

**FFECT OF THREE INSECT GROWTH REGULATORS  
SYNERGISED WITH SURFACTANTS ON SOME  
BIOCHEMICAL ASPECTS OF THE ADULT STAGE OF  
MUSCA DOMESTICA.**

By

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**ABSTRACT**

*Newly emerged adults of Musca domestica were topically treated with three different insect growth regulators (BAY SIR 8514, SIR 8514 and IKI) at dosages of 0.55, 0.75, 0.98 and 1.15  $\mu\text{g}/\text{adult}$ . Results revealed that the mean value of the total haemolymph and fat body protein was reduced in adults treated with BAY SIR 8514 and SIR 8514. An increase was observed in haemolymph and fat body protein contents in adults treated with IKI.*

*An increase was also detected in the total haemolymph and fat body lipids and carbohydrate contents of the adult stage treated with the tested IGRs. The tested IGRs wre more effective when combined with the surfactants, Tween 80 and Span 20 which acted as synergists.*

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## INTRODUCTION

In recent years, the development of insect growth regulators has received much attention. Insect growth (IGRs) are one of the effective agents during insect metamorphosis; they also affect the synthesis of protein, lipids and carbohydrates; consequently any imbalance of these agents induces confusion in the sequence of metamorphosis and metabolism, (Bakr et al., 1991, Eid et al., 1985 and El Gammal, 198). The aim of the present work is to investigate the biochemical effects of the insect growth regulators chlorfluazuron (IKI, EC) and two different formulations of Triflumuron (BAY SIR 8514, EC and SIR 8514, EC) on the adult stage of *M. domestica* when synergised with two different surfactants (Tween 80 and Span 20).

## MATERIALS AND METHODS

*M. domestica* adults were obtained from a laboratory stock culture, maintained in the Entomology Department, Faculty of Science, Benha Branch, Zagazig University in Benha. The breeding media of *M. domestica* were prepared according to technique described by Ibrahim (1991) surfactants tested in this investigation were Tween 80 and Span 20, at concentration of 2%.

### **Insect growth regulators used were:**

1- BAY SIR 8514: Emulsifiable concentrate 6.5%

[1-(4-trifluoromethoxy phenyl)--(2-chlorobenzoyl)-urea],

Common name: Triflumuron.

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2- SIR 8514; Flowable concentrate 6.5%

[2-chlor-N-(4-trifluoromethoxy phenylaminol]- carbonyl] benzamid,

Common name triflumuron.

- IKI, Emulsifiable concentrate 5%,

N-[3,6-dichloro-4- (-chloro-5-trifluoromethyl-2-pyridyloxy) phenyl carbonyl]-2, 6-difluorobenzamide.

Common name: chlorfluazuron.

BAY SIR 8514 and IKI were dissolved in acetone, whereas SIR 8514 was dissolved in water. Different concentrations of each compound were applied topically using automatic pipette. IGRs doses used for each test were 0.55, 0.75, 0.98 and 1.15 µg/adult. Two groups of 48 hrs old adult stage of *M. domestica* were collected from the stock culture, the first group was topically treated with different doses of the tested compounds and the second one treated with the same doses synergised with the selected surfactants. Treated and untreated individuals were incubated at constant conditions of 27±2°C and 70±2% R.H. Control group was maintained without any treatments as check experiments. Samples of the haemolymph and fat bodies were collected from the treated and check groups and the mean values of haemolymph and fat body content of protein, carbohydrates and lipids were estimated within 48 hrs after treatments, following the technique described by Singh (1977) and Abd El-Magid (1993). All data were statistically corrected according to Abbott's Formula (1925).

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## RESULTS

### 1-Protein content:

The mean value of the haemolymph and fat body protein content during 48hrs old of the adult stage *M. domestica* are presented in table 1 and 2. Statistical analysis of results indicated that the haemolymph and fat body protein contents of adult stage treated with BAY SIR 8514 and SIR 8514 were significantly decreased as compared with the untreated control group ( $P < 0.05$ ). The effect was a dose dependant, i.e. as a doses increased the protein content decreased. On the other hand, IKI treatments, caused a significantly higher total protein than that of untreated control group ( $P < 0.05$ ). It is clear that haemolymph and fat body protein content in all treated and untreated groups tend to decrease as a result of synergism between IGRs and surfactants.

### 2-Carbohydrate content:

Statistical analysis of data in Tables 3 and 4 revealed the following: significant increases in the haemolymph carbohydrate content was observed at a dose of 0.55  $\mu\text{g}/\text{adult}$ , it reached 52.1 and 48.1 mg/ml haem for BAY SIR 18514 and SIR 8514, respectively, as compared with 28.88 mg/ml haem in the control group. The dose of 1.51  $\mu\text{g}/\text{adult}$  of IKI increased the level of the haemolymph carbohydrate content as compared with those obtained by other doses, when it increased from 28.75 to 42.22 mg/ml haem. The dose of 0.55  $\mu\text{g}/\text{adult}$  of BAY SIR 8514 and IKI increased the level of carbohydrate content in the fat body as compared with other doses, where reached 40.3 and 72.5 mg/g fat body. Synergism between IGRs

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and surfactant decrease the level of carbohydrate in haemolymph and fat body in all employed dosage of IGRs.

#### **3- Lipid content:**

Statistical analysis of data in tables (5 and 6) revealed the following: treatments with IGR compounds significantly increased the haemolymph lipid content. Treatments with SIR 8514 with dosage of 0.55 µg/adult induced a pronounced increase in haemolymph lipid content, it was 32.1, while it was 32.5 mg/ml haem. When adults treated with SIR 8514 at a dosage of 1.15 µg/adult. The highest lipid content for IKI treatments was 29.3 mg/ml haem. at the dose of 0.75 µg/adult.

In the present study an increase was observed in haemolymph and fat body lipid contents of treated adult stage of M. domestica. This observations may be explained that IGRs increased the conversion rate of carbohydrate to lipid leading to a high level of lipid in the haemolymph and fat body of the treated adult. It was also noticed that the IGRs plus surfactants affected mainly the fat body and this also leads to a strong accumulation of carbohydrates in tissues. Results may indicated that the IGRs plus surfactants inhibited the anabolism of the treated insects. The metabolic activity is mostly of catabolic pattern. Our findings were in agreement with results obtained by El-Gammal et al (1990), Hassan (1990) and Aboul El-Ela et al., (1990).

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**Table (1):** Haemolymph protein content of 48 hrs-old-adult stage of *Musca domestica* topically treated with different doses of BAY SIR 8514, SIR 8514 and IKI Synergised with 2% Tween 80 and Span 20.

**Table (1-a):** Treatments were carried out with IGRs.

Dose µg/adult	Haemolymph protein content (mg/ml. Haem.)± S.E.		
	BAY SIR 8514	SIR 8514	IKI
1.15	18.73±0.97 ***	25.95 ± 1.91 ***	55.53 ± 0.60 ***
0.98	29.25 ± 1.65 **	31.02 ± 1.4 ***	61.48 ± 1.15 ***
0.75	31.08 ± 0.61 *	34.01 ± 1.52 **	73.83 ± 0.98 **
0.55	37.4 ± 1.38 *	35.7 ± 0.082 **	78.6 ± 1.05 **
Control	42.5 ± 1.38 **	42.5 ± 0.018 *	42.5 ± 1.018 *

**Table (1-b):** IGRs plus surfactant at concentration of 2%.

Dose µg/adult	Surfactant used	Haemolymph protein content (mg/ml Haem.) ± S.E.		
		BAY SIR 8514	SIR 8514	IKI
1.15	Tween 80	15.2 ± 0.73 **	21.5 ± 0.24 **	48.7 ± 0.86 **
	Span 20	14.2 ± 0.86 **	19.3 ± 0.63 **	44.3 ± 0.46 **
0.98	Tween 80	16.1 ± 1.01 *	23.7 ± 0.45 *	55.3 ± 1.68 **
	Span 20	15.2 ± 1.71 *	21.5 ± 0.60 *	51.2 ± 0.46 *
0.75	Tween 80	26.3 ± 1.01 *	28.1 ± 0.67 **	63.9 ± 0.63 *
	Span 20	22.1 ± 0.41 *	24.3 ± 0.86 **	61.5 ± 1.82 **
0.55	Tween 80	29.5 ± 0.675 *	31.5 ± 0.16	71.5 ± 0.36 **
	Span 20	27.1 ± 0.60 *	26.2 ± 0.46	68.4 ± 0.45 *
Control	Tween 80	40.1 ± 0.99 *	38.4 ± 0.56	38.4 ± 0.92 *
	Span 20	39.03 ± 0.86 **	36.4 ± 0.34	36.9 ± 0.91 *

\* Significant.

\*\* Highly significant.

\*\*\* Very highly significant.



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Table (2): Fat body protein content of 48hrs-old-adult stage of *Musca domestica* topically treated with different doses of BAY SIR 8514, SIR 8514 and IKI and synergised with 2% Tween 80 and Span 20.

Table (2-a): Treatments were carried out with IGRs.

Dose µg/adult	Fat body protein content (mg/g Fat B.) ± S.E.		
	BAY SIR 8514	SIR 8514	IKI
1.15	6.93 ± 0.13 *	12.7 ± 0.18 *	16.54 ± 1.06 *
0.98	9.38 ± 1.72 *	13.5 ± 1.32 *	54.2 ± 0.31 *
0.75	11.78 ± 0.98 *	13.8 ± 1.01*	24.8 ± 0.96 *
0.55	12.9 ± 0.95 *	14.9 ± 0.96 *	33.5 ± 0.81 *
Control	14.73 ± 0.46 *	15.01 ± 0.72 *	14.9 ± 0.96 *

Table (2-b): IGRs plus surfactants at concentration of 2%.

Dose µg/adult	Surfactant used	Fab body/Protein content (mg/g Fat B)		
		BAY SIR 8514	SIR 8514	IKI
1.15	Tween 80	5.9 ± 0.96 **	10.7 ± 1.53	14.1 ± 0.86 **
	Span 20	4.7 ± 0.183 **	8.2 ± 0.71	11.5 ± 0.54 *
0.98	Tween 80	6.8 ± 0.96 **	12.0 ± 1.39	48.1 ± 0.182 *
	Span 20	5.4 ± 0.45 **	10.3 ± 0.45	32.5 ± 0.72 *
0.75	Tween 80	9.01 ± 1.36 *	12.4 ± 1.85	19.5 ± 0.45
	Span 20	7.9 ± 0.52 **	11.0 ± 1.01	16.1 ± 0.40
0.55	Tween 80	10.3 ± 0.72 **	13.5 ± 0.46	28.9 ± 0.018
	Span 20	9.1 ± 1.82 **	12.01 ± 0.46	22.1 ± 0.35
Control	Tween 80	13.5 ± 0.86 **	14.2 ± 1.35	14.1 ± 1.72
	Span 20	11.2 ± 0.16	11.9 ± 0.41	11.5 ± 0.96

\* Significant.

\*\* Highly significant.

\*\*\* Very highly significant.

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**Table (3):** Haemolymph carbohydrate content of 48 hrs-old-adult stage of *Musca domestica* topically treated with different doses of BAY SIR 8514, SIR 8514 and IKI.

**Table (3-a):** Treatments were carried out with IGRs.

Dose µg/adult	Haem carbohydrate content (mg/ml Haem.)		
	BAY SIR 8514	SIR 8514	IKI
1.15	36.51 ± 1.31 **	31.1 ± 0.67 *	42.22 ± 1.56 **
0.98	39.2 ± 0.62 **	35.1 ± 0.81 *	33.1 ± 0.71 ***
0.75	48.5 ± 1.52 **	42.7 ± 1.31 **	36.5 ± 0.83
0.55	52.1 ± 0.71 **	48.1 ± 1.63 *	38.2 ± 0.51
Control	28.88 ± 1.38 **	28.71 ± 0.72 ***	28.75 ± 1.22

**Table (3-b):** IGRs plus surfactants at concentration of 2%.

Dose µg/adult	Surfactant used	Haemolymph carbohydrate content (mg/ml Haem.)		
		BAY SIR 8514 ± **	SIR 8514	IKI
1.15	Tween 80	34.2 ± 1.23 *	29.1 ± 0.53 *	41.5 ± 0.75*
	Span 20	32.1 ± 0.15 *	28.4 ± 0.89 *	36.1 ± 0.31*
0.98	Tween 80	37.5 ± 0.16*	32.9 ± 1.32	31.9 ± 0.64 **
	Span 20	36.1 ± 1.32 *	30.7 ± 1.51	28.5 ± 0.86 **
0.75	Tween 80	45.4 ± 0.56 *	38.5 ± 0.71	32.9 ± 1.32 **
	Span 20	41.3 ± 0.72 *	36.1 ± 0.81	31.0 ± 0.96 **
0.55	Tween 80	47.3 ± 0.15*	44.5 ± 1.21	36.5 ± 1.63 **
	Span 20	42.3 ± 1.38 *	41.7 ± 1.65	34.2 ± 0.91 *
Control	Tween 80	25.1 ± 0.96 *	25.6 ± 0.72	25.1 ± 1.32 *
	Span 20	23.2 ± 0.72	23.7 ± 1.36	23.4 ± 1.86

\* Significant.

\*\* Highly significant.

\*\*\* Very highly significant.

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**Table (4):** Fat body carbohydrate content of 48 hrs-old-adult stage *Musca domestica* topically treated with different doses of BAY SIR 8514, SIR 8514 and IKI synergised with 2%.

**Table (4-a):** Treatments were carried out with IGRs.

Dose µg/adult	Fat body carbohydrate content (mg/g Fat B.)		
	BAY SIR 8514	SIR 8514	IKI
1.15	27.53 ± 0.53 *	19.71 ± 1.36 *	26.4 ± 1.35 *
0.98	46.1 ± 1.36 **	8.41 ± 0.56 *	53.2 ± 0.19 **
0.75	41.5 ± 0.15 **	16.5 ± 1.36 *	84.7 ± 1.63 *
0.55	40.3 ± 1.36 **	11.4 ± 0.52 *	72.5 ± 0.72 *
Control	6.58 ± 0.18 *	6.33 ± 1.37 *	6.61 ± 1.36 *

**Table (4-b):** IGRs plus surfactants at concentration of 2%.

Dose µg/adult	Surfactant used	Fat body carbohydrate content (mg/g fat B.)		
		BAY SIR 8514	SIR 8514	IKI
1.15	Tween 80	25.1 ± 0.12 **	15.4 ± 1.5 *	22.1 ± 0.72 *
	Span 20	23.2 ± 0.12 **	13.2 ± 0.45 *	18.1 ± 1.32 *
0.98	Tween 80	42.5 ± 1.32 **	8.1 ± 0.2 *	52.1 ± 0.71 *
	Span 20	37.7 ± 0.69 **	7.9 ± 0.5 *	49.9 ± 1.36 *
0.75	Tween 80	38.18 ± 1.32 **	15.0 ± 1.36 *	82.3 ± 0.96 *
	Span 20	36.12 ± 0.92	13.2 ± 1.5 *	79.5 ± 1.32 *
0.55	Tween 80	36.1 ± 1.52 **	9.1 ± 0.87 *	68.5 ± 0.92 *
	Span 20	34.4 ± 0.91 **	9.1 ± 0.86 *	61.7 ± 0.83 *
Control	Tween 80	4.5 ± 0.13 **	4.6 ± 0.53 *	4.4 ± 1.32 *
	Span 20	4.2 ± 1.23	4.1 ± 1.4 *	4.3 ± 0.92 *

\* Significant

\*\* Highly significant.

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**Table (5):** Haemolymph lipid content of 48 hrs-old-adult stage of *Musca domestica* topically treated with different doses of BAY SIR 8514, SIR 8514 and IKI synergised with 2% Tween 80 and Span 20.

**Table (5-a):** Treatments were carried out with IGRs.

Dose µg/adult	Haemolymph lipid content (mg/ml Haem).		
	BAY SIR 8514	SIR 8514	IKI
1.15	26.4 ± 1.31 **	32.5 ± 0.67 *	27.6 ± 1.56 **
0.98	25.3 ± 0.62 **	25.1 ± 0.81 *	26.4 ± 0.71 ***
0.75	28.6 ± 1.52 **	27.1 ± 1.31 **	29.3 ± 0.83
0.55	32.1 ± 0.71 **	28.4 ± 1.63 *	23.54 ± 0.51
Control	23.54 ± 1.38 **	23.11 ± 0.72 ***	23.23 ± 1.22

**Table (5-b):** IGRs plus surfactants of concentration of 2%.

Dose µg/adult	Surfactant used	Haemolymph lipid content (mg/ml Haem.)		
		BAY SIR 8514	SIR 8514	IKI
1.15	Tween 80	22.7 ± 1.23 **	30.5 ± 0.53 **	25.3 ± 0.75 *
	Span 20	21.5 ± 0.15 *	29.1 ± 0.89 **	24.1 ± 0.31 *
0.98	Tween 80	20.9 ± 0.16 *	22.13 ± 1.32	20.5 ± 0.64 **
	Span 20	18.7 ± 1.32 *	** 20.9 ± 1.51*	19.3 ± 0.86 **
0.75	Tween 80	26.5 ± 0.56 *	24.1 ± 0.71 **	22.9 ± 1.32 **
	Span 20	23.1 ± 0.72 *	22.9 ± 0.81 **	21.0 ± 0.96 **
0.55	Tween 80	28.5 ± 0.15 *	26.5 ± 1.21 **	20.2 ± 1.63 **
	Span 20	26.1 ± 1.38 *	17.5 ± 1.65 **	17.5 ± 0.91 **
Control	Tween 80	20.1 ± 0.96 *	20.15 ± 0.71	20.2 ± 1.32 **
	Span 20	18.7 ± 0.72 *	** 19.2 ± 1.36	19.1 ± 1.86 **

\* Significant.

\*\* Highly significant.

\*\*\* Very highly significant.

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Table (6): Fat body Lipid content of 48 hrs-old-adult stage of Musca domestica topically treated with different doses of BAY SIR 8514, SIR 8514 and IKI synergised with 2% Tween 80 and Span 20.

Table (6-a): Treatments were carried out with IGRs.

Dose µg/adult	Fat body lipid content (mg/g Fat B.)		
	BAY SIR 8514	SIR 8514	IKI
1.15	176.65 ± 0.53 *	141.79 ± 1.36 *	170.65 ± 1.35 *
0.98	168.06 ± 1.36 *	127.1 ± 0.56 *	149.06 ± 0.19 **
0.75	91.13 ± 0.15 **	92.9 ± 1.36 *	3335.1 ± 1.63 *
0.55	112.5 ± 1.36 **	120.4 ± 0.52 *	380.1 ± 0.72 *
Control	62.11 ± 0.18 *	62.7 ± 1.37 *	63.0 ± 1.36 *

Table (6-b): IGRs plus surfactants at concentration of 2%.

Dose µg/adult	Surfactant used	Fat body lipid content (mg/g Fat B.)		
		BAY SIR 8514	SIR 8514	IKI
1.15	Tween 80	150.2 ± 0.12 **	136.5 ± 1.5 *	160.5 ± 0.72 *
	Span 20	146.7 ± 0.12 **	122.3 ± 0.45 *	154.3 ± 1.32 *
0.98	Tween 80	142.9 ± 1.32 **	111.6 ± 0.2 *	131.5 ± 0.71 *
	Span 20	138.5 ± 0.69 **	106.3 ± 0.5 *	116.7 ± 1.36 *
0.75	Tween 80	77.2 ± 1.32 **	78.5 ± 1.36 *	301.0 ± 0.96 *
	Span 20	68.5 ± 0.92 **	72.4 ± 1.5 *	297.5 ± 1.32 *
0.55	Tween 80	106.4 ± 1.52 **	101.7 ± 0.87 *	365.3 ± 0.92 *
	Span 20	101.2 ± 0.91 **	99.2 ± 0.86 *	311.4 ± 0.83 *
Control	Tween 80	62.1 ± 0.13 **	62.7 ± 0.53 *	63.4 ± 1.32 *
	Span 20	57.8 ± 1.23 **	56.1 ± 1.4 &	61.5 ± 0.92 *

\* Significant.

\*\* Highly significant.

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**تأثير ثلاثة من منظمات النمو الحشرية المنشطة بالمواد ذات النشاط  
السطحي على بعض المظاهر البيوكيميائية للطور اليافع للذبابة  
المنزلية موسكا دومستكا**

فاتن فريد أبو الذهب

قسم علم الحشرات - كلية العلوم - فرع بنها - جامعة الزقازيق

لوحظ أن معاملة الطور اليافع للذبابة المنزلية موسكا دومستكا  
بالأنواع الثلاثة من منظمات النمو IKI, BAY SIR8514, SIR8514  
بالجرعات ٠,٠٥, ٠,٧٥, ٠,٩٨, ١,١٥ adult/ $\mu$ g له تأثير على بعض  
المظاهر البيوكيميائية. كما أن إضافة المواد ذات النشاط السطحي  
Tween 80 and Span 20 يزيد من فعالية منظمات النمو في تأثيرها على  
المظاهر البيوكيميائية قيد الدراسة.