**Original Research Article**

**Relative Efficacy of Selective Insecticides against Gram Pod Borer, *Helicoverpa armigera* (Hubner) in chickpea**

**Abstract**

The present investigation entitled was carried out at Student’s Instructional Farm of Acharya Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya (U.P.), India during *Rabi*, 2019-20. The experiment was laid out in Randomized block design with three replications along with seven treatments *viz*., Spinosad 45 SC (0.2%), Indoxacarb 14.5 SC (0.4%), Neem oil 0.5%, Cow urine 5%, Ha NPV 250 LE/ha, Garlic extract 5% and Untreated check. Results revealed that among treatments application of Indoxacarb proved superior to other treatments with respect to maximum pest control (81.30%), followed by Spinosad 45 SC 0.2%. Maximum net return and benefit cost ratio (1:18.8) was found with the application of Indoxacarb 14.5 SC.

**Key words:** Chickpea, efficacy, *H. armigera*, insecticides and benefit cost ratio

**Introduction**

The chickpea, or *Cicer arietinum* L., is a significant legume crop that is a member of the Fabaceae family. The great nutritional content of chickpea seeds, which are also abundant with vegetable protein, carbohydrate, cholesterol-lowering fibre, oil, ash, calcium, and phosphorus, makes them vital as well. There are numerous insect pests that affect the roots, foliage, and pods of the chickpea plant (Rao and Shanower, 1999). One of the most significant chickpea insect pests is the Gram pod borer (*Helicoverpa armigera* H.), which is also very important economically (Ahmed and Awan, 2013). It is a very polyphagous insect that also feeds on cotton, tobacco, safflower, tomato, maize, cabbage, peanuts, and lentils, among many other crops. Its main host are legumeous crops like chickpea, saw significant production loss (37–50%) and in extreme cases, up to 90% pod destruction. A single larva can destroy 40 pods and only feeds on the host plant's growth points and reproductive organs. It consumes flower buds, blossoms, and immature pods from the crop in growth. Gram pod borer was challenging to control due of its vast host range, many generations, migratory behaviour, and high fertility. Due to its quick known effects, chemical control is still regarded as the final resort for its management (Sreekanth, 2014). Insecticides must, however, be used carefully in order to prevent their negative effects on the environment and natural biocontrol agents (Suhail *et al*., 2013). Exploring novel insecticides with a high level of effectiveness and a distinctive mode of action is therefore crucial. In recent years, efforts have been made to concentrate newer substances with unique mechanisms of action to control the gram pod borer infestation. The purpose of the current study was to assess the effectiveness of several pesticides against the gram pod borer in a field-grown chickpea crop in light of the severe gram pod borer attack.

**Materials and methods**

A field experiment was conducted at Acharya Narendra Deva University of Agriculture and Technology, Kumargaj, Ayodhya. Departmentof Agricultural Entomology. The trial was laid out during rabi 2019-20 in randomized block design with seven treatments replicated thrice having a plot size of 20 sqm. The chickpea variety Pant G-186 was sown and all the normal agronomical practices were followed for the cultivation of the crop. Spraying was initiated at the ETL of *H. armigera* i.e. 1 larva/mrl. The larval population of *H. armigera* was recorded before spraying and 1, 3 and 7 days after spraying.

**Results and Discussion**

**Relative efficacy of different treatments**

The data on the effect of various treatments on the larval population of *Helicoverpa armigera* presented in Table 1 and it is evident from the data that the mean larval population per 10 plants was non-significant before application of different treatments. Data observed after 1 day of spray showed that all the treatment were effective in reducing larval population of pod borer. Most effective treatment was Indoxacarb 14.5 SC (0.7 larvae/10 plants) which was significant superior over all the treatments. Next best treatment was Spinosad 45 SC (0.9 larvae/10 plants) which was at par with Neem oil 5% (1.1 larvae/10 plants). Rest all the treatments were significantly superior over control. Data recorded after 3 days of spray reflect that Indoxacarb 14.5 SC @ 0.4% again significantly superior over all the treatments and recorded only 0.3 larvae/10 plants. Next best treatment was Spinosad 45 SC @ 0.2% (0.6 larvae/10 plants). Treatment Neem oil @ 5% having third place in reducing larval population and recorded 1.0 larvae/10 plants which was at par with *Ha* NPV @ 250 LE/Ha (1.2 larvae/10 plants).

Observation recorded after 7 days of spraying showed that Indoxacarb 14.5 SC @ 0.4% was superior (0.3 larvae/10 plants) followed by Spinosad 45 SC @ 0.2% (0.7 larvae/10 plants). Next best treatment was Neem oil @ 5% which was at par with *Ha* NPV @ 250 LE/Ha. Cow urine @ 0.5% was least effective (2.2 larvae/10 plants) in reducing the larval population.

Data presented in Table 1 also showed that overall, per cent reduction of larval population recorded maximum 81.3 per cent in treatment Indoxacarb 14.5 SC followed by in Spinosad 45 SC (69%). Neem oil treated plot was the next best treatment recorded 55.3% reduction followed by *Ha* NPV (43.6%). Lowest population reduction was observed in cow urine treated plot (16.6%). These findings are in partial agreement with Reddy *et al.* (2010) who reported that larval reduction was highest with NSKE 1.66% + HaNPV 250LE/ha + Endosulfan 0.023% followed by NSKE 1.66% + Endosulfan 0.023%, NSKE 2.5% + HaNPV 250LE sprayed twice at 15 days interval. Findings are also in accordance with the findings of Gautam *et al. (*2018) who found that the Indoxacarb @ 14.5SC, Neem seed oil @ 5ml and karanj oil @ 5ml were significantly superior over untreated control. Indoxacarb 14.5@ SC, gave maximum grain yield of chickpea in compared to other treatments as well as in managing the population of *H. armigera*. Besides Neem seed oil @ 5ml and karanj oil @ 5 ml were found the second and third most effective treatments respectively. Mihretie *et al. (*2020)also observed that percentage pod damage, mean larval count per plant, hundred seed weight and grain yield were significantly affected by the treatments; all tested insecticides significantly reduced the percentage pod damage and mean larvae per plant accordingly increased grain yield ha-1 among insecticides Indoxacarb (48.11%) and Spinosad (43.37%) gave higher relative yield increment with maximum MRR 8112.24% and 7698.28% respectively. Thus, the application of Indoxacarb (Avaunt 150 SC) 0.3 Lha-1 or Spinosad (Tracer 480 SC) 0.15 Lha-1 three times with a week interval can be advised for the management of *H. armigera*; however, it needs further investigation for the interval and frequency.

**Effect of treatments on yield**

All the treatments were found effective over control that gave significantly higher grain yield of chickpea. Indoxacarb 14.5 SC treated plots gave maximum grain yield (19.5 q/ha) (Table 2). Next higher grain yield producing treatments was Spinosad 45 SC @ 0.2% which recorded 17.2 q/ha grain yield. Cow urine @ 0.5% treated plots gave 11.80 q/ha that was at par with untreated control (11.20 q/ha). Present results endorse the findings of Mihretie *et al.*(2020) who observed that percentage pod damage, mean larval count per plant, hundred seed weight, and grain yield were significantly affected by the treatments; all tested insecticides significantly reduced the percentage pod damage and mean larvae per plant accordingly increased grain yield ha-1 among insecticides Indoxacarb (48.11) and Spinosad (43.37%) gave higher relative yield increment with maximum MRR 8112.24% and 7698.28% respectively. Thus, the application of Indoxacarb (Avaunt 150 SC) 0.3 Lha-1 or Spinosad (Tracer 480 SC) 0.15 Lha-1 three times with a week interval can be advised for the management of *H.armigera*; however, it needs further investigation for the interval and frequency.

## Economics of treatments

The economics of treatments were determined to find out the cost effectiveness of treatment in the term of cost -benefit ratio. The maximum cost - benefit ratio was obtained in plot treated with 0.4 % Indoxacarb 14.5 SC (1:18.8). Next effective treatments in the term of cost -benefit ratio were Neem oil @ 5% (1:16.4) followed by Garlic extract 5% (1.16:3). Lowest cost -benefit ratio (1:6.7) was found in cow urine 0.5% treated plot (Table 3). Present results are in partial agreement with Singh *et al* (2020) who found that Maximum yield i.e. 21. 40q/ha was given by cow urine + neem leaf which was closely followed by cow urine + tobacco leaf and cow urine + lantana leaf. ICBR of cow urine i.e.1:15.5 was the highest followed by cow urine + neem leaf having ICBR 1:13.52. Similar trend in percent increased yield over control was observed in this investigation.

**Reference**

Ahmed K, Awan MS, 2013. Integrated management of insect pests of chickpea *Cicer arietinum* (L.) Walpin South Asian Countries: Present status and future strategies - a review. *Pak. J. Zool*., 45: 1125-1145.

Gautam. M. P.; Chandra, U; Singh ,S. N., Yadav ,S. K. and. Giri, S. K. 2018. Studies on efficacy of Botanicals against *Helicoverpa armigera* (Hubner) on Chickpea (*Cicer arietinum* L.) *Int.J.Curr.Microbiol.App.Sci* 7: 612-618.

Mihretie, A.; Yimer, D.; Wudu, E.; and Kassaw, A.2020 Efficacy of insecticides against African bollworm (*Helicoverpa armigera* Hubner) on chickpea (*Cicer arietinum*) in the lowlands of Wollo, Northeastern Ethiopia Cogent Food & Agriculture 6 ( 1) .

Rao, RGV, Shanower TG, 1999. Identification and management of pigeonpea and chickpea insect pests in Asia. Information Bulletin no. 57. (In: En. Summaries in En, Fr.) Patancheru, 502 324, International Crops Research Institute for the Semi-Arid Tropics, Patancheru, A.P. India.

Reddy, V.; Anandhi, P.; Elamathi, S. and Simon, S. 2010. Efficacy of some common insecticides for the management of pod borer Helicoverpa armigera (Hubner) on chick pea at field condition. *Agricultural Research Communication Centre*, 33 (1) : 74-75.

Singh, Gulab.; Dwivedi, R. K and Shukla,A. 2020 Study of Biology and Effective Management of Gram Pod Borer, Helicoverpa armigera Hub on Field Pea. *Int.J.Curr. Microbiol.App.Sci* .; 9 (9): 2725-2729.

Sreekanth M, Lakshmi MSM, Rao YK, 2014.Bio-Efficacy and economics of certain new insecticides against gram pod borer, Helicoverpa armigera(Hubner) infesting Pigeonpea (Cajanus cajanL.). *Int. J. Plant Anim. Environ. Sci*.,4: 11-15

Suhail A, Iqbal J, Arshad M, Gogi MD, Arif MJ, Shafait T, 2013. Comparative efficacy ofinsecticides as seed treatment against wheat aphid and its coccinellid predator. *Pak. Entomol*., 35: 17-22.

**Table 1. Relative efficacy of different treatments against larval population of gram pod borer (*H. armigera* Hub.) in chickpea during *Rabi,* 2019-20**

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Tr.**  **No.** | **Treatments** | **Dose** | **Mean larval population/10plants** | | | | **Percent reduction of larval population over control** | | | |
| **Before one day of spray** | **After1dayof spray** | **After 3**  **Days of spray** | **After7**  **Days of spray** | **After1dayof spray** | **After3**  **Days of spray** | **After 7**  **Days of spray** | **Mean** |
| T1 | Neem oil | 5% | 2.0  (1.58) | 1.1  (1.25) | 1.0  (1.21) | 1.1  (1.26) | 50.0 | 56.5 | 59.3 | 55.3 |
| T2 | Garlic extract | 5% | 1.9  (1.56) | 1.4  (1.38) | 1.6  (1.45) | 1.6  (1.46) | 36.4 | 30.4 | 40.7 | 35.8 |
| T3 | Cow urine | 0.5% | 2.2  (1.63) | 1.8  (1.50) | 2.0  (1.57) | 2.2  (1.63) | 18.2 | 13.0 | 18.5 | 16.6 |
| T4 | *Ha* NPV | 250  LE/Ha | 2.1  (1.61) | 1.6  (1.45) | 1.2  (1.29) | 1.2  (1.32) | 27.3 | 47.8 | 55.6 | 43.6 |
| T5 | Spinosad 45 SC | 0.2% | 1.9  (1.54) | 0.9  (1.18) | 0.6  (1.06) | 0.7  (1.11) | 59.1 | 73.9 | 74.1 | 69.0 |
| T6 | Indoxacarb 14.5 SC | 0.4% | 2.2  (1.63) | 0.7  (1.08) | 0.3  (0.91) | 0.3  (0.91) | 68.2 | 87.0 | 88.9 | 81.3 |
| T7 | Untreated control | - | 1.8  (1.53) | 2.2  (1.65) | 2.3  (1.67) | 2.7  (1.78) | - | - | - | - |
|  | **SEm±** |  | - | 0.03 | 0.04 | 0.03 | - | - | - | - |
|  | **C.D.(p=0.05)** |  | NS | **0.09** | **0.11** | **0.10** | - | - | - | - |

**Figures in parentheses indicates transformed value (√x+0.5)**

**Table 2: Efficacy of different treatments against *H. armigera* based on seed yield of chickpea during *Rabi,* 2019-20**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Tr. No.** | **Treatments** | **Dose** | **Total** | **Mean** |
| T1 | Neemoil | 5% | 43.8 | 14.6 |
| T2 | Garlicextract | 5% | 40.1 | 13.4 |
| T3 | Cowurine | 0.5% | 35.5 | 11.8 |
| T4 | *Ha*NPV | 250LE/Ha | 41.8 | 13.9 |
| T5 | Spinosad45SC | 0.2% | 51.5 | 17.2 |
| T6 | Indoxacarb 14.5 SC | 0.4% | 58.6 | 19.5 |
| T7 | Untreated control | - | 33.5 | 11.2 |
|  | SEm± | | | **0.39** |
|  | CDat5% | | | **1.21** |
|  | CV% | | | **4.7** |

**Table 3: Benefit Cost - ratio of different treatments used for the management of gram pod borer (*H. armigera* Hub.) in chickpea during *Rabi,* 2019-20**

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| **Tr.**  **No.** | **Treatments** | **Dosage** | **Cost of treatment (Rs/ha)** | **Yield (q/ha)** | **Saved yield over control (q/ha)** | **Benefit due to treatment (Rs/ha)** | **Benefit-Cost ratio** |
| T1 | Neem oil | 5% | 1059.00 | 14.6 | 3.4 | 17340.00 | 1:16.4 |
| T2 | Garlic extract | 5% | 680.00 | 13.4 | 2.2 | 11050.00 | 1:16.3 |
| T3 | Cow urine | 0.5% | 480.00 | 11.8 | 0.6 | 3230.00 | 1:6.7 |
| T4 | *Ha* NPV | 250 LE/Ha | 1390.00 | 13.9 | 2.7 | 13940.00 | 1:10.0 |
| T5 | Spinosad 45 SC | 0.2% | 3776.00 | 17.2 | 6.0 | 30430.00 | 1:8.1 |
| T6 | Indoxacarb 14.5 SC | 0.4% | 2260.00 | 19.5 | 8.3 | 42500.00 | 1:18.8 |
| T7 | Untreated control | - | - | 11.2 | - | - | - |

Price of Seed: Rs.5100.00/q, Labour charges Rs.215.00/day/man, Sprayer Rent :Rs.50/day