International Journal of Chemical Studies

P-ISSN: 2349–8528
E-ISSN: 2321–4902
www.chemijournal.com
IJCS 2020; 8(4): 3070-3073

Received: 22-05-2020
Accepted: 24-06-2020

Prasanna PM
College of Agriculture, Hanumanamatti University of Agricultural Sciences, Dharwad, Karnataka, India

Bharmaraj Badiger
College of Agriculture, Hanumanamatti University of Agricultural Sciences, Dharwad, Karnataka, India

Shivamurthy D
College of Agriculture, Hanumanamatti University of Agricultural Sciences, Dharwad, Karnataka, India

Corresponding Author:
Prasanna PM
College of Agriculture, Hanumanamatti University of Agricultural Sciences, Dharwad, Karnataka, India

Bio-efficacy of insecticide, Cyclaniliprole 100 DC against gram pod borer, *Helicoverpa armigera* Hubmer. Infesting chickpea

Prasanna PM, Bharmaraj Badiger and Shivamurthy D

DOI: https://doi.org/10.22271/chemi.2020.v8.i4ak.10118

Abstract
The present investigation was conducted at Ariculture Research Station, Hanumanamatti, University of Agricultural Sciences, Dharwad during *rabi* Season. Gram pod borer *Helicoverpa armigera* larval population was observed from vegetative stage of the crop. The peak population of gram pod borer were observed from flowering stage. The new insecticide molecule Cyclaniliprole 100 DC different dosages *Viz.*, 30,35 and 40 g a.i./ha gave significantly highest in reduction of larval population compared to Chlorantraniliprole 18.5 SC @ 25 g a.i./ha and Novaluron 10% EC @ 75 g a.i./ha without causing any significant effect on natural enemies. The highest yield was obtained from Cyclaniliprole 10% DC @ 40 g a.i /ha treated plots (13.25 q/ha) which was statistically at par with the treatment of Cyclaniliprole 10% DC @ 35 g a.i/ha, Chlorantraniliprole 18.5 SC @ 25 g a.i./ha and Cyclaniliprole 10% DC @ 30 g a.i./ha (12.92, 12.80 and 11.71 q/ha, respectively).

Keywords: *Helicoverpa armigera*, cyclaniliprole, chlorantraniliprole, pod borer

Introduction
Chickpea (*Cicer arietinum* L.) is a legume crop of the Fabaceae family originated in present day South eastern Turkey and adjoining Syria (Sexena and Singh, 1987). It is the second most important food legume in the world after common bean. The major chickpea-producing countries are India (67.41%), Australia (6.21%), Pakistan (5.73%), Turkey (3.86%), and Myanmar (3.74%) (FAOSTAT 2015) [10]. Chickpea is an important and favorable pulse of many people of India. The per cent chickpea crop area covered in major states India is Madhya Pradesh (32.97%), Maharashtra (18.36%), Rajasthan (16.70%), Andra Pradesh (8.55%), Karnataka (8.21%), Uttar Pradesh (6.85%) and Gujarat (2.92%). In India, the area under chickpea was 7.37 million hectares with a production of 5.89 million tonnes with productivity of 799 kg/ha (Anon, 2011) [2]. In Karnataka, the crop is grown in an area of 6.05 lakh hectares with a productivity of 937 kg/ha. The insect pest Gram pod borer, *Helicoverpa armigera* (Lepidoptera- Nocttuidae) is most important pest on wide variety of food, fibre, oilseeds and other horticulture crops and development of resistance to insecticide to (Dhingra *et al.*, 1998). *Helicoverpa armigera* is a major pest of grain crops and represents a significant challenge for the grains industry and relied on chemical control methods. *H. armigera* significantly influences on reduction of yield of pulses, oilseeds, coarse grains and occasionally winter cereals (ICRISAT, 1992) [1]. Economic losses result from larvae feeding directly on the reproductive structures of crops (seeds and grain). Grain quality may also be downgraded through unacceptable levels of damage. The extent of losses in Chickpea and pigeon pea has been estimated over $ 6.45 milion per annum in semi arid tropics (ICRISAT,1992) [1]. Although widely distributed and recorded in all states and territories of India. There are over 200 insecticide products registered in India against *H. armigera* for grain, cotton and vegetable crops. The majority are from 3 chemical sub-groups with broad-spectrum activity: carbamates, organophosphates and synthetic pyrethroids. Insecticides emamectin benzoate, indoxacarb and chlorantraniliprole and other insecticides have become more widely used in pulses due to their high efficacy and low impact on beneficial insects. Control is complicated because field populations are resistant to numerous insecticide groups. Due to these factors, timing of chemical applications and coverage are critical issues, and growers need to understand how to

minimise yield loss without increasing resistance levels (Anon, 2018) [3]. This Resistance Management Strategy (RMS) should guide growers' selection of control options and provides best practice recommendations including product windows and use restrictions to manage resistance in *H. armigera*. Resistance management and minimisation strategy (Anon, 2018) [3]. The aim of the strategy is to minimise the selection pressure for resistance to the same chemical groups across consecutive generations of *H. armigera*.

Materials and Methods

The experiment was conducted in field condition at Agriculture Research station, Hanumanamatti, University of Agricultural Sciences, Dharwad during *rabi* season. It was designed in a randomized complete block design (RCBD) with four replications. Chickpea seed JG-11 variety was used as planting material. The field was ploughed to bring the soil to fine tilth and fertilizer Nitrogen and Phosphorus was applied at the rate of 10:20 kg/ha at the time sowing. The plot size was 5 × 5 m^2 with spacing between rows and plants of 30 and 10 cm, respectively. Each insecticide was sprayed twice at different growth stages of the crop. Spraying was done at wind free time of the day early in the morning. The Cultivation, weeding and all recommended agronomic practices were performed according to package of practice given by University of Agricultural Sciences, Dharwad.

The experiment comprised of eight treatments including the test insecticide Cyclaniliprole 100 DC at three concentrations *viz.*, 30, 35 and 40 ml a.i. per ha. The two other insecticides are Chlorantraniliprole 18.5% SC @ 25 ml and Novaluron 10% EC @ 75 ml a.i.per ha. The two sprays were provided during the study period with an interval of two weeks.

The observations on larval population of chickpea pod borer was taken on ten randomly selected plants from each treatment of every replication were recorded at the interval of a day before , day after, three, seven and ten days after application of spray and 14 days at second spray. The population of natural enemies, Lady bird beetles and spiders were also observed on treatment imposed chickpea plant from each replications. The crop yield was recorded at the time of harvest and converted on hectare basis. The data on larval population were transformed to square root values ($\sqrt{X+1}$). The yield parameters were analyzed and treatment means were compared by following Duncan's multiple range test (DMRT) as suggested by Gomez and Gomez (1984) [11].

Results and Discussions

The results of the experiment are presented in table 1 and 2. It is revealed that the larval population of pod borer were found non statistical significance across the treatments before spraying at first and second spray. But, among the treatments of Cyclaniliprole 100DC @ 30, 35 and 40 ml a.i./ha were found significantly superior over other treatments at 1, 3, 7 and 10 DAS in reduction of larval population . However, best reduction of larval population was observed at 3 and 7 DAS *viz.*, Cyclaniliprole 100DC @ 30 ml a.i./ha (0.50 and 0.75), Cyclaniliprole 100DC @ 35 ml a.i./ha (0.50 and 0.75) and Cyclaniliprole 100DC @ 40 ml a.i./ha (0.25 and 0.50) respectively, which found at par with check Chlorantraniliprole 18.5% SC @ 25 g a.i./ha at first spray. Whereas in second spray, similar results were obtained, where the treatment Cyclaniliprole 100DC @ 40 ml a.i./ha was found superior over other treatments by causing cent per cent mortality at 3 and 7 DAS (Table-1). However, Cyclaniliprole 100DC @ 30 and 35 ml a.i./ha were found next best treatments with a significant reduction of larval load at 3 (0.25 and 0.25 larval population per plant, respectively) and 7 DAS (0.50 and nil larval population per plant, respectively) compared to Chlorantraniliprole 18.5 SC @ 25 g a.i. /ha and Novaluron 10

EC @ 75 ml/ha, on overall consideration it was recorded that the treatment Cyclaniliprole 100DC @ 40 ml a.i./ha has given highest larval mortality (92.31%) followed by Cyclaniliprole 100DC @ 30 and 35 ml a.i./ha and Chlorantraniliprole 18.5 SC @ 25 g a.i. /ha (88.46%, respectively) at first spray (fig-1). Where in second spray, Cyclaniliprole 100DC @ 40 and 35 ml a.i./ha gave cent per cent reduction in pod borer population followed by Cyclaniliprole 100DC @ 30 ml a.i./ha and Chlorantraniliprole 18.5 SC @ 25 g a.i. /ha (92.31%). The efficacy of Chlorantraniliprole 18.5 SC @ 25 g a.i. /ha and Novaluron 10 EC @ 75 ml/ha was found highly conformity with findings of Bala (2020) [5], Bala and Sarkar (2017) [6], Barber *et al.* (2012), Chankapue *et al.*, 2014 [8], Chitralekha *et al.* (2018) [7], Patel *et al.* (2016) [12], Patil *et al.* (2018) [13], Sapkal *et al.* (2018) [14]. Since, the Cyclaniliprole 100DC is new molecule, the efficacy of this insecticide was reported by Bala (2020) [5] and Thomas *et al.* (2015). However, Cyclaniliprole 100DC was having no significant effect on the population of natural enemies (Lady bird beetle, Mantids and Spiders) and on plants in chickpea ecosystem (table-3). The highest crop yield of 13.38 q/ha (Table-2) was recorded in Cyclaniliprole 100DC @ 40 ml a.i./ha followed by treatments Chlorantraniliprole 18.5% SC @ 25 g a.i./ha (12.80 q/ha) and Cyclaniliprole 100DC *viz.*, 35 and 30 a.i./ha (12.92 and 11.71 q/ha, respectively). The present findings are having close conformity with results of Bala (2020) [5] However, the pest infestation was highest in untreated check with a lowest yield of 8.44 q/ha. The efficacy of the insecticide Cyclaniliprole 100DC on pest was long lasting without causing any significant effect on natural enemies and plant cover and it can be used as next best alternate insecticide against chickpea pod borer, *H.armigera*, in order to avoid resistance development.

Table 1: bio-efficacy of Cyclaniliprole 100DC against *Helicoverpa armigera* in Chickpea

Sl. No.	Treatments	Dosage/ha a.i. (g)	First Spray Application (larval/plant)						Second Spray Application (larval/plant)						
			DBS	1 DAS	3 DAS	7 DAS	10 DAS	% Reduction *	DBS	1 DAS	3 DAS	7 DAS	10 DAS	14 DAS	% Reduction *
T1	Cyclaniliprole 100DC	30	4.50 (2.33)	1.25^{ab} (1.47)	0.50^{ab} (1.20)	0.75^{a} (1.28)	1.50^{a} (1.57)	88.46	2.25 (1.79)	0.50^{a} (1.21)	0.25^{ab} (1.10)	0.50^{ab} (1.20)	0.25^{a} (1.10)	0.75^{a} (1.31)	92.31
T2	Cyclaniliprole 100DC	35	5.00 (2.44)	1.00^{a} (1.39)	0.50^{ab} (1.20)	0.75^{a} (1.28)	1.00^{a} (1.39)	88.46	2.25 (1.78)	0.50^{a} (1.21)	0.25^{ab} (1.10)	0.00^{a} (1.00)	0.25^{a} (1.10)	0.75^{a} (1.31)	100.00
T3	Cyclaniliprole 100DC	40	5.50 (2.54)	1.50^{abc} (1.57)	0.25^{a} (1.10)	0.50^{a} (1.21)	1.00^{a} (1.39)	92.31	2.20 (1.78)	0.25^{a} (1.10)	0.00^{a} (1.00)	0.00^{a} (1.00)	0.50^{a} (1.20)	0.50^{a} (1.20)	100.00
T4	Chlorantraniliprole 18.5% SC	25	6.00 (2.63)	1.75^{abc} (1.65)	1.00^{ab} (1.39)	0.75^{a} (1.28)	1.50^{ab} (1.57)	88.46	3.75 (2.17)	1.50^{b} (1.57)	0.25^{ab} (1.10)	0.50^{ab} (1.20)	0.75^{a} (1.31)	0.75^{a} (1.31)	92.31

T5	Novaluron 10% EC	75	5.75 (2.58)	2.00^{bc} (1.73)	1.25^{b} (1.49)	2.25^{b} (1.79)	3.25^{c} (2.05)	65.38	4.75 (2.39)	2.25^{b} (1.80)	1.50^{c} (1.57)	1.50^{c} (1.57)	1.75^{b} (1.67)	1.25^{a} (1.49)	76.92
T6	Untreated control	-	5.50 (2.54)	6.25^{d} (2.69)	6.25^{c} (2.68)	6.50^{c} (2.74)	6.75^{d} (2.78)	-	6.50 (2.71)	6.75^{c} (2.78)	7.25^{d} (2.87)	6.50^{d} (2.73)	6.75^{c} (2.78)	7.00^{b} (2.83)	-
	S.Em±		NS	0.09	0.10	0.09	0.09	-	NS	0.10	0.09	0.09	0.10	0.07	-
	CD @ 5%		NS	0.28	0.30	0.28	0.27	-	NS	0.29	0.28	0.29	0.31	0.23	-

- Per cent reduction of larval load on chickpea plants over untreated control at 7 DAS at 1st and 2nd spray
- Figures in the parenthesis are (√X + 1) values
- Means in the columns followed by the same alphabet do not differ significantly by DMRT (P=0.05)
- DBS: Day Before Spray DAS: Day After Spray

Table 2: Effect of Cyclaniliprole 100DC on crop yield of Chickpea

Sl. No.	Treatments	Dosage/ha a.i.(g)	Yield (q/ha)
1	Cyclaniliprole 100DC	30	11.71^{abc}
2	Cyclaniliprole 100DC	35	12.92^{ab}
3	Cyclaniliprole 100DC	40	13.25^{a}
4	Chlorantraniliprole 18.5% SC	25	12.80^{ab}
5	Novaluron 10% EC	75	11.15^{c}
6	Untreated control	-	8.44^{c}
	S.Em±		0.54
	CD @ 5%		1.61

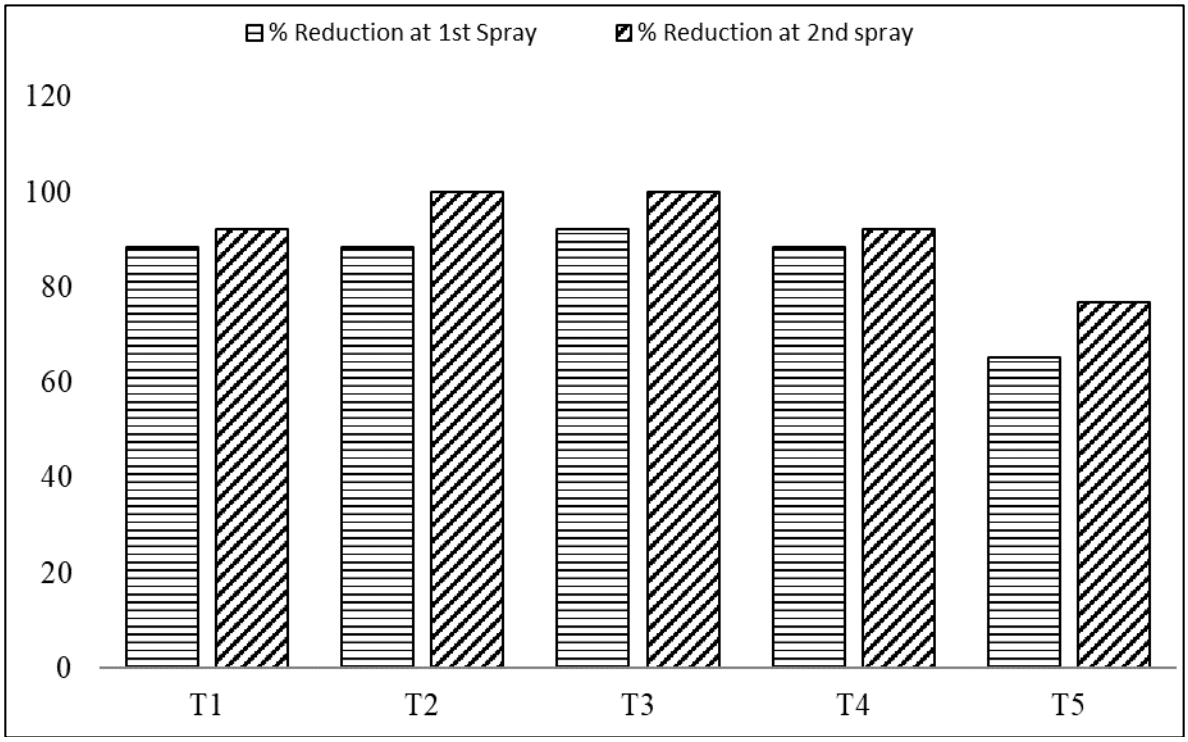

Fig 1: Pod borer, *Helicoverpa armigera* Hubner per cent Larval reduction over untreated control

Table 3: Effect of Cyclaniliprole 100DC against Natural Enemies of pod borer

S. No.	Treatments	Lady bird beetle/mrl			Spiders /mrl		
		D.B.S.	5 DAS	10 DAS	D.B.S.	5 DAS	10 DAS
1	Cyclaniliprole 100DC	0.59 (1.04)	0.57 (1.03)	0.59 (1.04)	1.70 (1.48)	1.68 (1.47)	1.70 (1.48)
2	Cyclaniliprole 100DC	0.57 (1.03)	0.52 (1.00)	0.63 (1.06)	1.68 (1.47)	1.68 (1.47)	1.72 (1.48)
3	Cyclaniliprole 100DC	0.53 (1.01)	0.50 (1.00)	0.55 (1.02)	1.65 (1.46)	1.64 (1.46)	1.66 (1.46)
4	Chlorantraniliprole 18.5% SC	0.60 (1.04)	0.55 (1.02)	0.57 (1.03)	1.83 (1.52)	1.85 (1.53)	1.90 (1.54)
5	Novaluron 10% EC	0.62 (1.05)	0.60 (1.04)	0.62 (1.05)	1.74 (1.49)	1.70 (1.47)	1.62 (1.45)
6	Untreated control	0.60 (1.04)	0.58 (1.03)	0.66 (1.07)	1.70 (1.48)	1.67 (1.47)	1.70 (1.48)
	CD at 5%	NS	NS	NS	NS	NS	NS

- Figures in the parenthesis are (√X + 0.05) values
- Means in the coloumns followed by the same alphabet do not differ significantly by DMRT (P=0.05)
- DBS: Day Before Spray DAS: Day After Spray

References

1. Annual Report-ICRISAT-1992
2. Anonymous, 2011, http://www.agropedia.iitk.ac.in
3. Anonymous, 2018, Resistance management strategy for *Helicoverpa armigera* in Australian grains: https://ipmguidelinesforgrains.com.au/ipm-information/resistance-management-stratagies.
4. Babar TK, Hasnain M, Aslam A, Ali Q, Ahmad KJ, Ahmad A. Comparative Bioefficacy of newer insecticides against tomato fruit borer, *Helicoverpa armigera* (Hubner) on tomato crop under field conditions. Pak. Entomol. 2016; 38(2):115-122.
5. Bala SC. Population fluctuation and management of Gram pod borer, *Helicoverpa armigera* (Hubner) infesting chichpea in new alluvial zone of West Bengal, India. Journal of Entomology and Zoology Studies. 2020; 8(1):262-266.
6. Bala SC, Sarkar A. Population abundance and eco-friend management of tomato fruit borer, *Helicoverpa armigera* Hb. on tomato under West Bengal condition. Journal of Entomological Research. 2017; 41(1):39-43
7. Chitralekha, Yadav GS, Tarun V. Efficacy of insecticides against *Helicoverpa armigera* on chickpea. Journal of Entomology and Zoology Studies. 2018; 6(3):1058-1061.
8. Chankapue RJ, Undirwade DB, Raut, AM. Efficacy of New Molecules of Insecticides Against Helicoverpa armigera (Hub.) In Laboratory Condition. Trends in Biosciences. 2014; 7(18):2783-2785.
9. Dingra S, Phokela A, Mehrotrak N. Cypermethrin resistance in the population of *Helicoverpa armiger* Hubner National Academy Science Leltas, India 1988; 11:123-125.
10. Food and Agricultural Organization of the United States (FAOSTAT), 2015, www://faostat.fao. org/site/339/default. aspx.
11. Gomez KA, Gomez AA. Statistical procedures for agricultural research (2 ed.). John wiley and sons, New York, 1984, 680.
12. Patel RD, Parmar VR, Patel NB. Bio-efficacy of Chlorantraniliprole 35WG against *Helicoverpa armigera* (Hubner) Hardwick in Tomato. Trends in Biosciences. 2016; 9(15):793-798.
13. Patil PV, Pawar SA, Kadu RV, Pawar DB. Bio-efficacy of newer insecticides, botanicals and microbial against tomato fruit borer *Helicoverpa armigera* (Hubner) infesting tomato. Journal of Entomology and Zoology Studies, 2018; 6(5):2006-2011.
14. Sapkal SD, Sonkamble MM, Gaikwad BB. Bioefficacy of newer insecticides against tomato fruit borer, (Hubner) on tomato, *Lycopersicon esculentum* (mill) under protected cultivation. International Journal of Chemical Studies. 2018; 6(4):3326-3330.
15. Sexena M, Singh K. The chickpea. In: Saxena, MC., Singh, KB. (ed.): CAB international, UK. 1987, 163-189.