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Effect of Some Insect Growth Regulators Against Gram Pod Borer *Helicoverpa armigera* (Hb.) On Chickpea *Cicer arietinum* (L.) Under Laboratory Conditions

Imran Khatri[1*], Akram Ali Shaikh[1], Riffat Sultana[2], Muhammad Saeed Wagan[2] and Zubair Ahmed[3]
[1]*Department of Entomology, Sindh Agriculture University, Tandojam*
[2]*Department of Zoology, University of Sindh, Jamshoro*
[3]*Department of Zoology, Federal Urdu University of Arts, Sciences and Technology, Karachi 75300*

Abstract.- The laboratory studies on the effects of different insect growth regulators against 3rd instar larvae of Gram Pod Borer *Helicoverpa. armigera* (Hb.) were conducted at the department of Entomology, Sind Agriculture University Tandojam during winter (Rabi season). In each treatment six various concentrations were prepared and the mortality was recorded after 48, 72, 96 and 120 h of the treatment. The results indicate that the 50 percent mortality of the 3rd instar larvae of *H. armigera* (Hb.) after 120 h of treatment caused at concentrations; 0.0075 %, 0.0076 %, 0.0133 % and 0.0181 %; by Lufenuron, Flufenoxuron, Chlorfluazuron and Diflubenzuron respectively. The results thus suggest that all insect growth regulators were effective in controlling *H. armigera* (Hb.). However, preference can be given to Lufenuron and Flufenoxuron.

Key words: Insect growth regulators, lufenuron, flufenoxuron, chlorfluazuron, diflubenzuron.

INTRODUCTION

Chickpea *Cicer arietinum* L. (Leguminosae) is an important pulse crop of Rabi season. It covers a major portion of rice area in Rabi season and is cultivated as a common crop in rice-based system, constituting 11% of the total area, where the crop is grown on residual moisture after rice. In Pakistan, chickpea was grown on an area of about 0.97 million ha. (Baloch and Zubair, 2010). The cultivation of chickpea not only increases the income of the growers but also supplements the fertility of the soil (Khoso, 1980). The gram pod borer *Helicoverpa armigera* (Hiibner) (Noctuidae) is the well known pest of chickpea attaining a status of national importance and is widespread in Asia, Africa and Oceania (EPPO, 2006). It is a polyphagus pest of agricultural importance (Rajurkar *et al*., 2003)

Host plants of *H. armigera* include nearly all the major field crops: cotton, sorghum, maize, sunflower, chickpea, lucerne, tobacco, wheat, tomato, chillies, chrysanthamum and roses suffer high rates of damage (Mathews, 1999). The caterpillars feed on leaves and defoliate the tender parts of the plant in December when the plants develop and set pods, they cut hole in them, enter and feed on their seeds and the attack continues till March.

Chitin in arthropods is a logical target for selective pest control. The acylurea compounds, which act as insect growth regulators, are widely used in integrated pest management (IPM) programs. The first commercial product reaching the market was diflubenzuron (Dimilin), which was followed by a large number of structurally similar bioactive molecules (Cohen, 2003). The IGRs act on the larvae of the gram pod borer *H. armigera* by inhibiting chitin synthesis and thus affects the integrity of the insect exoskeleton at the time of molting. Most larvae die from ruptures of the new malformed cuticle or from starvation (see plate 1). Diflubenzuron and Lufenuron are commercialized. The great advantage of IGRs is their safety to non-target organisms.

MATERIALS AND METHODS

Laboratory studies were carried out to study the larvicidal action of Flufenoxuron, Chlorfluazuron, Diflubenzuron and Lufenuron on *Helicoverpa armigera* (Hb.). The larvae were collected from Atomic Energy Research Centre

* Corresponding author: imrankhatri.agri@gmail.com
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field, Tandojam. The laboratory experiment was conducted at Department of Entomology Sindh Agriculture University Tandojam during Rabi (Winter) season 2012.

Rearing method

The laboratory temperature was maintained at 25° ± 2°C and 60 ± 5% R.H. with a normal day-night photoperiod. The collected fourth instar larvae of *H. armigera* (Hb.) were kept individually, inside the 'Plastic bottles' (2.25" x 3") due to their cannibalistic nature. Approximately 1" layer of soil was placed at the bottom of plastic bottles and tender leaves of gram were provided daily to the larvae. The full fed larvae of *H. armigera* pupated inside the soil provided in plastic bottles. The pupae of gram pod borer *H. armigera* were collected from plastic bottles. When the adults emerged, each pair was placed in cages of, 12"x24"x30" size containing gram leaves.

The adults were supplied food in petri dishes containing cotton wool dipped in 10 % glucose solution Gram leaves were replaced by fresh for the purpose of egg laying. After mating, females laid eggs on the leaves of gram, cage walls and on the cotton wool. The leaves on which the eggs were laid, were placed inside petridishes (10 "x5") and provided moisture by keeping a moist cotton wool. When hatching took place, the newly hatched larvae were transferred to other petridishes; 2.5", 3", 4" and plastic containers (2.25"x3"). The larvae were provided fresh leaves of gram daily.

Method of treatment

The experiment was conducted on total 672 larvae. Each treatment containing 168 larvae; replicated thrice. In each replication, there were 7 groups of total 56 larvae and each group consisted 24 larvae. Six groups were treated with 6 different concentrations (*i.e.*, 0.0125, 0.025%, 0.05%, 0.1%, 0.2%, 0.4%) and one group was kept as control. In control the larvae were provided untreated fresh leaves.

Chemical solution of Dimilin (Diflubenzuron 25 WP) was prepared by suspending in distilled water. The required quantity of growth regulators *i.e.*, Cascade (Flufenoxuron 100EC), Atabron (Chlorfluazuron 50 EC), Dimilin (Diflubenzuron 25 WP) and Match (Lufenuron 50 EC) was taken with the help of syringe, and pesticide was diluted by required amount of water with the help of measuring cylinder. Concentrations were shaken for short period. Gram leaves were dipped for 30 seconds and dried in shade. Then with the help of camel hair brush the 3rd instar larvae of *H. armigera* (Hb.) were introduced on treated leaves and kept for 48 h. Later fresh leaves were replaced daily. Mortality of larvae was observed after 48, 72, 96 and 120 h after the treatment.

Data analysis

Probit analysis of the data is done by probit analysis program, made by Raymond (1985) U.S.A. and the graphs are prepared with software Origin 8.0.

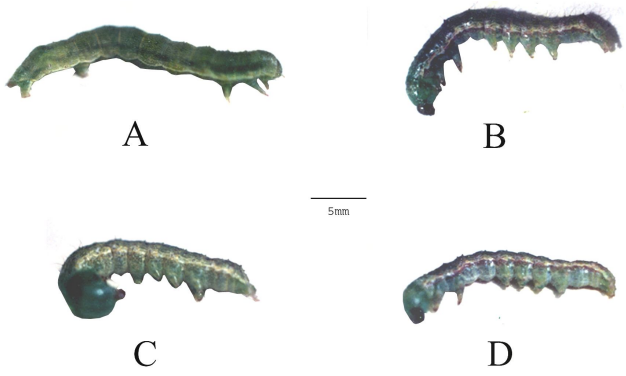

Fig. 1. *Helicoverpa armigera*; A, untreated larva; B-D, after effects of various insect growth regulators.

RESULTS AND DISCUSSION

These IGRs act on the larvae of the gram pod borer *H. armigera* by inhibiting chitin synthesis and thus affects the integrity of the insect exoskeleton at the time of molting. IGRs causes improper attachment of new cuticle during molting and produced a cuticle that lacks some of the layer that normally occur. Most larvae died from ruptures of the new malformed cuticle or from starvation. In affected larvae, the swelling of initial segment is obvious (Fig. 1). Figure 2 shows comparative efficacy of different insect growth regulators at different intervals after treatment against 3rd instar

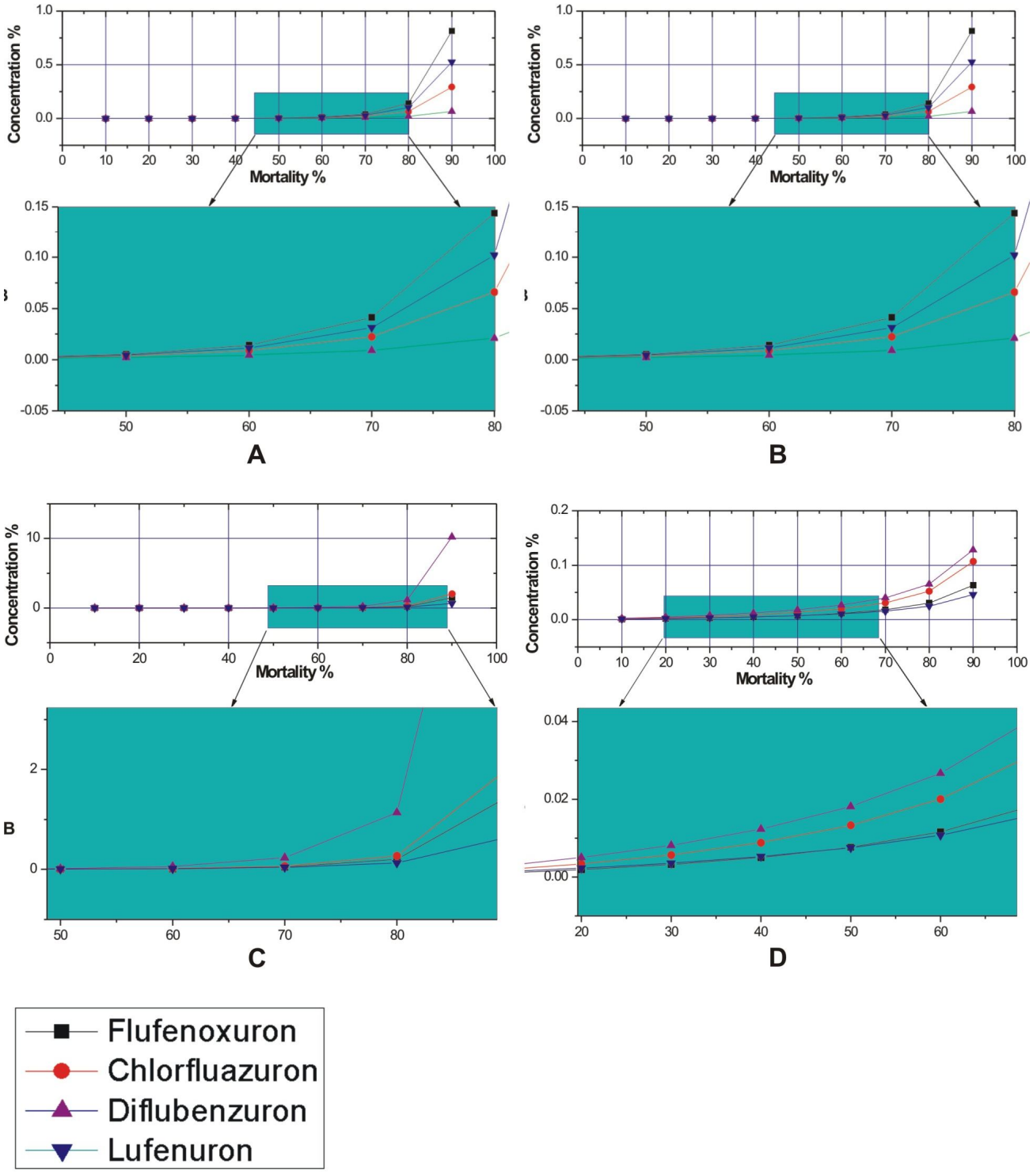

Fig. 2. Effect of different insect growth regulators at 48 h (A), 72 h (B), 96 h (C) and 120 h after treatment against 3rd instar larvae of *Helicovera armigera*.

larvae of *H. armigera* (Hb.). Slopes of all the growth regulators are comparable.

The results indicate that the 50 percent mortality of the 3rd instar larvae of *H. armigera* (Hb.) at 120 h after treatment was caused by Lufenuron at 0.0075% concentration. It was followed by Flufenoxuron, which caused 50 percent mortality at 0.0076% concentration. The Chlorfluazuron and Diflubenzuron caused 50 percent mortality at 0.0133 % and 0.0181 % concentrations, respectively. The results thus suggest that all the insect growth inhibitor were effective in controlling *H. armigera* (Hb.). However, Lufenuron and Flufenoxuron were comparatively more effective than Chlorfluazuron and Diflubenzuron.

CONCLUSION

It is concluded that all evaluated insect growth regulators are effective in controlling *H. armigera* (Hb.). However, preference can be given to Lufenuron and Flufenoxuron.

REFERENCES

AL-MEKHLAFI, F.A., ALI M.A.M., WADAAN M.A. AND AL-MALLAH N.M. 2012. Effect of different applicable conditions of the insect growth regulator (Cyromazine) on the Southern cowpea weevils, *Callosobruchus maculatus* Reared on Peas. *Pakistan J. Zool.*, **44**: 481-488.

BALOCH M. S. AND ZUBAIR, M., 2010. Effect of nipping on growth and yield of chickpea. *J. Anim. Pl. Sci.*, **20**: 208-210.

COHEN, E., 2003. Chitin. In: *Encyclopedia of insects* (eds. V. Resh and R. T. Cardé), Academic Press, an imprint of Elsevier Science, pp. 180.

EPPO, 2006. *Distribution maps of quarantine pests.* Helicoverpa armigera. On-line available at www.eppo.org/QUARANTINE/insects/Helicoverpa_armigera/HELIAR_map.htm.

KHOSO, A.W., 1990. *Crops of Sindh.* 4th ed. Hyd. Asra Print. Press, pp. 176 - 178.

MATHEWS, M., 1999. *Heliothine moths of Australia.* CSIRO Publishing, Collingwood.

RAJURKAR, R.B., KHAN, Z.H. AND GUJAR, G.T., 2003. Studies on levels of glutathione S-transferase, its isolation and purification from *Helicoverpa armigera. Curr. Sci.*, **85**: 1355-1360.

RAYMOND, M., 1985. Log-probit analysis basic programme of microcomputer. Cohiers ORSTOM Serie. *Ent. Med. Parasitol.*, **23**: 117-121.

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