

## EFFECT OF HEXAFLUMURON ON SOME BIOLOGICAL ASPECTS OF THE PREDATOR MITE *EUSEIUS HUTU* (PRITCHARD & BAKER)

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### **Abstract**

This study was conducted to evaluate the toxicological effect of LC<sub>50</sub> Hexaflumuron 10% EC on eggs of the predator mite, *Euseius hutu* (Pritchard & Baker) when fed on the *Tetranychus urticae* Koch as a prey under laboratory conditions at 25 ±1 °C and 65-70% R.H. Also, biological effect on different developmental stages of this predator emergence from treated eggs was recorded. Data proved a prolongation in the duration of different predator stages and fecundity, the larvae, protonymph and deutonymph stages lasted 3.76, 5.13 and 3.11 days/ female/ F1, and 4.1, 3.7 and 4.2 days/ female / F2, respectively, compared to 1.25, 1.49 & 2.73 days in control, while males averaged 2.23, 3.83 & 3.93 days in F1 and 3.23, 3 & 3 days in F2 compared to 1.55, 1.48 and 3.23 days, in control. The longevity of predaceous mite under experimental conditions was found 36.5 & 10.39/days for female & male in F1 and 44.5 & 8.6 days in F2, respectively compared to 31.0 & 6.58 days in control. On the other hand, food consumption of immature stages of *E. hutu* predator for two generation F1 & F2 averaged 9.5 & 9.13 prey/ ♀ and 7.9 & 8.2/prey ♂, respectively, compared to 15.1 & 10.02 prey/, in control.

### **INTRODUCTION**

The phytophagous mite (*Tetranychus urticae*) has a worldwide distribution and infest over 150 agricultural crops including major food, fiber crops and ornamentals (Bolland *et al.*, 1998). Recently, it has described as a cause of occupational allergic disease (Delgado *et al.*, 1997)

Acaricides has been applied to control the two spotted spider mite (Dekeyser and Downer, 1994 and Nauen, *et al.*, 2001).), however the extensive use of chemical pesticides in pest control resulted in some problems such as pollution, increasing the pests' resistance and destroying predators. Therefore, a new approach is to use substances that affect pest growth and development, these substances are insect growth regulators (IGRs) which receiving more practical attention to provide safer foods and cleaner environment (El-Barkey, 2009). These substances were found effective against insect pests and mites infesting field crops but it might affect beneficial species (Goktay and Kismali 1990). The predaceous mites are considered one of the most important natural beneficial species of several phytophagous mites

and other pests on various crops where, *Euseius hutu* has found commercially available in the world as a control agent for different pests on different crops.

Therefore, this research was conducted to examine the effect of Hexaflumuron (IGRs) compound on some biological aspects of the predator mite *Euseius hutu* to understand its role, as a natural enemy of insect pests in cotton fields.

## MATERIALS AND METHODS

### Laboratory experiment:

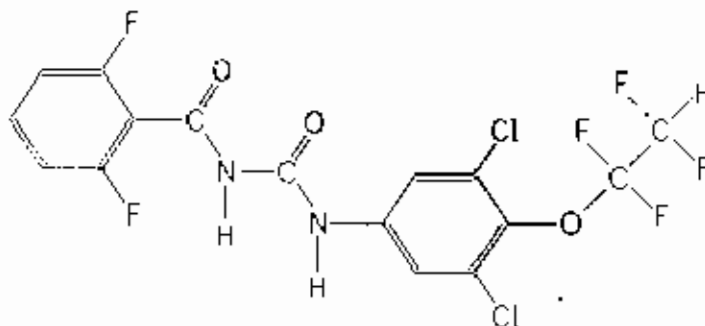
#### Insecticide used:

#### Trade name: Consult

Hexaflumuron 10 % (benzoylphenylurea chitin synthesis inhibitors)

1-[3, 5-dichloro-4-(1, 1, 2, 2-tetrafluoroethoxy) phenyl]-3-(2, 6-difluorobenzoyl) urea

**FORMULA:**  $C_{16}H_8Cl_2F_6N_2O_3$



Hexaflumuron was diluted with water in a series of concentrations (6.25, 3.12, 1.56, 0.78, 0.375 and 0.187 ppm).

#### Rearing the prey:

For establishing a colony of the two spotted spider mite *T. urticae* in the laboratory, the technique of Guinguis *et al.* (1977) was employed. The stock culture of the mite was collected from castor bean leaves infested with the mite. The colony was reared in the laboratory of Plant Protection Research Institute, under laboratory condition of  $25 \pm 1^\circ\text{C}$  and  $65 \pm 5\%$  R.H.

The females of *T. urticae* which used as a prey, transferred by a fine brush to surfaces of castor bean leaves. each leaf was placed on moisten cotton wool in Petri dish lined with water.

#### Rearing the predator

For establish a colony of the predator mite *Euseius hutu* in the laboratory, the original samples of the predator mite was collected from castor bean leaves. The colony was reared in the laboratory of Plant Protection Research Institute, Agricultural

Research Center, and Giza, Egypt. Adult females of the predator *E. hutu* mite were transferred by a fine brush to upper surfaces of castor been leaves. The leaf was placed on water saturated cotton wool in Petri dish. The females were allowed to lay eggs for 2-3 hours and then removed. Obtained eggs were used to treat by IGR compound.

#### **Latent effect of Hexaflumuron 10% LC50 on the biological parameters of *E. hutu***

To determine the LC<sub>50</sub> of Hexaflumuron on egg and the subsequent progeny of *E. hutu*, aqueous dilutions were freshly prepared and checked in pilot experiment. The eggs were sprayed by the prepared concentrations (3.12, 1.56, 1.01, 0.78, 0.375, 0.187 & 0.093 ppm), then held in open air for 1-2 hours to allow drying. Three replicates were tested/ concentration, each replicate contains 30 eggs. In addition, three replicates were sprayed by water and used as control. The treated and the untreated were kept at the same controlled conditions of rearing. The percentage of hatchability/ concentration were estimated, and the LC50 was calculated using proban software.

#### **Rearing the predator mites treated by LC<sub>50</sub> of Hexaflumuron (1.01ppm)**

Sixty individuals mite predator were reared from eggs to maturity on *T. urticae* as a prey. Sixty newly emerged mites were placed individually and transferred by a fine brush on surfaces of castor been leaves. Each leaf was placed in Petri dish lined with water saturated cotton wool. Sufficient numbers of the two spotted spider mite *T. urticae* were offered daily until the end of larvae, protonymph and deutonymph stages, after that, these adult females and males were sexed and offered daily with the prey. The number of *T. urticae* were recorded daily. Also, the numbers of deposited eggs and the hatchability percentage were counted as well as pre oviposition, oviposition, post oviposition, longevity and food consumptions of females and male were estimated.

**RESULTS AND DISCUSSION**

This Study was conducted to evaluate biological effects of LC<sub>50</sub> Hexaflumuron 10% EC on different developmental stages of the predator mite, *Euseius hutu* (Pritchard & Baker) emerged from treated eggs when fed on the *Tetranychus urticae* Koch as a Prey under laboratory conditions at 25 ±1 °C and 65-70% R.H.

**Incubation period**

Data presented in Table (1) revealed that the incubation period lasted 3.18 & 3.1 days/ female and 3&2.9 days/ male when the predator resulted from eggs treated and reared two generation F1 and F2, respectively, compared with 3.1 &3 days for untreated male and female, respectively.

Table 1. Development of immature stages of *Euseius hutu* mite result from treated eggs and reared for two generation on *T. urticae* at 25±1°C and 65-70 % R.H.

Stages		Duration days ± S.E.			LSD
		F1	F2	Control	
Female	Incubation period	3.18±0.1	3.10±0.1	3.19±0.33	0.761
	Larvae	3.76±0.12a	4.10±0.4a	1.25±0.04a	1.021
	Protonymph	5.13±0.34	3.70±0.3	1.49±0.19	0.603
	Deutonymph	3.11±0.48	4.20±0.3	2.73±0.15	0.520
	Total developmental period	15.18±1.2b	15.10±0.49b	8.66±0.9a	2.531
Male	Incubation period	3.03±0.05	2.9±0.17	3.0±0.0	
	Larvae	2.23±0.1	3.23±0.3	1.55±0.13	0.964
	Protonymph	3.83±0.8b	3.0±0.3b	1.48±0.15a	0.342
	Deutonymph	3.93±0.2	3.0±0.2	3.23±0.11	0.51
	Total developmental period	13.02±1.44	12.13±0.2	9.26±0.92	2.012

**Larval stage**

It was observed that the average duration of the female and male larval stage resulted from treated eggs (F1) prolonged to 3.76 &2.23 days, while when the larvae

completed to 2<sup>nd</sup> generation it lasted 4.18 & 3.23 days compared to 1.25 & 1.55 days, respectively, in control.

#### **Protonymph:**

Data in Table (1) indicated that the duration of females and males protonymphal stage of *E. hutu* predator prolonged to 5.13 & 3.83 days in F1 and 3.7 & 3 days in F2 compared to 1.49 & 1.48 days/ females and males, respectively, in control.

#### **Deutonymphal stage:**

Results in Table (1) recorded that the deutonymphal stage of *E. hutu* predator resulted from treated eggs (F1) 3.11 & 3.93 days/ female and male, while it lasted 4.2 & 3 days / female and male in F2 compared to 2.73 & 3.23 / female and male, respectively, in control.

#### **Developmental time of spider ling stage:**

The observed results documented that the duration of all developmental stages of the predatory mite, *E. hutu* was affected significantly by LC<sub>50</sub> concentrations, as it prolonged during the first and second generation when compared to control (Table 1).

#### **Oviposition period and fecundity**

Data in Table (2) showed that the pre-oviposition, oviposition and post oviposition periods of mite resulted from eggs treated with LC<sub>50</sub> of Hexaflumuron (1.01ppm) and reared for two generation F1 and F2 averaged 11.1, 21.0 & 5.5 days in F1, while, in 2<sup>nd</sup> generation this period were found 28.3, 14.5 & 2.5 days, compared to untreated which recorded 5.6, 18.3 & 6.5 days, respectively.

Table 2. Effect of Hexaflumuron on longevity and fecundity of the mite at 25±1°C and 65-70 % R.H

	Ovipositional period			Fecundity		Longevity	
	Pre-oviposition	oviposition	Post-oviposition	Mean no. of eggs/♀	% hatchability	♀	♂
F1	11.0±0.5	21.0±0.6	5.5±0.29	12.6±3.7	48	36.5±1.28	10.39±0.33
F2	28.3±10.02	14.5±4.4	2.5±1.4	10.3±3.2	20	44.5±7.4	8.64.13±0.81
Control	5.68±0.1	18.3±0.17	6.5±0.14	30.3±2.1	97	31.0±0.48	6.58±0.6

**Number of deposited eggs/female:**

Data in Table (2) revealed that the average number of deposited eggs by the females of *E. hutu* mite predator resulted from treated eggs and fed on *T. urticae* at 25°C and 60-70 % RH. was 12.6 eggs in F1 and 10.3 eggs in F2 compared to 30.3 eggs/ female in control

**Female and male longevity:**

The longevity of predaceous mite under experimental conditions was found 36.5 & 10.39/days female & male in F1 and 44.5&8.6 days in F2 compared to 31.0&6.58 days in control (Table, 2).

Food consumption of the *E.hutu* mite predator resulted from treated eggs when fed on the two spotted spider mite species *T. urticae* at 25 °C and 60-70 % R.H.

Data in Table (3) demonstrated that the total immature stages of *E. hutu* resulted from treated eggs and reared for two generation consumed an average 9.5 & 9.13 prey/ and 7.9 & 8.2/ for F1 &F2 , respectively, compared to 15.1 &10.02 prey/daily, in control.

Table 3. Food consumption of *Euseius hutu* mite result from treated eggs and reared for two generation on *T. urticae* at 25±1°C and 65-70 % R.H.

Stages		Consumption/ day ±S.E.			LSD
		F1	F2	Control	
Female	Larvae	0.74 ± 0.05.	0.66 ± 0.2.	1.2 ± 0.1.	0.013
	Protonymph	4.1 ± 0.7b	3.77 ± 0.3.b	6.6 ± 1.05a	2.036
	Deutonymph	4.7 ± 0.8.b	5.1 ± 0.1b	7.3 ± 0.3a	1.171
	Total immature stage	9.54 ± 0.52b	9.13 ± 0.3b	15.1 ± 1.4a	4.351
Male	Larvae	0.5 ± 0.1a	0.61 ± 0.2a	0.7 ± 0.1a	0.547
	Protonymph	3.6 ± 0.7b	3.06 ± 0.6b	4.16 ± 0.3a	0.358
	Deutonymph	3.8 ± 0.2b	4.57 ± 0.32b	5.16 ± 0.2a	1.267
	Total immature stage	7.9 ± 0.6a	8.24 ± 0.8b.	10.02 ± 0.5b	1.698

From the above results, it could be demonstrated that LC<sub>50</sub> concentration of Hexafluomeron affected significantly the duration of all developmental stages of the predatory mite, *E. hutu*, as they prolonged during the first and second generation in compared to control. Similarly, several authors obtained the same data using different IGRs against many pests Ismail, (1980), Sokar (1995) Shaurub *et al.*, (1999), Abdel-Aal, (2003) and Yin *et al.* (2008) reported that prolonged in the immature stage and the survival rate.

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دراسة تأثير مادة الهكسافلومبرون على بعض الظواهر البيولوجية المفترس  
*Euseius hutu* (Pritchard & Baker)

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معهد بحوث وقاية النباتات - مركز البحوث الزراعية - الدقي - الجيزة - مصر

تم دراسة تأثير مادة الهكسافلومبرون ( أحد منظّمات النمو الحشرية ) على النواحي البيولوجية للمفترس الأكاروسى *Euseius hutu* عند تغذية على بيض العنكبوت الأحمر عند درجة حرارة  $25 \pm 1$  م و رطوبة نسبية 65-70 % هذا وقد أظهرت النتائج حدوث اطالعة في عمر الأطوار المختلفة للمفترس وزيادة في نسب وضع البيض. فقد سجلت فترة عمر الأطوار الغير كاملة, البيض, اليرقة و الحورية لهذا المفترس 3.18 و 3.76 & 5.13 يوم/ لأنثى الجيل الأول و 3.1 و 4.1 & 3.7 يوم/ لأنثى الجيل الثانى على التوالي . مقارنة بالكنترول 3.19 و 1.25 & 1.4 يوم/ لأنثى. هذا سجلت فترة العمر الغير كاملة لذكر المفترس 3.03 و 2.23 & 3.83 يوم لجيل الأول و 2.9 و 3.23 & 3.0 يوم لجيل الثانى على التوالي . مقارنة بالكنترول 3 و 1.55 & 1.48 وعلى الصعيد الآخر سجلت الفترة على التغذية لأطوار الغير كاملة المفترس و 9.5 و 9.13 فريسة/ لأنثى لجيل الأول و الثانى على التوالي 7.9 و 8.2 فريسة لذكر الجيل الأول و الثانى على التوالي .