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EVALUATION OF THE EFFICACY OF THE INSECT GROWTH REGULATOR MATCH IN CONTROLLING THE HAIRY GRAIN BEETLE (KHABRA) *TRAGODERMA GRANARIUM* EVERTS (COLEOPTERA; DERMESTIDAE) IN VITRO

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Abstract: *This study was conducted at the AL- Musayyib Technical College / Department of Biological-Control Techniques for the period from 2021-2022. The present investigation has the aim of testing the influences of the insect growth regulator Match on some aspects of life performance of T.granarium in vitro.This research was carried out to investigate the effects of the Match Insect Growth Regulator at concentrations of 0.25, 0.50, and 0.75 ml/L Lon the larvae of the second and fourth instars and adults of the hairy grain beetle (Khabra) T. granarium. It was found that the use of 0.75 ml/ L of Match Insect Growth Regulator had a significant effect in killing the second and fourth larval instars and adultus with mortality rates of (100.0, 93.3 , 86.7) respectively after 7days of treatment .*

Keywords: hairy grain beetle , *Tragoderma granarium*, Match .

1. INTRODUCTION

Cereals and their products are exposed to various damages in the field and storage facilities as a result of being infected with many different pests, The incidence of infection with these pests is estimated at 30-25% of the world's annual production of field crops, whether inside the field or at storge [2] The wheat species *Triticum aestivum* L. is among these crops as it constitutes one-third of the world's grain production, The importance of wheat lies in its nutritional value . being the main source of carbohydrates, including starch. One of the problems facing the cultivation of different crops in developing countries is the losses that occur after the harvest and during the storage period , These crops are exposed to damage as a result of infections with various warehouse pests [9]. One of the most serious difficulties facing the process of maintaining the quality of grains and their products during storage is the storehouse insects. The most important store pests that attack these grains is the hairy grain beetle (Khabra) *T.granarium* Everts, which is one of the most dangerous and pesticide,resistant insects [10]. It attacks the stored grains and their products, which suffer from remarkable damages due to their usage as a food by the larvae. The infection is usually determined by the presence of the pest, whether adults or larvae, as well as the presence of molting skins[7] . all these problems prompted the farmers to use pesticides as the fastest

means to eliminate the pests, However the misuse of pesticides, both in terms of high concentration and frequency, causes the contamination and accumulation of their residues in human food and the environment, The development of resistance to pesticides by these insects is additional problems [3]. All of these reasons urged researchers to find alternatives to chemical pesticides, that are safe, environmentally friendly, and have equal efficacy. Among these alternatives is the use Insect growth regulators or so-called third-generation pesticides were used, as they are characterized by their high specialization because they have a promising effect on adult insects, larvae or eggs, where it was found that the match growth regulator has an effect on the growth and development of the large beetle *Bruchus rufimanus* [11] The present investigation has the aim of testing the influences of the insect growth regulator Match on some aspects of life performance of *T.granarium* in vitro.

2. MATERIALS AND METHODS

2.1. Collection and breeding of T. granarium .

The hairy grain beetle (Khabra) *T. ganarium* was obtained from the laboratories of the Ministry of Science and Technology Healthy grains of wheat were cleaned of impurities and placed in the freezer for(72) hours at (-20) Celsius to ensure that they are internally free from infection with any other insect. Ten adult pairs of males and female beetles were placed on (1 kg) of healthy wheat grains, in(100)ml plastic bottles with a diameter of 10 cm. The opening of the bottle was covered with a piece of muslin fabric and sealed with a rubber band to prevent the escape of the adults. The replenishment of the culture was ensured from time to time **.**

2.2. Preparing the concentrations of the insect growth regulator match

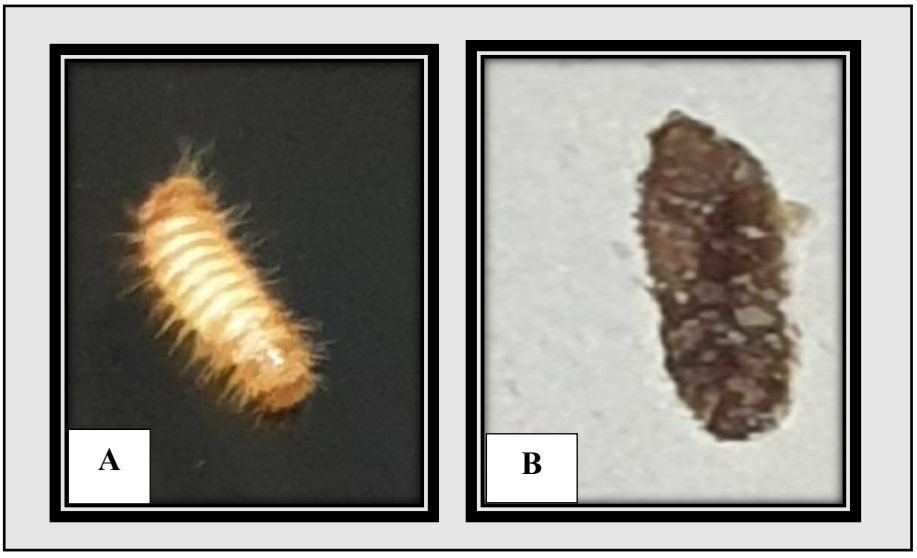
The growth regulator match was obtained from the market and the company producing it Syngenta. The concentration recommended by the company is 0.5 per liter of water. The recommended concentration, lower concentration and higher concentration were taken for the purpose of testing its effect on *T. granarium* Three concentrations of the insect growth regulator were prepared. To conduct the experiment, it is (0.25, 0.50, 0.75) ml / L . As for the comparison treatment, it contained only water .

2.3. Effects of insect growth regulator match the mortality rate of the second and fourth larval instars of T. granarium .

Twenty larvae from the second and fourth instars were used to study the effects of the three concentrations of the extract tested, in addition to the control treatment. For each treatment,(5) larvae were placed in a petri dish and sprayed with the insect growth regulator at concentrations of (0.25, 0.50, and 0.75 ml/L) by utilizing a hand sprayer. To ensure complete coverage, the spraying was conducted

from a distance of(5 cm) After spraying, food was provided for the larvae, which is a mixture of previously-prepared wheat powder and yeast. The dishes were incubated at a temperature of 30 (± 2 °C). The control treatment comprised 5 ml of ethyl alcohol which was completed to (100 ml) with distilled water. The mortality rate was calculated after periods of (1, 3, 5, and 7 days).

Picture (1) shows the growth regulator match



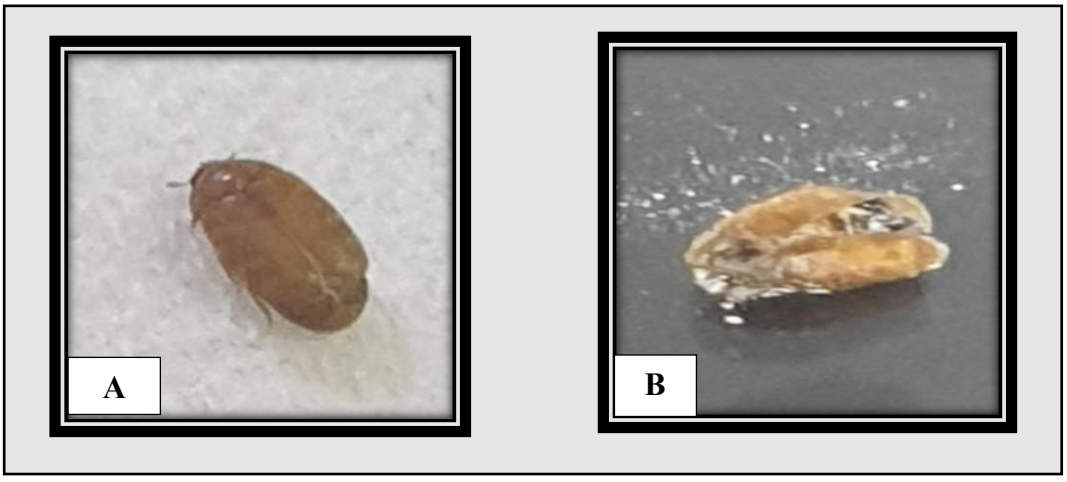
Picture (2) shows the effect of the growth regulator match on the second larval instar of the hairy beetle *T.granarium.* (A) Before treatment : (B) After treatment

2.4. Effect of Match Insect Growth Regulator on the Percentage of Destruction of Adults of T. granarium .

Twenty adult insects, males and females, were taken for each concentration, with three replicates, with the comparison treatment for each concentration. The food for the adults is a mixture of wheat powder and yeast prepared previously. The dishes were incubated in the incubator at a temperature of 30 ± 2 °C. The control treatment was 5 ethyl alcohol and was completed to 100 ml of water. The mortality rate was calculated after (7, 5, 3 1) days of treatment.

2.5. Statistical analysis

The laboratory experiment was carried out according to the Complete Randomizd Design (C.R.D), based on the factorial experiments. The Least Significant Difference (LSD) test was used under the probability level of 0.05 to test the significance of the differences. The mortality rate was corrected according to Abbott's equation [1].



Picture (3) shows the effect of the growth regulator on the death of adults of the hairy grain beetle *T.granarium* (A) Before treatment : (B) After treatment

3. RESULTS AND DISCUSSION

3.1 The effect of the growth regulator match on the percentage of mortality rate of the second and fourth larval instars and adults of the T.granarium beetle.

3.1.1 Effects of insect growth regulator match on the second and fourth instar larvae of T. granarium .

The results of Table (1) show the effect of the interaction between the rate of larval instars and the

concentrations of the growth regulator match and the time period on the percentage of mortality rate of adults of the hairy grain beetle (Khabra) *T. granarium*. shows the superiority of insect growth regulator match at the concentration of 0 ,75ml/L which exerted the highest mortality rate of 83.3% for the second larval stage, whereas the lowest was 61.7% at the 0,25ml/L. As for the fourth larval stage, the highest mortality rate was 0.75% at the concentration of 0,75 ml/L whereas the lowest was 56.7% at 0,25ml/L. It is noticed that the longer the time period after the treatment with the insect growth regulator, the higher the mortality rate, which reached values of (31.7, 50.8, 60.0, and 65.8) after (1, 3, 5, and 7) days, respectively. It was also noticed that the higher the concentration, the higher the mortality rate, which reached 61.7 %, 75.0.7%, and 83.3% at concentrations of (0.25 , 0.50, 0.75)ml/L, respectively, for the second larval instar. For the fourth instar, the values of mortality rate reached(56.7, 65.0, 75.0)% at concentrations of ,(0.25, ,0.50, 0.75)ml/L, As for the effect of a type factor for the larval instar, the second instar was more sensitive than the fourth, with a mortality rate of (55.0 and 47.5)% for the second and fourth larval instars, respectively. respectively. As for the concentration/period interaction treatment, the highest mortality rate for the second larval instar (100.0%) was recorded at the concentration of 0.75ml/L, showing highly significant differences with the remainder of the treatments, where the lowest was 80.0% at the concentration of 0.25ml/L concentration. As for the fourth larval instar, the highest mortality rate was 93.3% at 0.75ml/L concentration and the lowest was 73.3% at 0.25ml/L concentration. However, the control group did not exert mortality.

Table 1: Effects of insect growth regulator match on the second and fourth instar larvae of *T. granarium* .

Larval instar	Period (days) / Conc ML/L	1	3	5	7	Mean mortality rate for concentrations	Larval stage rate
Second larval instar	0	0.0	0.0	0.0	0.0	0.0	55.0
	0.25	33.3	60.0	73.3	80.0	61.7	
	0.50	46.7	73.3	86.7	93.3	75.0	
	0.75	53.3	86.7	93.3	100.0	83.3	
Fourth	0	0.0	0.0	0.0	0.0	0.0	

larval instar	**0.25**	**33.3**	**53.3**	**66.7**	**73.3**	**56.7**	**47.5**
	0.50	**40.0**	**60.0**	**73.3**	**86.7**	**65.0**	
	0.75	**46.7**	**73.3**	**86.7**	**93.3**	**75.0**	
Mean mortality rate for period		**31.7**	**50.8**	**60.0**	**65.8**		
L.S.D (0.05) Infiuence of the larval type factor					**3.65**		
LSD (0.05) for concentration					**4.12**		
LSD (0.05) for period					**4.12**		
LSD (0.05) for conc./period interaction					**10.85**		

3.1.2 Effects of insect growth regulator match on Adult of T. granarium

The results of Table (2) showed the superiority of the growth regulator match at a concentration of 0.75 ml / liter, where the highest percentage of adult mortality was 65.0% and the lowest was 46.7% at concentration 0.25 ml / liter. It reached 60.0, 46.7, 36.7, 23.3%) after 7, 5, 3, (1) days in a row, and it is also noted that the higher the concentration, the higher the death rate, reaching 65.0, 55.0, 46.7 percent (concentration) 0.75, 0.50, 0.25 (ml / liter, respectively. As for the interaction, it was the highest percentage of the adult mortality rate at the concentration of 0.75 ml / L, which reached 86.7% after 7 days, with significant differences from the remaining treatments. As for the comparison treatment, there was no death rate .

Table 2: Effects of insect growth regulator match on Adult of *T. granarium* .

Time period Day / Con Ml/L	**1**	**3**	**5**	**7**	**Mean mortality rate for concentrations**
0	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**
0.25	**20.0**	**40.0**	**53.3**	**73.3**	**46.7**
0.50	**33.3**	**46.7**	**60.0**	**80.0**	**55.0**
0.75	**40.0**	**60.0**	**73.3**	**86.7**	**65.0**

Mean mortality rate for period	**23.3**	**36.7**	**46.7**	**60.0**
LSD (0.05) for concentration				**3.23**
LSD (0.05) for period				**3.23**
LSD (0.05) for conc./period interaction				**6.35**

The cause of the death is due to the effect of the growth regulator, which affects the process of kioticle formation, which leads to a defect and inhibits the molting process of larvae from one instar to another[6] It also affects the process of synthesis of chitin in the membrane around the middle alimentary canal among us, leading to a defect in its functions, including the larval stop About feeding hours after treatment and it remains alive for hours. and thus the insect dies after 2-4 days of starvation [5] This study agrees with what was reached. In his study, the effect of the growth regulator match on the adults of the southern cowpea beetle

[4]The mortality rate after 7 days of treatment was (100.0, 93.3, 86.67) with concentrations (0.7, 0.5, 0.3)ml/L, respectively.[8] studied the growth regulator Admiral and its effect on the larval stages of the insect Rhyzopertha dominica, where the mortality rate for the first larval stage was (93.33, 73.33, 73.33)% at concentrations (6, 4, 2) ppm, respectively.

4. CONCLUSIONS

The growth regulator Match had an effective effect on the second and fourth larval instars and adult of the where there was a direct proportion between the concentrations and rates of killing. *T. granarium*

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