

EFFECT OF AN INSECT GROWTH INHIBITOR ON THE
NEWLY HATCHED LARVAE OF *PECTINOPHORA*
GOSYPIELLA (SAUND.); CYANOX RESISTANT
AND SUSCEPTIBLE STRAINS

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Abstract

Laboratory experiments were conducted using the growth inhibitor, CGA- 72662 against the newly hatched larvae of the pink bollworm *Pectinophora gossypiella* (Saund.) to evaluate its biological activity and latent effect on this pest. Data revealed that LC₅₀ values were 176.2 and 1046.44 ppm for susceptible and cyanox resistant strains, respectively.

Treating the newly hatched larvae of the two strains with LC₂₅ concentrations of the compound (10.86 and 247.13 ppm) resulted in a significant reduction of the pupal weight, number of deposited eggs/ female and eggs hatchability. Reduction in pupal weight was more evident in case of susceptible strain (32.51%) than the resistant one (7.8%). Compared to control, reduction in the mean number of deposited eggs reached 54.9 and 43.95% for cyanox resistant and susceptible strains, respectively. However, reduction of egg hatchability was about 27% for the two strains. The compound could be fairly considered potent against the larvae of the pink bollworm.

INTRODUCTION

The pink bollworm *Pectinophora gossypiella* (Saund.) has firmly established itself in all governorates cultivated with cotton. New approaches of pest control will continue to be needed in the future to manage the pest's populations more effectively and economically, and in the meantime to replace the chemical insecticides which ceased to give reliable control due to the development of resistance. In order to reduce build up of resistant strains in insects and minimize insecticide toxicity hazards, insect control must be accomplished with low toxic chemicals. This goal may be achieved by using different mode of action materials including insect growth inhibitors, which prevent the development of the insects. Flint and smith (1977) and Flint *et al.* (1978) found that diflubenzuron prevented the development of pink bollworm to adult when administered in the larval diet at 1-10 ppm. Moore and Taft (1975) and

Meisner *et al.* (1986) reported that benzoylphenyl urea insect growth regulators are claimed to act by inhibiting the synthesis of chitin in larvae and this leads to mortality. Kubo and Klocke (1984) in California USA, mentioned that azadirachtin, which did not directly kill the pests, but lowered their growth rate, made them more vulnerable to other mortality factors.

The present investigation evaluates the effect of an insect growth inhibitor, CGA-72662 on the newly hatched larvae of *Pectinophora gossypiella* (saund.) in a cyanox resistant strain compared to a susceptible strain.

MATERIALS AND METHODS

Source of insects: the susceptible strain was a laboratory strain, which has been maintained for several years, while cyanox resistant strain was selected from a field strain for 20 generations (Rofail *et al.*, 1995). The resistance level to cyanox was 29 fold. The artificial diet and all laboratory rearing techniques were the same as reported by Abd El-Hafez *et al.* (1982).

Growth inhibitor treatment: The insect growth inhibitor was CGA-72662 (50% 2-cyclopropylamino-4,6-diamino -S triazine). Six aqueous concentrations were sprayed in Petri dishes (9cm diam.) using hand atomizer. Treated surfaces were left to dry. Thirty neonates were transferred with the aid of a fine camel-hair brush to each treated Petri dish. An hour after exposure, treated and check insects were transferred individually to a semi-artificial diet poured into (2x7.5 cm) glass tubes.

Tested growth inhibitor concentrations were 4000, 2000, 1000, 500, 250, 125, and 62.5 ppm for the cyanox resistant strain and 2000, 1000, 500, 250, 125, 62.5, and 31.25 ppm for the susceptible strain. Treated and control tubes were held at $27 \pm 1^{\circ}\text{C}$ and $80 \pm 5\%$ R.H. Mortality was recorded after 7 days. LC 50 and slope values of mortality errors were statistically calculated through a Proban software computer program.

Three hundred newly hatched larvae from each strain were treated (with the same technique) by LC₂₅ of the insect growth inhibitor, as well as, the control. Larval tubes were examined daily and pupae were weighed at the next day to pupation. Emerged moths were paired (5-10 pairs/ replicate), however, daily inspections were made to calculate the average number of eggs/ female and the percentage of hatchability.

RESULTS AND DISCUSSION

Table 1 & Fig. 1 show the mortality percentages of newly hatched larvae of *P.gossypiella* (susceptible and cyanox resistant strains) treated with the insect growth inhibitor (IGI) CGA-72662. It appears that both strains were influenced by the IGI. However, the susceptible strain was more affected than cyanox resistant strain (LC50=176.2 and 1046.44 ppm., respectively). Larval mortality increased by increasing concentration and the highest percentages of mortality 72.13 and 73.4% occurred in case of the highest concentration (2000 and 4000 ppm for the two strains, respectively). Mortality decreased to 33.67 and 9.5% in the lowest concentration (31.25 and 62.5 ppm respectively). Moore & Taft (1975) and Meisner *et al.* (1986) reported that insect growth regulators are claimed to act by inhibiting the synthesis of chitin in larvae and this leads to mortality.

Data in Table 2 show that treating newly hatched larvae of pink bollworm susceptible and cyanox resistant strains with LC25 (10.86 and 247.13ppm, respectively) significantly decreased the pupal weight, the mean number of deposited egg/female and egg hatchability. The mean weight of pupae resulting from treated larvae of the two strains (0.0164&0.0168 gm, respectively) were significantly less than those of control (0.0243 and 0.0182 gm, respectively), while, t values ($P>0.05$) were 8.27 and 2.05, respectively. Moreover, reduction in pupal weight was more evident in case of the susceptible strain (32.51%) than that of the resistant one (7.8%). Marshall *et al.* (1985) studied the effect of the growth inhibitors (12-0 tetradecanoylphorbol -13- acetate and 12-0- (2methyl) butyrylphorbol-13- decanoate) against the pink bollworm. They attributed the growth inhibition to difference in larval weight.

Treatment of newly hatched larvae of both cyanox and susceptible strains with LC 25 of the IGI compound , drastically reduced egg production of resultant females. The mean number of deposited eggs/ control female of the two strains were 146 and 107.85 eggs, respectively. These means were significantly reduced to 66.01 and 60.45 eggs/ female after the treatment (t 0.05=4.78 and 11.304, respectively). Reduction of the deposited egg/ female reached 54.5 and 43.95% compared to the control for both considered strains.

The hatchability of eggs was significantly affected and decreased from 87.08 and 70.15% for control to 63.45 and 50.86 %, respectively when the newly hatched larvae of the susceptible and cyanox resistant strains were treated with the LC 25

Table 1. Effect of CGA-72662 on newly hatched larvae of *P.gossypiella* susceptible and cyanox resistant strains.

Strain	Concentration (ppm)	% Corrected (m)	Slope (b)	LC50 (ppm)	LC25 (ppm)
Susceptible	31.25	33.67	0.5536	176.20	10.86
	62.5	40.00			
	125	46.90			
	250	53.20			
	500	60.02			
	1000	66.25			
	2000	72.13			
Resistant	62.5	9.50	1.069	1046.44	247.13
	125	15.10			
	250	25.17			
	500	36.57			
	1000	49.30			
	2000	61.70			
	4000	73.40			

Table 2. Effect of treating newly hatched larvae of *P.gossypiella* susceptible and cyanox resistant strains with LC25 concentration of CGA-72662 on pupal weight, number of eggs and percent hatchability.

Strain and Treatments	pupal weight (gm)		deposited eggs/female		% hatchability	
	Mean	% Reduction	Mean	% Reduction	Mean	% Reduction
Susceptible						
Treatment	0.0164	32.51	66.01	54.5	63.45	27.14
Control	0.0243		146.00		87.08	
t-value	8.27*		4.78*		7.10*	
Resistant						
Treatment	0.0168	7.8	60.45	43.95	50.86	27.5
Control	0.0182		107.85		70.15	
t-value	2.05*		11.304*		4.11*	

* Significant at 0.05 probability level.

concentration. Reduction in egg viability was nearly equal for both treated strains (27.14 and 27.5%, respectively). Attia (1991) stated that *Heliothis armigera* (Hb.) treated with insect growth inhibitor laid less number of eggs than untreated.

Results indicate that the response of the developmental processes of the pink bollworm to one dose of the growth inhibitor CGA-72662 is gaining grounds as a useful approach in pest management. Such compound as well as the similar ones seem to be recommended for use in the field. Since the pink bollworm has more than one generation per year, and laying eggs extended widely during each generation, it may be expected that these compounds, when applied, may probably have a potent effect on the newly hatched larvae and, subsequently, help suppressing its populations.

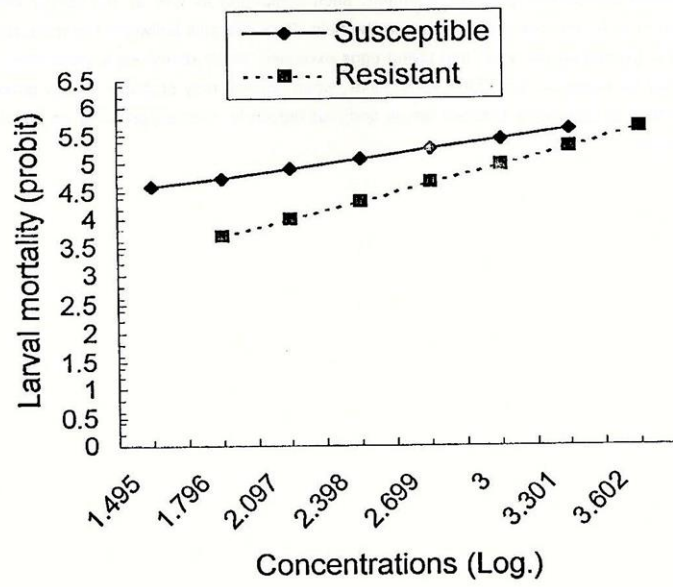


Fig. 1. Ldp lines of CGA-72662 on newly hatched larvae of *P.gossypiella* susceptible and cyanox resistant strains.

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تأثير أحد مثبطات النمو الحشرية على اليرقات حديثة الفقس لدودة اللوز القرنفلية الحساسة والمقاومة لمبيد السيانوكس

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أجريت تجارب معملية لتقدير فعالية مثبط النمو الحشرى GA-72662 على الفقس الحديث لدوده اللوز القرنفلية الحساسة والمقاومة لمبيد السيانوكس. وقد وجد أن التركيز المميت لـ ٥٠٪ من الافراد هو ١٧٦,٢ و ١٠٤٦,٤٤ جزء فى المليون لكل من السلالتين ، على التوالى .

وقد ادت معاملة الفقس الحديث لكل من السلالتين بالتركيز المميت لـ ٢٥٪ من الافراد (٨٦, ١٠ و ٢٤٧, ١٣ جزء فى المليون إلى حدوث انخفاض معنوى فى متوسطات اوزان العذارى الناتجة ، وعدد البيض للفراشات الناتجة من اليرقات المعاملة، ونسبة فقسه . وقد اظهرت النتائج نقصا فى وزن العذارى بنسبه ٣٢,٥١ و ٧٠,٨٪ فى كل من السلالتين على التوالى مقارنة بالحشرات غير المعاملة . أما عدد البيض فقد تناقص بنسبة ٤٥,٥ و ٤٢,٩٥ ٪ للسلالتين على التوالى ، كما تناقصت نسبة الفقس بمقدار ٢٧٪ تقريبا فى كلتا السلالتين . وبذلك فان المركب محل الدراسة يوحى بكفاءه استعماله كاحد اساليب المكافحه ضد الفقس الحديث لدوده اللوز القرنفليه.