Management of gram pod borer *Helicoverpa armigera* (Hubner) in chickpea with bio-pesticides and combination

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**Abstract**

An experiment was laid during *Rabi* 2019 at central research field, SHUATS, Prayagraj, U.P. Bio-pesticides and combination were used with seven treatments and three replications. Experiment was carried out in Randomized Block Design. The results obtained based on pest population, grain yield and B: C ratio are as follows, Emamectin benzoate (220gm/ha) + Indexacarb (30gm/ha) (2.19) and (1932.67kg/ha) was most effective treatment followed by Indoxacarb (60gm/ha) (3.3) (1880.33kg/ha), NSKE (25kg/ha) + Indoxacarb (30gm/ha) (3.6) (1584.33kg/ha), Neem oil (5ml) + Indoxacarb (30gm/ha) (3.9) (1435.00kg/ha), Beauveria bassiana (400gm/ha) + Indoxacarb (30gm/ha) (4.4) (1332.00kg/ha) and Bacillus thuringiensis (750-1000gm/ha) + Indoxacarb (30gm/ha) (5.2) (1224.33kg/ha). The highest cost benefit ratio was obtained from Emamectin benzoate + Indexacarb (1:2.70) > Indoxacarb (1:2.65) > NSKE + Indoxacarb (1:2.23) > Neem oil + Indoxacarb (1:2.03) > Beauveria bassiana + Indoxacarb (1:1.84) > Bacillus thuringiensis + Indoxacarb (1:1.64) > control (1:1.21).

**Keywords:** Bio-pesticides, combination, B: C ratio, *Helicoverpa armigera*, gram pod borer

**Introduction**

Chickpea (*Cicer arietinum*) a member of family Fabaceae, is an ancient self-pollinated leguminous crop. Chickpea is mostly grown in soils, poor in fertility and moisture retention capacity. Gram commonly known as Chickpea or Bengal gram is the most important *Rabi* season pulse crop of India. In India it is also known as “King of pulses”. It is the world’s third most important legume food and is currently grown on about 11 million hectares, with 96% cultivated in the developing countries. The total area and production of chickpea in Uttar Pradesh is 0.0604 million hectare and 0.0732 million tonnes, respectively, with an average yield of 1212kg/ha having productivity of 748.51kg/ha (Anonymous 2013-14) [1]. Chickpea crop is attacked by a number of insect- pests from seedling to its maturity. The major insect-pests attacking chickpea crop are *Helicoverpa armigera*, *Spodoptera litura*, *Agrotis ipsilon*, *Plutia orichalchea* and *Bemisia tabaci* during winter and summer seasons (Yogeeswarudu and Krishna 2014) [10]. Gram pod borer, *Helicoverpa armigera* (Hubner) (Lepidoptera: Noctuidae) is the most important pest of chickpea. It is the major pest of gram and the damage is caused by caterpillar. The pest starts its attack at early stage and become severe during maturity stage of the crop. The pest accounts for 90-95% of total damage (Verma et al., 2015) [15]. A single larva of *H. armigera* can damage 25-30 pods of gram in its life time. Conventionally farmers are using various types of synthetic chemical insecticides to control gram pod borer. But the unconscious and unjustified use of synthetic pesticides creates several problems in agro-ecosystem such as direct toxicity to beneficial insects and humans. The repeated use of systemic insecticides alone has resulted in the development of resistance in the insect pest, and disturbance to the agro-ecosystem by affecting the non target ones. Farmers largely follow the chemical method as it gives quick results. High frequency application is the common scenario. However these chemicals in many cases invited the problems of pesticide resistance, resurgence, secondary pest outbreak, environmental contamination, residual toxicity, phytotoxicity and toxicity to beneficial organisms like predator and parasitoids as well as disturbance in homeostasis of natural population (Patil et al., 2018) [11]. Thus, we need to use integrated approaches for the control of gram pod borer in order to avoid indiscriminate use of pesticides. Therefore, it is now an urgent need to use integrated approaches for the control of
gram pod borer in order to avoid indiscriminate use of pesticide.

Materials and Methods
Field trails were conducted to study the “Management of gram pod borer, Helicoverpa armigera (Hubner) in Chickpea with bio-pesticides and combination” at central research field, SHUATS, Prayagraj, U.P. during Rabi 2019. The trail was laid out in RBD having seven treatments and three replications with the plot size 2 x 2m. The experiment was carried out on Chickpea variety Pusa-362. Two rounds of spray were given at fifteen days interval using a hand operated sprayer during morning hours to avoid photo oxidation of chemicals. The treatments details are: T1 Emamectin benzoate (220gm/ha) + Indoxacarb (30gm/ha), T2 Indoxacarb (60gm/ha), T3 Neem oil (5ml) + Indoxacarb (30gm/ha), T4 Bacillus thuringiensis (750-1000gm/ha) + Indoxacarb (60gm/ha), T5 NSKE (25kg/ha) + Indoxacarb (30gm/ha), T6 Beauveria bassiana (400gm/ha) + Indoxacarb (30gm/ha) and T7 Control.

Observations and calculations on pest population, grain yield and B:C ratio were made on 5 randomly selected plants in each replication along with the unsprayed control. Post treatments observations on number of larvae were recorded on 3rd, 7th and 14th days of each spray and were subjected to statistical analysis.

Result and Discussion
The results (Table: 1) after 1st and 2nd spray revealed that all the treatments were significantly superior to control in managing the pest population of Helicoverpa armigera on chickpea. The lowest pest population was observed in Emamectin benzoate (5% SG) + Indoxacarb (14.5% SC) @ 30gm/ha (1932 kg/ha) of chickpea as against (856 kg/ha) in untreated control. Whereas the treatment with Indoxacarb (14.5% SC) @ 60gm/ha recorded (1880 kg/ha) yield of chickpea. However, the treatments with Emamectin benzoate (5% SG) @ 200gm/ha + Indoxacarb (14.5% SC) @ 30gm/ha registered maximum (1:2.70) B:C ratio followed by Indoxacarb (14.5% SC) @ 60gm/ha (1:2.65), NSKE (25kg/ha) + Indoxacarb (14.5% SC) @ 30gm/ha (1:2.23), Neem oil (5ml) + Indoxacarb (14.5% SC) @ 30gm/ha (1:2.03), Beauveria bassiana (400gm/ha) + Indoxacarb (14.5% SC) @ 30gm/ha (1:1.84), Bacillus thuringiensis (750-1000gm/ha) + Indoxacarb (14.5% SC) @ 30gm/ha (1:1.64). Although the treatment with Emamectin benzoate (5% SG) @ 200gm/ha + Indoxacarb (14.5% SC) @ 30gm/ha was found most effective against gram pod borer and obtaining good yield of chickpea. It reported lowest B: C ratio Bacillus thuringiensis + Indoxacarb (14.5% SC) @ 30gm/ha (1:1.64) similar results were reported by (Singh et al., 2017) [14].

The highest yield was recorded in Emamectin benzoate (5% SG) @ 200gm/ha + Indoxacarb (14.5% SC) @ 30gm/ha (1932 kg/ha) of chickpea as against (856 kg/ha) in untreated control. Whereas the treatment with Indoxacarb (14.5% SC) @ 60gm/ha recorded (1880 kg/ha) yield of chickpea. However, the treatments with Emamectin benzoate (5% SG) @ 200gm/ha + Indoxacarb (14.5% SC) @ 30gm/ha registered maximum (1:2.70) B:C ratio followed by Indoxacarb (14.5% SC) @ 60gm/ha (1:2.65), NSKE (25kg/ha) + Indoxacarb (14.5% SC) @ 30gm/ha (1:2.23), Neem oil (5ml) + Indoxacarb (14.5% SC) @ 30gm/ha (1:2.03), Beauveria bassiana (400gm/ha) + Indoxacarb (14.5% SC) @ 30gm/ha (1:1.84), Bacillus thuringiensis (750-1000gm/ha) + Indoxacarb (14.5% SC) @ 30gm/ha (1:1.64). Although the treatment with Emamectin benzoate (5% SG) @ 200gm/ha + Indoxacarb (14.5% SC) @ 30gm/ha was found most effective against gram pod borer and obtaining good yield of chickpea. It reported lowest B: C ratio Bacillus thuringiensis + Indoxacarb (14.5% SC) @ 30gm/ha (1:1.64) similar results were reported by (Singh et al., 2017) [14].

Table 1: Percent infestation of gram pod borer (Helicoverpa armigera) on chickpea at different days of interval

<table>
<thead>
<tr>
<th>Sr.no</th>
<th>Treatment</th>
<th>Population of Helicoverpa armigera (Number)/plot</th>
<th>Yield in kg/ha</th>
<th>B:C Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1st spray</td>
<td>2nd spray</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3rd DAS 7th DAS 14th DAS Mean</td>
<td>3rd DAS 7th DAS 14th DAS Mean</td>
<td></td>
</tr>
<tr>
<td>T1</td>
<td>Emamectin benzoate (220gm/ha) + Indoxacarb (30gm/ha)</td>
<td>2.9 2.5 2.1 2.5 2.2 2.1 1.2 1.8</td>
<td>1932</td>
<td>1:2.70</td>
</tr>
<tr>
<td>T2</td>
<td>Indoxacarb (60g/ha)</td>
<td>4.0 4.4 4.0 4.1 2.9 3.0 1.8 2.5</td>
<td>1880</td>
<td>1:2.65</td>
</tr>
<tr>
<td>T3</td>
<td>Neem Oil (5ml) + Indoxacarb (30gm/ha)</td>
<td>4.2 4.6 4.8 4.5 3.8 3.5 3.1 3.4</td>
<td>1435</td>
<td>1:2.03</td>
</tr>
<tr>
<td>T4</td>
<td>Bacillus thuringiensis (750-1000gm/ha) + Indoxacarb (30gm/ha)</td>
<td>4.7 6.0 6.1 5.6 4.2 4.2 4.0 4.1</td>
<td>1224</td>
<td>1:1.64</td>
</tr>
<tr>
<td>T5</td>
<td>NSKE (25kg/ha) + Indoxacarb (30gm/ha)</td>
<td>4.1 4.5 4.6 4.3 3.2 3.4 2.5 3.0</td>
<td>1584</td>
<td>1:2.23</td>
</tr>
<tr>
<td>T6</td>
<td>Beauveria bassiana (400gm/ha)+ Indoxacarb (30gm/ha)</td>
<td>4.6 5.1 5.4 5.0 4.0 3.9 3.6 3.8</td>
<td>1332</td>
<td>1:1.84</td>
</tr>
<tr>
<td>T7</td>
<td>Control</td>
<td>8.1 8.3 8.3 8.3 9.0 9.2 9.6 9.2</td>
<td>856</td>
<td>1:1.21</td>
</tr>
<tr>
<td></td>
<td>F- test</td>
<td>S S S S S S S S</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>S.E (m)</td>
<td>0.33 0.59 0.66 0.31 0.36 0.38 0.52 0.27</td>
<td>15.64</td>
<td></td>
</tr>
<tr>
<td></td>
<td>C.D at 5%</td>
<td>0.72 1.28 1.44 0.67 0.78 0.83 1.14 0.60</td>
<td>7.638</td>
<td></td>
</tr>
</tbody>
</table>

Conclusion
From the analysis of the present findings, it can be concluded that among all the treatments Emamectin benzoate (220gm/ha) + Indoxacarb (30gm/ha) proved to be the best treatment followed by Indoxacarb (60gm/ha), NSKE (25kg/ha) + Indoxacarb (30gm/ha), Neem oil (5ml) + Indoxacarb (30gm/ha), Beauveria bassiana (400gm/ha) + Indoxacarb (30gm/ha) and Bacillus thuringiensis (750-1000gm/ha) + Indoxacarb (30gm/ha) in managing Helicoverpa armigera pest population. This does not create different problems like contamination of ecosystem, including soil, water pollution and occurrence of pesticides residue in

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food, pest resurgence, effect on non-target pest etc. Therefore bio-pesticides with combination may be useful in devising proper Integrated pest management strategy against Helicoverpa armigera.

References