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EFFECT OF THE INSECT GROWTH INHIBITOR LUFENURON ON UTILIZATION AND CONSUMPTION OF FOOD IN *Spodoptera Littoralis* (BOISD.)LARVAE

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ABSTRACT

Newly 4th instar larvae of *Spodopetra littoralis* were fed on lufenuron treated leaves for two days and then on untreated leaves till the end of the experiment. Food consumption and larvae were weighted every day. Data indicated that the weight gained and foods consumed were decreased in the treated larvae compared with untreated check at all periods of the experiment. Data also indicated that lufenuron decreased the values of consumption index (C.I.) and growth rate (G.R.) compared with the untreated ones. The values of the efficiency of conversion of ingested food (E.C.I.) explain the efficiency of conversion of food to weight gained. Data clearly revealed the pronounced variations between the high values of average of (E.C.I.) in untreated and the low levels in treated larvae. Data also indicated that the average of the efficiency of conversion of ingested food was negatively propotional with the increase of lufenuron concentration.

INTRODUCTION

The considerable economic and quarantine significance of the cotton leafworm , *Spodoptera littoralis* (Boisd.) as a notorious pest of field and vegetable crops in Egypt has necessitated intensive and regular use of highly potent insecticides.

Recently considerable interest has been devoted to seek for new approaches in pest management or/and alternative non conventional insect control agents, more specific and safer, such as insect growth inhibitors (Mulder and Giswijt, 1973; Ascher and Nemny, 1976.)

Field studies of *S. littoralis* biology to clarify the effect of insecticides on growth rates and body weight are few. Some authors indicated that insecticides treatment caused a reduction in growth rate and increase in body weight of *Pieris rapae* (Turunen, 1975) and *Paropsis atomaria* (Tanton and Khan, 1978) as compared to untreated check. Also, Stewart and Philogene, (1983) revealed that *Manduca sexta* larvae subjected to sublethal doses of fenitrothion, treated larvae had greater maximum larval body weight than control. Also, (Shaaban and Mourad ,1994) reveald that the insect growth inhibitor, flufenoxuron had an antifeedant action againest the fourth instar larvae of the cotton leafworm *S.littoralis*, (Jaganndah and Nair, 1996) indicated that azadirachtin treatments adversely affected the amount of food consumed and weight gained by the treated larvae *of S. littoralis* .The present study was carried out to investigate the effect of lufenuron as a representative of insect growth inhibitors, on the consumption and utilization of food in *Spodoptera littoralis* larvae.

MATERIAL AND METHODS

The original culture of the cotton leafworm *S.littoralis* was start as egg-masses collected from cotton fields in Sharkia Governorate and reared under laboratory conditions at 25 ± 2 C and 65 ± 5 relative humidity for more than 70 generations according to rearing technique of El-Defrawi et al., (1964).Fourth instar larvae of *S. littoralis* were treated by leaf-dip technique in five concentrations of lufenuron (0.125, 0.25, 0.5, 1.0 and 1.5 ppm). Fifty newly moulted 4th instar larvae were fed on treated castor bean leaves (for each concentration) for 48 hours thenafter the treated leaves were removed and fresh untreated leaves were provided for 5 successive days. The insects were kept separately in plastic ice cubes. Fifty larvae of the same age were left as control and provided with untreated castor bean leaves as larval food. Larvae and food were weighted every day respectively. Thus the whole period of the experiment was 7 successive days. Food utilized by newly moulted larvae was calculated according to the equation devoted by Waldbauer (1968). Consumption index (C.I.), growth rate (G.R.) and efficiency of conversion of ingested food (E.C.I.) were calculated as follows :

$$C.I = \frac{F}{AT}$$

Where :

F = weight of food eaten.

T = Duration of feeding period (days)

A = Meanweight of insect during feeding period and could be

Calculated according to Gordon (1959) as follows :

$$A = \frac{\text{Initial weight + Final weight}}{2}$$

$$G.R = \frac{G}{TA}$$

Where:

G = Weight gain of insect during feeding period.

T = Duration of feeding period (days)

A = Mean weight of insect during feeding period.

$$E.C.I. = \frac{\text{Weight gained (G)}}{\text{Weight of food ingested (F)}} \times 100$$

RESULTS AND DISCUSSION

Table (1) summarize the results for the effect of the insect growth inhibitor, lufenuron on larval weight for *S. littoralis* .

Results indicated that generally the weight gained was decreased in the treated larvae as compared with the untreated ones at all periods of the experiment during 7 days.Data also indicated that the increasing in concentration of the compound is accompanied by decreasing in the weight gained .

Table (1):Effect of the insect growth inhibitor lufenuron on Larval weight in *S.Littoralis* Larvae

Conc. Ppm	Mean of larvae weight (g) after different feeding periods (in days)					Average of weight gained/ Larvae after		
	0-day	1-day	2-day	3-day	4-day	5-day	6-day	7-day	7days
0.125	0.0514	0.0961± .00390	0.1372±. 0.0090	0.2734±. 0.0197	0.4265± 0.0250	0.4115± 0.0229	0.3684± 0.0106	0.2987± 0.0256	0.2874
0.25	0.0452	0.0899± 0.0027	0.1104± 0.0055	0.1987± 0.0123	0.3817± 0.0211	0.4033± 0.0212	0.3005± 0.0088	0.2967± 0.0086	0.2544
0.5	0.0420	0.0661± 0.0026	0.0677± 0.0111	0.0740± 0.0062	0.0921± 0.0107	—	—	—	0.0747
1	0.0496	0.0846± 0.0042	0.0728± 0.0048	0.0980± 0.0097	0.0547± 0.0036	—	—	—	0.0775
1.5	0.0423	0.0760± 0.0021	0.0500± 0.0009	0.0732± 0.0063	0.0921± 0.0165	—	—	—	0.0728
Check	0.0491	0.0978± 0.0033	0.1895± 0.0115	0.2927± 0.0178	0.4916± 0.0145	0.4219± 0.0110	0.3738± 0.0070	0.3104± 0.0071	0.3111

Table (2):Effect of the insect growth inhibitor lufenuron on food consumption in *S. Littoralis* larva.

Conc. Ppm	Mean of food consumption (g) (in days)							Average of food Consumed after 7 days
	1-day	2-day	3-day	4-day	5-day	6-day	7-day	
0.125	0.1687± 0.0040	0.1372± 0.0105	0.3328± 0.0078	0.4215± 0.0135	0.3812± 0.0085	0.3901 ± 0.0071	0.4266 ± 0.0102	0.3225
0.25	0.1594± 0.0041	0.1233± 0.0007	0.2584± 0.0020	0.4074± 0.0203	0.3680± 0.0.212	0.1251± 0.0094	0.2691± 0.0071	0.2443
0.5	0.0699± 0.0036	0.0539± 0.0102	0.0326± 0.0062	0. 0766± 0.0322	—	—	—	0.0582
1	0.0887± 0.0010	0.0427± 0.0050	0.0972± 0.0104	0.1220± 0.0082	—	—	—	0.0876
1.5	0.0895± 0.0016	0.0383± 0.0031	0.0587± 0.0117	0.1300± 0.0007	—	—	—	.07910
Check	0.1763± 0.0077	0.2491± 0.0078	0.3560± 0.0044	0.4918± 0.0194	03849± 0.0200	0.3914± 0.0027	0.4697± 0.0081	0.3598

Likewise the food consumption (Table 2) decreased remarkably in treated larvae with lufenuron during the whole experimental periods compared with the untreated check. It could be noticed that the weight gained of larvae and the food consumed were decreased in the treated larvae as compared to the untreated ones at the time intervals of the experiment; and it is obvious that the increasing in concentration of the compound is accompanied by decreasing in the weight gained and food consumed .

The decrease in food consumed and weight gained may be attributed to the antifeedant effect of the insect growth inhibitor lufenuron against *S. littoralis* larvae. This result agree with that obtained by Shaaban and Mourad (1994) who indicated that the weight gained and food consumed were decreased in the treated larvae with the insect growth inhibitor flufenoxuron as compaired with the untreated check at all periods of the experiments, and Ahmed *et al.*, (1991), who indicated that the weight gained and food consumed by 6th instar larvae of *S. littoralis* were increased in the treated larvae with non-lethal dose of methamidophos as compared to the untreated at time intervals of 24, 48 and 72 hours post treatment. On the other hand these results disagree with the results of Tanton and Khan (1978), on *Paropsis atomaria* and Turunen (1975 & 1977), on *Pieris rapae.* They revealed that when larvae are treated with insecticides, an increasing in body weight had been occurred compared to untreated check. The same conculusion was obtained by Stewart and Philogene (1983) who found that *Manduca sexta* larvae, subjected to sub-lethal doses of fenitrothion, had a great maximum larvae body weight compared to the untreated check.

Data In (Table 3) represent the effect of the insect growth inhibitor lufenuron on consumption index (C.I.). Results revealed that feeding of the newly 4th instar larvae on lufenuron treated leaves decreased the values of consumption index compared with untreated ones, it's mean that the consumption index decreased with time elapse.The consumption index values for the lowest concentration (0.125 ppm) were 2.289, 0.727, 0.683, 0.432, 0.329, 0.309 and 0.348 and the same values for the highest concentration (1.5 ppm) were 1.413, 0.414, 0.222 and 0.484 with noticed that all larvae were dead after the 4th day compared with 2.398, 1.044, 0.694 ,0.454, 0.326, 0.308 and o.373 for the untreated larvae at the 7 days feeding periods .

As for the growth rate , (Table 4), it is obvious that the values were highly decreased at all treatments compared with the untreated control, except the low concentrations (0.125 and 0.25 ppm) at the 1st day and after the 4th day with 0.125 ppm and the 5th day with 0.25 ppm where the variation was very low. The values of growth rate were 0.567, 0.455, 0.456, 0.392, 0.311, 0.251 and 0.201 (with 0.125 ppm) and 0.662, 0.421, 0.419, 0.197, 0.319, 0.245 and 0.101 (with 0.25 ppm) but in the higher concentrations, its found that the values were 0.446, 0.234, 0.184 and 0.187 (with 0.5 ppm) and 0.522, 0.189, 0.086 and 0.025 (with 1 ppm) 0.569, 0.083, 0.178 and 0.185 (with 1.5 ppm) compared with 0.663, 0.588, 0.475, 0.409, 0.316, 0.256 and 0.207 for the untreated control. It is clear from the present data that the insect growth inhibitor, lufenuron reduced obviously food consumption and this was apparently reflected, on the reduction of growth rate values obtained. This

clearly indicated that lufenuron had an antifeedant action against the fourth instar larvae of the cotton leafworm *S. littoralis*, which rared feeding activities of larvae and reduce their food consumption by rendering the treated leaves unattractive for feeding. These results in this respect are in agreement with earlier reports which indicated that insect growth disruptors interefer with feeding (Mulder and Giswijt, (1973); Ascher and Nemny (1976) and Shaaban, and Mourad (1994).

Table (3) : Effect of the insect growth inhibitor lufenuron on consumption index (C.I.) in *S. Littoralis*

Conc. Ppm	Mean of C.I. values						
	Days after treatment						
	1-day	2-day	3-day	4-day	5-day	6-day	7-day
0.125	2.289	0.727	0.683	0.432	0..329	0.309	0.348
0.25	2.36	0.792	0.706	0.238	0.328	0.120	0.225
0.5	1.293	0.616	0.187	0.285	———	———	———
1	1.321	0.348	0.441	0.584	———	———	———
1.5	1.413	0.414	0.222	0.484	———	———	———
Check	2.398	1.044	0.694	0.454	0.326	0.308	0.373

Table (4) : Effect of the insect growth inhibitor lufenuron on growth rate (G.R.) in *S. Littoralis*

Conc. ppm	Mean of G.R values						
	Days after treatment						
	1-day	2-day	3-day	4-day	5-day	6-day	7-day
0.125	0.567	0.455	0.456	0.392	0.311	0..251	0.201
0.25	0.662	0.421	0.419	0.197	0.319	0.245	0.101
0.5	0.446	0.234	0.184	0.187	———	———	———
1	0.522	0.189	0.086	0.025	———	———	———
1.5	0.569	0.083	0.178	0.185	———	———	———
Check	0.663	0.588	0.475	0.409	0.316	0.256	0.207

Table (5) Effect of the insect growth inhibitor lufnuron on effeciency of conversion

Conc. Ppm	Mean of E.C.I. values % Days after treatment					Averageof E.C.I.after 7days		
	1-day	2-day	3-day	4-day	5-day	6-day	7-day	
0.125	32.41	62.52	66.70	88.99	94.46	81.25	57.96	68.33
0.25	28.04	52.87	59.40	82.59	97.31	22.76	21.02	51.99
0.5	34.47	47.68	98.15	65.40	____	____	____	61.42
1	39.45	54.33	49.79	4.22	____	____	____	36.94
1.5	37.65	20.10	52.64	38.30	____	____	____	37.17
Check	27.64	56.36	68.43	89.97	96.85	82.95	55.63	68.26

Thevalues of efficiency of conversion of ingested food(E.C.I.) (Table 5), explain the efficiency of conversion of food to weight gained. The values of E.C.I. were 32.41, 62.52, 66.70, 88.99, 94.46, 81.25 and 57.96 % (with 0.125 ppm), and 28.04, 52.87, 59.40, 82.59, 97.31, 22.76 and 21.02 % (with 0.25 ppm), but at higher concentrations the values of E.C.I. were 34.47, 47.68,98.15 and 65.40% (with 0.5 ppm),and 39.45, 54.33, 49.79 and 4.22 % (with 1 ppm), and 37.65, 20.10, 52.64 and 38.30 % (with 1.5 ppm), with noticed that all larvae were dead after the 4th day compared with 27.64, 56.36, 68.43, 89.97, 96.85, 82.95 and 55.63 % for the untreated control at 1, 2, 3, 4, 5, 6 and 7-day, respecively .Considering the effect of lufenuron concentration on E.C.I. values, results revealed that the average of efficiency of conversion of ingested food was negatively proportional with the concentration increase. In a previous study, Radwan *et al,* (1986) found that the efficiency of converting ingested and digested food into body was obviously reduced in larvae fed on the insect growth inhibitor diflubenzuron treated leaves.

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تأثير مثبط النمو الحشرى اللوفينيرون على أستهلاك الغذاء و تمثيله فى يرقات دودة ورق القطن

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تمت تغذية العمر اليرقى الرابع لدودة ورق القطن على ورق الخروع المعامل بمثبط النمو الحشرى لوفينيرون لمدة يومين ثم تم أستبداله بورق خروع غير معامل وتمت التغذية حتى أنتهاء التجربة ولقد تم وزن الغذاء المستهلك و كذلك اليرقات يوميا.

و قد أظهرت النتائج أنخفاض وزن اليرقات و كذلك الغذء المستهلك فى اليرقات المعاملة مقارنة باليرقات الغير معاملة .

كما أظهرت النتائج أن أستخدام اللوفينيرون يقلل من قيم معامل أستهلاك الغذاء وكذلك معدل النمو لليرقات المعاملة بالنسبة للغير معاملة.

و قد أوضحت النتائج زيادة متوسط معامل كفاءة التحول الغذائى فى اليرقات الغير معاملة مقارنة باليرقات المعاملة و كذلك فان متوسط معامل كفاءة التحول الغذائى يقل بزيادة تركيز اللوفينيرون