Effect of Novel Insecticides against *Helicoverpa armigera* (HBN.) on Chickpea crop under Field Conditions

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Abstract- The study was carried out at pulse section of Agriculture Research Institute (ARI) Tandojam. Chickpea crop is significantly important and rich in protein considered as major pulse crop in Pakistan and its surrounding and is attacked by number of insect pests, especially pod borer. The results declared that the control plot showed maximum population of *Helicoverpa armigera* throughout the study period. Whereas, after spraying novel pesticide (Radiant) at 100 ml/acre, results were maximum found as (0.75, 0.70, 0.80/plant) after 24 hours, (0.86, 0.80, 0.91/plant) after 48 hours, (0.91, 0.97, 0.94/plant) after 72 hours, (1.03, 1.08, 1.14/plant) after one week and (1.41, 1.68, 1.98/plant) after two weeks. Whereas, after the spraying of (Belt) at 50 ml/acre results (0.75, 0.80, 0.75/plant) after 24 hours, (0.80, 0.75, 0.91/plant) after 48 hours, (0.86, 0.91, 0.96/plant) after 72 hours, (1.01, 1.10, 1.05/plant) after one week and (1.41, 1.71, 1.98/plant) after two weeks were depicted. The result further revealed that (0.75, 0.70, 0.75/plant) after 24 hours, (0.86, 0.80, 0.86/plant) after 48 hours, (0.96, 1.01, 0.89/plant) after 72 hours, (0.98, 1.17, 1.10/plant) after one week and (1.42, 1.68, 1.98/plant) after two weeks after the application of (Steward) at 90 ml/acre. In conclusion our study resulted that Radiant pesticide showed maximum effects on the population reduction of *H. armigera* in Chickpea crop followed by Belt and Steward, respectively.

Index Terms- Novel Insecticides, *Helicoverpa armigera*, Chickpea, efficacy, Field Condition.

I. INTRODUCTION

In Pakistan Chickpea, *Cicer arietinum* L. is significantly important as major pulse crop. It is rich in protein, making it vulnerable to a number of insects, roots, leaves and pods of their attacks. Gram is the third most important food legume grown in 1 million ha with 9 million ton production (FAO, 2002). It is grown in over 45 countries in all continents of the world. It is a source of high quality protein for the people in developing countries. Gram is majorly cultivated in rain and irrigated areas of Punjab province, covers an area of 1.11 m ha and 475,000 tons of grain yield (Anonymous, 2008).

Gram pod borer, *H. armigera* Huber has great economic significance on most of the crop pests. This pest is a major constraint to chickpea production caused up to several rounds of insecticide applications 100% in spite serious losses. Sometimes, in severe cases, there may be a complete crop failure. *H. armigera* is highly polyphagous pests on a wide range of food, oil and fiber crops. Because of its wide host range, multi-generational, migratory behaviour, high fecundity and existing insecticide resistance; it has become a difficult pest to be controlled. Among the main host legumes, chickpea has been reported to be severely affected by this pest. It selectively fed when growing point, and cause significant yield losses genital area of the hosts. Pest status of this species has increased steadily over the past 50 years due to the diversification of agricultural ecosystems has launched a host of winter crops such as chickpea (Knight *et al*., 1980). Other crops like cotton, tobacco, tomatoes, corn, cabbage, peanuts and other pulses are also attacked by *H. armigera*. In 2-5 days, the eggs hatch the larvae bore pods. 40 pods can be damaged by single caterpillar. Fully mature larvae drop to the ground to pupate. It took 30-37 days for the completion of life cycle. In one year there are 5-7 generations (Malik, 1994).

The Gram pod borer 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. The pesticides play vital role for the reduction of this pest (Balasubramanian et al., 2001) only if the insect population crosses the economic threshold level (ETL) and control measures are taken when population exceeds ETL. For the control of *H. armigera* different studies were carried out around the globe for proper control of this pest. In view of the significance of this pest, we conducted the present study to test the different novel insecticides in the chickpea crop under field conditions at Tandojam.

II. MATERIALS AND METHODS

The present study was conducted to test the effect of novel insecticides against *H. armigera* (hbn) on chick pea (*C. arietinum* L.) under field conditions at the Village Pusia near Tandojam. The experiment was designed in Randomized Complete Block Design (RCBD) with 4 treatments and three replications. The variety namely (Cholla) was grown by drilling method of sowing with all slandered agronomical practices examined with each Plot size of 9.8×4.6 m. Three insecticides, Radiant (Spinetorm) 100ml/acre, Belt (Flubediamide) 50ml/acre and Steward (Indoxacrab) 90ml/acre were tested in this study. All insecticides were applied with knap sack sprayer machine commonly used in the study area. The further details of each insecticide are given in Table-1. The observations were taken before and after application of the sprays. The efficacy of the insecticides was recorded after 24hrs, 48hrs, 72hrs, one week and

two weeks after spray. For this purpose, 10 plants from each replication were randomly observed and pest population was counted. The observation was recorded at morning hours (8-10 am).

The data were statistically analyzed by analysis of variance (ANOVA) and (LSD) test was performed by measuring the means.

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

Trade Name	Common Name	Group Name	Manufacturing	Dose/Acre
Radiant	Spinetorm	New Chemistry	Arysta Life Science	100ml/Acre
Belt	Fubediamide	Pyrethroid	Bayer Crop Science	25ml/Acre
Steward	Indoxacrab	New Chemistry	Duepond	175ml/Acre
Control	Without Pesticide			

III. RESULTS

The present study was carried out to examine the effect of novel insecticides against *H. armigera* on chickpea crop under field conditions at Village Pussia near Tandojam, Sindh-Pakistan.

First spray

The pre-treatment and post-treatment after 24, 48, 72 hours, one week and two weeks results after the application of first spray of tested insecticides against gram pod borer are presented in Table-1. At pre-treatment observations the average populations of *H. armigera* on sub plots (T_1, T_2, T_3) and T4 control were (2.08 ± 0.19), T2 (2.12 ±0.2) , T3 (2.14 ±0.19) and control (3.13) per plant, respectively . The post treatment observations after 24 hours interval of insecticides application revealed that the average pest populations in T_1, T_2, T_3 were (0.75 ± 0.05),(0.82+0.05),(1.00+ 0.5) and (1.09) larvae per plant, respectively, which showed that the effect of these insecticides against *H. armigera* in ascending order was T_1 (Radiant) > T_2 (Belt) > T_3 (Steward) > T4 (Control). Moreover, effectiveness of these pesticides varied with the time intervals, maximum effect was found after 72 hours of 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 Radiant performed well followed by Belt and steward. The LSD test showed that significant difference between all treatments with (P= 0.0000) value.

Table-2 Average of the population of *Helicoverpa armigera* per plant after application of insecticides (First spray)

Treatments	Pre-Treatment	Post-treatment					Mean
		24 HRS	48 HRS	72 HRS	1 WEEK	2 WEEK	
Radiant	2.08 ± 0.19	0.75 ± 0.05	0.86 ± 0.07	0.72 ± 0.05	1.03 ± 0.06	1.41 ±0.15	1.142
Belt	2.12 ± 0.2	0.82 ± 0.05	0.92 ± 0.07	0.91 ± 0.08	1.09 ± 0.08	1.44 ± 0.13	1.217
Steward	2.14 ± 0.19	1.00 ± 0.05	0.99 ± 0.08	0.96 ± 0.09	1.14 ± 0.12	1.53 ± 0.2	1.354
Control	3.13	1.09	1.44	1.31	2.00	2.90	1.978

Second Spray

The data on average population of *H. 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 (T_1, T_2, T_3 and T_4) were (1.90±0.09), (2.01±0.09) (2.05±0.12) and (3.13) larvae per plant respectively. The post treatment observation after 24 hours interval of insecticides application revealed that the average pest populations in T_1, T_2, T_3 and T_4 were (0.4±0.0), 0.8, 0.9, and 1.09 larvae per plant respectively, which showed that the effect of these insecticides against *H. armigera* in ascending order was T_1 (Radiant) > T_2 (Belt) > T_3 (Steward) > T_4 (Control). It is noticed from this table that after 24 hours of insecticides application 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 Radiant performed well followed by Belt and Steward. The overall mean population of *H. armigera1*, 1.11, 1.23, 1.32 and 1.97 was per plant respectively. LSD test showed that significant difference between all treatments with (P= 0.0000) value.

Table-3: Average population of *Helicoverpa armigera* per plant after application of insecticides (Second spray)

Treatments	Pre-treatment	Post-treatment					Mean
		24 hrs	48 hrs	72 hrs	1 week	2 week	
Radiant	1.90 ± .09	0.4 ± 0.0	0.8 ± 0.07	0.81 ± 01.4	1.08 ± 0.11	1.68 ± 0.18	1.112
Belt	2.01 ± 0.09	0.8 ± 0.7	0.75 ± 0.05	0.97 ± 0.14	1.15 ± 0.09	1.71 ± 0.18	1.232
Steward	2.05 ± 0.12	0.9 ± 0.0	0.96 ± 0.05	1.01 ± 0.14	1.17 ± 0.1	1.88 ± 0.19	1.328
Control	3.13	1.09	1.44	1.31	2.00	2.90	1.978

Spray 3

The average population of the pre-treatment observations of *H. armigera* on sub plots (T_1, T_2, T_3) were (1.07± 0.15), (2.16± 0.19), (2.98± 0.18) and (3.13) larvae per plant, respectively. The post treatment observation after 24 hours interval of insecticides application revealed that the average pest populations in T_1, T_2, T_3 were (0.8± 0.07), (0.75± 0.05), (0.95± 0.05) and (1.09) larvae per plant respectively, which showed that the effect of these insecticides against *H. armigera* in ascending order was T_1 (Radiant) > T_2 (Belt) > T_3 (Steward) > (Control). It is noticed from this table that after 24 hours of insecticides application Radiant 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 Radiant performed well followed by Belt and Steward. The overall mean population of *H. armigera* was 1.13, 1.31 and 1.51 per plant respectively. LSD test showed that significant difference between all treatments with (P= 0.0000) value. From the results it is noticeable that Radiant performed better in the reduction of H. *armigera* population on chick pea crop followed by Belt and Steward throughout all the three sprays. Significant difference has been analyzed for variance between LSD tests and treatments, whereas the non-significant effects have been observed on efficacy of different insecticides at 24, 48 and 72 hours.

Table-4: Average population of *Helicoverpa armigera* per plant after application of insecticides (Third spray)

Treatments	Pre-treatment	Post-treatment					Mean
		24 hrs	48 hrs	72 hrs	1 week	2 week	
Radiant	1.07 ± 0.05	0.8 ± 0.07	0.91 ± 0.08	0.94 ± 0.1	1.5 ± 0.09	1.56 ± 0.1	1.130
Belt	2.16 ± 0.19	0.75 ± 0.05	0.97 ± 0.08	0.96 ± 0.1	1.14 ± 0.09	1.89 ± 0.11	1.312
Steward	2.98 ± 0.18	0.95 ± 0.05	0.99 ± 0.08	0.99 ± 0.1	1.22 ± 0.1	1.98 ± 0.11	1.518
Control	3.13	1.09	1.44	1.31	2.00	2.90	1.978

IV. DISCUSSION

The present study was carried out to examine the effect of novel insecticides against *H. armigera* on chickpea under field conditions. The efficacy of different treatments against *H. armigera* larvae was determined on the basis of number of larvae per plant. The data revealed that all the treatments were significantly superior over control. The maximum larval population was recorded (2.14, 2.08, 2.12) when crop was untreated. The minimum larval population was recorded (0.75, 0.70, 0.80/plant) after 24 hours, (0.86, 0.80, 0.91/plant) after 48 hours, (0.91, 0.97, 0.94/plant) after 72 hours, (1.03, 1.08, 1.14/plant) after one week and (1.41, 1.68, 1.98/plant) after two weeks of spray by Radiant. Mean while, (0.75, 0.80, 0.75/plant) after 24 hours, (0.80, 0.750.91/plant) after 48 hours, (0.86, 0.91, 0.96/plant) after 72 hours, (1.01, 1.10, 1.05/plant) after one week and (1.41, 1.71, 1.98/plant) after two weeks were observed after sprayed with Belt and (0.75, 0.70, 0.75/plant) after 24 hours, (0.86, 0.80, 0.86/plant) after 48 hours, (0.96, 1.01, 0.89/plant) after 72 hours, (0.98, 1.17, 1.10/plant) after one week and (1.42, 1.68, 1.98/plant) after two weeks sprayed by Steward were recorded. Our results are in agreement with Anis-ur-Rahman *et al.*2006, who reported that indoxacarb as the most effective insecticides in reducing the larval population in chickpea crop. Wakil *et al.* 2006, who reported that indoxacarb was the most effective in reducing the larval population of *H. armigera* in sunflower. Karar *et al.* 2002 also reported that minimum larval population was recorded for lambda cyhalothrin in cotton crop. Yogeeswarudu and Venkata 2014, examine the efficacy of different insecticides. Indoxacarb 14.5 SC @ 0.5 ml was found best with minimum population of *H. armigera* larvae/five plants at first spray among all the treatments. Shahzad *et al.* 2003 conducted a trial for insecticides viz. cypermethrin (10 EC) at 350 ml/acre, endosulfan (35 EC) at 1000 ml/ acre, lambda cychalothrin (2.5 EC) at 250 ml/ acre and chlorpyrifos (40 EC) at 800 ml/ acre. endosulfan, lambdacyhalothrin, cypermethrin, in all the above mentioned aspect they proved the better comparison control.

Rashid *et al.* 2003, investigated the effect of insecticides i.e. Chlorpyrifos, (2500ml/ ha), Endosulfan (2500ml/ hac), Indoxicarb (425 ml gac-1), profenofos (2500ml /ha) and spinosad (200ml/ ha) along with untreated check against gram pod borer (*H. armigera* Hubner). Among the various insecticides tested, Spinosad (Tracer) and Indoxicarb (Steward) were highly effective against gram pod borer while Endosulfan was found to be the least effective insecticides. Khan *et al.* 2009, conducted a trial against gram pod borer and to assess comparative efficacy of insecticides (Thiodan 40EC, Lorsban 40EC, Ripcord 10EC, Nurell-D (Chlorpyrifos + Cypermethrin 50 + 500 g/L EC) and Methomy 45 WP). Methomyl was found most effective against the tested pest under field conditions.

V. CONCLUSION

From the present research study, it was concluded that approaches for chemical management of *H. armigera* were found effective. The chemical insecticide Radiant 100ml/acre, Belt 50ml/acre and Steward 90ml/acre were found most effective in controlling *H. armigera* larval population, to reduce the pod infestation and also produce the maximum grain yield.

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