

Efficacy Of Different Insecticides Against Gram Pod Borer On Chickpea (*Cicer arietinum* L.)

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ABSTRACT: The insecticides Proclaim, Radiant and Jatara were applied thrice at the interval of 15 and 20 days of second and third spray, respectively. The results showed that all three insecticides performed well in reducing pest population. However, Proclaim gave best results against gram pod borer. The overall mean population of *Helicoverpa armigera* 0.36, 0.44 and 0.49 per plant was recorded in the plots treated with Proclaim, Radiant and Jatara, respectively as compared to control plot (1.23 larvae per plant) during the first spray. During second spray the overall mean population of *H. armigera* 0.33, 0.51 and 0.56 per plant was recorded in the plots treated with Proclaim, Radiant and Jatara, respectively as compared to control plot (2.21 larvae per plant). Whereas, during third spray the overall mean population of *H. armigera* 0.29, 0.44 and 0.48 per plant was recorded in the plots treated with Proclaim, Radiant and Jatara, respectively as compared to control plot (2.68 larvae per plant). All insecticides performed well up to 72 hours interval. ANOVA results showed significant difference between treatments and LSD test showed that efficacy of different insecticides remained non-significant at 24, 48 and 72 hours.

Keywords: *Cicer arietinum*; *H. armigera*, Proclaim, Radiant and Jatara

INTRODUCTION

The pulses in Pakistan are cultivated on an area of 1.492 million hectares, with a production of 983,000 tons. Chickpea (*Cicer arietinum* L.) belongs to family Fabaceae, and subfamily Papilionaceae, is the largest Rabi pulse crop in Pakistan and during the year 2010-11, the Chickpea was cultivated on an area of 1068 thousand hectares with a production of 523 thousand tons indicating 6.9 percent decrease in production against last year crop (GOP, 2011). According to the Food and Agriculture Organization (FAO) statistics, cultivated chickpea is in the first rank, with about 10,671,503 ha cultivated, among cool season food legumes in the world and Turkey as well. Like other pulse crops, chickpea is traditionally grown and is an important food and cash crop in Turkey, where it is cultivated on over 557,800 ha annually (FAO, 2006). Gram plays a vital role in human diet. It is the main source of vegetable protein in human diet as it contains 21%

protein and 38-59% carbohydrates (Gupta, 1989). Chickpeas are a helpful source of zinc, foliate and protein. They are also very high in dietary fiber and hence a healthy source of carbohydrates for persons with insulin sensitivity or diabetes (Deppe, 2010).

The major reasons for its low yield are cultivation on marginal land and inadequate or imbalance fertilizer application and attack of diseases and insect pests. (Zohary and Maria, 2000). Chickpea also known as gram is attacked by eleven species of insect pests, i.e. gram pod borer, thrip, jassid, aphid, cutworm, leaf miner etc, (Hossain, 2009). The chickpea has relatively few insect pests but gram pod borer, *Helicoverpa armigera* is the major pest, cause considerable loss to chickpea production. The adult of *H. armigera* measures about 30-36 mm in its wing expanse and 14 to 18 mm in its body length. The forewings are marked with grayish wavy lines and black spots of varying size on upper side and a black kidney shaped mark and a round spot on the upper side. The hind

wings are whitish and lighter in color. Eggs are yellowish, shiny and lay singly on all parts of plant. Full grown larva is 40 mm long and hairy and varied in color. The pod borers inflicted heavy crop losses from seedling to maturity. But the losses reached at its peak when the pods appeared. Lal, (1996) reported that the seed yield losses due to *H. armigera* were 75-90% and in some places the losses were up to 100%. These losses can be reduced by the application of insecticides (Balasubramanian *et al.*, 2001). The population increased greatly during the pod formation stage (Patel and Koshiya, (1999) and caused substantial damage to pods, therefore, at this stage control measures become necessary.

For the control of *Helicoverpa armigera*, chemical insecticides are applied only if the insect population crosses the economic threshold level (ETL) and control measures are taken when population exceeds ETL. However, for effective control of this insect pest population, Endosulfan 35 EC @ 1000 ml ha⁻¹, Deltamethrin 2.8 EC @ 750 ml ha⁻¹, Quinalphos 25 EC @ 1000 ml ha⁻¹ can be applied. In case of severe infestation, application of Olytrin C 44 EC @ 1000 ml ha⁻¹, Profenophos 50 EC @ 1500 ml ha⁻¹, Spark 36 EC at the rate of 1000 ml ha⁻¹ or Chlorpyrifos 20 EC (200 ml) + Acephate 100 ml ha⁻¹ are recommended (Anonymous, 2011). Jadhav and Suryawanshi, (1998) reported that the application of insecticides reduced the larval population of *Helicoverpa armigera* to a considerable extent and hence increased the yield. Moreover, Balasubramanian *et al.*, (2001) reported that Chlorpyrifos was the most effective insecticide to control gram pod borer. In view of the economic significance of gram pod borer, the present study was carried out on efficacy of different insecticides against gram pod borer on chickpea (*Cicer arietinum* L.) at Tandojam.

MATERIALS AND METHODS

The present experiment work was conducted at the experimental field of Nuclear Institute of Agriculture, Tandojam, Sindh Agriculture University, Tandojam during the winter season of 2011 for determining the efficacy of different insecticides against gram pod borer on chickpea (*Cicer arietinum* L.) crop. The experiment was designed in RCBD (Randomized Complete Block Design) with four (4) Treatments and three (3) Replications. A total of 2075 m² (½ acre) land, while 172.91 m² as sub-plot was used for sowing and conducting experiment. The variety (Cholla) was sown by drilling method of sowing with all other agronomical practices were carried out as usual for this experiment. Three insecticides against gram pod borer i-e, Proclaim, Radiant and Jatara were selected from different groups their effectiveness was compared when larval population reached near Economic Injury Level. Three different insecticides were applied, first when newly bud formation appeared on 15-06-2011, second application was done after the interval of 15 days of first spray i.e., on 30-06-2011, and third and last application was done after 20 days of second spray i.e., on 20-07-2011. All insecticides were applied with Knap Sack spray machine and application was done in the early morning. The further details of each insecticide are given in Table-1. Six observations were taken for each application i-e., one day before spray (Pre-treatment observation) and five (5) observations after spray (Post-treatment) at the interval of 24, 48, 72 hours, one week and two weeks. Twenty plants from each treatment were randomly examined and pest population was recorded. The data were statistically analyzed by analysis of variance (ANOVA) and significance of population means differences were also compared by (LSD) test.

Table 1. Insecticides with their trade, common names, group and doses used in present study

S. #.	Trade name	Common name	Group	Manufacturer	Dose mL/acre	Dose mL/sub plot
1	Ammamectin benzoate 19% EC	Proclaim	Avermectin	Syngenta	200 ml	8.33 mL
2	Spinetorm 120% SC	Radiant	Spinocid	Arysta Life Science	80 ml	2.66 mL
3	Bifenthrin 60%EC	Jatara	Pyrethroid	Jaffer Agro Services	400 ml	13.33 mL
Control	Without Pesticide	-	-	-	-	-

RESULTS

The experiment on the efficacy of different insecticides against gram pod borer on chickpea (*Cicer arietinum* L.) was conducted during the winter season of 2011 to evolve best insecticide for the control of gram pod borer at the experimental field of Nuclear Institute of Agriculture, Sindh Agriculture University, Tandojam. In the present study, the Gram Pod Borer population was counted before and after the application of insecticides. The obtained data was subjected to analysis of variance. The overall results of all three sprays at different time

intervals with their statistical analysis are given in Table 2-4.

First spray

The data on average population of *Helicoverpa armigera* at pre-treatment and post-treatment intervals of 24, 48, 72 hours, one week and two weeks are presented in Table-2. At pre-treatment observations the average populations of *H. armigera* on sub plots (T₁, T₂, T₃ and T₄) were 0.77, 0.75, 0.80 and 0.73 larvae per plant, respectively. The post treatment observation after 24 hours interval of insecticides application revealed that the average pest populations in T₁, T₂, T₃ and T₄ were 0.47,

0.53, 0.57 and 0.87 larvae per plant respectively, which showed that the effect of these insecticides against *H. armigera* in ascending order was T₁ (Proclaim) > T₂ (Radiant) > T₃ (Jatara) > T₄ (Control). It is noticed from this table that after 24 hours of insecticides application Proclaim was found to be more effective against *H. armigera* than other insecticides. The post-treatment effectiveness of these pesticides varied with the time intervals, displayed the maximum effect at 72 hours intervals. After 72 hours interval all pesticides lost their effectiveness. Consequently, the population of *H. armigera* started increasing. Overall performance of the pesticides revealed that Proclaim performed well followed by Radiant and Jatara. The overall mean per plant population 0.36, 0.44 and 0.49 of *H. armigera* was recorded for these insecticides, respectively, as compared to control (1.23 larvae per plant). LSD test showed that significant difference between all treatments.

Second spray

The data on average population of *Helicoverpa armigera* at pre-treatment and post-treatment intervals of 24, 48, 72 hours, one week and two weeks are presented in Table-3. At pre-treatment observations the average populations of *H. armigera* on sub plots (T₁, T₂, T₃ and T₄) were 0.62, 0.88, 0.93 and 2.02 larvae per plant, respectively. The post treatment observation after 24 hours interval of insecticides application revealed that the average pest populations in T₁, T₂, T₃ and T₄ were 0.42, 0.65, 0.70 and 2.12 larvae per plant respectively, which showed that the effect of these insecticides against *H. armigera* in ascending order was T₁ (Proclaim) > T₂ (Radiant) > T₃ (Jatara) > T₄ (Control). It is noticed from this table that after 24 hours of insecticides application Proclaim was found to be more effective against *H. armigera* than other insecticides. The post-treatment effectiveness of these pesticides varied with the time intervals, displayed the maximum effect at 72 hours intervals. After 72 hours interval all pesticides lost their effectiveness. Consequently, the population of *H. armigera* started increasing. Overall performance of the pesticides revealed that Proclaim performed well followed by Radiant and Jatara. The overall mean per plant population 0.33, 0.51 and 0.56 of *H. armigera* was recorded for these insecticides, respectively, as compared to control (2.21 larvae per plant). LSD test showed that significant difference between all treatments.

Third spray

The data on average population of *Helicoverpa armigera* at pre-treatment and post-treatment intervals of 24, 48, 72 hours, one week and two weeks are presented in Table-4. At pre-treatment observations the average populations of *H. armigera* on sub plots (T₁, T₂, T₃ and T₄) were 0.68, 0.92, 0.95 and 2.62 larvae per plant, respectively. The post treatment observation after 24 hours

interval of insecticides application revealed that the average pest populations in T₁, T₂, T₃ and T₄ were 0.45, 0.68, 0.70 and 2.63 larvae per plant respectively, which showed that the effect of these insecticides against *H. armigera* in ascending order was T₁ (Proclaim) > T₂ (Radiant) > T₃ (Jatara) > T₄ (Control). It was noticed from this table that after 24 hours of insecticides application Proclaim was found to be more effective against *H. armigera* than other insecticides. The post-treatment effectiveness of these pesticides varied with the time intervals, displayed the maximum effect at 72 hours intervals. After 72 hours interval all pesticides lost their effectiveness. Consequently, the population of *H. armigera* started increasing. Overall performance of the pesticides revealed that Proclaim performed well followed by Radiant and Jatara. The overall mean per plant population 0.29, 0.44 and 0.48 of *H. armigera* was recorded for these insecticides, respectively as compared to control (2.68 larvae per plant). LSD test showed that significant difference between all treatments.

It is very clear from the result obtained that Proclaim performed well in reducing the population of *H. armigera* on chick pea crop followed by Radiant and Jatara during the all three sprays. Analysis of variance showed significant difference between treatment and LSD test showed that efficacy of different insecticides remained non-significant at 24, 48 and 72 hours.

DISCUSSION

The result of the present study indicated that the gram pod borer, *Helicoverpa armigera* was one of the serious pests of chick pea crop. Its damage was more severe at the stages of bud, flower, fruit formation and seed setting. Gohokar *et al.*, (1984) investigated the treatment with fenvalerate of 0.01% was found to be very effective in controlling the pod borer infestation followed by cypermethrin 0.006%, monocrotophos 0.04%, decamethrin 0.004%, cypermethrin 0.009%, fenvalerate 0.02% and endosulfan 0.07% and these were at par with each other. Khan and Faizullah, (1999) applied efficacy of three insecticides against *H. armigera* (Hb.) namely Thiodan 35 EC, Cymbush 10EC and Actellic 50 EC. All the tested insecticides significantly reduced the infestation of gram pod borer *Helicoverpa armigera* (Hb) as compared to control plots. Thiodan (Endosulfan) was found most effective than Actellic (Pirimiphos methyl) and Cymbush (Permethrin). Padmaja *et al.*, (2000) evaluated the efficacy of different insecticides to control sesamum leaf webber and pod borer, *Antigastra catalaunalis* Duponchel showed the highest reduction in the larval population (75.37%) by quinalphos 0.05 percent which was on par with monocrotophos 0.05 percent, fenvalerate 0.4 percent dust and carbosulfan 0.05 percent. The results of present study are also in partial agreement to those of Shahzad *et al.*, (2003) who tested the effectiveness of four insecticides

viz. cypermethrin (10 EC) at the rate of 350 ml acre-1, endosulfan (35 EC) at the rate of 1000 ml acre-1 lambdacyhalothrin (2.5 EC) at the rate of 250 ml acre-1 and chlorpyrifos (40 EC) at the rate of 800 ml acre-1 twice for the control of chickpea pod borer, *H. armigera* (Hubner) during Rabi season. The screening of best insecticide was determined by comparing treated plots with untreated plots. Chlorpyrifos proved to be the best insecticide in reducing the pod damage.

The present result showed that Proclaim performed well in reducing *H. armigera* population on chick pea crop followed by Radiant and Jatara but their effectiveness almost non-significant with each other. The result is partially in agreement with those of Patil *et al.*, (2008) who reported that the lowest pod damage of 0.5% was recorded in thiodicarb 75 WP @ 562.50 g.a.i./ha followed by chopyrphos (5.3%) and endosulfan (5.6%). The results further indicated that the best effect of all pesticides tested was recorded until 72 hours of intervals; however, it did not go beyond two weeks of intervals. This was agreed with the findings of Janwari, (2000) who reported that the effect of Karate (2.5 EC) and Baythroid (5 EC) were more effective in controlling tomato fruit borer in both the sprays at 24, 48, 72 hours. On over all basis Karate and Baythroid found to be superior to all the insecticides under trial in controlling the pest. Besides that, it was observed that the insecticides showed a gradual decline in their effect (less reduction in the pest population) one week after the treatment and onward. Kabir and Mia, (1987) conducted an experiment for controlling insect pest of black gram, applied carbofuran 1.0 kg/ha in farmers; hand pick clusters of hairy caterpillar or spot treat with sumithion as needed; treat plots with Sumithion when 5% raceme show signs pod borer infestation-schedule was most effective and gave significantly higher yield than other treatments.

The results further indicate that the overall mean per plant population after first spray 0.36, 0.44 and 0.49 of *Helicoverpa armigera* was recorded for these insecticides, respectively, as compared to control (1.23 larvae per plant), while after second spray the overall mean per plant population 0.33, 0.51 and 0.56 of *H. armigera* was recorded for these insecticides, respectively, as compared to control (2.21 larvae per plant). Whereas, the overall mean per plant population after third spray 0.29, 0.44 and 0.48 of *H. armigera* was recorded for these insecticides,

respectively, as compared to control (2.68 larvae per plant). LSD test showed that significant difference between all treatments. Where as, Abdalla *et al.*, (2006) evaluated the efficacy of Agerin 6.5 WP, Tracer 240 SC, and Somicidin 20% EC against the pod borer, *H. armigera* and chickpea yield. Each product was tested at three rates versus an untreated control. An other study was carried out by the Samara *et al.*, (1991) tested the insecticides (Deltamethrin, Fenvalerate, Cotton dust, Dimper, *Bacillus thuringensis* kurstakii, and Diflubenzuron against *Helicoverpa armigera* (Hb.) on local chickpea (winter sowing) with three different application dates at 10 days intervals. That showed that Deltamethrin and Fenvalerate were superior to other tested insecticides in both seasons. Using these two insecticides resulted in high percentage of dead larva after 24 hours of application: 93 and 89 for Deltamethrin and 84, and 91 for Fenvalerate for the two seasons respectively compared with 12 and 5 for control.

It was very clear from the result obtained that Proclaim performed well in reducing the population of *Helicoverpa armigera* on chick pea crop followed by Radiant and Jatara during the all three sprays. Analysis of variance showed significant difference between treatment and LSD test showed that efficacy of different insecticides remained non-significant at 24, 48 and 72 hours. (Tiwari and Sehgal, 2007; Suganthy and Kumar, 2000) evaluated the different integrated pest management strategies techniques against gram pod borer, *H. armigera* (Hubner) and controlled successfully to this vigorous pest. Jadhav and Suryawanshi, (1998) examined the effectiveness of some insecticides against *H. armigera* and concluded that Cypermethrin at 0.0135% and 0.0075% was found effective in reduction of pods damage and in increase of gram yield. It was concluded from the results of present study that all insecticides were found effective against, *Helicoverpa armigera*. The best control was recorded after 72 hours intervals after that the pest population was started increasing. Proclaim was the most effective insecticide. The best effect was found at fruit stage of chick pea crop. On behalf of the results of present study it is recommended that, Proclaim, Radiant and Jatara may be sprayed on chick pea crop against increasing population of *Helicoverpa armigera*. The crop may be sprayed at 15 days of interval after ascertaining the ETL for the pest. At least three (3) sprays may be applied for the control of *Helicoverpa armigera* from sowing up to harvesting of the crop.

Table 2. Average population of *Helicoverpa armigera* per leaf after application of insecticides (first spray)

Treatments	Pre-treatment	Post-treatment					Mean
		24 hrs	48 hrs	72 hrs	1 week	2 week	
Proclaim	0.77	0.47	0.22	0.10	0.27	0.35	0.36
Radiant	0.75	0.53	0.30	0.22	0.37	0.45	0.44
Jatara	0.80	0.57	0.37	0.23	0.40	0.55	0.49
Control	0.73	0.87	1.07	1.23	1.67	1.82	1.23

Table 3. Average population of *Helicoverpa armigera* per leaf after application of insecticides (second spray)

Treatments	Pre-treatment	Post-treatment					Mean
		24 hrs	48 hrs	72 hrs	1 week	2 week	
Proclaim	0.62	0.42	0.17	0.07	0.20	0.47	0.33
Radiant	0.88	0.65	0.42	0.20	0.32	0.58	0.51
Jatara	0.93	0.70	0.45	0.23	0.37	0.68	0.56
Control	2.02	2.12	2.13	2.17	2.33	2.48	2.21

Table 4. Average population of *Helicoverpa armigera* per leaf after application of insecticides (third spray)

Treatments	Pre-treatment	Post-treatment					Mean
		24 hrs	48 hrs	72 hrs	1 week	2 week	
Proclaim	0.68	0.45	0.22	0.12	0.12	0.15	0.29
Radiant	0.92	0.68	0.38	0.18	0.22	0.27	0.44
Jatara	0.95	0.70	0.43	0.22	0.26	0.30	0.48
Control	2.62	2.63	2.70	2.65	2.63	2.83	2.68

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