



**Sudan University of Science and Technology**

**College of Agricultural Studies**

**Department of Plant Protection**



## **The efficacy of Natural Bee Honey of Sennar State against the fungus Growth (*Penicillium digitatum*)**

A thesis submitted in partial fulfillment  
Of the requirement for the B. Sc. degree  
In plant protection

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## الآية

قال تعالى:

﴿ وَمِنْ ثَمَرَاتِ النَّخِيلِ وَالْأَعْنَابِ نَتَّخِذُونَ مِنْهُ سَكَرًا وَرِزْقًا حَسَنًا إِنَّ

فِي ذَلِكَ لَآيَةً لِّقَوْمٍ يَعْقِلُونَ ﴿٦٧﴾ وَأَوْحَىٰ رَبُّكَ إِلَى النَّحْلِ أَنْ اتَّخِذِي مِنَ الْجِبَالِ

بُيُوتًا وَمِنَ الشَّجَرِ وَمِمَّا يَعْرِشُونَ ﴿٦٨﴾

سورة النحل: ٦٧ - ٦٨

## **Dedication**

***TO MY:***

***Family, to my beloved mother and  
beloved father , to my ancule , and sisters ,  
teachers***

***And every Friends***

***ABDALLA***

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## Abstract

This experiment was carried out under the laboratory condition of the college of Agricultural Study \_Shambat, in order to analyze the moisture of the honey samples of the compost of Sennar from(Sennar,El\_suki) we found (Sennar 16.81% and El-suki 22.17%).

And also to study the effect of natural honey product on the growth fungus (*Penicillium digitatum*), as an alternative to pesticides and chemical growth inhibitors.

The honey sample taken from city of Sennar gave the effect on the growth fungus (*Penicillium digitatum*) better than the honey sample from city of Suki .

The honey sample taken from Suki effect is not clear to inhibit the growth of fungus (*Penicillium digitatum*) was very fast in the first stages of the beginning of the experiment.

## ملخص البحث

أجريت هذه التجربة تحت ظروف المعمل بكلية الدراسات الزراعية (شمبات) جامعة السودان للعلوم والتكنولوجيا وذلك لتحليل الرطوبة بمعمل جايكا لعينات عسلية أخذت من منطقتين في ولاية سنار عينة من سنار المدينة واخرى من السوكي ( فوجدت الرطوبة لعينة سنار 16.81%، وعينة السوكي 22.17).

وأیضا لدراسة تأثير المنتج الطبيعي عسل النحل على نمو فطر العفن الأخضر في الموالح كبديل للمبيدات ومثبطات النمو الكيميائي. العينة التي أخذت من مدينة سنار كان تأثيرها على نمو الفطر واضحا حيث من عسل مدينة السوكي

# CHAPTER ONE

## 1.1: INTRODUCTION:

Honey is sweet food made by bees foraging nectar from flowers. The variety produced honey bee (the genus *apis*) is most commonly referred to it is the type of honey collected by most beekeepers and consumed by people. Honey gets its sweetness from the monosaccharides, fructose, glucose and has about the same relative granulated sugar. (Geiling, Natasha, 2013)

Honey is collected from wild bee colonies or from domesticated bee hives. Wild bee nests are some time located by following honey guide bird. The bee may first be pacified by using smoke from bee smoker. The honey comb is removed from the hive and the honey may be extracted from that. The honey is then usually filtered to remove bee wax and other. (Prescott, Joho, et al, 1999)

The physical properties of honey vary, depending on water content, the type of flowers used to produce it (pasturage), temperature and the proportion of the specific sugar it contains, fresh honey is super saturated liquid, containing more sugar than water can typically dissolve at ambient temperature. Honey is a sugar cooled liquid, in which the glucose. (Jull, Cullum, et al, 2015).

The chemical characteristics of compounds present in honey, their stability when heated or stored for long periods of time. Therefore, the chemical characteristics of those compounds, such as sugar, proteins, amino acids, enzymes, organic acids, vitamins, minerals, phenolic and volatile compounds present in honey. In addition, the indent and quality standards were described such as sugar, moisture, acidity, ash and electrical conductivity. (John, 1999)

Honey contains trace amounts of compounds implicated in preliminary studies to have wound healing properties such as hydrogen peroxide and

methyl glyoxal, there is some evidence that honey may help healing in skin wound after sugar and mild (partial thickness), but in general the evidence for the use of honey in wound treatment is of such low quality that firm conclusion cannot be drawn. (White, 2016).

## **1.2 THE OBJECTIVES**

- 1.** To detect moisture in the honey samples from Sennar state.
- 2.** To study the efficacy of honey samples from Sennar against fungus growth (*penicillium digitatum*).

# CHAPTER TWO

## LIETRETUREAL REVIEW

### 2.1Honey Adulteration Detection:

Honey is an acient valuable food and in most cases has enchanted it is consumers by its medic characteristic its consist mainly of sugar but also contains some amount of acids,nitrogenous compound,phenolic content,HMF,mainly dependant and different in various honey. Honey adulteration is complex problem which currently has significant economic impact and undeniable nutritional and many methods utilized for honey adulteration detection by most researchers for instance Gas Chromatography (GC)and Liquid Chromatography(LC)the methods are all applicated and provide useful information of honey adulteration.(Mohsen Esmaili,2011).

The value of the determination of hydroxy methayl (HMF) in the detection invert surip adulteration of honey is examined.Analysis of(481)sample of extracted honey and (41)comb honey before and after processing from(8)packers provide basic data for establishing for( HMF)content of honey.(White,1980).

Honey can be adulterated method in various away are of the adulteration method in the addition of different sugar syrups during off after honey production starch based sugar,syrups high fructose corne syrups (HFCS)glucose syrups(GS)and (SS)wich are produced from beet can be use for adulteration honey.in the study adulteration honey sample were prepared with the addition of (HFCS),(GS)and (SS)(beet sugar)at aratio of 0%,10%,20%,45%and 50%by weight adulteration by using (SS)beet sugar still serious detection problem.(Tosun andMurat,2013).

This study was carried out to detect some causes of simulated adulterants intentionally added to the commercial Sudanese honey ,an authentic honeys sample was intentionally adulteration with 30%cane

syrops,commercial glucose syrups ,Gum Arabic and Gamardin ,the result indicated the need for comprehensive investigation of the commercial honeys and developing simple method of detection of adulterations.(Mohamed,S.A,AliE.E,(2007).

The detection of honey adulteration with ivert sugar syrups from various (C3)and (C4)plant source was realized by coupling and isotope ratio mass spectrometry both to an elemental analyzer and to liquid chromatography(EA,LC\_IRMS).Authentic honey measured individual value of bulk honey,its protein fraction,fructose,glucose added and trisochrides from 22\_5 to 28.2%and did not show different (Elflein.L,Land Raezke.K.P,(2008).

## **2.2 Physical properties of natural honey:**

Honey has several important quality in addition to composition and taste.Hygroscopicity is another property of honey and describes the ability of honey to absorb and hold moisture from environment normal honey with water content of 18.8% or less will absorb moisture from air of relative humidity of above 60% .The color in liquid honey varies from clear and color less (like water)to dark amber or black the various honey colors are basically all shades of yellow and amber.(Chow,2002)

## **2.3 Chemical composition of natural honey:**

Natural honey contains about 200 substance including amino acid,vitamins,minerals and enzymes but it primarily contains sugar and water ,sugar accounts for 95\_99% of honey dry matter the principal carbohydrate constituents of honey are fructose (32\_56to 38.2%)and glucose(28.54to 31.3%)which represent 85\_95%of total sugar that are readily absorbed in the gastrointestinal tract ,other sugar include disaccharid,sucros,maltose,sucrose,isomaltose,turanose,nigrose.(Whit,1979).



## **2.4 Traditional uses of natural honey:**

Human use of honey is traced to some 8000 years ago as depicted by stony age painting. The ancient Egyptians, Assyrians, Chinese, Greeks and Romans employed honey for wound and diseases of the gut here, some of the beneficial effects of honey which have been utilized by ancient races are summarized (Jeffrey, 1996).

### **2.4.1 in ancient Egypt:**

Honey was the most popular drug being mentioned 500 times in 900 remedies. Its prescription for standard wound salve discovered in the Smith Papyrus (an Egyptian text dating from between 2600 and 2200 B.C) Call for mixture of mirth (grease), byte (honey) and fit (lint/fiber) as transliterated from hieroglyphic symbols. Almost all Egyptian medicine contained honey together with wine and milk. The ancient Egyptians offered honey to their deities as a sacrifice they also used honey for embalming the dead (Emsen, 2007).

### **2.4.2 Egypt at the Manchester museum:**

The Manchester museum contains an intriguing object numbered 296. At 38cm long and 7.8cm in diameter, at first sight it looks like a thin pottery vessel, open at one end and with a small hole at the other. Were it not for the chance discovery of a lead bee inside (and traces of pollen), the function of this object may have gone unrecognized as an ancient Egyptian beehive.

The ancient Egyptians were extremely fond of honey which they used to sweeten cakes and beer- beekeeping is most famously depicted in the Theban tomb of Pabasa (TT2791, an official eluding the 26<sup>th</sup> dynasty (c.650Bc). John Coving Williams (1937).

### **2.4.3 Beekeeping ancient Egypt:**

Bee are being wiped out across the planet – this is not an issue with is only effecting England. Cause is unknown but very likely the new breed of pesticides which are nicotine based and are extremely popular, are the cause. (John, 2012)

### **2.5 Parameters of sugar feeding honey produced from honey bees:**

This study aimed to investigate and evaluate a physiochemical characterization of different honey sample from different origins to confirm it's economical and nutritional quality .... The result of pollen analysis indicated that, all investigated sample of honey were rich in pollen types but with low percentage this might affect the physiochemical and granulation characteristic of the type of honey.(Abd Alla, 2014)

### **2.6 Antimicrobial properties of honey:**

In addition to important role of natural honey in the traditional medicine, during the past few decades, it was subjected to laboratory and clinical investigations. Antibacterial activity of honey is one of most important findings that was first recognized in 1892- by van Kesterel .(Al-Waili,2004)

### **2.7 pathogens found sensitive to honey:**

Honey has been reported to have an inhibitory effect to around 60 species .... Of bacteria including aerobes and anaerobes, gram-positives and gram negatives. Pathogen that are found to be sensitive to Ant-infective properties of honey are manifold. The MIC (minimum inhibitory concentration) of honey was found to Range from 1, 8% (V\V), ie. The honey had sufficient antibacterial potency to still be able to stop bacterial growth if diluted at least nine times, and up to 56 times for *Staphylococcus aureus*, the most common wound pathogen.

(Medhi, Kaman, et- al, 2008)

## **2.8 possible mechanisms of antimicrobial activity of honey:**

Mechanisms of antimicrobial activity of honey are different from antibiotics, which destroy the bacteria cell wall or inhibit intra cellular metabolic pathways. The antibacterial activity is related to four properties of honey. First honey draws moisture out of the environment and thus dehydrate bacteria the sugar content of honey is also high enough to hinder the growth of microbes but the sugar content alone is not the sole reason for honeys antibacterial properties.(Hegazi and Abd –Elhady,2009)

## **2.9 fungal infections:**

Honey has been reported to have inhibitory effects on fungi. Pure honey inhibits fungal growth and diluted honey appears capable of inhibiting toxin production an Antifungal activity has also been observed for some yeast and species of Aspergillus and Penicilliumas well as all the common dermatophytes. Candidiasis, cawsed by candidaalbicans, may respond to honey. In addition, some studies have reported to that topical application of honey was effective in treating seborrheic dermatitis and dandruff.

## **2.10 Antiviral effects of honey:**

In addition to antibacterial and antifungal effects, natural honey has showed antiviral effect al- waili (2004) investigated the effect of the topical application of honey on recurrent attacks of herpes lesions and conclude d that topical honey application was safe and effective in the management of the signs and symptoms of recurrent lesions from labial and genital herpes compared honey has also been reported to have inhibitory effects on rubella virus activity . (Bilsel, Bugra, et- al, 2002)

### **2.10.1 ophthalmology and honey:**

Honey is used worldwide for the treatment of various ophthalmological condition like blepharitis, keratitis, conjunctivitis, corneal injuries , chemical and thermal burns to eyes. In one study, with nonresponsive eye disorders, improvement was seen in 85% patients and in remaining 15% there was no disease progression. (Julie, 2011)

### **2.10.2 honey and diabetes:**

The Was of honey in type"1"and type"11" diabetes was associated with significantly lower glycemic index than with glucose or sucrose in normal diabetes. Honey compared with dextrose caused a significantly lower rise in p.... glucose level in diabetic subjects. It also caused reduction of blood lipids, homocysteine level and c-reactive protein (cap) levels in normal and hyperlipidemic subjects. (Medhi, puri, et. Al, 2008)

### **2.11 fungi and Relationship of honey:**

A fungus: plural: fungi one fungus is any member of the group of eukaryotic organisms that includes unicellular micro Organisms such as yeasts and molds, as well as multicellular fungi that produce familiar fruiting .known as mushrooms. These organisms are classified as a kingdoms, fungi, which is separate from the other eukaryotic life kingdoms of plant and animal. A characteristic that place fungi a different kingdom from plants, bacteria and some protists, is chitin in their cell wall. Similar to animals, fungi are heterotrophic. They acquire their food by absorbing dissolved molecules, typically by secreting digestive enzyme in to their environment Fungi do not photosynthesize. (Hibbett, et- al,2007)

## 2.12 shared features:

With other eukaryotic: fungal cell contain membrane – bound nuclei with chromosomes that contain DNA with noncoding regions called introns and coding regions called exons. Fungi have membrane. Bound cytoplasmic.

Organell such as mitochondria, sterol- containing membrane and ribosomes of the 80s type with animal: fungi lack chloroplasts and hetero trophic organisms and so require preformed organic compound as energy souree. With plant fungi have a cell wall and vacuoles. They reproduce by bath sexual and asexual means, and like basal plants groups similar to mosses and alage, fungi typically have haploid nuclei with eaglenoids and bacteria: higher fungi, and some bacteria produce the amino acid l-lysine in specific biosynthesis steps, called the x-amino dipate pathway booth fungi and oomgctes grow as filamentous hyphal calls. In common with some plant and animals bio luminesce (Simpson, 1979).

## 2.13 Mycology:

Andi and Qian, (2006) defined is the branch of biology concerned with the systematic study of fungi, including their genetic and biochemical properties, their taxonomy, and their use to humans as a sours of medicine, food, and psychotropic substance consumed for religious purposes as well as their danger, such as poisoning or infection the field of phytopathology, the study of plant diseases closely related because many plant pathogens are fungi.

## **2.14 Reproduction:**

Fungal reproduction is complex reflecting the different in lifestyles and genetic makeup within this diverse kingdom of organism estimated that a third of all fungi reproduce using more than one method of propagation; for complex, reproduction may occur in two well-differentiated stages within the life cycle of species the teleomorph and the anamorph. Environmental conditions trigger genetically determined developmental states that lead to the creation of specialized structures of sexual or asexual reproduction by efficiently dispersing spores containing propagation. (Bruns, 2006).

### **2:14:1 Asexual reproduction:**

Asexual reproduction occurs vegetative spores (Candida) or through mycelia fragmentation. Mycelia fragmentation occurs when fungal mycelium separates into pieces and each component grows into separate mycelium. Mycelia fragmentation and vegetative spores maintain clonal populations adapted to specific niches and allow more rapid dispersal than sexual reproduction. The (fungi imperfecti) (fungi lacking the perfect or sexual stage) or deuteromycota comprise all the species that lack an observable sexual cycle. (Palmer, 1993).

### **2:14:2 Sexual reproduction :**

Sexual reproduction with meiosis exists in all fungal phyla except Glomeromycota. It differs in many aspects from sexual reproduction in animals or plants. Differences also exist between fungal groups and can be used to discriminate species by morphological differences in sexual structure and reproductive strategies. Mating experiments between fungal isolates may identify species on the basis of biological species concepts. Most fungi have both haploid and diploid stages in their life cycle. In sexually reproducing fungi, compatible individuals may combine by fusing the hyphae together into an interconnected network. (Tackson, 2000)

## **2.15 Human use:**

The human use of fungi for food preparation or preservation and other purposes is extensive and has long history. Mushroom gathering are large industries in many countries. The study of the history used and sociological impact of fungi is known as ethnomycology because of the capacity of this group to produce an enormous range of natural products with antimicrobial or other biological activities many species have long been used or are being developed for industrial production of antibiotic vitamin and anti\_cancer cholesterol\_lowerring drugs.(Desjardin,et\_al,2010).

## **2.16 Pest control:**

In agriculture, fungi may be useful if they activity compete for nutrient and space with pathogenic microorganisms such as bacteria or other fungi via the competitive exclusion principle or if they are parasite of these pathogens for example certain species may be used to eliminate or suppress the growth of harmful plant pathogens such as insect, mites, weeds, nematodes, and other fungi that causes diseases of important crop plant.(Shoji,Arioka,et\_al,2006).

### **Classification**

*Kingdom:Fungi*

*Phylum:Ascomycota*

*Class:Eurotimycetes*

*Order:Eurotiales*

*Family:Trichocomaceae*

*Genus:Penicillium*

*Species:Digitatum*

Penicillium is a genus of ascomycetes fungi of major importance in the natural environment as well as food and drug production. Some members of the genus produce penicillin, a molecule that is used as an antibiotic which kills or stops the growth of certain kinds of bacteria inside the body. Other species are used in cheese making according to the dictionary of the fungi which contains over 300 species. (Kirk and Minter, 2008).

### **2.17 Economic value:**

Several species of the genus Penicillium play a central role in the production of cheese and of various meat products. To be specific, Penicillium molds are found in blue cheese,

producing enzymes and other macromolecules, such as gluconic, citric, tartaric acids, as well as several pectinases, lipase, amylases, and proteases. (Rifkind, 2005)

### **2.18 fungal physiology:**

Scientists classify living things into a number of different kingdoms, with plants and animals being just two of them. There was a time when fungi

were thought of as plants but they have since been awarded a well-deserved kingdom of their own.

In fact, fungi are more closely related to animals. Fungi are made up in quite a unique way and don't have cells like those of a plant. Instead (with the exception of yeasts), their smallest units are thin threads known as hyphae. Astonishingly, while hyphae can be tiny, there can be 100 metres of them in a gram of soil, and in a hectare (2.5 acres) of British woodland. (Allaby, 1987)

### **2.18.1 feeding habits:**

Whereas plants get their energy directly from the sun and atmosphere using photosynthesis, fungi get theirs by digesting living or dead organic



matter as animals do. Fungi obviously have no mouths or stomachs and instead they work their way through or over their food, absorbing nutrients directly through their cell walls. Nutrients with simple molecules, such as sugar, can be absorbed fairly readily. Larger more complex molecules, such as proteins, are harder to tackle, and the fungi must then make use of various enzymes (chemicals that help to dissolve and simplify the molecules) so that they are easier to absorb. (Baker, 2004)

### **2:18:2 forest full of fungi:**

Autumn is the best time for fungus lovers to walk through a native pinewood. Not because there are more fungi, but because many of the fungi that are there all year round become more conspicuous. Sending forth the familiar mushrooms and toad stools. Since they depend on moist conditions to feed and grow, autumn is an ideal time for reproduction. The familiar smell associated with autumn woodland is all down to fungi working their way through the soil. Our native woodlands have an abundance of fungi. In the Caledonian pinewoods at Abernethy for example, 699 species have been recorded so far. Fungi have been largely overlooked in spite of their importance. (Philips, 1981)

### **2.19 Honey as an antifungal effect against candida species:**

The incidence of candida infection is escalating worldwide. The serious nature of these infections is compounded by increasing levels of drug resistance. We report that certain honeys have significant antifungal activity against clinical isolates of candida species. Importantly, the minimum inhibitory concentration of these honeys would be achievable in a clinical setting. (Molan, 1992)

Results of the susceptibility of *C.albicans*, *C.glabrata*, and *C. dubliniensis* to various honey are shown in table (1). Jarrah honey was significantly more active against the three candida species. The antifungal activities of the floral honeys were significantly greater than the artificial honey against *C. albicans* and *C. glabrata*, but for *C. dubliniensis*, only jarrah honey was significantly more active. *C. dubliniensis* was more susceptible to the osmotic effect of all honey, and to the antifungal effect of jarrah honey, exhibiting significantly lower MICs than the other species. *C. glabrata*, which is innately less susceptible to many conventional antifungals, was the least susceptible to the honey tested. (Cooper, Molan and Harding, 2002).

## **2.20 Citrus fruit:**

### **2.20.1 Definition:**

The orange (specifically) the sweet orange is the fruit of the citrus species (*Citrus sinensis*) in the family rutaceae. The fruit of the citrus of *Citrus sinensis* is considered a sweet orange, whereas the fruit of the *Citrus aurantium* is considered a bitter orange. The sweet orange reproduces asexually (apomixes through nucellar embryony), varieties of sweet orange arise through mutations. The orange is a hybrid, between pummel (*Citrus maxima*) and mandarin (*C. reticulata*). It has genes that are 25% pummel and 75% mandarin hybrid, but hybridized over multiple generations.

### **2.20.2 Botanical information and terminology:**

Kimball (1999), reported all citrus trees belong to the single genus citrus and remain almost entirely inter fertile. This means that there is only one super species that includes grapefruit, lemons, limes, orange, and various other types and other hybrids as the inter fertility of orange and other

citrus has produced numerous hybrids and cultivars, and bud mutation have also been selected, their taxonomy is fairly controversial, confusing or inconsistent. The fruit of any citrus tree is considered a hesperidium, a kind of modified herry, it is covered by a rind originated by a rugged thickening of the ovary wall.

### **2.20.3 Cultivation:**

Like most citrus plant, orange dwell under moderate temperatures-between 15.5 and 29c (59.9 and 84.2 f) and require considerable amount of sunshine and water. It has been suggested the use of water resources by the citrus industry in the middle east is a contributing factor to the desiccation of the region. Another significant dement in the fall development of the fruits in the temperature variation between summer and winter, between day and night. In cooler climates, orange can be grown indoors. (Andres, 2013)

## CHAPTER THREE

### MATERIALS AND METHODS

#### 3. 1 Site location:

This study was conducted in the laboratory of plant pathology department of plant Protection College of Agricultural Studies Sudan of Science and Technology (SUST) during July 2017. The study was conducted to know effect and control of honey samples on fungus *Penicillium digitatum*, honey samples collected from two area from Sennar state ,(Sennar city and El-suki) and explore the methods of control under laboratory conditions

#### 3.2 Material of the study:

Lab coat \_ gloves\_ gags\_ Petri dishes 9\_ sensitive balance\_ Desecrator \_ oven\_ laminar flow\_ needle\_



**Plate(1): Sensetive Balance used to weighting of samples**



**Plate(2): Oven to use of dry samples**



**Plate(3):** Destecator used keeping of the samples before extracting from oven

### **3.3 Methodology:**

#### **3.3.1 Humidity analysis:**

The humidity analyzed in JAICA Laboratory where weight petri dishes blank and taked tow gram from the honey sample (sennar ,el soki) and placed in the sensetive blance and then transfer to oven whrere temperature about  $105^{\circ}\text{C}$  to period six hours ,after that taken in to destecator and weighting other was result (moisture sennar sapmle= $22.17\%$ )and(moisture el-soki sample= $16.81\%$ ) with used modium finally = $19.49\%$  this is not stander moisture,but the stander moisture = $17.3\%$

#### **3.3.2 Study treatments:**

Samples honey were collected from the(sennar) and (el-soki),and samples orang from the central market of bahri ,and covered with honey and then treated with fangus (*Penicillium digitatum*) compared with control ,the first reading was taken after 48 hours the beginning of experiment and then after 24 hours of five dayes



**Plate(4):** orange covered with honey

## CHAPTER FOUR

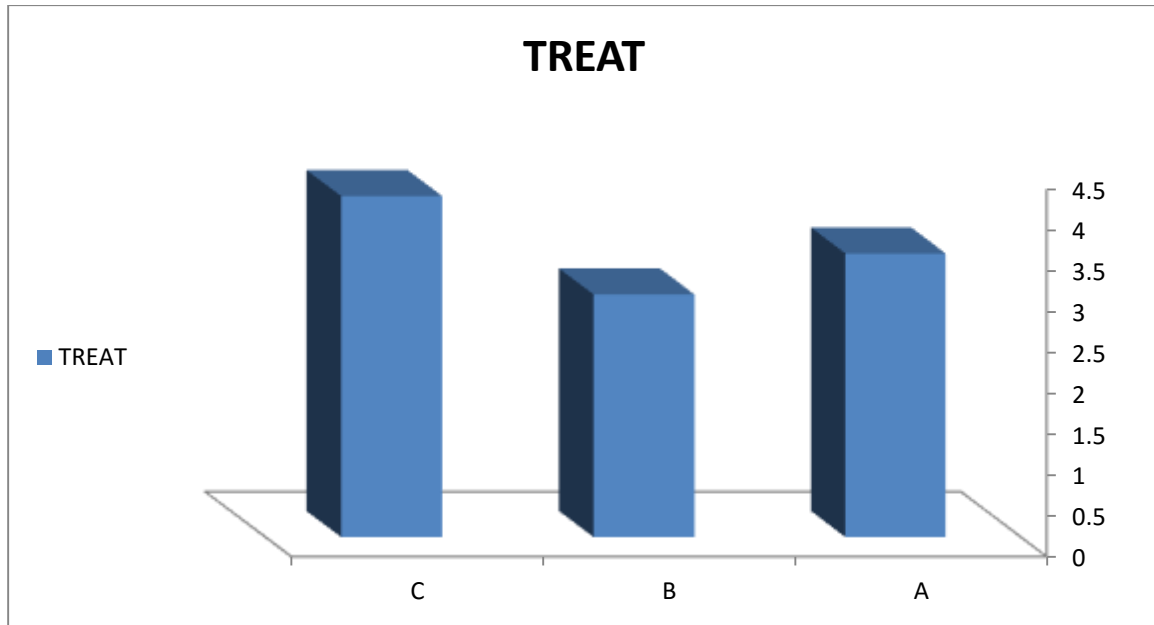
### RESULTS

#### 4.1 Effect of samples honey from Sennar state against fungus growth (*Penicillium digitatum*) under laboratory conditions.

Full results of this test are shown in table (1) and figure (1). The result indicated that significant differences on fungus growth, if we compared between Sennar honey sample (A) and Suki honey sample (B) with control treatment we noticed that the honey sample (B) performed best than control in the growth of the fungus.

**Table (1): Effect of honey samples from Sennar state against fungus growth (*penicillium digitatum*) during July.**

Treatments	Rate of injury
A	3.40 <sup>B</sup>
B	2.90 <sup>C</sup>
C	4.10 <sup>A</sup>
LSD	2.024
C.V	1.27
S.E	38



**Fig (1): Effect of honey samples from Sennar against fungus growth (*penicillium digitaum*).**

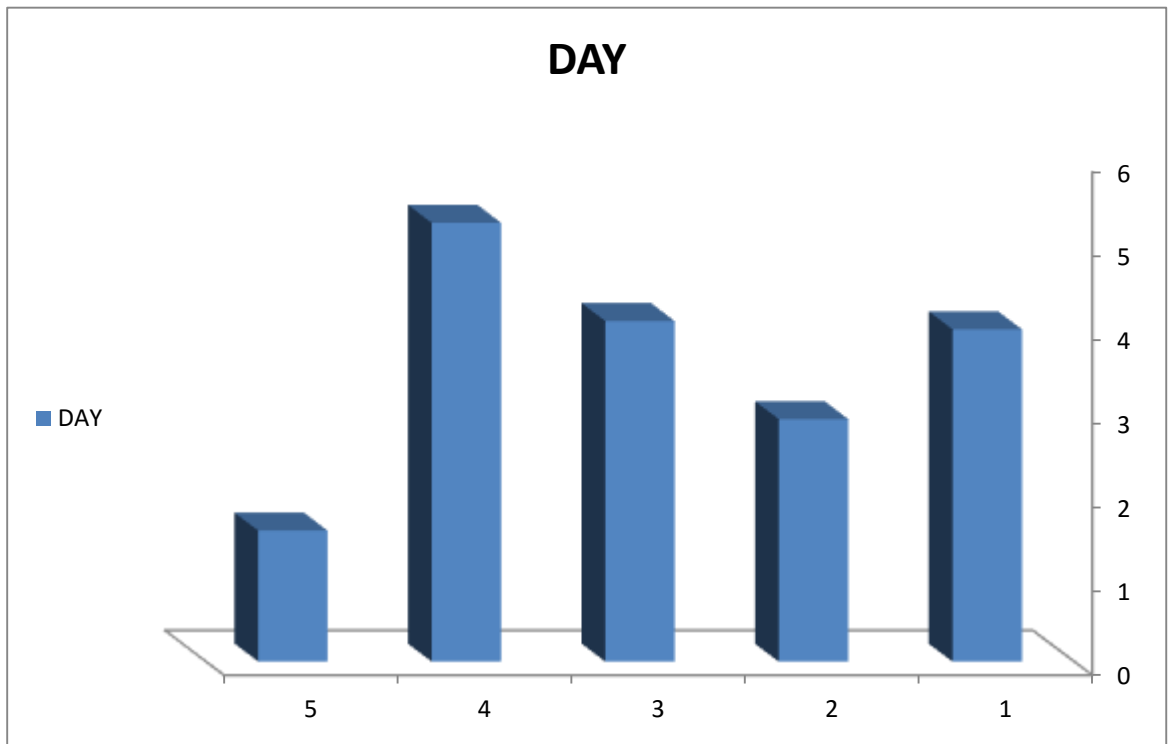
#### **4.2 Effect of honey samples from Sennar state on fungus growth after five days during July.**

Result of this test are shown in table (1) and figure(2).After 3days of treatment we noticed in fungus growth .after 4 days the fungus are growth apparently

**Table (2): Effect of honey samples from Sennar state against fungus growth after five days.**

<b>DAY</b>	<b>Rate of injury (%)</b>
<b>1</b>	<b>3.97</b>
<b>2</b>	<b>2.90</b>
<b>3</b>	<b>4.07</b>
<b>4</b>	<b>5.23</b>
<b>5</b>	<b>1.57</b>





**Fig (2): Effect of honey sample from Sennar state against fungus growth (*Penicillium digitatum*) after five days.**

## CHAPTER FIVE

### 5.1 DISCUSSION:

If we compared between honey samples from Sennar and El-soki in the effected fungus(*penicillium digitatum*) growth, we found the honey of Sennar the best than honey of El-soki compared with the contrl.

Differeces between honey samples (Sennar and El-soki) in the fungus growth (*Penicillim digitatum*) refer to differences humidity analysis. the experiment was conducted under laboratory condition to measure the moisture content of of these honey samples

Where was sample for Sennar(16.81%),and El-soki(22.17%) ,hence the apparent differece in moisture and because fungi growth in wet environments

### 5.2 CONCLUSION:

- 1.Honey samples from Sennar state not work inhibit to fungus growth because high humidity
2. Fungus(*Penicillium digitatum*) growth very fast in control in tempearture room than other treatments.

### 5.3 RECOMMENDATON:

1. I recommended to used natural inhibition in experiments instead of chemical.

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