due to characters of variety used in the experiment, which had many hairy, spines like structure throughout the shoot region. Probably, this characteristics of host plant is unattractive to the *L. orbonalis* Guenee for oviposition, feeding, or shelter. However, fruit infestation was

started right from the fruit initiation and it was in increasing trend up to the final harvest.

The fruit infestation observation of shoot and fruit borer, *Leucinodes orbonalis* Guenee were recorded at each picking with an overall 5 picking. At each pickings, infested and healthy fruit were separated to record pest infestation and reduction in yield for the statistical analysis of data. Insecticide BAS 550 1 I SC @120g.a.i/ha was most effective and statistically significant over rest of the treatments with the fruit borer infestation BAS 550 01 I SC @120g.a.i/ha, (12.59%), BAS 550 01 I SC @120g.a.i/ha, (12.59%), followed by BAS 550 01 I SC @108g.a.i/ha, (14.10%), and BAS 550 01 I SC @96g.a.i/ha, (15.66%), BAS 550 01 I SC @84g.a.i/ha, (16.70%), respectively. There was maximum (34.84%) shoot and fruit borer infestation noticed in untreated control.

More or less, similar findings were recorded by the Singh *et al*. (2009) [14] reported that the profenophos 15 EC @ 0.1 % and spinosad 45SC @0.01 %were most effective in reduction of shoot and fruit infestation of *Leucinodes orbonalis* Guenee besides recorded higher yield of brinjal fruits. Anil and Sharma (2010) [2] evaluated that the bio-efficacy of insecticides against shoot and fruit borer, *Leucinodes orbonalis* Guenee on brinjal. The results revealed that emamectin benzoate 5 SG (0.002%) was highly effective in reducing the shoot (0.56%) and fruit (16.58%) infestation among endosulfan 35 EC (0.05%), novaluran 10 EC (0.01%), lamda- Cyhalothrin 5 EC (0.004%), spinosad 2.5 SC (0.0024%) and agrospray oil (0.2%).

Bio-efficacy of BAS 550 01 I SC against Jassids, *Amrasca bigutulla bigutulla* on brinjal

The non significant difference was observed in different plots during the pretreatment observation. A day after foliar application of insecticides, the minimum jassids population per plant was observed in BAS 550 01 I SC @120 g.a.i/ha (3.84 jassid/plant) followed by BAS 550 01 I SC @108 g.a.i/ha (4.83 jassid/plant), BAS 550 01 I SC @96 g.a.i/ha (5.79 jassid/plant), BAS 550 01 I SC @84 g.a.i/ha (6.26 jassid/plant), Diafenthuron 50% EC@ 300 g.a.i/ha (7.49 jassid/plant) and in Cypermethrin 25%EC 300 g.a.i/ha (jassids/plant).

Shaik (2012) observed that the Profenophos 50EC @ 1000ml/ha was most effective against sucking pest with 3.42 whiteflies and 5.31 jassids per plant. It was followed by Chlorpyriphos 50+ Cypermethrin 5 EC @ 1000ml/ha for whitefly (4.35/plant) and spinosad 45 SC 187.5 ml/ha for jassids (6.97/plant).

Fruit yield and economic assessment

The total fruit yield of all the treatment was significant higher over untreated control. Yield of healthy fruits of brinjal ranged between 135.78 to211.24 q/ha. Maximum yield was recorded from treatment by BAS 550 01 I SC @ 120g a.i/ha (211.24q/ha) followed by BAS 550 01 I SC @ 108 g a.i/ha (194.24q/ha). The lowest total fruit yield recorded from untreated control (T7) (135.78q/ha). The percent reduction in yield due to shoot and fruit borer *Leucinodes orbonalis* Guenee of brinjal varied ranged between 12.59 to 36.84 percent. The least percent reduction was recorded in treatment BAS 550 01 I SC @ 120g a.i/ha (211.24q/ha) (12.59%), followed by BAS 550 01 I SC @ 108g a.i/ha (194.24q/ha) (14.10%), and maximum reduction yield was noticed in Cypermethrin 25% EC@ 300 g.a.i/ha (176.72q/ha) (19.47%) as compared to untreated control was 19.47%. Thus the study suggest that BAS 550 01 I SC @ 120 g.a.i/ha could be a part in the control programme of brinjal fruit borer complex

Patra *et al*. (2016) [9] observed that the chlorantraniliprole was the best treatment in reducing the shoot infestation and gave highest marketable brinjal fruit yield (155.01 q ha-1).

Conclusion

The new chemical insecticides BAS 550 01 I SC was evaluated for its bio-efficacy against major insect pests of brinjal in the department of Entomology, IGKV, Raipur during *Kharif* 2019. During the bio-efficacy trial, the effect of all tested doses of BAS 550 01 I SC effectively control the population of major insect pests of brinjal. It was also observed that BAS 550 01 I SC at all dosages levels tested for bio-efficacy has non-significant lower population of natural enemies under field condition.

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