

## Research Paper 2

**Bio efficacy of new molecule insecticide against Pod borer *Helicoverpa armigera* (Hubner) in *Cicer arietinum* under field condition**

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**ABSTRACT:**

*The present investigations entitled “Bio efficacy of new molecule insecticide against Pod borer H. armigera (Hubner) in Cicer arietinum under field condition” was carried out at Students’ Instructional Farm, School of Agriculture, Lovely Professional University during Rabi, 2017-18 and 2018-19. Seven chemical among the one spilt dose and neem oil compared with uncontrolled were tested for their bio efficacy towards regarding reduction of larvae number and loss of pod damaged percent recorded. Significant lower mean pod borer population after first spray within 24 hours 2.00 larvae/5plant were recorded on the crop treated with Indoxacarb 14.5% SC with dose (0.70ml/lit) with 16.32% and 16.22% reduction over control which provide significantly highest yield 1.53 and 1.56kg with additional yield over control 1.12kg found most effective treatment. The lower dose(0.5ml/lit) of same insecticides after first day spray pod borer populations were recorded 2.33 and 2.66 larvae/5plant with 24.97 and 18.56 percent reduction over control during both year which provide 1.25kg and 1.33kg with 0.86kg additional yield over control had second effective treatment. The ascending ranking of insecticide on the basis of percent reduction over control for the management of pod borer was Indoxacarb 14.5% SC(0.70& 0.5 ml/lit)<Emamectin benzoate 5%SG<Lambda cyhalothrin 4.9%SC<Cypermethrin 25%EC<Fipronil 5%SC and Chlorpyriphos 20%EC<Neem oil. Among all treated insecticide botanical insecticide neem oil found least effective for the management of pod borer.*

**INTRODUCTION:**

*Cicer arietinum*L. is considered as “King of Pulses” and commonly known as “Bengal gram, Chana and gram”, being legume improves soil fertility by fixing symbiotic atmospheric nitrogen near about 140kg/ ha.(Rupela et.al.1987) It is known to be originated from India, Afghanistan

and Persia. The most important chickpea growing states in India are Maharashtra, Gujarat, M. P., U.P, and Punjab. India have largest producer of gram. Its cultivation on 8.95 m.ha area with production 7.06 m.t. and productivity 801kg/ha. (Anonymous, 2016) It is rich source of proteins (52-70%), carbohydrates (52-70%), fats (4-10%), mineral and vitamins useful for human and animal consumption.

Gram pod borer, *H. armigera* act as major constraints to increase production of gram that required many time uses of insecticide total loss, completely failure of crops. It is a polyphagous, multi-voltine and cosmopolitan pest ((Wakil et al., 2009a, b; 2010).) It is reported to feed and breed on 182 species of host plants belonging to 47 families in India (Pawar, 1998). High reproduction rates, broad genetic variability for adjust metabolic process developed resistance against chemicals. A single larva can consume 30-40 pods in its life time (Taggar and Singh, 2012) Reduction of gram production due to this pest may range from 70 to 95 percent (Prakash et al., 2007). The immature stage of *H. armigera* consumed on foliage but they occurred most dangerous at flowering and pod formation condition causing significant damage to crop. (Moral Garcia, 2006). larval number of this became at peak level at pod formation stage (Patel and Koshiya, 1999) they consumed half portion of developing grain get damage, therefore, it became main reason to reduction of yield due to at this stage control measures become necessary. For control of this pest population new molecule insecticides play key role because having ability to develop resistance against frequently used chemical. (Balasubramanian et al., 2001) when larval number crosses the economic threshold level (ETL) then management practices are utilize to reduce population. Regarding management of *H. armigera* different worked already carried out around the globe for proper but this work became fail to control after passing some times. *H. armigera*, act as key pest, having international importance and most significant regarding reduction of yield work on necessary to conduct the present study to find out effective different novel insecticides against this pest in the chickpea crop under field conditions.

#### MATERIAL AND METHODS:

Experiments were conducted on agricultural research form, School of Agriculture, LPU Punjab during 2017-18 and 2018-19 in RBD using nine treatments and 3 replication of chickpea cultivar USHA 362 having plot size 5x3m by maintaining spacing 45x10cm. All package of practices for chickpea cultivation adopted given by PAU, Ludhiana for rising of crop except plant protection. Seven different new molecule chemicals, among them Indoxacarb 14.5SC was utilized with spilt doses and botanical insecticides Neem oils utilized for same research work. Spraying of chemicals done with Hand sprayer.

Plan of experiments for population fluctuation: The observations were recorded after germination of crop at weekly intervals till ETL surpassed. The monitoring of pest was carried by visual observation by using pheromone traps. When pest population cross ETL then spraying of different insecticides done. The bio efficacies were recorded after 24 hrs. 3DAS, 7DAS and 15

DAS on five randomly selected plants/plot. The observation was recorded at morning hours (7.00-9.00 am).

Preparation of insecticidal spray solution: The insecticidal spray solution of desired concentration as per treatments was freshly prepared every time at the field of experiment just before the start of spraying operations. The quantity of spray chemical required for crop was gradually increased as the crop advanced in age. The spray solution of desired concentration was prepared by adoption the following formula.

Formula:  $N1V1 = N2V2$

N1: Concentration of commercial formulation in percent or grams

V1: Volume or amount of commercial formulation required in milliliter or grams

N2: Desired concentration of spray fluid in percent

V2: Volume or amount of spray fluid required (in milliliter)

Assessment of Pod damage: Five plants in each plot from the each replication were selected randomly from eight lines of centre portion of plots for the recorded the larvae number of pod borer. In reproductive stage of crop, 100 capsules were picked up randomly from ten plants in every plot for this pest capsule damage assessment and represent as a percentage of the total number of pods. Seed yield recorded from each plot was converted into Kg/ha. Data on larval population of *H. armigera*, pod damage and yield corresponding to each treatment was subjected to statistical analysis after suitable transformation (Gomez and Gomez, 1984).

## RESULTS:

Effect of new molecule insecticides on pod borer management during 2017-18

The present research work on the bio efficacy of various new molecule chemicals against *H. armigera incicer arietinum* before spraying treatment recorded larvae number of pest was not significant but caterpillar population varied significantly among the treatments after the application of different insecticides. A sharp reducing in the caterpillar number of pod borer was noted 24 hours after the application of spray compared to control. The data on *Helicoverpa armigera* at 1, 3, 7 and 15 days after spray of different insecticides was calculated and the polled result are presented in Table 1 and 2 (Fig.1 &2)

Larval population at 1 DAS: In all tested chemicals were competent significantly in reducing juvenile form pest. Out of the tested chemicals, Indoxacarb 14.5 SC (0.70ml/lit) showed highest population reduction with 2.00 larvae/5plant after that E. Benzoate 5% SG (0.5ml/lit),

Indoxacarb 14.5 SC (0.5ml/lit) (2.00 and 2.33 larvae/5plant), respectively proceed that next effective chemical for larval number reduction was Chlorpyrifos 20% EC (2.5ml/lit.), Neem oil (2ml/lit.), Lambda cyhalothrin 4.9% CS (1ml/lit.), Fipronil 5% SC(1ml/lit.) and Cypermethrin 25% EC (0.5ml/lit) has recorded with 11.33, 4.66, 5.33, 5.33 and 5.66 larva/5plant.

Larval population at 3 DAS: Indoxacarb 14.5 SC (0.70ml & 0.50ml/lit.) has noted maximum population as compare to untreated checks with 1.00 & 1.33 larva/5plant after that E. Benzoate 5% SG, Chlorpyrifos 20% EC significantly effective recorded with 2.00 and 4.00 larva/5plant. Another better chemical found effective on the causing mortality of larval population Cypermethrin 25% EC, Fipronil 5% SC and Lambda cyhalothrin 4.9% CS has recorded with 2.66, 4.00 and 1.66 larva/5plant. Lastly, Neem oil was recorded very less effective recorded with 4.66larva/5plant.

Larval population at 7 DAS: Indoxacarb 14.5 SC (0.70ml/lit) has observed that highest population reduction over control with 1.33 larva/5plant supervised by Indoxacarb 14.5 SC (0.5ml/lit), Lambda cyhalothrin 4.9% CS (1ml/lit.) and Emamectin Benzoate 5% SG (0.5ml/lit) significantly effective recorded with 1.66, 3.33 and 3.00 larva/5plant proceed that next better treatments decrease down the larval population Cypermethrin 25% EC (0.5ml/lit), Fipronil 5% SC (1ml/lit.) and Chlorpyrifos 20% EC (2.5ml/lit.) has recorded data 5.33, 3.00 and 4.00 larva/5plant, respectively. Lastly, Neem oil (2ml/lit.) was recorded very less effective with 4.00larva/5plant.

Larval population at 15 DAS: Indoxacarb 14.5 SC (0.70ml & 0.50ml/lit.) has noted most of the population reduction over control with 0.33 & 0.66 larva/5plant followed by E. Benzoate 5% SG (0.5ml/lit), Lambda cyhalothrin 4.9% CS (1ml/lit.) significantly effective recorded with 1.33 and 1.66 larva/5plant. After that better insecticide found effective on the larval population Cypermethrin 25% EC (0.5ml/lit) has recorded data of population with 2.66 larva/5plant. Lastly, Fipronil 5% SC (1ml/lit.), Chlorpyrifos 20% EC (2.5ml/lit.) and Neem oil (2ml/lit.) has recorded very less effective recorded with 5.33, 5.33 and 5.66 larva/5plants

**Table 1: Effect of new molecular insecticide on pod borer management (2017-18)**

T. Number	Treatment Details	doses	Before spray	1 DAS (%)	3 DAS (%)	7 DAS (%)	15 DAS (%)
T1	Indoxacarb 14.5% SC	0.5ml/lit	9.33(3.13 <sup>a</sup> )*	2.33(1.67 <sup>b</sup> ) (24.97)	1.33(1.34 <sup>c</sup> ) (14.25)	1.66(1.34 <sup>cd</sup> ) (17.14)	0.66(1.05 <sup>e</sup> ) (7.07)
T2	Emamectin Benzoate 5% SG	0.5ml/lit	10.66(3.32 <sup>a</sup> )	2.00(1.52 <sup>b</sup> ) (18.76)	2.00(1.55 <sup>bc</sup> ) (18.76)	3.00(1.55 <sup>bcd</sup> ) (28.14)	1.33(1.34 <sup>de</sup> ) (12.47)
T3	Cypermethrin 25% EC	0.5ml/lit	11.33(3.42 <sup>a</sup> )	5.66(2.48 <sup>b</sup> ) (49.95)	2.66(1.77 <sup>bc</sup> ) (23.47)	5.33(1.73 <sup>bcd</sup> ) (47.04)	2.66(1.77 <sup>cd</sup> ) (23.47)
T4	Chlorpyriphos 20% EC	2.5ml/lit	11.33(3.43 <sup>a</sup> )	3.66(2.03 <sup>b</sup> ) (32.30)	4.00(1.67 <sup>bc</sup> ) (35.30)	4.00(2.12 <sup>bc</sup> ) (35.30)	5.33(2.41 <sup>bc</sup> ) (47.04)
T5	Lambda cyhalothrin 4.9% SC	1ml/lit	9.66(3.17 <sup>a</sup> )	5.33(2.41 <sup>b</sup> ) (55.47)	1.66(1.95 <sup>bc</sup> ) (17.18)	3.33(1.46 <sup>cd</sup> ) (34.47)	1.66(1.46 <sup>de</sup> ) (17.18)
T6	Fipronil 5% SC	1ml/lit	11.33(3.44 <sup>a</sup> )	5.33(2.41 <sup>b</sup> ) (47.04)	4.00(1.85 <sup>bc</sup> ) (35.30)	3.00(2.09 <sup>bc</sup> ) (26.47)	5.33(2.40 <sup>bc</sup> ) (47.04)
T7	Neem oil	2ml/lit	10.33(3.28 <sup>a</sup> )	4.66(2.24 <sup>b</sup> ) (45.11)	4.66(2.03 <sup>b</sup> ) (45.11)	4.00(2.27 <sup>b</sup> ) (38.72)	5.66(2.48 <sup>b</sup> ) (54.79)
T8	Indoxacarb 14.5% SC	0.70ml/lit	12.33(3.57 <sup>a</sup> )	2.00(1.58 <sup>b</sup> ) (16.32)	1.00(1.34 <sup>c</sup> ) (8.11)	1.33(1.22 <sup>d</sup> ) (10.78)	0.33(0.88 <sup>e</sup> ) (2.67)
T9	control		10.66(3.33 <sup>a</sup> )	14.33(3.82 <sup>a</sup> )	12.33(3.13 <sup>a</sup> )	9.33(3.57 <sup>a</sup> )	14.66(3.89 <sup>a</sup> )
C.V≤20%		----	NS	18.77	11	13.89	11.59
CD@ 0.005%		----	NS	0.45	0.41	0.50	0.42
SEm(±)		----	NS	0.15	0.13	0.16	0.14

DAS= Days after spraying      \*Data in bracket percent reduction over control

**Effect of new molecules insecticide on pod borer management during 2018-19**

Larval population at 1 DAS: Indoxacarb 14.5 SC (0.70ml/lit) has recorded highest population reduction over control with 2.33 larva/5plant succeeded by Indoxacarb 14.5 SC (0.5ml/lit), E. Benzoate 5% SG (0.5ml/lit) significantly effective recorded with 2.66 and 3.00 larva/5plant. Followed by chemical show impotent in the mortality of larvae was Chlorpyrifos 20% EC (2.5ml/lit.), Lambda cyhalothrin 4.9% CS (1ml/lit.), Neem oil (2ml/lit.), Fipronil 5% SC(1ml/lit.) and Cypermethrin 25% EC (0.5ml/lit) has recorded with 4.33, 4.66, 5.00, 5.33 and 5.33 larva/5plant respectively

Larval population at 3 DAS: Indoxacarb 14.5 SC (0.70ml & 0.50ml/lit.) has found maximum number population got decrease on control with 1.66 and 1.66 larva/5plant followed by Emamectin Benzoate 5% SG and Lambda cyhalothrin 4.9% CS significantly effective recorded with 2.33 and 3.00 larva/5plant. Next effective insecticide found causing death of the larval population were Chlorpyrifos 20% EC, Fipronil 5% SC, Neem oil and Cypermethrin 25% EC has recorded data with 3.66, 4.00, 4.33 and 4.33 larvae /5plant respectively.

Larval population at 7 DAS: Similarly, Indoxacarb 14.5 SC (0.70ml/lit) has recorded highest population reduction over control with 1.00 larva/5plant succeeded by Indoxacarb 14.5 SC (0.5ml/lit) ,E. Benzoate 5% SG (0.5ml/lit) significantly effective recorded with 1.33 and 1.66 larva/5plant. Third number better treatment found effective on the larval population were Lambda cyhalothrin 4.9% CS (1ml/lit.), Cypermethrin 25% EC (0.5ml/lit) and Chlorpyrifos 20% EC (2.5ml/lit.) has recorded data of population 2.00, 3.00 and 3.33 larva/5plant, respectively. Lastly, Fipronil 5% SC (1ml/lit.) and Neem oil (2ml/lit.) was recorded very less effective recorded with 4.33 and 5.00 larva/5plant respectively.

Larval population at 15 DAS: Simultaneously, Indoxacarb 14.5 SC (0.70ml) has recorded highest population reduction over control with 0.66 larva/5plant followed by Indoxacarb 14.5 SC(0.5ml/lit.), Lambda cyhalothrin 4.9% CS (1ml/lit.) and Emamectin Benzoate 5% SG (0.5ml/lit) significantly effective recorded with 1.00, 1.33 and 1.66 larva/5plant followed by Cypermethrin 25% EC (0.5ml/lit) has recorded data of population with 2.66 larva/5plant. Lastly, Chlorpyrifos 20% EC (2.5ml/lit.), Fipronil 5% SC (1ml/lit.) and Neem oil (2ml/lit.) has recorded very less effective recorded with 3.66, 4.00 and 5.66 larva/5plant.

The bio efficacy of various tested chemical for causing mortality of pest was counted larvae randomly selected on five plants. On the basis of results findings, it was inferred that all the treated chemicals were significantly superior over control. Minimum larval quantity noted both year of in *Rabi* season was recorded with Indoxacarb 14.5 SC @ 0.70 ml/lit with 2.00, 1.00, 1.33 and 0.33 larvae/five plant over control at 1 DAS, 3 DAS, 7 DAS and 15 DAS, Indoxacarb 14.5

SC @ 0.50 mili /lit, E. Benzoate 5% SG @ 0.5 mili /lit., Lambda cyhalothrin 4.9% SC @ 1 ml/lit., Cypermethrin 25% EC @ 0.5 ml/lit., Chlorpyriphos 20% EC @ 2.5 ml/lit., Fipronil 5% SC @ 1 ml/lit. and Neem oil @ 2 ml/lit., respectively.

**Table 2: Effect of new molecules insecticide on pod borer management (2018-19)**

T. Number	Treatment Details	Doses	Before spray	DAS 1 (%)	DAS 3 (%)	DAS 7 (%)	DAS 15 (%)
T1	Indoxacarb 14.5% SC	0.5ml/lit	10.66(3.33 <sup>a</sup> )*	2.66(1.77 <sup>de</sup> ) (18.56)	1.66(1.46 <sup>c</sup> ) (12.76)	1.33(1.34 <sup>ef</sup> ) (9.5)	1.00(1.22 <sup>e</sup> ) (7.50)
T2	EmamectineBenzoate 5% SG	0.5ml/lit	9.66(3.18 <sup>a</sup> )	3.00(1.85 <sup>cde</sup> ) (20.93)	2.33(1.67 <sup>bc</sup> ) (17.92)	1.66(1.46 <sup>ef</sup> ) (11.85)	1.66(1.46 <sup>de</sup> ) (12.45)
T3	Cypermethrin 25% EC	0.5ml/lit	10.33(3.27 <sup>a</sup> )	5.33(2.41 <sup>b</sup> ) (37.19)	4.33(2.19 <sup>b</sup> ) (33.30)	3.00(1.87 <sup>cd</sup> ) (21.42)	2.66(1.77 <sup>cd</sup> ) (19.95)
T4	Chloropyriphos 20% EC	2.5ml/lit	10.66(3.34 <sup>a</sup> )	4.33(2.19 <sup>bcd</sup> ) (30.21)	3.66(2.03 <sup>b</sup> ) (28.15)	3.33(1.95 <sup>c</sup> ) (23.78)	3.66(2.03 <sup>bc</sup> ) (27.45)
T5	Lambda cyhalothrin 4.9% SC	1ml/lit	10.33(3.28 <sup>a</sup> )	4.66(2.27 <sup>bc</sup> ) (32.51)	3.00(1.85 <sup>bc</sup> ) (23.07)	2.00(1.58 <sup>de</sup> ) (14.28)	1.33(1.34 <sup>de</sup> ) (9.97)
T6	Fipronil 5% SC	1ml/lit	11.00(3.38 <sup>a</sup> )	5.33(2.40 <sup>b</sup> ) (37.19)	4.00(2.11 <sup>b</sup> ) (30.76)	4.33(2.19 <sup>bc</sup> ) (30.92)	4.00(2.12 <sup>bc</sup> ) (30.00)
T7	Neem oil	2ml/lit	11.66(3.48 <sup>a</sup> )	5.00(2.33 <sup>b</sup> ) (34.89)	4.33(2.18 <sup>b</sup> ) (33.30)	5.00(2.33 <sup>b</sup> ) (35.71)	5.66(2.47 <sup>b</sup> ) (42.46)
T8	Indoxacarb 14.5% SC	0.70ml/ml	11.00(3.28 <sup>a</sup> )	2.33(1.67 <sup>c</sup> ) (16.25)	1.66(1.46 <sup>c</sup> ) (12.76)	1.00(1.22 <sup>f</sup> ) (7.14)	0.66(1.05 <sup>e</sup> ) (4.95)
Control			11.33(3.43 <sup>a</sup> )	14.33(3.84 <sup>a</sup> )	13.00(3.66 <sup>a</sup> )	14.00(3.80 <sup>a</sup> )	13.33(3.71 <sup>a</sup> )
C.V≤20%			----	NS	7%	9.52%	5.77%
CD@ 0.005%			----	NS	0.30	0.37	0.21
S.Em(±)			----	NS	0.10	0.12	0.07

**DAS= Days after spraying**

**\*Data in bracket percent reduction over control.**

Effect of treatment by additional yield over control and percent yield increase over control

Significantly highest yield of 1.53 kg seed was obtained in the plots treated with Indoxacarb 14.5 percent SC (0.70ml/lit.) proceed that same insecticide lower dose (0.50ml/lit.) 1.25 kg, Emamectin Benzoate 5% SG (0.5ml/lit.) 1.09 kg which were at par with Lambda cyhalothrin 4.9% CS (1ml/lit.) 1.03 kg as against the minimum seed yield of 0.43 kg in untreated control in *Rabi* season of 2017-18 (Table-3)

Table 3: Effect of treatment by additional yield over control and percent yield increase over control

Treatments	Dose	2017-18	2018-19	Mean	Additional Yield over control	% Increase in yield over control
Indoxacarb 14.5% SC	0.5ml/lit	1.25 <sup>b</sup>	1.33 <sup>b</sup>	1.29 <sup>b</sup>	0.86	200
Emamectin Benzoate 5% SG	0.5ml/lit	1.09 <sup>c</sup>	1.13 <sup>bc</sup>	1.11 <sup>c</sup>	0.68	158.13
Cypermethrin 25% EC	0.5ml/lit	0.91 <sup>de</sup>	0.93 <sup>cd</sup>	0.92 <sup>de</sup>	0.49	113.95
Chlorpyriphos 20% EC	2.5ml/lit	0.82 <sup>e</sup>	0.77 <sup>de</sup>	0.79 <sup>e</sup>	0.36	83.72
Lambda cyhalothrin 4.9% SC	1ml/lit	1.03 <sup>cd</sup>	1.04 <sup>c</sup>	1.03 <sup>cd</sup>	0.6	139.53
Fipronil 5% SC	1ml/lit	0.81 <sup>e</sup>	0.79 <sup>de</sup>	0.80 <sup>e</sup>	0.37	86.04
Neem oil	2ml/lit	0.62 <sup>f</sup>	0.63 <sup>ef</sup>	0.62 <sup>f</sup>	0.19	44.08
Indoxacarb 14.5% SC	0.70ml/lit	1.53 <sup>a</sup>	1.56 <sup>a</sup>	1.55 <sup>a</sup>	1.12	260.46
control	---	0.43 <sup>g</sup>	0.43 <sup>f</sup>	0.43 <sup>g</sup>	---	---
CD	---	0.030	0.045	0.31	---	---
CV	---	1.233	1.862	1.254	---	---

Similarly, Indoxacarb maintained its superiority during *Rabi* season 2018-19too, Indoxacarb 14.5% SC (0.70ml/lit.) with a maximum seed yield of 1.56 kg followed by Indoxacarb 14.5% SC (0.50ml/lit.) 1.33 kg, Emamectin Benzoate 5% SG (0.5ml/lit.) 1.13 kg which were at par with Lambda cyhalothrin 4.9% CS (1ml/lit.) 1.04 kg as against the lowest seed yield in untreated control with 0.43 kg (Table-3)

From both years pooled data represent that highest seed yield was obtained in Indoxacarb 14.5% SC (0.70ml/lit.) treated plots (1.55 kg) with 260.4 percent increase over control, proceed that same insecticide lower dose by that is (0.50ml/lit.) treated plot yield 0.86 kg, Emamectin Benzoate 5% SG (0.5ml/lit.) treated yield 1.11 kg and Lambda cyhalothrin 4.9% CS (1ml/lit.) seed yield 1.03 kg with 200, 158.1 and 139.5 percent increase on control, respectively as against the lowestseed yield of 0.43 kg in uncheck treatments.

#### DISCUSSION:

Present experimental findings on the bio efficacy of various treated chemical against *H. armigera* juvenile number were decided on the basis of quantity of caterpillar per five plants. The research work observation present that all the treated insecticides were found significant. Lowest caterpillar population was found on treated with Indoxacarb 14.5 SC @ 0.70 ml/lwere recorded 2.00,1.00,1.33,0.33 and 2.32,1.66,1.00,0.66 larvae/five plants 1,3 , 7 & 15 DAS during both year respectively followed by another dose of same treatment @ 0.50 ml/l were counted 2.33,1.33,1.66,0.66 and 2.66,1.66,1.33, 1.00 larvae/five plants 1,3 , 7 & 15 DAS during both year was most effective treatment among all this result supported by Yogeewarudu *et al.* 2014 because they also revealed that Indoxacarb 14.5 SC @ 0.5 ml/lit recorded superior among all the treatments with the minimum larval population at first spray of 1.53, 0.46, 0.73 larvae/five plant respectively, followed by 0.00, 0.26 and 0.00 larvae/five plants over control at 3 , 5 & 7 DAS respectively. Meena*et. al.* 2018 reported that the minimum pod damage (4.69%) was noticed in Indoxacarb 14.5 SC @1.0 ml/lit. Gowda *et al.*2004 among the different formulation tested on same insecticide but different dose @ 25g active ingredients /ha was found effective as compared to Chlorpyriphos 20 EC@ 250 g a.i./ha. Gautam *et. al.*2018 the present investigation on Indoxacarb 14.5@ SC gave maximum seed production of chickpea in compared to other treatments as well as in managing the population of *Helicoverpa armigera*. Anis *et.al.*(2006)also

support on same chemical cause maximum larval mortality and reduce pest population. Wakil, et.al 2006 also given positive feedback regarding effectiveness of Indoxacarb was the most potent by reducing the larvae of *H. armigera* in sunflower.

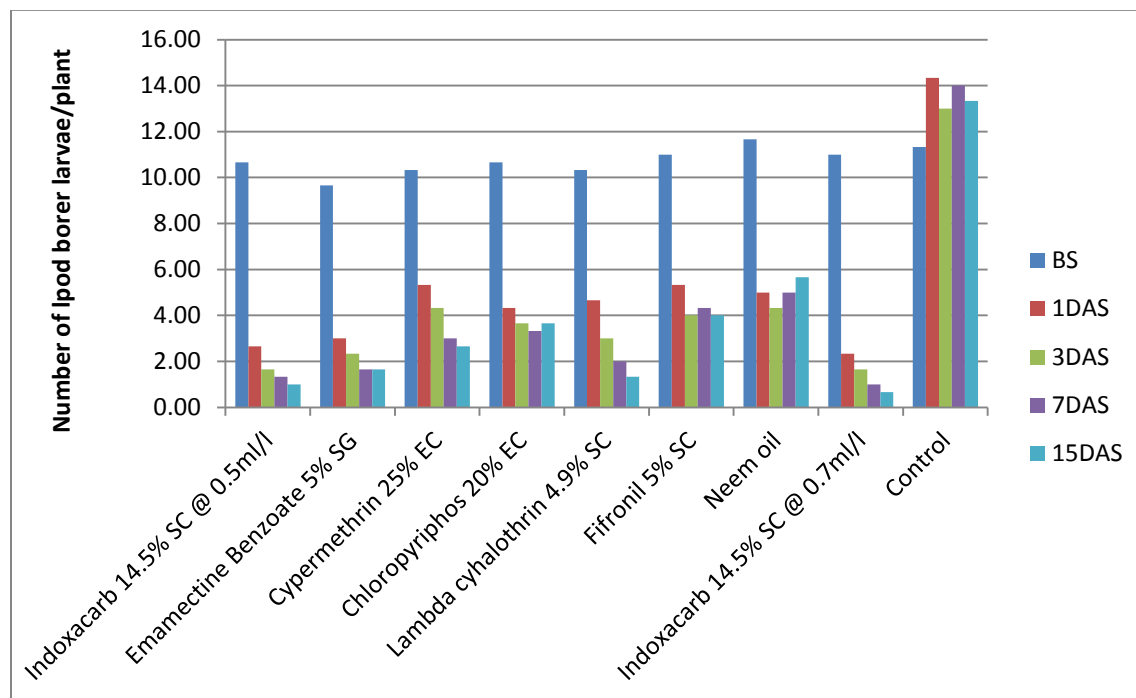
This results also similar with the finding of Gautam *et.al.*2018 reported that maximum yield was obtained against treated with Indoxacarb 14.5SC with 4.90kg/plot. Earlier, observed that Khorasiya *et.al.* 2014 the highest yield was also recorded in the treated with same chemical of dose 0.007 per cent (1658 kg/ha) proceed by Emamectin benzoate (1494 kg/ha). Gowda *et.al.* 2007 also supported to this chemical obtain Indoxacarb significantly higher grain yield 8.99q/ha at dose of 14.5 SC @ 25 g a. i. /ha All people mention work highly support to my final yield result.

#### CONCLUSION:

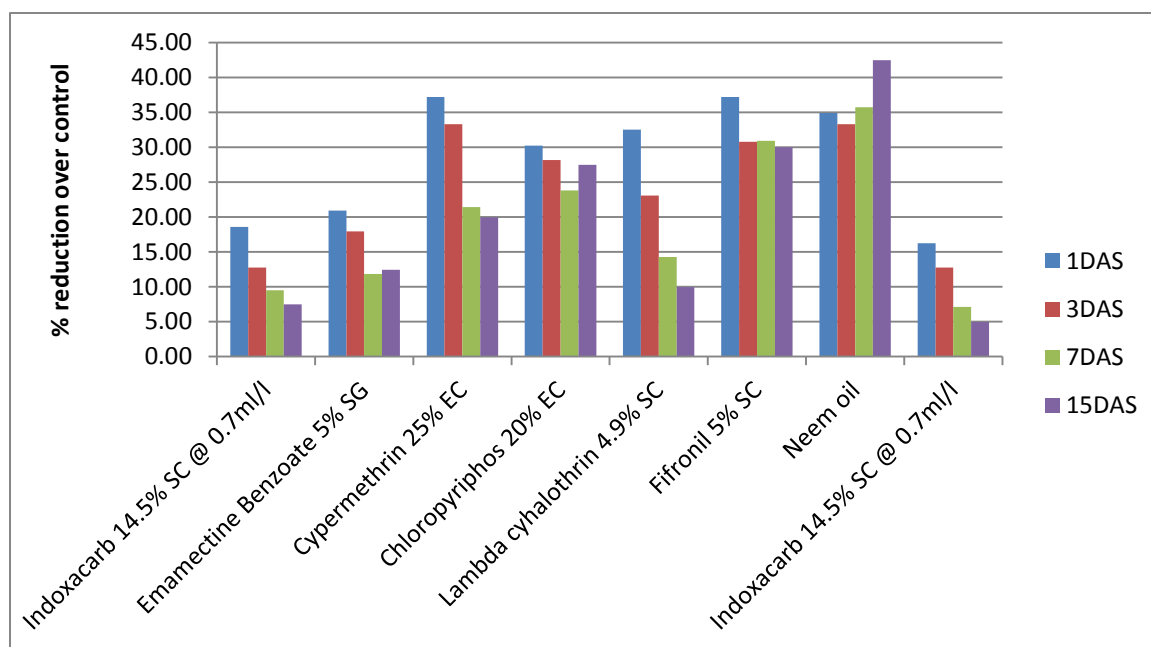
This research work results conclude that the new molecule chemical Indoxacarb 14.5 SC@0.70&0.5 ml/l, were given best response for causing mortality of *H. armigera* along with provided additional yield in chickpea among all treated insecticides. Hence, it is cleared that the effectiveness of treated chemical may be alternated in harmony with existing Integrated Pest Management programs in order to avoid the problems associated with insecticide usage like development of insecticidal resistance, pest resurgence, high residual effect in food commodity etc.

**ACKNOWLEDGEMENT:**The authors are highly grateful School of Agriculture,Lovely Professional University, Punjab for providing the facilities required to conduct this experiment.

**Fig 1: Graphical representation of new molecule insecticide effect on *Helicoverpa armigera* (2017-18)**



**Fig 5: Graphical representation of new molecule insecticide effect on *Helicoverpa armigera* (2018-19)**



**Reference:**

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