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Arvind Parmar
Assistant Professor, Department of Agriculture, IES University, Bhopal, Madhya Pradesh, India

Amit Kumar Patel
Assistant Professor, Department of Agriculture, Dr. CV Raman University, Bhagwanpur, Bihar, India

Shiv Bhavan
Assistant Professor, Department of Agriculture, SAM Global University, Bhopal, Madhya Pradesh, India

Anand Rao Azad
Assistant Professor, Department of Agriculture, SAGE University, Bhopal, Madhya Pradesh, India

Vishal Sarsaiya
Assistant Professor, Department of Agriculture, Mandsaur University, Mandsaur, Madhya Pradesh, India

Corresponding Author:
Arvind Parmar
Assistant Professor, Department of Agriculture, IES University, Bhopal, Madhya Pradesh, India

Management by biorational insecticides against of gram pod borer (*Helicoverpa armigera* hub.) in chickpea (*Cicer arietinum* L.)

Arvind Parmar, Amit Kumar Patel, Shiv Bhavan, Anand Rao Azad and Vishal Sarsaiya

Abstract
The field experiment was conducted during *rabi* season 2018-2019 in order to evaluate the Management by biorational Insecticides against of gram pod borer (*Helicoverpa armigera* hub.) in chickpea (*Cicer arietinum* L.). Gram pod borer (*Helicoverpa armigera* Hub.) is a serious pest of chickpea which is injurious to pulses crop of India and in the world also, however it is qualitative and quantitative loss and therefore, management of gram pod borer population by spraying of *Helicoverpa armigera* nuclear polyhedrosis virus (*HaNPV*), Bacillus thuringiensis (Bt.), *Beauveria bassiana* (BB), NSKE 5%, *HaNPV* + Bt., *Beauveria bassiana*+ NSKE, *Bacillus thuringiensis*+ *HaNPV*+ *Beauveria bassiana. Helicoverpa armigera* nuclear polyhedrosis virus (*HaNPV*) + *Bacillus thuringiensis* (Bt.) becomes imperative to minimize the larval population of gram pod borer. Further it was noted that there was lowest damage range i.e. 2.00, 1.33 and 1.67 was recorded at the first spray and 1.67, 1.00 and 1.33 was found at the second spray.

Keywords: Chickpea, gram pod borer, insecticides

Introduction
Chickpea (*Cicer arietinum* L.) is a main pulse crop in our country and all over the world. It is tropical, subtropical and temperate crop (Gautam *et al*. 2018) [4]. Madhya Pradesh is the leading state of chickpea production indeed adopting modern technology for crop production and use of high-yielding varieties becomes imperative. Productivity of 780 kg/ha during *rabi* 2007-08 (Deshmukh *et al*. 2010) [1]. It is a protein-rich pulse crop that contains 21 percent protein. Further seed of chickpea was also recommended to cure the serious disease of human beings such as scurvy. Since it also contains a large amount of malic acid and oxalic acid in the leaves it is recommended for purification of blood in the intestinal disorder. Chickpea is also eaten for weight gain. *Helicoverpa armigera* known as gram pod borer is a polyphagous insect and under customary this insect attacks at the maturity of the crop. It has also been reported that single larvae of gram pod borer can easily damage almost 30 living pods in the life. The caterpillar not only defoliates the tender leaves but also makes holes in the pods and feed upon the developing grains (Golvankar *et al*. 2015) [3]. On average 40 percent of pods are damaged by an attack of *Helicoverpa armigera*. In a serious infection, 90-95 percent of pods can be damaged if the favorable condition of the insect is availed (Verma *et al.* 2015) [10]. The pest feeds voraciously from seedling stage to maturity and causes about 50 to 60 per cent damage to the chickpea pods (Khare *et al*. 1977) [9]. A single larva of *H. armigera* can damage 25-30 pods of gram in its life time. It feeds on tender shoots and young pods. It makes holes in pods and insert its half body inside the pod to eat the developing seeds. (Gautam *et al*. 2018) [4]. Insect population data was taken at a 3 DAS, 7 DAS and 10 DAS interval. Bio-pesticides, microbial and botanical products are found to be effective in gram pod borer. These microbial and botanical pesticides are safe against the hazards that are caused mostly by humans, animals, and soil.

Materials and Methods
The field experiments were conducted at the Organic Research farm, Agriculture farm of Bundelkhand University, Jhansi (U.P.), during *rabi* season 2019 – 2020. The size of the plot was kept 3x3 meter, and in that the distance row to row was kept 30cm and plant to plant was kept 10cm. different microbial and botanical pesticides *Helicoverpa armigera* nuclear

polyhedrosis virus (*HaNPV*), *Bacillus thuringiensis* (*Bt.*), *Beauveria bassiana* (*BB*), *NSKE* 5% and without spray at untreated plot. Time to time microbial and botanical insecticides were sprayed with Knapsap sprayer in the crop. The field experiment was laid out in a randomized block design (RBD) with three Replications and eight treatments. All the treatments were allocated randomized plot. The sowing of chickpea was done on 8th November 2019 with 30X10cm plant spacing. Two types of pesticides Microbial (*HaNPV, Bt., Beauveria bassiana*) and botanical pesticide NSKE 5% were sprayed against control of *Helicoverpa armigera*.

Results and Discussion

The result of the population of gram pod borer (*Helicoverpa armigera* Hub.) in chickpea. The larval population taken before spray do not differ significantly ranged from 3.33 to 4.67 larvae/ml, which did not differ significantly among different plots and indicated that it was well distributed and identical in all experimental plots. All the treated plots were found effective and good in reducing the larvae population. Among the *HaNPV* solution was effective and reducing the larval population of larvae and recorded range is 2.33, 2.00 and 2.33 larvae per plant at 3, 7 and 10 DAS respectively. *Bacillus thuringiensis* formulation was effective and reduced the larval populations of gram pod borer, and recorded range is 2.67, 2.33 and 2.67 at 3, 7 and 10 DAS. Entomo-pathogenic fungi, *Beauveria bassiana* with 3.33, 3.00 and 3.67 at 3, 7 and 10 DAS respectively. NSKE-5% reducing the larvae of *Helicoverpa armigera* with 2.33, 2.00 and 2.33 at 3, 7, and 10 DAS. *HaNPV + Bt* was found to be most effective decrease the larval population of *Helicoverpa armigera* (Hubner) range 2.00, 1.33 and 1.67 at 3, 7, and 10 DAS. *NSKE + Beauveria bassiana* had significantly different efficacy with each other in decrease the larval population of *Helicoverpa armigera* (Hubner), range 3.00, 2.67 and 3.00 at 3, 7 and 10 DAS. *HaNPV + Bt. + Beauveria bassiana* was reducing the population of *Helicoverpa armigera*, range 2.33, .67 and 2.33 at 3, 7 and 10 DAS. (Table- 1).

The result of the population of gram pod borer (*H. armigera* Hub.), In chickpea during season rabi 2019-20. The larval population of *H. armigera* (Hubner) ranged from 3.00 to 4.33 larvae/mrl, which did not differ significantly among different plots and indicated that it was well distributed and identical in all experimental plots. Among the biorational insecticides *HaNPV* is very effective and, reducing the larval population of *H. armigera*, and recorded range is 2.17, 1.67 and 2.00 at 3, 7 and 10 DAS respectively. *Bacillus thuringiensis* formulation was effective and reduce the larval populations, and recorded range is 2.33, 2.00 and 2.33 at 3, 7 and 10 DAS respectively. Entomopathogenic fungi, *Beauveria bassiana* with 3.17, 2.50 and 3.17 at 3, 7 and 10 DAS respectively. NSKE-5% reducing the larvae of *Helicoverpa armigera* with 2.17, 1.67 and 2.00 at 3, 7, and 10 DAS. *HaNPV + Bt* was found to be most effective decrease the larval population of *Helicoverpa armigera* (Hubner) range 1.67, 1.00 and 1.33 at 3, 7, and 10 DAS. *NSKE + Beauveria bassiana* had significantly different efficacy with each other in decrease the larval population of *Helicoverpa armigera* (Hubner), range 2.67, 2.33 and 2.83 at 3, 7 and 10 DAS. *HaNPV + Bt. + Beauveria bassiana* was reducing the population of *Helicoverpa armigera*, range 2.18, 1.33 and 2.00 at 3, 7 and 10 DAS. (Table- 2).

HaNPV + Bt. Biorational insecticides were most effective and minimize the larval population of *Helicoverpa armigera* (Hubner), in chickpea. These two biorational insecticides were most effective in first and second spray.

Table 1: To ascertain the bio-efficacy of biorational insecticides for management of gram pod borer (*Helicoverpa armigera* Hubner) First spray in chickpea.

Treatments	Treatment Details	Number of larvae/meter row length after first spray			
		1 DBS	3 DAS	7 DAS	10 DAS
T0	Control (Without spray)	3.33 (2.06)	4.33 (2.31)	5.67 (2.58)	6.00 (2.64)
T1	*Nuclear Polyhedrosis Virus* (*NPV*)	4.00 (2.21)	2.33 (1.81)	2.00 (1.72)	2.33 (1.81)
T2	*Bacillus thuringiensis* (*Bt..*)	3.33 (2.08)	2.67 (1.90)	2.33 (1.82)	2.67 (1.91)
T3	*Beauveria bassiana*	3.67 (2.13)	3.33 (2.08)	3.00 (1.99)	3.67 (2.14)
T4	*Neem Seed Kernel Extract* (*NSKE* 5%)	4.67 (2.34)	2.33 (1.82)	2.00 (1.720	2.33 (1.82)
T5	*Nuclear Polyhedrosis Virus + Bacillus thuringiensis* (*NPV+Bt.*)	4.33 (2.29)	2.00 (1.72)	1.33 (1.52)	1.67 (1.63)
T6	*Beauveria bassiana + NSKE*	4.67 (2.34)	3.00 (1.99)	2.67 (1.91)	3.00 (1.99)
T7	*NPV+Bt..+ Beauveria bassiana*	3.67 (2.16)	2.33 (1.82)	1.67 (1.63)	2.33 (1.82)
	SEm ±	0.25	0.13	0.14	0.14
	C.D (at 5%)	NS	0.40	0.41	0.44

Table 2: To ascertain the bio-efficacy of biorational insecticides for management of gram pod borer (*Helicoverpa armigera* Hubner) Second spray in chickpea.

Treatments	Treatment Details	Number of larvae/meter row length after first spray			
		1 DBS	3 DAS	7 DAS	10 DAS
T0	Control (Without spray)	3.00 (1.99)	3.67 (2.16)	5.00 (2.44)	5.33 (2.52)
T1	*Nuclear Polyhedrosis Virus* (*NPV*)	3.67 (2.14)	2.17 (1.76)	1.67 (1.63)	2.00 (1.72)
T2	*Bacillus thuringiensis* (*Bt..*)	3.00 (2.00)	2.33 (1.82)	2.00 (1.72)	2.33 (1.82)
T3	*Beauveria bassiana*	3.33 (2.06)	3.17 (2.04)	2.50 (1.87)	3.17 (2.04)
T4	*Neem Seed Kernel Extract* (*NSKE 5%*)	4.33 (2.28)	2.17 (1.76)	1.67 (1.63)	2.00 (1.72)
T5	*Nuclear Polyhedrosis Virus + Bacillus thuringiensis* (*NPV+Bt..*)	4.00 (2.23)	1.67 (1.63)	1.00 (1.41)	1.33 (1.52)
T6	*Beauveria bassiana + NSKE*	4.33 (2.28)	2.67 (1.90)	2.33 (1.82)	2.83 (1.96)
T7	*NPV+Bt..+ Beauveria bassiana*	3.00 (1.99)	2.18 (1.77)	1.33 (1.52)	2.00 (1.72)
	SEm ±	0.20	0.16	0.11	0.13
	C.D (at 5%)	NS	0.37	0.34	0.38

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