Sudan University of Science and Technology

College of Agricultural Studies

Plant Protection Department

Survey of Peach Fruit Fly (*Bactrocera zonata*) (Saunders) (Diptera: Tephritidae), and other fruit flies in Khartoum North AL-kadro area

مسح ذبابة ثمار الخوخ وانواع اخرى من الفاكهة في منطقة الخرطوم شمال الكدرو

A Dissertation Submitted in Partial Fulfillment for the Requirements of B. Sc (Honor) Degree in Plant Protection.

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October- 2020

الآية

بسم الله الرحمن الرحيم

(وَفِي الأَرْضِ قِطَعٌ مُّتَجَاوِرَاتٌ وَجَنَّاتٌ مِّنْ أَعْنَابٍ وَزَرْعٌ وَنَخِيلٌ صِنْوَانٌ وَغَيْرُ صِنْوَانٍ يُسْقَى بِمَاء وَاحِدٍ وَنُفَضِّلُ بَعْضَهَا عَلَى بَعْضٍ فِي الأُكُلِ إِنَّ فِي ذَلِكَ لَآيَاتٍ لِّقَوْمٍ يَعْقِلُونَ).

صدق الله العظيم

(ســـورة الرعـــــد الآية 4)

DEDICATION

To the one who taught me to give without waiting for me to bear his name with all pride……. My dear father, may Allah enjoy the health and wellness.

To the surprise of my eyes and the joy of my heart. And to the one whose pure and inexhaustible tenderness watered me, and she was the one who carried me to her frailty…… My dear mother, Allah blessed her with health and wellness.

To whom their love runs in my veins and delights in remembrance of them, so my heart to those with their presence has acquired boundless power……. My brothers and sisters and all members of my family.

To the companions of the trail, I spend the most beautiful years of study with them, and their memory will remain in my heart.

ACKOWLEDGEMENTS

First of all I render my thanks and praise to almighty Allah, who offered me the health and strength to accomplish this humble work.

I also extend my sincere thanks and appreciation to the supervisors of Prof. Awad KhalafAlla Taha El-hag. For his continuous assistance, support, essential guidance, kindness, continuous inspiration and assistance of the most valuable.

I also extend my sincere thanks to the evacuated professors in the Plant Protection Department for overcoming them from all difficulties.

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ABSTRACT

This study was carried to monitor and survey of the fruit flies species in the Kadro area north Khartoum Bahri locality, during the period from December 2019 to march 2020, to identify fruit flies species. Types of traps were used: A food tarp contains: Guava juice (160ml) water (100ml) Malathion 57% (5ml). And the sticky traps consisted of (Methyl Eugenol) were surveyed in Al-kadro area.

The results of the survey showed that there are two species of fruit flies the Peach fruit fly *Bactrocera zonata,* which was the dominant species. And the Asian fruit fly *Bactrocera invadens* in the study area.

الملخص

اجريت هذه الدراسة لرصد ومسح انواع ذباب الفاكهة في منطقة الكدرو شمال محلية الخرطوم بحري , خلال فترة من ديسمبر 2019 إلى مارس 2020 , للتعرف على أنواع ذباب الفاكهة . انواع المصائد المستخدمة : مصائد الطعام يحتوي على: عصير جوافة (160 مل) ماء (100 مل) Malathion 57%

(5 مل) . وتم مسح باستخدام المصائد اللاصقة المكونة من (Methyl Eugenol) في منطقة الكدرو . اظهرت نتائج المسح ان هناك نوعين من ذباب الفاكهة هما ذبابة ثمار الخوخ *Bactrocera zonata* والتي كانت نوع السائد . وذبابة الفاكهة الاسيوية *Bactrocera invadens* تغزو منطقة الدراسة .

CHAPTER ONE

INTRODUCTION

1. INTRODUTION

Tephritidae fruit flies are a group of dangerous insects Attack fruits in all of fruit trees and certain vegetable fruits in all over the world causing direct and indirect economic injury level.

The damage of genus *Bactrocera spp*. has wide host ranges of its species and the invasive power of some species within the genus **(Clarke** *.et. al* **2005).**

Peach fruit fly (PFF) *Bactrocera zonata* (Saunders) (Order: Diptera; Family: Tephritidae.)

Is known as a most serious pest of tropical and sub tropical fruits it was recorded on more than 50 cultivated and wild plant species , mainly those with fleshy fruits the main host including Citrus , Guavas , Mangoes , Peach , Apricots , and Figs (**Khalid** *.et …al* **2016**) . The most important economical insect pests which attack fruits, fruit flies cause significant damage to the fruits and vegetable productions all over the world; one of

The most damaging fruit flies are the peach fruit fly *Bactrocera zonata* (Saunders) significant losses to the fruit crops. Infection of the fruit flies not only cause post-harvest losses but the free trade of fresh horticultural produce to large profitable markets like the United States of America and Japan is also restricted which considered fruit flies as quarantine pests plant extracts have been used to manage different insects including fruit flies worldwide .

However, the work on plant extracts for the management of fruit flies is still lacking at Sudan level (Ayesha**. 2017).**

The main objective:

. Collection and identification of the different species of fruit flies in Khartoum state (AL-Kadro).

CHAPTER TWO

LITERATUREREVIEW

2. LTERATURE REVIEW

2.1. Fruit flies

2.1.1. Taxonomic statues of fruit flies:

Kingdom: Animalia

Phylum: Arthropoda

Class : Insecta (Hexapod)

Order: Diptera

Family: Tephritidae

2.1.2. Origin and distribution:

Bactrocera ssp. These are natives to tropical Asia, Australia and South pacific region, with a few species found in Africa and warm temperate areas of Europe. ***Bactrocera zonata*** is native to south and Southeast Asia. Is occurs in Northern Africa (Egypt and Libya).

Recently it has been reported from several regions in Sudan, suggesting a southward spread and 2007; Shehata *et al.;* 2008. In Mozambique, *Bactrocera invadens* was first detected in 2007 in Cuamba district, Niassa province **(Carreia** *et al.,* **2008).**In Sudan fruit flies were reported at Khartoum state by **(Venkatraman and ELkhidir., 1965).** Found fruit flies in the Northern region (Shendi, Hudeba) Khartoum, Kassala and the northern region (Yombio, meridi and Juba). Now it's wide spread in Sudan. Occurring in all regions of fruit and vegetables.

2.1.3. Host plants:

Most of fruit-infesting Tephritids are polyphagous pest there are 353 plant species as hosts or potential host for fruit flies.

Bactrocera zonata infests most of the known fruits, such as mango (*Mangifera indica*), guava (*Psidium guajava*), peach (*Prunus persica*) , papaya (*Carica papaya*) , pear (*Pyrus armeniaca*) ,plum (*Spondia scytherea*), apple (*Mauls domestica*), citrus (*Citrus SPP.*), Dates (*Phoenix dactylifera*), in addition to secondary vegetable hosts such as cucurbits and tomatoes **(Ehtahir 2019)** .

2.1.4. Damage and economic importance:

These pests are of height economic importance to the fact that the females ovipositor is inserted inside the sound fruits causing the ovipunctures which lead to the entry of micro-organisms and cottoning of the fruits, this is besides the main damage of the developing stages inside the fruit which render them unsuitable from human consumption, the situation is for more serious in international trade, since infestation may

Cause importing countries to reject an Entire shipment or more worse exporting countries may have to lose the market **(Abbas, 2008).**

The level of infestation in Sudan varied with location ranging from 26 to 207, 3. Flies per kg of fruit. There was a significant inverse relationship between numbers of flies per kg of fruit and elevation at which fruit war collected.

2.1.5. Economic importance:

The damage caused by this pest is due to the ovipositor punctures in the fruits. The infested fruit develop watery soaked appearance. Young fruits became distorted and usually drop. The Oviposition punctures and the larval. Tunnels provide entry passage for bacteria and fungi that cause rotting and lead to complete destruction of the fruit.

The symptoms vary from one type of fruit to another e.g. infestation appears as dark spots in citrus and as black sunken areas in the lower half of the guava fruits . In mango the symptoms appear as fluids which exude from ovipunctures in the form of droplets that later dry up and turn brown. **(Ali, 2019).**

2.1.6. Life cycle and behavior:

The life cycle of various stages were reviewed by many anthers.

Stated that the biology of the mango fruit fly *C. cosyra* was similar to that of *C. capitata.*

Females pierce the ripening fruit and insert the eggs into the punctures. The maggots feed on the pulp. Making the fruit unacceptable. Pupation occurs either inside the fruit or in the ground.

The adult is small fly. Which holds its wings partly extended when at rest; it's about 4-5 mm long. And wing span is 10 mm. There are probably 2-10 generation per year in Africa according to the species and climate **Deng (1990).**

2.1.6.1. The egg stage:

The adult female punctures the skin of the fruit with its sharp pointed long ovipositor and lays the eggs in the pulp **(FAO, 2004).**

The eggs are laid singly or in clusters. They are tiny (0, 8 mm long, 0,2mm wide) and white in color.

2.1.6.2. The larval stage:

The larvae moult two; the second instars larva measure 7, 5 – 10mm in length and 1, 5 – 2 mm in Width **(Elson –Harris, 1992).**The maggots are white, boarder at the posterior end and

pointed at the anterior end. They feed on. The interned tissues of infested fruits causing rot and the fruits fall from the tree **(FAO: 2004).**

Larvae pass through three instars within 9-25 days after which they drop into soil for pupation to adept of about 5cm depending on soil type.

2.1.6.3. The pupal stage:

The pupa stage marks the beginning of the fruit fly metamorphosis, or change in form from earlier stages to becoming an adult **(https: //study).**

2.1.6.4. The adult stage:

Adult flute feed on various kinds of food, such as glandular secretions of plants, flower nectar, plant sap, bird droppings, and honey-dew secreted by homopterous insects **(Ali, 2003).**

The longevity of *Bactrocera* PP. females ranged between 50 – 45 days while that of the males Ranged between 30 -45 days **(FAO, 2004).**

2.1.7. Behavior of the fruit flies:

Tephritids exhibit a wide array of interesting and sometime spectacular behavior in many aspects of their life especially during their feeding and ovipostion.

2.1.7.1. Ovipostion behavior:

The ovipositor behavior appears to be more uniform than epigamic behavior. The female lays several eggs singly or in cluster beneath the skin of mature ripe fruit during an extended period of many hours **(Aluja and Norrbom, 1999)**.

2.1.7.2. Feeding behavior:

The larvae feed on the eternal tissues of in fasted fruit causing rot and the fruit drop **(FAO, 2004).** Adult nutritional requirements vary and largely depend on the quality of the larval food and usually include at least carbohydrates and water.

Adult may feed on plant exudates, including those

From the ovipostion punctures or rotting fruits, bird feces, nectar, honey – dew, pollen grains and rain drops **(Goeden, 1994).**

2.1.8. Control of fruit flies:

The study of the biology of pests belonging to this family offers no clue because the larvae live in the fruits, vegetable nuts, or in the buds of the growing plants and therefore, insecticides that may be applied in the form of dusts or spray cannot reach them and cannot be recommended because of the risk of the residues and environmental contamination. The economic Entomologist is left with only non-chemical methods such as trapping the adult flies, especially before they start laying eggs in order to reduce the incidence of the pest population **(Ali 2019).**

The methods of control that can use for the management of fruit flies are:

2.1.8.1. Cultural control of fruit flies:

Among the techniques that have shown good Result the following are the most successful sanitation measures, growing crops that better can withstand fruit flies attacks, early harvest, and bagging **(Sarango, 2009).**

Sanitation measures: This infested fruit should be removed; in particular the fruit on the tree that present signs of attached

should be removed instead of removing fallen fruit on the ground were the larvae have already left the fruit. In fields where sanitation measures are practice the level of fruit flies decreases significantly **(Verghese** *et al..,* **2004).**

Resistance crops: The production of crop varieties that are less attractive for fruit flies has shown good effects. There are some chili varieties that are classified as non-hosts for fruit flies in Thailand there are some fruit crops that are not susceptible to fruit fly attacks **(All wood** *et al..,* **2001).**

The pupa and many fruit flies can be targeted by disturbing the Soil medium in which they pupate.

This can be done by ground swamping (causing pupae anoxia) or ploughing (causing physical damage, desiccation to the pupae and exposing those to natural enemies). **(FAO, 2015).** Early harvest. Fruit flies prefer to attack fruits and vegetables depending on the stage of maturity. In some crops there is the possibility to harvest fruit early to avoid fruit flies infesting.

2.1.8.2. Biological control of peach fruit fly:

Introduction of parasitoids to infested fields has given good results in management of fruit flies. The use of biological control to control fruit flies started already in 1902. There are example where reduction of infestation have been nearly 95% as the experiment in Hawaii showed when larvae parasitoids belonging to the families Eulophidae , Braconidae , and Chalcidedae were introduced **(Allwood** *et al..,* **2001**). *Psyttalia fletcheri* (Hymenoptera: Beaconidae) is one of the parasitoids that vas showed a high parasitism Degree in *Bactrocera cucurbitae Fopius arisanus* (sonan) is other promising parasitoids tested in Hawaii to

control *B. latifrons* **(Bokonon-Gatan** *et al..,* **2007).** A biological control can also be conducted via measures that favour the established parasitoids in a kind of conservation of biological control agents. The biolo-control agents are often reared in different localizations them the place where they will be released **(Ramadan and messing, 2002).**

2.1.8.2.1. Parasitoids:

Many parasitoid species especially in the family Braconidae are used for biological control of fruit flies. *Tetastichus giffardii* Silvestre (Hymenoptera: Eulophidae) is a gregarious, larvae – pupal undo parasitoid of many fruit fly species **(LaSalle and Wharton, 2002).**

2.1.8.2.2. Predators:

Some predators from different families' such as Staphlinidae, Chrysopidae, pentatomidae, Eulophidae and few mites were reported to prey on Tephritids **(Bateman, 1972).**

2.1.8.3. Chemical control of fruit flies:

Chemical control is widely used among farmers. The first synthetic chemical insecticide used to control fruit flies was DDT. Eventually .DDT was replaced by organophosphates. The application of insecticides is done by spray cover on the entire crop or tree. This is a technique called Male Annihilation technique (MAT) and consists of many bait stations throughout the field. Experience in flied demonstrated that the level of infestation in mango in India decrease to 5% from levels of infection between 17% and 66% by using this technique **(Varghese** *et al..,* **2006).**

2.1.8.4. Legislative control

Avoid transferring infested fruit from a highly infested area to

Slightly infested area or pest-free areas without post harvest treatment such as quarantine disinfection and prevent planting of different types of hosts at one place in order to break the food cycle of the fly around the year **(FAO. 2004).**

2.2. Classification of the garlic

Kingdom: Plantae

Class: Liliopsida

Subclass: Liliidae

Super order: Liliianae

Order: Amaryllidales

Family: Alliaceae

Genus: Allium

Species: sativum

Allium sativum L.

Belongs to the Family Alliaceae, Genus *Allium*. The taxonomic position of *Allium* and related genera had been a latter of controversy for long

2.2.1. General characteristics of garlic

Cultivation of garlic and some other alliums started with the extension of the civilization and development of the Human race in general. Its botanical name is *Allium* sativum where (sativum)

means cultivated. That is because wild garlic does not exist **(Block, 2010).**

2.2.2. Origin of garlic

Garlic is one of the oldest known horticultural crops. There are many evidences that was used in the Egyptian and Indian culture 5000 years ago. Ionians 4500 years ago and in Chinese tradition

Over 2000 years ago. As it was mentioned before, garlic was used for centuries mainly in traditional medicine. First quotations about medical application of *Allium sativum* appeared in the codex Ebers (1550 B. C.), and Egyptian medical papyrus (Ghaleh kandi).

2. 2.3. Use and importance of garlic

After Allium cepa, garlic is the second most important species in the genus *Allium.* The mostly consumed part of the plant is bulb, which can be composed from few too many cloves. Beside the bulb, the other parts of the plant like fresh leaves and topsets are also used **(Fritsch and friesen, 2002).**

2. 2.4. Description of garlic

The garlic is the herbaceous perennial plant, with foliage leaves attached to an underground stem. Leaves of garlic emerge from the stem are situated on the base of the bulb which looks like the flat plate. Leaves are without stalk. V-shaped in cross section, with both solid scape and foliage.

Garlic clove is consisted from protective leaf. Storage leaf, sprout leaf, foliage leaf primordial. Root primordial and basal plate, the inflorescence is called umbel and it's composed from small flowers pedicels. Each of pedicels has own flower stalk and six petals which is pink, white, off-white or purple colored, depending

on cultivar. Garlic also has small bulbils which are asexual prop gules and after planting those can develop in the mature bulb (Meredith, 2008). The other ways of vegetative reproduction of Allium sativum are by maxillary blubs. Topsets and division of Sativum are by rhizomes as well **(Kamenetsky and Rabino witch, 2006).**

CHAPTER THREE

MATERIALS AND METHODS

3- MATERIALS AND METHODS:

3.1. Survey, Collection, Rearing and Identification of fruit flies:

3.1.1. Survey and the study Area:

This part of the study was carried out from December 2019 to March 2020. Guava fruits, at different stages of maturation, were collected after they fall to the ground. The collection area Khartoum state: Bahri (AL-Kadro).

(Figure No. 1) and (Plate No 1).

Collected fruits were placed in paper bags, labeled and then transported for further study at the Entomology Laboratory; College of Agricultural studies Shambat, Sudan University of Science and Technology. On arrival to the Laboratory, the collected fruits were transferred to a rearing room. fruits from separate collections were placed in pupae rearing cages (plastic boxes , each measuring : 25cm x18cm x18 cm) with moistened sterile sand at the bottom which serves as a substratum for pupation , while the upper cover of the container was cut and replaced by affine inch for ventilation as seen in (plate No.2). When fruits partially rottener, dissection took place to allow for the movement of the larvae that may be stuck in the pulp.

3.1.2. Identification of fruit flies species in the study Area:

For specific identification of different species of fruit flies, and to determine the predominant species that invade different fruits at area.

After emergence, Adult flies were provided with diet, consisting of: one part yeast and four parts sugar and water, for 2—3 days till they attained their full body coloration to facilitate easy Identification.

3.1.3. Rearing of fruit flies:

This part of the study was carried out through collection of infested fruits from Guava orchards at the study sites of AI-Kadro (figure No.3). Rearing of fruit flies was made at the Entomology Laboratories, college of Agricultural Studies – Shambat, Sudan University of Science and Technology.

Fig (1) Khartoum Bahri – AL-Kadro or Collection Area

Plate No. 1: Guava trees at Collection Area

Plate No. 2 Larvae and Pupae rearing plastic cages

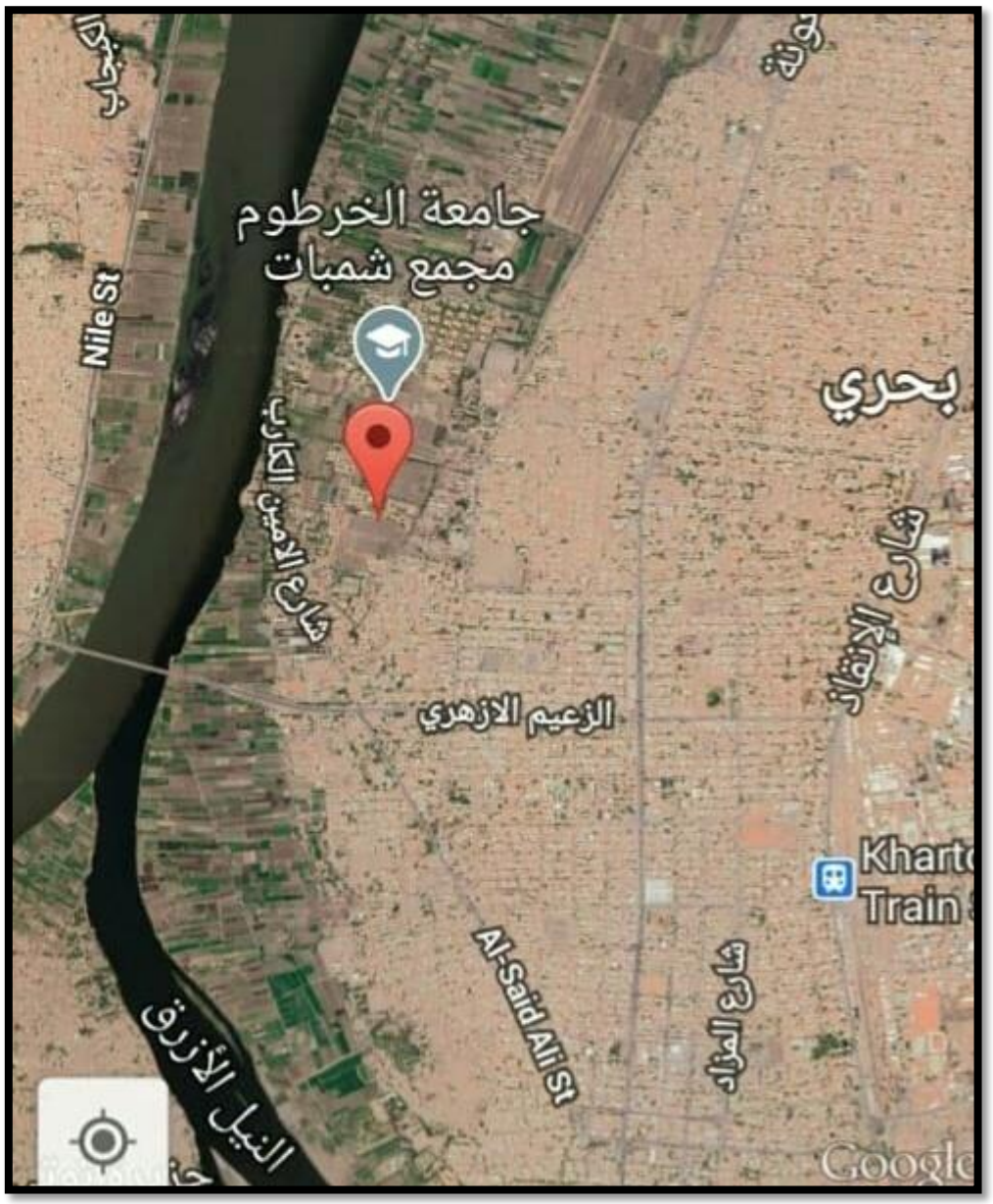

Figure No. 2: College of Agricultutural Studies (Laboratory Rearing of fruit flies)

3.1.4. Collection and rearing of fruit flies

Rearing started in January 2020 and continued up to March In the same year at rearing room in the Entomology Laboratory College of Agricultural studies – Shambat. Large quantities in infested Guava fruit were collected and kept under Laboratory conditions in plastic boxes provided with moistened sterilized sand layer. Large numbers of emerging adults , up to 1000 individuals)were identifies and transferred to separate culturing wooden cages (30x30x30cm) (plate No. 3 and plate No.4) and provided with food composed of : Sucrose and Hydrolyzed protein at 3:1 ratio, and water , (plate NO. 4)

Plate No. (3) Wooden Cage for Rearing Adult Fruit Flies

Plate NO. (4) Fruit flies in Rearing Cage

Plate No. (5) Food and water for Adult Fruit flies

3.1.5. Survey and monitoring of fruit flies

This survey was carried during the period from December 2019 to March 2020 in the Ahmed (Al – Kadro) orchard to determine the fruit fly species in the study area. Ahmed trees represent guava the major plant, in addition to clover and mango trees, Type of traps were used: a food traps (plate 6), and a sticky traps (plate 7). The food trap contains: Guava juice (160ml), water (100ml) and Malathion 57 %(5ml). The sticky trap consisted of a yellow square – shaped adhesive trap, with cotton in the middle and a dose of methyl Eugenio (5ml) to attract the flies. The traps were suspended at 1, 5 -2 meters on strong branches to support the weight of the trap. 10 food traps were used and the distance between traps was 18-20 meter. Sticky traps were 10 traps distributed rand only. The traps were checked weekly and the data were recorded, the food trap and the pheromones traps were replaced every week. The flies caught in each trap were collection using a hair brush and placed in avail containing

Ethanol 75% .The samples were taken to the laboratory and were identified according to the fruit fly keys viable (e.g. Invasive Fruit Fly Pest in Africa).

Plate No. (6) The Food trap

Plate No. (7) A Sticky trap

CHAPTER FUOR

RESULTS

4. RESULTS

4.1. Survey and Identification of fruit flies species in the study area:

The results of the survey and identification indicated that, only two species of fruit flies belong to the family Tephritidae, were found in the study area. These include:

1. The Peach fruit fly, *Bactrocera zonata* (sanders). The male *Bactrocera zonata* **(plate No.8)** and the female *Bactrocera zonata* **(plate No. 9).**
2. The Asian fruit fly, *Bactrocera invadens* (Drew). The male *Bactrocera invadens* **(plate No.10)** and female *Bactrocera invadens* **(plate No.11).**

Also these results showed that, the peach fruit fly, *Bactrocera zonata* was found to be the dominant species in the study periods, attacking guava. Where a significant difference between numbers of B. zonata and B. invadens was ***(*Table No. 1 and Table No. 2).** Which were caught by food traps bait as well as sticky traps. There was significant difference between the *B. zonata* number caught in the food traps and those caught in the sticky traps, the numbers of each species caught in the two types in the study area.

Plate No. (8): The Asian Fruit fly, Bactrocera invadens (Male)

Plate No. (9): The Asian Fruit fly *Bactrocera invadens* (Female)

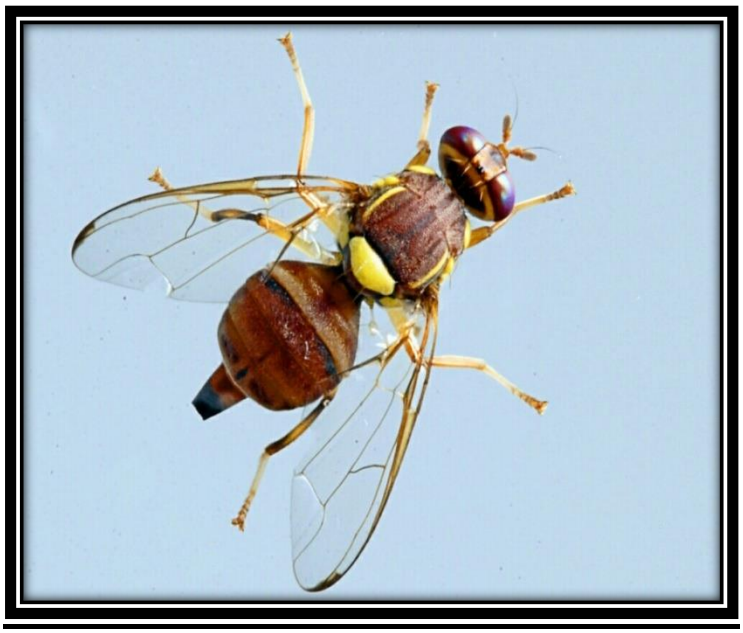

Plate No. (10): The Peach Fruit fly *Bactrocera zonata* (female)

Plate No. (11): The Peach Fruit fly *Bactrocera zonata* (male)

4.1. 1. Characteristics of fruit fly species in the study sites

4.1.1.1. The Asian fruit fly, *Bactrocera invadens* (Drew)

The main distinctive characters of the Adults of *B. invadens* are:

Scutum brown to black, but with high degree of variation from dark brown to complete black. Scutellum yellow with yellow lateral stripes, no medial stripes. Males with pectin (Plate No.)

4.1.1.2. The peach fruit fly, *Bactrocera zonata*

The main distinctive characters of the Adults of *Bactrocera zonata* are:

At the fly's thorax, we notice the presence of two yellow bands on both sides, and the terminal and of the thorax is yellow.

The abdomen is oval, reddish brown, and there are two black bands.

Table No. (1): Numbers of fruit flies species caught throughout experimental period by the food traps (Al-kadro area)

Week	Food traps	Food traps
	B. invadens	B. zonata
Week	57	219
Week	171	372
Week	130	450
Week	90	289
Week	124	312
Total	572	1642

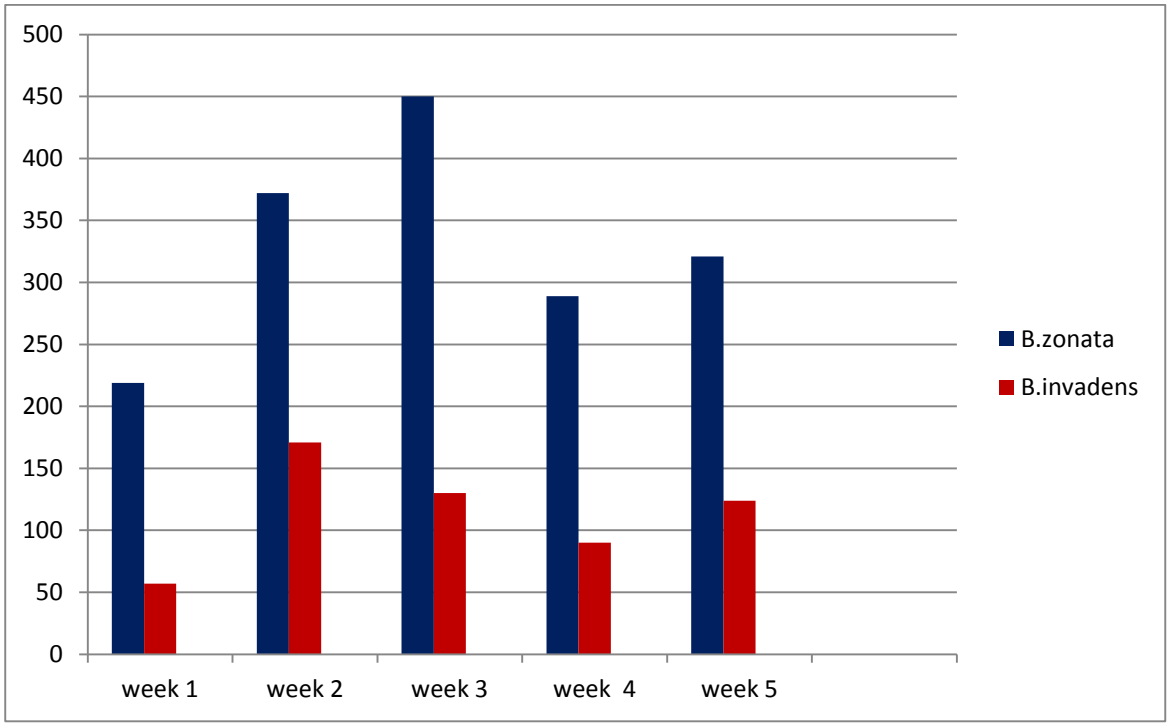

Figure No. (3): Numbers of fruit flies caught throughout **experimental by the food trap (Al-kadro area)**

Table (2): Numbers of fruit flies species caught throughout experimental by the sticky tarps (Al-kadro area)

Week	Sticky trap	Sticky trap
	B. zonata	B. invadens
Week 1	2906	491
Week 2	1424	495
Week 3	1514	600
Week 4	1719	477
Week 5	1505	739
Total	8280	2802

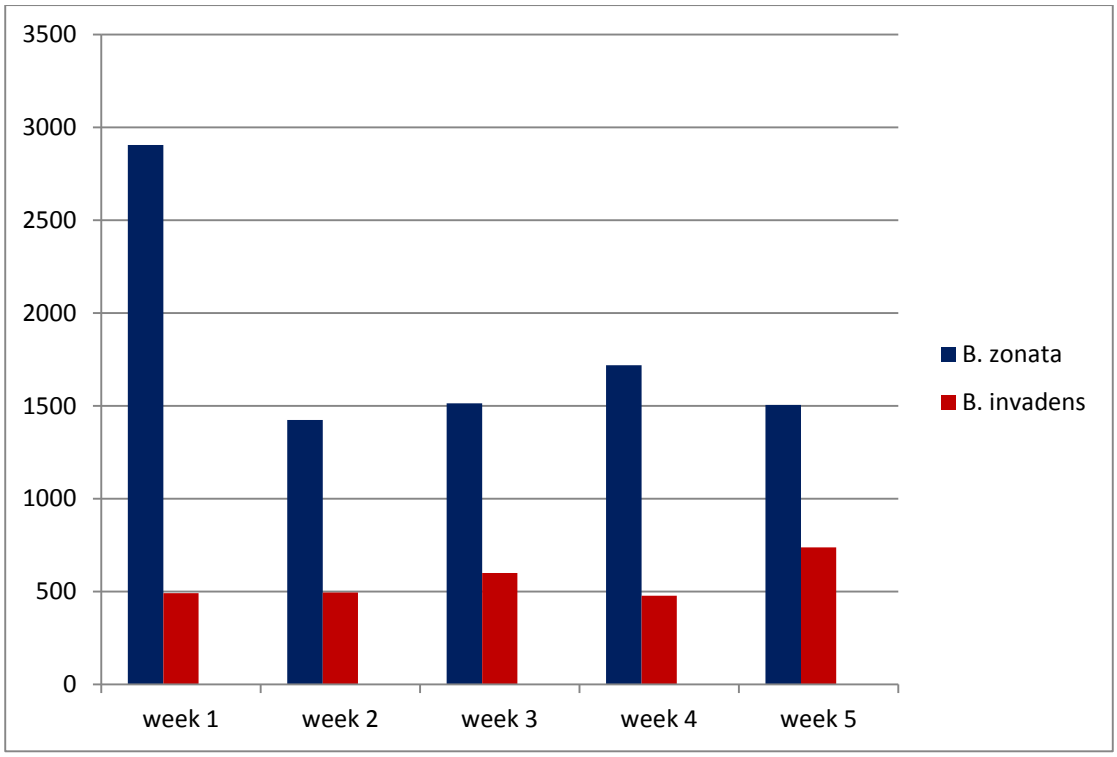

Figure No. (4): Numbers of fruit flies species caught throughout experimental period by the sticky trap (Al-kadro area)

CHAPTER FIVE

DISCUSSION

5. **DISCUSSION**

Monitoring of fruit flies was made during the period from December 2019 to March 2020 by using food bait traps and male sticky traps at Al-kadro area, Khartoum North. In study area, monitoring proved the presence two species of fruit flies, *Bactrocera zonata* and *Bactrocera invadens*. During this study, *B. zonata* was found to be the dominant species in the study area. Current results have shown that sticky traps were more effective in attracting fruit flies. Although food traps attract both male and females of the fruit flies species present in the study area. Were the sticky traps only attracting males.

These results are somewhat similar to those stated by **(Basher, 2010)** *B. invadens* and *C.cosyra* were the main species found infesting mango fruits in Al-faki Hashim area (Khartoum North), with *B. invadens* was the most prevalent species.

(Abdel-gader and Salah, 2016) a survey was initiated to determine the abundance of *B. zonata* in relation to *B.dorsalis* at various periods in three different locations in Wad madani, Al-Gazira state, central Sudan. The proportions of *B. zonata* were also recorded in various directions at different dates in one location. The study aimed to investigate any tendency of *B. zonata* to displace B. dorsalis in central Sudan. *B. zonata* became predominant in all study sites.

Also in another study by **(Suliman, 2013)** in the River Nile state, have 3 species fruit flies were found, Asian fruit fly*, B. invadens,* mango fruit fly *Ceratitis cosyra* and Mediterranean fruit fly, *Ceratitis capitates,* from these studies, it can be said that in past years *Ceratitis spp.* Were very widespread in fruit

production areas, but have gradually disappeared and begun to be replaced by *Bactrocera spp.* **(Duyck *et al,* 2004 and 2007)** reported that *Bactrocera spp*. Was able to displace ceratitis flies, as observed in recent invasions. *Bactrocera invadens* become to be the dominant in horticultural production areas but according to the present results *B. zonata* began to dominate the fruit flies species within the horticultural production areas and spread rapidly in all areas of fruit production.

CONCLUSION AND RECOMMENDATIONS

Conclusion

- The results showed that there were two species of fruit flies: Bactrocera zonata and Bactrocera invadens in the study area.
- Bactrocera zonata is the dominant species in the study area, and become one of the most serious national pests in Sudan.
- The study proved that sticky traps are more effective in attracting fruit flies.
- The study concerning application of botanical extracts were not added according to the advice of my Supervisor: Prof. Awad Khalafalla Taha Elhag.

RECOMMENDATIONS

- ❖ Food plastic bottle traps and sticky traps with their simple design and high cache ability are recommended for use by farmers' mass trapping, training and rehabilitation workers in orchards farms.
- ❖ Monitoring of the fruit flies using food bait traps in necessary for detecting the presence of the species found and their abundances because the species and their population are continuously changing.
- ❖ Putting the infected fruits in plastic bags, closing them tightly and placing them under the sun to kill all stages of the snake inside the fruits.
- ❖ More work in mechanism of competitive displacement of invasive species should be conducted in fruits production areas.

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