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Effect of insect growth regulators on the development of *Helicoverpa armigera*

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Abstract

In laboratory study various developmental changes were exhibited by *Helicoverpa armigera* by the treatment of different insect growth regulators (IGRs) *i.e.* lufenuron, novaluron and UPI-106. Gram pod borer, *H.armigera* is a dreaded enemy of chick pea, pigeon pea, cotton, tomato and many other economically important crops. In the study, the efforts were concentrated in seeking effective toxicant for managing *H. armigera* population. IGRs are newer chemicals having less pollution effect on environment. Lufenuron, novaluron and UPI-106 are chitin synthesis inhibitor (CSI) belonging to acyl urea group. Lufenuron effectively suppressed *H. armigera* populations resulting in significant reduction in crop damage (Gogi, *et al*. (2006)). The insect growth regulators are much more effective than conventional insecticides. IGR inhibits the production of chitin in larval forms and affects the life cycle of *H.armigera*. The different criteria studied were length of body, weight of body, width of body and width of head capsule. Among the different concentration of three IGRs used, the most effective IGR was the treatment of UPI-106 (0.08% conc.) while the least effective was Novaluron (0.025% conc.).

Keywords: *H. armigera*, *IGRs, lufenuron*, *novaluron*, *UPI-106*, *chitin synthesis inhibitors*

Introduction

The basic need of human is air, water and food. This food is obtained from plants. In India various types of crops like wheat, rice, maize. Sorghum, millet and pulses etc. are grown. Among them pulses hold a prominent place due to losses caused by insect pest. The most damaging insect of gram in our country is *H. armigera.* It is a polyphagus insect and beside pulses found on many economically important crops like tomato, potato, cotton, sunflower, groundnut etc. To control *Harmigera* various techniques has been employed and lots of money is expensed every year. In such cases insect growth regulators are better option due to its characterstics like they are less toxic to man and domestic animals. They do not persist or accumulate in the environment and are degraded to simple molecules that are unlikely to cause problems of environmental contamination. The insect growth regulators, studies conducted so far, indicate that IGRs are comparatively safer to natural enemies. IGRs are active at very low concentration and effective against target insects. Insect Growth Regulators are also called "Third Generation Insecticides". The use of IGRs is being increased for controlling various insect pest of agriculture, horticulture, stored product and public health pest. The study is therefore, aimed to test the efficacy of IGRs against caterpillar of *H. armigera* so that their population can be managed.

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Materials and Method

The larvae of *H. armigera* were collected from the crop field of chick pea. Selection of healthy

and active larvae was done and transferred into petridishes singly. Incubation of these larvae were done at 25±20 ^{0}C with in 2-3 days pupation cell was formed by larvae and pupa were formed. The identified pupae were transferred to rearing jars in ratio 2:4 where 2 male and 4 female were taken. After emergence of moth from pupa, the process of egg laying took place where 200-800 eggs were laid in each rearing jar. After hatching larvae were transferred to semi-synthetic diet. When these larvae reached third instar the tests were conducted on them. The IGRs were obtained as sample from manufacturers and were diluted with ordinary tap water to obtain required concentrations. The application of insect growth regulators was done with the help of micropipette. Treatment dose was prepared by applying following formula

$$\frac{\text{Volume required in ml}}{\text{Strength of formulation}} \times \text{Concentration required in Percent}$$

To prepare 10 ml UPI 106 10% (500 mg/ml) stock solution in Water, the formula is

$$\frac{100}{10} \times 0.4$$

Different concentrations of each IGRs were tested and control were applied with tap water. Every treatment was repeated thrice and averages used for the estimation of Median Lethal Concentrations. Topical application of IGRs was done on insects and allowed to crawl for 1 hour. Observations taken after 24 hour of treatment as -

Living – which could walk normally

Slightly affected (Paralysed) – the trembling ones.

Moribound - showing no other movement except slight movement of head after touching themwith brush.

Dead - showing no movement even when repeatedly touched with brush

Throughout the experiment the moribund insects were considered dead. Living and slightly affected were classed as living. The mortality thus obtained was corrected for the mortality observed in the control as per formula given as follows.

$$P = \frac{f - c}{100-c} \times 100$$

Where,

p = corrected mortality

f = percent kill in treatment

c = percent kill in control

Table.1:Strength of IGR to tested

S.No	Name of IGR	Dose gm.ai/ha	Formulation Dose ml/ha.	% Con C	Volume Of Stock	Volume Of Buffer /Water	Total
					4 ml	16 ml	20
1	UPI 106 10 EC	30	600	0.04	0.4	19.60	20
2	UPI 106 10 EC	50	1000	0.08	0.8	19.92	20
3	UPI 106 10 EC	70	1400	0.16	0.16	19.984	20
4	NOVALURON 10 EC	75	750		0.025	19.975	20
5	LUFENURON 5.4 EC	30	600		0.08	19.980	20
6	LUFENURON 5.4 EC	60	1200		0.016	19.971	20

Results and Discussion

After 24 hours the maximum mortality percent is found by the treatment of UPI-106 (0.08). The least mortality percent (zero) is found by the treatment of UPI-106 (0.016). The above results thus indicate that UPI-106 is the most effective insect growth regulators among all other growth regulators used in experiment. Similar observation have also been reported by Butter *et al.* (2003), Iain (2007), Kranthi *et al.* (2002), Ma *et al.* (2000), Rao *et al.* (1990) and Whiting *et al.* (2000).

Effect of IGRs was seen on the length, weight, width of body and width head capsule after 24, 48, 72, 96,120 and 144 hours. The average of all the hours was taken and overall impact was shown in Table. 3.

Table. 2: Treatment of UPI

S.No.	Treatment (%Conc.)	Dead	Moribond	Slightly Affected	Alive	Total	% Mortal
1	**UPI – 106 (0.04)**	1	1	1	2	5	40
2	**UPI – 106 (0.08)**	1	2	0	2	5	60
3	**UPI – 106 (0.016)**	0	0	2	3	5	0
4	**NOVALURON (0.025)**	0	1	1	3	5	20
5	**LUFENURON (0.08)**	0	2	1	2	5	40
6	**LUFENURON (0.016)**	0	1	1	3	5	20
7	**CONTROL**	0	0	0	5	5	0

Table:3 Average overall percent

S.No.	Treatments	Overall Average Percent			
		Length	Weight	Width	Width Of Head Capsule
1	**UPI – 106 (0.04)**	96.52	98.69	120.83	128.45
2	**UPI – 106 (0.08)**	96.42	95.26	126.38	130.89
3	**UPI – 106 (0.016)**	99.20	99.52	108.33	108.13
4	**NOVALURON (0.025)**	99.12	99.52	111.11	116.26
5	**LUFENURON (0.08)**	97.43	98.93	116.66	121.95
6	**LUFENURON (0.016)**	99.05	99.58	115.27	117.88
7	**CONTROL**	100	100	100	100

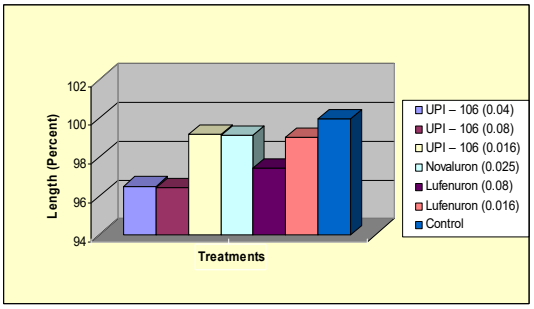

Fig.1. Effect of growth regulators on length of larvae (average percent)

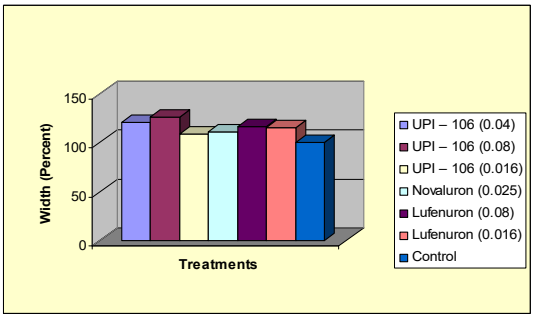

Fig. 3. Effect of growth regulators on the width head capsule of larvae (average percent)

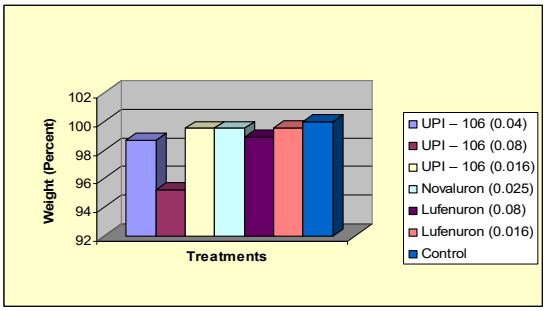

Fig. 2 Effect of growth regulators on weight of larvae (average percent)

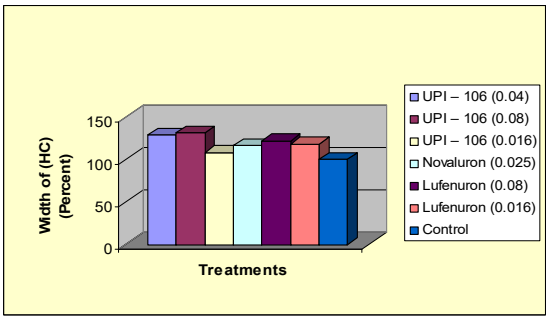

Fig. 4. Effect of insect growth regulators on the width of of larvae (average percent)

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