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USES OF DIFFERENT TEMPERATURES TO CONTROL INSECT *Tribolium castaneum* (Herbest) AND WHAT IS THE PREFERRED OWN FOOD IN THE GRAIN STORES

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Abstract

The paper aimed to achieve a laboratory experiment in order to study the type of food favorite by the insect Tribolium castaneum (Herbest), a rusted flour beetle, and the impact of different temperatures at various stages of its life in a university laboratory in Baghdad. The study showed that the favorite food of the rusted flour beetle is flour or grain dust as well as rice, barley, millet and cowpea, but it does not prefer the lentils. This beetle feed is based on grain which has been already hit by one of the primary insects or grain or break the material and fine grains dust while unable the hatched larvae of some insects such as grain beetle (ryzaephilus surinamensis) and beetle (Trogoderma granarium) to produce grain injury. But the older larvae can and start feeding the fetus. The correlation between the degree of the outside air temperature and the degree of grain mass temperature is weak. If the air temperature is at the freezing point, the heat from the interior of grains does not reach such a degree. The optimum temperature for most of stored grain pests ranges between 25-30 C°. Below 20° C, the activity of the insect becomes weak, resulting the decline in egg-laying rate and prolongation of spawns, and the length of the larval stage, and the process of the Virgin, and the duration of generation and thus the lack of the number of generations, and the lowering of the numerical density. Exposed at 5C° for a longer period of time, most of the pests of stores die. At 35C°, the multiplication of many pests of the stores, the shortage of the egg laying, and the life of the insects are affected. But, the beetle (Trogoderma granarium) can live at higher temperatures than the one mentioned above. As a conclusion, it is preferably that grain products to be sterilized at a temperature of 60 C° for 10 minutes to kill all life stages of insects.

***Key words*:** rusted flour beetle herbest, *Tribolium castaneum, Iraq*

INTRODUCTION

Cereal is the main food for humans as wheat, barley, maize and used as a meal by mixing concentrated with some legumes, grain or other feed for animals. The area planted with grain in the world is estimated at about half of the arable land. Cereals are a source of food for humans and animals, due to their chemical composition: 70% carbohydrates and 15% fat, 0.3% fiber & minerals, and this increases the importance of grains in poor countries where cereals are considered a source of cheap calories compared to other sources [3].

Grains and materials stored could be attached during their storage by various insects that cause severe damage[2]. About 20% of crops are destroyed by pests in the post-harvest period and this percentage reaches 80 % sometimes in the Third World as reported [6]. But this percentage of the damage could reach about 40% in the countries that apply the modern techniques in storage.

The disease, insects and the jungles are the main determinants and the biggest challenge for humans who have made unremitting efforts to solve this problem in the pan-Arab nations, in the world and in Iraq, in particular. The Studies of the Arab Organization for Agricultural Development showed that the losses resulting from the injury produced by agricultural pests are around 35-50% of total production and 10-14% of injury caused by lesions stores [1].

In general, the stored food crops in general, cereals and pulses which are particularly of a great significance it is recommended as all States to maintain a strategic stock enough for several months in anticipation of the lack of adequate supplies of the annual production of

food crops due to natural disasters. The material stored exposed to damage from many insects and rodents, microorganisms, fungi, and thus they lose the luster and appearance and seem bleak and spoiled and lose their nutritional value [5].

The insects are among the most important pests of crops and materials stored around the world. They cause great quantitative and qualitative losses,and the UN Food and Agriculture Organization estimated that in 1967 global losses accounting for 10% of the stored grains, which are equivalent to 13 million tons per year in Africa. The FAO estimated the same losses in yellow corn cro and legumes as a result of injury accounting for about 20-50%.

And that the damage arising from the insects in grain is the result of the direct feeding of insects on the endosperm and embryos grain not to mention the pollution caused by their droppings and skins flayed and in addition to the increasing exposure of grain to rot because of scratches and damage and thus unpleasant odors and the rot could infect the grain delivered which can not be accepted by human and animal [3].

Tribolium castaneum (Herbest) is one of the most important insects that affect stored grain [10]. It was found in crushed infected wheat (flour), dates and dried fruits as raisins [3].

The use of chemical control of pests and insects in stores is one of the treatment methods but it causes a lot of health problems and, in addition, over time it leads to the emergence of resistant strains to these pesticides [11]. In addition, a big problem is the deposition of these pesticides in nature and the contamination of food for humans and animals [8]. Because of the losses caused by pests, regarding stored materials and crops, many studies have been expanded on pests that infect crop and food after storage to find alternative methods and means for the use of chemicals to curb the activity and the spread of insects and to reduce the damage caused by it.So recent studies have focused on this area to study the effect of some non-living environmental factors which significantly and directly affect the activity and vitality of insects regarding the temperature in stores [3].

The difficulty of the fight against these insects in their presence with food and the use of pesticides leads to the contamination of those materials pesticides hence it was necessary to search for alternatives to chemical pesticides such as the use of pesticides of plant origin to the lack of residual effects and lack of toxicity to mammals since been expanded for use in various forms such as powders and plant extracts as material proof feed or toxic or inhibitory growth or attractive or repulsive materials.

In this paper it was studied the effect of the temperature and the duration of exposure on the proportion of the loss in the beetle flour, as well as the favorite type of food of this insect[7],[9],[12]. In this purpose, Rues extracts to resistance flour beetle were used. [4].

MATERIALS AND METHODS

In this study, the following methods were used:

(i)Methods of sample collection: The collection of samples from infected stores with flour beetle.

(ii)The food sample preparation: The sample (500 g) of favorite flour as a medium diet of insects and kept in a refrigerator for 48 hours for the purpose of getting rid of morbidity or pesticides, if any. The sample was distributed in two packs per 1 kg capacity.

(iii)The aim was to study the effect of different temperatures on the loss ratios adults and larvae of insect flour beetle *Tribolium castaneum* (Herbest).

Six transactions were selected for the adult insect larvae at a rate of three replicates per treatment and each repeater which put five adults and five larvae of the Insect. Then, it was put in the Petri dishes, containing 20 g of flour and then covered with a thin cloth and tied a rubber bond allow for ventilation and does not allow for the exit of insects from the dish.

Then the container with dishes and insects is treated to various degrees of heat (35, 40, 45, 50, 55, and 60) C° during two different periods (1-2 hours) in order to know the

number of perdition and then to calculate the perdition ratio as in the following equation:
Perdition ratio % = (number of dead insects/total number of insects) x100.

RESULTS AND DISCUSSIONS

Study on the effect of different temperatures on the proportions of adults and larvae perdition of flour beetle *Tribolium castaneum* (Herbest).

Table 1 shows the results of laboratory regrading the study of the effect of different temperatures (45, 50, 55, 60). The destruction of adults and larvae of the beetle *Tribolium castaneum* after one hour was zero for all temperatures, but after two hours the time of the ratio (zero, 46, 73,100) %, respectively, and it gave the highest proportion in the degree of 60 C°. This is consistent with what was found by [2]. We can conclude from the results of Table that: (1) The rates of murder in the insect was increased as the exposure to temperature increased, the temperature of 45 C ° had the best impact on the insect, while the degree of (40,45)° C temperature failed at different periods of exposure.

Table 1. Number and percentage of losses in adults and larvae of flour beetle (*Tribolium castaneum)* during 1-2 hours of various levels of temperatures

Temperature	Number of losses in adults during 2 hours	% of losses in adults during 2 hours	Number of losses in Larvae during 2 hours	% of losses in Larvae during of 2 hours
T1= 45°C	Zero	Zero	Zero	Zero
T2= 50°C	2.33	46	2	40
T3= 55°C	3.66	73	4	80
T4= 60°C	5	100	5	100
L.s.d.	1.373		1.667	

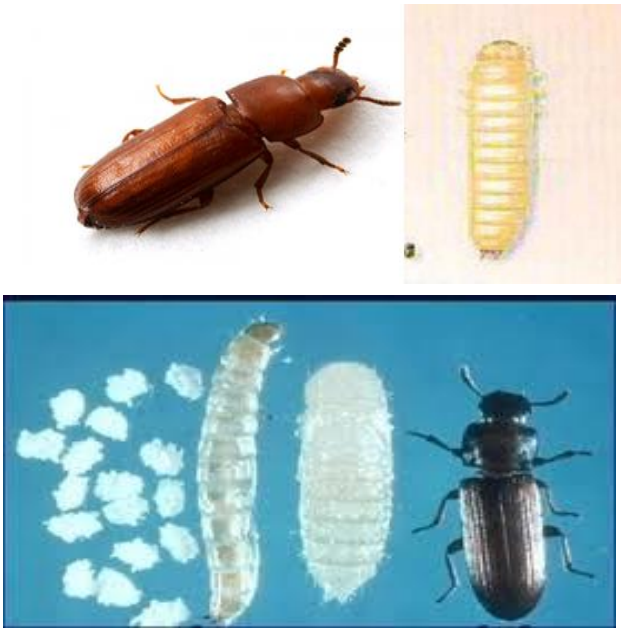
The difference of sensitivity probably goes back to the outer wall of the installation and the extent of its ability to thermal insulation and death body at high temperature. The release of protoplast also explain the high rates of killings of the insect: the mechanical opening of the respiratory stomata of the insect due to lack of oxygen, leading to increased speed of water loss from the body due to the temperature and for the lack of balance of the gas inside the body of the insect tissues followed by the rapid breathing, causing high exchange energy ATP.

Study on food preference of the adults of flour beetle *Tribolium castaneum*

Table 2 shows the preference for food of the adults of flour beetle fed on different types of grains (wheat flour, barley, rice, cowpea, millet) and was feeding ratio (18.54, 19.31, 19.35, 19.46, 19.57), respectively.

Table 2. Food preference of the adults of flour beetle *Tribolium castaneum (Herbest).*

Food Environment	Nutrition percent	Perdition ratio%
Wheat (flour)	18.54	zero
Barley	19.31	zero
Rice	19.35	zero
Cowpea	19.46	zero
Millet	19.57	zero
Lentils	zero	zero



Kingdom *: Animalia*
Phylum *: Arthropoda*
Subphylum: *Hexapoda*
Class *: Insecta*
Subclass *: Pterygota*
Infraclass: *Neoptera*
Order *: Coleoptera*
Family *: Tenebrionida*
Genus *: Tribolium*
Species ***:*** *castaneum*

Photo 1. Flour beetle *Tribolium castaneum* (Herbest).

The rate of death of insects ratio did not indicate any ratio perdition of the insect throughout the breeding period, which lasted 30 days.
On the contrary, the growth has been

observed and the evolution of the numbers of insects on those food circles during the period of education.

As for the Model Food (lentils), it was noted that it is preferable and found the percentage change in perdition insects with no loss of Model Food, which indicates a lack of insect feeding on lentils.

CONCLUSIONS

The favorite food for the flour beetle is wheat flour or grain dust as well as rice, barley, millet and cowpea but not lentils.

It was found a rare presence of flour beetle alone in the sound grain, because it is not strong enough to produce grain injury, but it feeds on grains that have already hit by one of the primary insect or break grain or article accurate and grain dust.

It failed to the newly hatched larvae of some insects, grain beetle and Khapra beetle *Trogoderma granarium* serratus, to sound grain injury, but older larvae can begin to feed the embryo.

The correlation between the outside air temperature and the degree of grain mass temperature is weak, if the air temperature reached the freezing point, the degree of grain temperature in the interior is not up to such a degree, because of the poor thermal conductivity of grain and because of the high degree of heat spots where the infected insects operate.

The optimal temperatures for most of stored grain pests ranges between 25-30 C°. A lower temperature of about 20 C° could reduce the insect activity: egg-laying rate and prolong the hatching, and the length of the larval stage, and the process of the Virgin, and the duration of generation and thus lack in the number of generations, and the lack of numbering density.

All the pests die if they are exposed to a temperature of 5C° for a long time. Also, a temperature of 35 C° is suitable for the multiplication of many pests of stores. An exception is the beetle (*Trogoderma granarium*) that can live at temperatures higher than this temperature. Most of the pests die if they are exposed for a short period at temperatures higher than 45 C°.

The optimum temperature to achieve the perdition of the insects and larvae of the flour beetle is 60C°.

Preferably grain products should be sterilized at a temperature of 60C° for 10 minutes to kill all stages of insects.

The process of larva and eggs are more resistant to smoking with smoking that is in tightly space.

Recommendations:

(i)It is recommended a temperature of 60 C° to combat the flour beetle in grain silos and stores.

(ii)The grain products must be sterilized at a temperature of 60 C ° for 10 minutes to kill all stages of insects.

(iii) The smoking process in a tightly space is frequently used after the eggs hatch and the larvae stage, because the smoke increases the effect on other stages of insects and not affect the eggs and larvae.

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