

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ



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Effect of the Water Extract of the Usher on the
Red flour Beetle (*Tribolium castaneum*)

تأثير استخراج المياه من فاتحة على خنافس الدقيق الأحمر
(*Tribolium castaneum*)

A thesis submitted in partial of the requirements for the B. Sc. Honors in Plant Protection.

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الآية

بسم الله الرحمن الرحيم

قال تعالى:

حَتَّىٰ إِذَا أَتَوْا عَلَىٰ وَادِ النَّمْلِ قَالَتْ نَمْلَةٌ يَا أَيُّهَا النَّمْلُ ادْخُلُوا
مَسَاكِنَكُمْ لَا يَحْطِمَنَّكُمْ سُلَيْمَانُ وَجُنُودُهُ وَهُمْ لَا يَشْعُرُونَ ﴿١٨﴾

صدق الله العظيم

سورة النمل الآية 18

Dedication

To my, fathers and brothers

To my extended families

*To all my teachers and friends with great regard
and respect.*

Acknowledgments

First of all, I render my gratitude and praise to the Almighty Allah (S B T).

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Abstract

This study was conducted at insect LAB, College of Agricultural studies, Sudan University of Science and Technology in September 2007 .

The objective knows the toxicity of Usher plant on adult of red *Tribolium castaneum*.

The data obtained indicated that plant extracts tested with three concentration 2.5 ,5 , 10% adversely affected the mortality of adult stage.

The concentration 10% showed high percentage of mortality and the concentration (2.5%) gave 5% percentage of mortality.

مستخلص الدراسة

أجريت هذه الدراسة في مختبر الحشرات، كلية الدراسات الزراعية، جامعة السودان للعلوم والتكنولوجيا في سبتمبر 2017

الهدف يعرف سمية النبات أوشر على الكبار من الأحمر تريبوليوم كاستانيوم.

وأشارت البيانات التي تم الحصول عليها إلى أن المستخلصات النباتية اختبارها مع ثلاثة تركيز 2.5، 5، 10% أثرت سلبا على وفيات مرحلة البالغين.

وأظهرت نسبة التركيز 10% نسبة عالية من الوفيات والتركيز (2.5%) أعطى 5% نسبة من الوفيات.

CHAPTER ONE

INTRODUCTION

Each year, stored product beetles render amount of food unusable by the different stored product beetles in the world.

The feeding of primary pest .some of these species will be found in grain stores such as *sitophilus* or *sitotroga* ,but often the secondary pests are to found in greatest numbers on flours , meals ,and other processed food These are only able to feed on damaged grains and seeds , where the test is cracked, holed , abraded or otherwise broken, either by physical damage during harvesting .

Most important of the secondary pests are *Tribolum* spp. They are generally distributed throughout the Sudan but are more plentiful in areas of higher humidity. *Tribulium confusum* and *Tribulium castaneum* which occur over wide variety of stored processed grain and are major pests in flour mills in the Sudan.

Objective:

To study the effect of Usher water leaf extract on red flour beetle (*Tribolium castaneum*).

CHAPTER TWO

LITERATURE REVIEW

2-1: Rust red flour beetle *Tribolium castaneum* (Herbst):

2-1-1: Classification:

Kingdom: Animalia

Phylum: Arthropoda

Class: Insecta

Order: Coleoptera

Family: Tenebrionidae

Genus: *Tribolium*

Species: *castaneum*

S.N: *Tribolium castaneum*

2-1-2: Distribution:

It is a cosmopolitan insect found throughout the world in India it is considered as serious stored grain pest ,well distributed all over the country . This pest is especially common in granaries, mills, ware houses etc .T. castaneum was first of All described in **1779**.

2-1-3: General characteristics:

The body of adult beetle is flattened reddish - brown in color and measures 3-4 mm in length. The head, thorax an abdomen are well developed, the last few segments being abruptly much larger than the preceding ones.

2-1-4: Life cycle:

A female beetle lay about 400 -500 eggs.

Eggs are laid singly in flour and dust of the grains. They soon become covered with small particles of dust and flour as they are moist and sticky when freshly laid. This renders their detection very difficult.

The eggs are minute, slender, and cylindrical in shape, rounded at both ends and of whitish colour.

The incubation period varies from 5 to 12 days, depending on temperature .the body segment have a number of fine hairs, the terminal segment being in addition furnished with a pair of spine like an appendages. The full grown grub is about $\frac{3}{16}$ inch long and is pale yellowish in color.

The larval period varies from 27 to 29 days but it may get prolonged up to 90 days, according to the food available and the prevailing temperature. Pupation takes place generally on the food. The pupa is naked. At first it is white but gradually becomes yellowish, the dorsal surfaces resembling those of the grub. Pupa stage lasts for 5-9 days.

The total life cycle from egg to the emergence of adult takes about six weeks there may be four to seven generations in one year.

2-1-5: Nature of Damage:

This pest is found infesting all stored products like seeds, grains, flour, dry fruits, nuts, oil cakes etc. it also infests dry museum specimens and stuffed animals .Tribolium castaneum does not cause as much damage as Sitophilus , Rhizopertha and other in whose company it is mostly found .

Neither the adult can generally damage sound grains, but they feed on those grains only which have already been damaged by other insect pests.

This is a serious pest of prepared cereal products such as at, Maida, Suji and is found in abundance in flour mills. In case of heavy infestation flour or Maida turns grayish - yellow or develops red taints which subsequently becomes moldy and emits offensive pungent smell.

The confused and red flour beetles cannot feed on whole undamaged grain; they are, however, often found among dust, fines, and dockage.

The beetles do cause damage by feeding but probably cause more problems by contaminating the grain. Large number of dead bodies, cast skins, and fecal pellets, as well as liquids (quinines), can produce extremely pungent odors in grain .The nauseous smell and taste caused by infestations of confused and red flour beetles can result in poor feed consumption by livestock and rejection by grain buyers. In most cases, the presence of live insects in a grain bin indicates that moisture buildup and molds are also present. The combination of these three factors can greatly reduce the quality and value of grain.

2-1-6: Polyandry and multiple mating in the red flour beetle:

Red flour beetles engage in polyandrous mating behavior. Polyandry specifically refers to when a female mates with multiple males. For females, polyandry can serve as a fertility assurance, thereby increasing the number of progeny.

2-1-7: Male competition for access to females:

The availability of resources and population size can greatly affect how many mating's each individual participates in . Increased population size within a given area with fixed resources can limit how many offspring

can survive, (Guiyun 2007). Therefore, males must often compete with other males to be the last male that mates with the female, to increase his fertilization rate, by being the last male to mate with a female, it is likely that his ejaculate removed previous males, increasing the chances that his sperm fertilizes the female, (Haubruge, L, E .1999). In fact, in areas with limited resources, higher rates of cannibalism among competitor males can result in an overall decrease in fitness of the population since there is net decrease in offspring production and survival.

2-1-8: Male and female recognition of relatives:

During mating, red flour beetles are known to engage in polygamous behavior. Male flour beetles have been known to recognize their relatives while the females do not have this capability .Lack of the ability to recognize their relatives has led females to mate with any male within the population, (F, Tregenze, T .2012).

Female red flour beetles are also known to store sperm after mating. More sperm is stored by the first mating, which leads to less sperm stored in subsequent matting's. However, amount of stored sperm does not stop the last male mate from fertilizing the egg. (Lewis, Jutkiewicz 1998).

This is due to the fact that with each mating, males can remove previously stored sperm thus giving their own sperm an advantage to fertilize the egg.

2-1-9: Control of red flour beetles:

Biological control

Tribolium castaneum was more susceptible to tape worms than *T. confusum*. There was only significant variation among strains and between sexes for both *Tribolium spp.* (Yan and Norman, 1995).

Parasitism of the mite *Acarophena xlacunatus* led to a reduction in the number of *T. Castaneum* larvae and adults, showing that the mite can affect populations of the beetle (Oliveira *et al.*, 2006).

Non – chemical methods :

These are particularly practices which are often effective in knocking down insect's infestation and should be encouraged and developed. They are:

Wood ashes:

Mixing material with flour to prevent insect damage was first practical many years ago and had never been entirely abandoned (Richard, 1956).

Sanitation:

To minimize the movement of insects from old grain and grain debris to new grain, thorough cleanup is necessary. At least 2 weeks before storing new flour, clean all grain and flour debris from within and around grain bins. (Weinzierl and Higgins, 2008).

Smoking:

Some farmers stored sorghum, the head inside of their huts, suspended from the roof. Other farmers used the fire under their storage cribs for the same purpose (Gile, 1964).

Sunning:

Exposing infested grain, in thin layers to the sun to minimize infestation were common practices in rural communities (Shazali, 1989).

Chemical control:

Pesticides are poisonous. Read and follow directions and safety precautions on labels. Handle carefully and store in original labeled containers right away, in a safe manner and place. Do not contaminate forge, stream, or ponds (Robert Fadt 1985).



Plate 1. Adult of Red flour Beetle

A



B



C



Plate 2. Larva and adult of Red flour Beetle

2-2: Usher plant *Calotropis procera*

2-2-1: Classification

Kingdom: Plantae

Division: Magnoliophyta

Class: Dicotyledoneae

Order: Asclepeadales

Family: Asclepeadaceae

Genus: *Calotropis*

Species: *Calotropis procera*

2-2-2: Description:

A large Shrub or small tree of 2-4m height, with white latex and smooth, grey - green stems and thick, soft bark. The plant has a deep tap root of 3-4m length. The simple and opposite leaves are 8-25 cm long, 4-14cm width, ovate, thick and waxy. They have a short pointed tip at the end and a heart - shaped base partly clasping the stem. The white and purple flowers have five lobes, are more or less tubular, and 2-3 cm in diameter. Fruits are grey - green, fleshy or dry capsules of 8-12cm length and 6-8 cm width.

They contain numerous small, brown and flattened seeds of 8-10mm length and 4-5mm width, with long white hairs attached at one end (Weber, 2003). Shrubs, mostly less than 6ft., but up to 15 ft. similar to *C. gigantean*, but leaves belong to elliptical corolla usually about in. Across with lobes move erect, coronalobes glabrous or pubescent, and follicle 4 - 5 long (Bailey and Bialy, 1976).

2-2-3: Distribution:

According to Erdman (1983) the Usher Plant has broad leaves, ever green and grows abundantly in arid land semi-arid regions of the world without irrigation, fertilization, pesticides, or other agronomic practices.

According to rahman and wildcok (1991). *C. Procera* is native to West Africa as far south as Angola .North and East Africa, Madagascar, the Arabian Peninsula, southern Asia, and In to China to Malaysia, central and South America and the Caribbean Islands.

Foster (1992) reported that *C. procera* is widely distributed in north tropical Australia .In Sudan it is spreading widely throughout Sudan, abundant and available the whole year round (Eltayeb,2004).

2-2-3: Used of usher plant:

This plant has been widely used in the Sudanese medicinal system (Ayoub and Kingston, 1981; Ayoub and Srenden, 1981).

The latex of the plant was reported having potential anti inflammatory, antidiarrhoeal, analgesic, antipyretic and Schizonticida activities (Kumar and Basu, 1994; Dewan, et al; 2000, Kumar et al; Sharma, 2000). Bioactivities of the plant such as insecticidal (Jacoband Sheila, 1993; Khan and Siddiqui, 1994 ; Moursy ,1997), acaridal (Chung Samanyart, et al.,1994), rematocidal (Rakesh, et al., 2001), molluscidal (Hussein et al., 1994), had been reported .

Water containing latex of the plants was able to avoid adult females of *Anopheles Stephens* and *Culexfatigans* to oviposit in the water and the latex water could kill eggs and larvae of *A. Stephens*, *C. Fatigans* and *Aedesaegypti*, (Girdhar, et al., 1984).

2-2-4: Chemical properties:

The milky sap contains a complex mix of chemical some of which are steroidal heart poison known as (cardiac a glycones). These belong to the same chemical family as chemicals found in foxglove (*Digitalis purpurea*).

The steroidal component includes and hydroxyl group in the C3 position, as second attached to the carbon, a C\D - Cis ring junction and a, B - unsaturated -Y -Lactone in the (17 position. In the plants, the steroidal coponent commonly attached via a glycosidic link to 2-deoxy or a 2.6 didesoxy sugar molecule (Aiton, 2010).

The features described are those required for toxicity but in addition there can be other substitutions into the steroid nucleus. These can Be a C19 - aldehyde in place of the more usual methyl group in position as additional hydroxyl functions and sometimes epoxide structures. In the case of the *Calotropis* glycoside, their names are calotropin, cal toxin, uscharidin and vorusharin (The latter involve are sugars with nitrogen and sulphur in the structures). The steroidal moiety (Known as "calotropagenin "Formula, $C_{23}H_{32}O_2$) has one more unusual structure the C-19formyl (CHO) group is present and there is an additional secondary alcohol as the common C3 and C14 hydroxyl function remains in some doubt it was apparently established by the Swiss group under the dues Rechistein as being in the C2 position with an equatorial configuration. However, this assignment does not explain some of the non-features and behaviors of this molecule, in particular the absence of spin - spin coupling of the two axial protons associated with their germinal hydroxyl group and failure react iodateinaclevadge reaction which presence of such ariscinal 1, 2 diol would require (Aiton , 2012) .

CHAPTER THREE

MATERILS AND METHODS

A study of the effect of Usher plant extraction red flour beetle under laboratory conditions was conducted in the college of agricultural studies, Sudan University of science and Technology in September 2017.

3-1: Mass culturing of insect:

I collected a few red flour beetle insects from a store in Khartoum Bahary and then in flour in the insect laboratory at college of agricultural studies of Sudan University of science and Technology.

3-2: Preparation Extraction of Usher plant:

Usher leaves were collected from the college of agricultural studies at the University of Sudan for science and Technology and dried under normal temperature and then crushed and weighed. Fifty gm of powder was added to 50 ml of water. And left for 24 hours and then filtered using 120 mm diameter. Then concentrations of 2.5%, 5%, 10% were prepared.



Funnel



Petri dishes



Brushes



Injection



Balance



Beaker

Plate 3. Laboratory Equipment

3-3: Contact method:

From the glass cages (250) insects of red beetle were taken and prepared for treatment each consists of 10 adults (male and female) and each replicated three times. Four ml of each concentration were placed in a Petri-dish which was lined filter paper and material was evenly distributed by rotating.

Distilled water used as control, and also we used Usher plant extract in this treatment. The mortality count were taken and recorded after 24, 48, 72 hours and 6 days of exposure.

CHAPTER FOUR

Results

4-1: The effect of *Calotropis procera* on adults of *Tribolium castaneum* after 24, 48, 72hours and week:

Table showed that the plant extract with concentrations 2.5%, 5%, 10%, gives a large mortality rate and all concentrations effect the red flour beetle at close rates within 24,48,72hours. The result is that we can use the usher plant extract in control applications.

Concentration	Means after (24)	Means after 48	Means after 72	After 5days
2.50%	1.6667	3.3333	4	3
5%	2	3	3.6667	2.8889
10%	2	3.3333	4	3.1111
Control	0.333	1	2	1.1111
std. error	0.28868	3.3333	0.37856	0.23055
CV	57.64	43.30070874	38.38118653	54.72307936
LSD	0.3333	0.3333	0.3333	0.2222

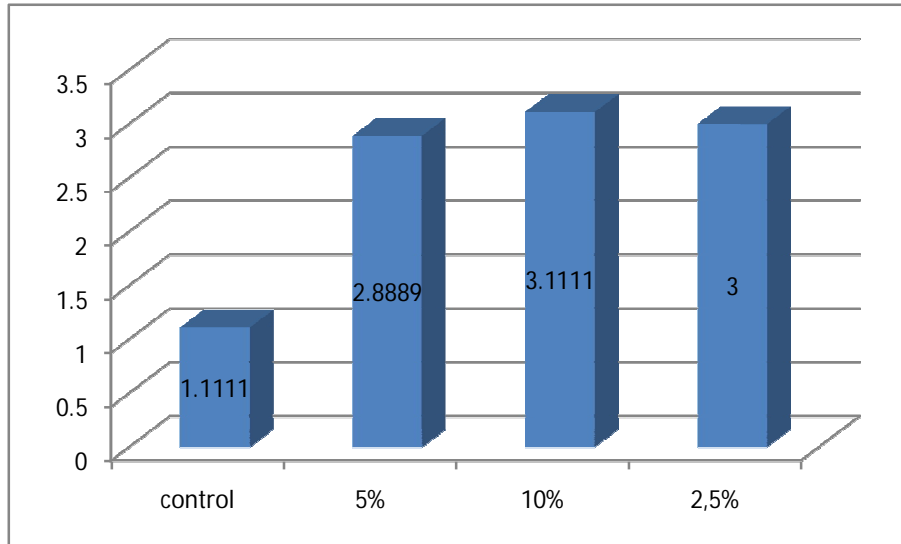


Fig. 1. The effect of *Calotropis procera* on adults of *Tribolium castaneum* after 24, 48, 72hours and week

CHAPTER FIVE

Discussion

The red flour beetle is a secondary storage pest of the flour and causing damage to the stock of flour.

In this study the effect of the usher leaves extract on the red flour beetle was investigated. The high concentration (10%) effect was the best was the most effective.

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