Evaluation of the effect of different concentrations of plant powders on the red Coleoptera:Tenebrionidae Herbest (flour beetles Tribolium castaneum)

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Abstract. This study was conducted to investigate the effect of different concentrations of some plant powders on some aspects of the life of the flour beetle Tribolium castaneum at 28°C and humidity of 50%. The study showed that duration of the larval stage was 19 days and pupa duration was 5.4 days while the average age of adults was 119.5 days at brown flour. As for the determination of effective repellant concentrations of plant powders after two days and the killer concentrations of plant powder after a week of treatment for some plant's powders the black pepper Piper nigrum, cinnamon Cinnamomum zylancium ,coriander Coriander sativum and Syphilis Syzygium aromaticum in concentrations 0, 2, 4, 6 %. The results showed that the powder of the black pepper plant was 6% higher than the effect of the repellant with an average expulsion of 8.67% on the rest of the plants with the same concentrations and an average of 8.17%, 8.00%, 7.17% for carnation, cilantro and cinnamon powder respectively. As for the assessment of the killer concentration after a week of treatment on the same plant powders the result shows Excellence of Pepper Black Pepper Powder 6% In the rate of homicide and in the rate 5.05% By comparison with 4.35%, 2.35% for powder of cloves, cilantro and cinnamon, respectively.

Keywords: flour beetle, black pepper, cinnamon, coriander, cloves.

Introduction

The grains are of great importance in global agriculture because they are linked to the food security of the peoples. They are also essential sources of protein for human food, and since the beginning of production and protection of agricultural crops, which are considered to be major sources of food, and since the beginning of production and protection of agricultural crops, which are a major sources of food and on this basis has developed studies and research, and with great progress to improve those crops and their products as a thing and then stored by modern technological methods to protect them from insect and fungal infections and other pests Which can be exposed during periods of storage and marketing (Shewry, 2007 and Abdul Karim, 2012). It is also known that the grain and its products are exposed during periods of storage to damage and loss of weight and poor quality due to several factors, the most important attack pests stored in stores, causing them large losses, especially in terms of commercial The Food and Agriculture Organization of the United Nations (FAO) has examined the losses of the various types of grain stored and produced due to exposure to warehouse
pests by 36 million tons annually on flour beetles. One of the most important types of flour beetles exposed to cereals and their products in stock Flour beetle (Sokoloff, 1972).

Important types of flour beetles that are exposed to cereals and their products are in storage:

- The red flour beetle *Tribolium castaneum* (The rust-red flour beetle)

- *Tribolium Confusum* (The confused flour beetle).

Flour beetles also known since ancient times as insect pests are found with foodstuffs stored as flour or grain and bran preserved in vessels and pottery vessels in the ancient Egyptians were observed in the tombs of the Pharaohs in (2500 BC) Its present existence is the same for more than four thousand years (Mallis, 1960, and Cotton, 1960) The group of flour beetles return to the family of Tenebrionidae flour beetle and the order is Coleoptera it is the largest families of the order most of the members of the decomposing plants while some of the other plants in the field and a few of them feed as an insect predator There are more than 100 species in the world among the types that affect the grain and its products in storage and there are in Iraq two types of flour beetles and They are red and boggling (Al-Azzawi and Mehdi, 1983).

The females of these insects put 400 - 500 eggs hatching during 3 - 12 days to larvae of the slaughter of several ecdysis during the period of 12 - 109 days converted to a pupa and after 3 - 9 days graduated adults, and take their life cycle from laying eggs until the exit of the insect about 4-10 weeks depending on temperature, relative humidity, quality and quantity of food (Abdullah, 2009).

Salman 2016 indicated that the economic damage caused by store insects is color change, weight loss, contamination of chemical residues, secretions and transfer of pathogens.

One of the most prominent methods of control of store insects, which have known since time immemorial is the use of fumigant gases such as methyl bromide, hydrogen phosphide and others (Abdullah, 2012). But the use of this method at present is undesirable for known reasons, including the emergence of strains resistant to the act of evaporators after a period of exposure or because of the remains of food or to involve the risks to the environment and the lives of workers in control (Abdullah and Aziz, 2002).

Therefore, specialists in the fight against insect stores to find alternatives to this method, including physical methods such as sterilization Kama rays (Aour and Makee, 2004). As well as the use of high or low temperature where found at (50 ° C) can fight red beet beetles all the stages when exposed for an hour or two (Yokohama, 1927) *Tribobium* female beetles were found to be unable to lay eggs at temperatures between 19-21 ° C (Khalifa and Badawy, 1955). The use of air discharge combined with high temperature is effective in combating beetles (Sabeat et al., 2011) In latest years, researchers have resort to safe alternatives to insect control of stored materials (El-lakwah et al., 1993), such as the use of natural plant products as a successful and effective natural control method for their desirable properties as rapidly degradable and highly effective compounds against harmful insects and little damage On humans, animals, and the environment (Petson et al., 2000). Therefore, many studies have been conducted on the use of plant parts that act as insecticides, repellents, or growth regulators (Mustafa, 1999)

The researchers conducted several studies to control the beetle beetle insect using plant powders (Khalaf & Aylan, 2002, Ferman, 2009, Al-Farahani and Khalaf, 2009)

The present study aims at identifying the effect of some plant powders on the percentage of adult mortality and the amount of repellent effect in the beetle insect (red) and studying some aspects of the insect at 28 ± 2°C.
Materials and Methods:

1. Collection of samples

The adult individuals of the *Tribolium castaneum* beetle were collected from the infected flour. The samples were stored at lab temperature at the college of Education, University of Iraqia for a week for the purpose of localization with laboratory conditions before Procedure the experiments.

2. Study the life of the insect

The life of the red flour beetle was studied under 28 ± 2 °C and 50% humidity in the memmert incubator. To create the moisture, the dryers were used to dissolve certain KOH weights in 100 cm³ of distilled water and use the Hygrometer to read the relative humidity level.

One day old larvae were formed and one larva was placed in each plastic dish with a little flour. The dishes were covered with muslin cloth and the nozzles were sealed with rubber band. The dishes were then placed by 5 replicates. The larvae were examined on a daily basis and observations were recorded with respect to their growth, periods of age, number of discharges, length of virginity, and in the full role, females were isolated from males, to determine the age of adults used by recording the date of appearance and the date of death.

3. Preparation of plant powders

Used *Cinnamomum zaylancium*, *piper nigrum*, *coriandrum sativum*, and *Syzygium aromaticum*, obtained from local markets, were used. The wheat grains were free from injury and were used with copper mortar and food for the insect.

4. Extruding effect testing of plant powder

The method of Naworth (1973) was adopted with some modifications in estimating the effect of plant powder repellent against the beetle insect by taking a large dish 14 cm in diameter and 1.5 cm in height and a small dish 8.5 cm in diameter and 1.3 cm in height. The small dish was placed in the middle of the large plate by adhesive after placing 10 g of crushed grains for each small dish. Then add the plant powders on concentrate 2, 4, 6%. Weight per dish and three replicates and then enter into the small dish 10 insects in the adult and covered the nozzle of the large dish with a cloth of boredom and linked by a rubber band, and then recorded the number of insects emerging from the small dish to the large dish after 48 hours of treatment, calculated the percentage of expulsion according to the following equation:

\[
\text{Percentage of expulsion} = \frac{\text{The number of insects emerging from the small dish to the large dish}}{\text{The number of insects introduced into the small dish}} \times 100
\]

5. Testing the effect of plant powders on the percentage of adult mortality

The plant powders and concentrations of 2, 4, 6% weight / weight per plant were added to the insect food, which consists of 10 g of crushed wheat grains for each dish and mixed well, then each dish was introduced with 10 adult insects and three replicates per concentration. The plates were covered with muslin cloth and tied with rubber bands. The percentage of dead insects was recorded one week after treatment and the results were corrected according to the Abbott equation known as Schneidir and orell (Abbott 1925).
\[ \text{Percentage of corrected killings} = \frac{\text{% the killing in treatment} - \text{% killing in control}}{\text{100} \times \text{% killing in control}} \times 100 \]

**Statistical analysis:**

The results of the experiments were analyzed according to the complete randomized design (C.RD) of the single factor using the statistical program Genstat. The results were then compared using the least significant difference of L.S.D (AL-Rawii and Khalaf allah, 1980).

**Results and discussion**

1. **Study the life of the insect**

The results of Table (1) indicate that the duration of the larval role was 19 days at 28 ± 2 °C and relative humidity was 50%, while the pupa stage was 5.4 days and the mean age was 119.5 days in the same conditions.

In this area show the researchers Park and Frank (1948), the average period of growth of larvae of red flour beetle at 29 and 34 °C was 16.6 and 15.5 days respectively, and found that the average duration of the virgin phase of the same temperature was 5.08 and 4.14 days on Respectively. While between Khalifa and Badawy (1955), the duration of the virgin phase of the same insect at 30 °C was 5.8 days, As for the age of adults, Okuni (1928) reported that the adult age of the red flour beetle was 104-374 days at 28 °C.

| Age of adults (day) | (Pupa role stage day) | Larval role stage (day) |
|--------------------|-----------------------|-------------------------|
| 119.5              | 5.4                   | 19                      |

2. **Extruding effect testing of plant powders**

The results of Table (2) showed that the black pepper fruit powder had a concentration of 6 % with an average expulsion rate of 8.67% for the reddish beetle beetle powder on the cloves, cilantro and cinnamon powder at the same concentration with 8.1%, 8.17%, 7.17% respectively.

These results were agreed upon with AL-Jassany (2007) that the use of black pepper seeds for use as a strong stalk of the *calosobruchus maculatus* because it had the highest expulsion rate among the used plant materials. The percentage of expulsion of 100%. And with Antonions and et. J (2007) the possibility of using the extracts of chili fruits in the emergence of a killer or repellent effect of some types of insect pests, the difference in the effect of plant powders may be due to differences in their chemical components, which may be effective nutrient inhibitors or catalysts. Sometimes the insect is attracted to undesirable material because the substances affecting the components of the food may not be recognized by the insect because its concentration may not be sufficient and affecting the toxic response to the insect (Roxtin, 1991).
Table (2) Extruding Effect of Different Concentrations of Plant Powders on *Tribolium castaneum* after Two Days of Treatment.

| Plant powder             | % Used concentrations | Percentage of expulsion % of adults |
|--------------------------|-----------------------|------------------------------------|
| *Piper nigrum*           | 2                     | 3.67                               |
|                          | 4                     | 8.67                               |
|                          | 6                     | 8.67                               |
| *Cinnamomum zaylancium*  | 2                     | 5.50                               |
|                          | 4                     | 5.67                               |
|                          | 6                     | 4.17                               |
| *Coriandrum sativum*     | 2                     | 7.17                               |
|                          | 4                     | 6.17                               |
|                          | 6                     | 8.00                               |
| *Syzygium aromaticum*    | 2                     | 4.00                               |
|                          | 4                     | 5.83                               |
|                          | 6                     | 8.17                               |
| Control                  | 0                     | 0                                  |

L.S.D 0.05

3. Testing the effect of plant powders on the percentage of adult mortality

The results of Table (3) showed the effect of adding different concentrations of black pepper, cloves, coriander and cinnamon powders to the ground wheat grains in the corrected kill rate of the beetle flour insect. Where the black pepper plant exceeded the concentration of 6% with an average killing of 5.05% on the powders of the rest of the plants with the same concentrations. On average, 4.35, 4.35, 2.35% were killed for powdered cloves, cilantro and cinnamon, respectively. The reason for the destruction of the reddish beetle after its release on a wheat treated with black pepper powder may be due to the failure of the larvae to feed or the arrival of toxic compounds of the compounds of Capsiacin or a compound dihydrocapsiacin to the digestive system in the case of feeding on the wheat treated. In this regard, Bowers (1984) pointed out that the cause of larvae destruction treated with some plant extracts occurs after the toxic substances reach their central digestive tract, causing damage to the epithelial layer lining them, disrupting the secretion of digestive enzymes and thus killing the larvae. Abdul Hamid and Abdul Majid (1988) attributed the cause of the losses in insect adult to the effect of the toxic chemical compounds found in the plant extract, which directly affect the nerves, causing rapid paralysis of the treated insects. The reason may be that black pepper seeds contain alkaloids, trabecular compounds, clays, and other active compounds that act as feed or feedstocks, killing the insect (Halawah and others 1998).
Table (3) effect of different concentrations of plant powders on adults mortality beetle *Tribolium castaneum*.

| Percentage of corrected killings% | Concentrations that used% | Plant powers            |
|----------------------------------|---------------------------|-------------------------|
| 2.70                             | 2                         | *Piper nigrum*          |
| 3.15                            | 4                         |                         |
| 5.05                             | 6                         |                         |
| 1.05                             | 2                         | *Cinnamomum zaylancium* |
| 1.65                             | 4                         |                         |
| 2.35                             | 6                         |                         |
| 3.55                             | 2                         | *Coriandrum sativum*    |
| 4.00                             | 4                         |                         |
| 4.35                             | 6                         |                         |
| 2.85                             | 2                         | *Syzygium aromaticum*   |
| 3.30                             | 4                         |                         |
| 4.35                             | 6                         |                         |
| 0                               | 0                         | Control                 |
| 1.48                             |                           | L.S.D 0.05              |

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