بسم الله الرحمن الرحيم

Sudan University of Science and Technology

Plant Protection Department

EFFECT OF GINGER (*ZINGIBER OFFICINALIS)* ETHANOLIC ROOT EXTRACT ON THE SHELF LIFE OF TOMATO (*SOLANUM LYCOPERSICUM)* FRUITS

تأثير المستخلص الإيثانولي لجذورالزنجبيل على العمر الرفي لثمار الطماطم

A thesis submitted in partial fulfillment of the requirements for B.Sc. Honors in plant protection

By:

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الآيـــة

قال تعالي:

بسم الله الرحمن الرحيم

(وَظَلَّلْنَا عَلَيْكُمُ الْغَمَامَ وَأَنْزَلْنَا عَلَيْكُمُ الْمَنَّ وَالسَّلْوَى كُلُوا مِنْ طَيِّبَاتِ مَا رَزَقْنَاكُمْ
وَمَا ظَلَمُونَا وَلَكِنْ كَانُوا أَنْفُسَهُمْ يَظْلِمُونَ (٥٧))

صدق الله العظيم

سورة البقرة (57)

Dedication

To my parents

To my friends and to everyone who helped me in this research

With Love

ACKNOWLEDGEMENTS

I would like very much to render His Almighty **Allah** who gives me the power and health to complete this work.

I would also like to express my sincere gratitude to my supervisor Ustaz. **Amin Hussein Ibrahim** for his keen interest, constant guidance, help and encouragement throughout the course of this study to bring this work to reality. It has been a privilege and a pleasure to work with him.

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My thanks to my sister **Kanar Ibrahim** for her keen and kind help in completing this stady.

My thanks are also extended to all my friends and colleagues who stand before me to complete this study. Especial thanks to my friend for her keen and kind help in completing this study:

Ro'aa Taj Elsir

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المستخلص

اجريت دراسه المختبر لتحديد اثار مستخلص الزنجبيل علي العمر الرفي للطماطم في مختبر امراض النبات بجامعه السودان للعلوم و التكنولوجيا في السودان.

وقد تم ترتيب التجربه في تصميم عشوائي تماما مع ثلاثه مكررات وقد شكلت تركيزات مختلفه (25%, 50%,100%) مع وجود الشاهد .

تم قياس التغيرات علي الطماطم من شكل ولون وانكماش وكل التغيرات الفسيولوجيه عليها .

اظهرت النتائج ان ثمار الشاهد حدث لها انكماش تام ، اما الثمار المعالجه بتراكيز 100%) (25 , تم اتلافها تماما ، بينما التركيز (50%) كان اقرب للشاهد .

وكل ذلك بدهن الطماطم بمستخلص الزنجبيل لعده ثواني .

ABSTRACT

The present investigation was undertaken under laboratory conditions at the Plant protection Department, College of Agricultural Studies, Sudan University of Science and Technology, to study the effect of ethanol extract of ginger rhizomes on the shelf life of tomato fruits.

Three concentrations of ginger rhizomeethanolic extract (100,50 and 25%) were used in addition to the untreated control. The assessment of their effect on the shelf life of tomato fruits was recorded. through the color change, damage, and shrinkage parameters.

The experiment was designed in a completely randomized block design with three replicates.

The results showed that the fruits in the control had a complete shrinkage and the fruits were reduced in size after 7 days. On the other hand the treated tomato fruits with the different concentrations of ginger extracts gave different responds. The concentrations (100% and 25%) were completely destroyed after 7 days, while the concentration 50% gave the best results compared to the other concentrations and the control. The shelf life is extended to reach 7 days with the concentration 50% which recorded to be the best of all treatments showing a significant difference at the level P-0.05.

These results are indicative of a bio potential effective material on the shelf life f the tomato fruits.

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CHAPTER ONE

INTRODUCTION

The tomato is the edible, often red fruit of the plant *Solanum lycopersicum*(previously *Lycopersicon esculentum*), commonly known as tomato. Both the species and its use as food originated in Mexico, and spread around the world following the Spanish colonization of the Americas. Its many varieties are now widely grown, sometimes in greenhouses in cooler climates (Warnock, 1991; Heuvelink, 2005).

In the Sudan however, tomato is second to onion among the most important vegetable crops grown, producing about 294 thousand tons of fruits annually representing about 27% of the country's total vegetable production (Ahmed, 1994).

The tomato is consumed in diverse ways, including raw, as an ingredient in many dishes, sauces, salads, and drinks. While it is botanically a fruit, that is considered a vegetable for culinary purposes. The fruit is rich in lycopene, which may have beneficial health effects (Heuvelink, 2005).

The tomato belongs to the nightshade family. The plants typically grow to 1–3 meters (3–10 ft.) in height and have a weak stem that often sprawls over the ground and vines over other plants. It is a perennial in its native habitat, although often grown outdoors in temperate climates as an annual. An average common tomato weighs approximately 100 grams (Warnock, 1991).

Tomato is subjected to a variety of diseases and disorders affecting its yield. One of the most important diseases is the "Early Blight" caused by the imperfect fungus *Alternariasolani*(Awad, 1990; Stone *et. al.*, 2000).

Pesticides are considered indispensable for sustainable agriculture production،in addition to their role in the protection of human health especially in the tropics. (Karan، *et.al* 2006).

Meanwhile, the increasing and irrational use of synthetic pesticides has become a source of great concern because of their possible effect on human health and non-target components of the environment (Akimbo, and Carvel, 2004). This concern is heightened by the non-specificity and high toxicity of some pesticides and development of resistant strains of microorganisms against other ones. The foregoing has initiated the exploration of safe alternate antimicrobial agents. Accordingly, increasing effects have been primary directed towards minimizing pesticides risks in the environment through ecologically sound innovative measures of diseases control (Guideword, et.al, 1990).

Recently, the uses of natural products for crop protection were greatly emphasized by scientists in everywhere (Guideword, *et.al*, 1990).Medicinal plants have become the focus of intense study in terms of validation of their traditional uses, and then it can be usedas natural pesticides. These pesticides are generally more selective in their action, economically feasible and less harmful to the environment than synthetic chemicals. (Songhua and Michailides, 2005).

Currently, control of plant pathogens requires employment of alternative techniques because traditional handling with synthetic chemicals has caused various problems such as toxicity to users and impairment of beneficial organisms (Anderson, *et.al.*2003). Another important aspect is that pathogenic organisms have generated resistance to the active ingredient of some synthetic fungicides in response to selection pressure due to high dose and continuous applications, causing to great economic losses.

Objectives:

The aim of this work is to find an alternative to chemicals that currently used in the lengthen the plant products materials shelf life..

In this work, we intended to use the ginger rhizomes ethanolic extracts to prolong the shelf life of tomato fruits.

CHAPTER TWO

LITERATURE REVIEW

2.1 Tomato plant

The tomato is the edible, often red fruit from the plant Solanum lycopersicum (formerly Lycopersicon esculentum), commonly known as a tomato plant. The tomato is consumed in diverse ways, including raw, as an ingredient in many dishes, sauces, salads, and drinks. While it is botanically a fruit, it is considered a vegetable for culinary purposes.

The tomato belongs to the nightshade family. The plants typically grow to (1-3m) in height and have a weak stem that often sprawls over the ground and vines over other plants. It is a perennial in its native habitat, although often grown outdoors in temperate climates as an annual. An average common tomato weighs (102-105 g).

2.1.1 Scientific classification

Kingdom::Plantae

Division: Magnoliophyta

Class: Magnoliopsida

Order: Solanales

Family: Solanaceae

Subfamily: Solanoideae

Tribe: Solaneae

S.N: ***Solanumlycopersicum***

About 150 million tons of tomatoes were produced in the world in 2009. China, the largest producer, accounted for about one quarter of the global output, followed by United States and India. For one variety, plum or processing tomatoes, California accounts for 90% of U.S. production and 35% of world production (Acquaah, 2002). In Sudan, however, as reported by Mirghani and El Tahir (1995) tomato is gaining importance and its consumption has increased. It ranks as the second vegetable crop and is usually produced by small farmers in rain-fed areas, irrigated private farms and in the big government schemes. The Central State is the most important production area in Sudan, followed by the Northern State. The production of tomato in Sudan has been increasing steadily up to 145909 hectors (*FAOSTAT Database, 2009).

2.1.2 Diseases

Tomatoes plants are subject to a large number of pests and diseases from the time of emergence to harvest. Among these; fungal, viral, bacterial phytoplasmas, and other physiological diseases and disorders, that consider to be the most important limiting factors in tomato production (Rich, 1983). However, other type of problems is the post harvest problems. Allare widespread in the tropics, subtropics and temperate zones and can attack the plants at any stage of development causing a significant risk to crop productivity in the field and to fruit quality in the market (Anon., 1983).

2.3 Ginger plant (*Zingiber officinale*)

Ginger (*Zingiberofficinale*) is widely used around the world in foods as a spice. For centuries, it has been an important ingredient in Chinese herbal medicines for the treatment of catarrh, rheumatism, nervous diseases, gingivitis, toothache, asthma, stroke, constipation and diabetes (Tapsell, *et al*., 2006).Several reviews have appeared in the literature about this plant, and this may reflect the popularity of the subject and its common use as a spice and a medicinal plant (Afzal*etal*., 2001; and Chrubasik*etal*., 2005).

2.3.1. Scientific classification

Kingdom: Plantae

Subkingdom: Tracheobionta

Super division: Spermatophyte

Division: Magnoliophyta

Class: Liliopsida

Subclass: Zingiberidae

Order Zingiberales

FamilyZingiberace

Genus: *Zingiber*

Species: *Z.officinale*

Binomial name:*Zingiberofficinale*

(Wikipedia.com).

2.3.2 Plant distribution

Ginger plants have known to originate in South East Asia, probably in India (Burkill, 1990; Purseglove *et al*., 1981). One of the species under this group is. *Zingiberofficinale* that is known to possess markedly high antioxidant potential compared to other species studied till date (Nan-Chen *et al*., 2008), is cultivated in several countries such as in Australia, Bangladesh, Haiti, Jamaica, Japan, Nigeria, Sri-Lanka, and South East Asian countries including China, Nepal, Malaysia, North Korea, Indonesia and India (Wu and Larsen, 2000). In addition to availability under cultivation, large populations of these plants are also available as land races in the wild, with Eastern and North-Eastern India. Rhizomes of the plants are used as spice whereas both rhizomes and leaves provide important source of medicine. Several landraces of *Zingiber officinale* have been identified by local communities to be elite with respect to medicinal and spice value (Sanjeev *et al*.,2011).Some of genotypes of *Zingiber officinale* are particularly valued for their non-fibrous rhizomes that are likely to provide high content of bio-molecules in the higher content of soft tissue (Kizhakkajii and Sasikumar, 2011). Being vegetative propagated by rhizomes that constitute the plant part for spices and medicines, such plants run the risk of over exploitation in the wild, this adds to the urgent need for Documentation Evaluation and Conservation of these plants. Understanding genome profiling vis-à-vis antioxidant (medicinal) potential of wild population of ginger plants for screening hitherto unexplored medicinal plants that would help to bring underutilized germplasm to cultivation focus, would repay careful investigation.

2.3.2.1 Medical Important

Ginger and many of its chemical constituents have been shown, in numerous clinical studies, to be useful in combating several metabolic diseases. Badreldin, *et al*. (2007) mentioned the document and comment on the publications that have appeared on ginger and its constituents in the last10 years or so.The papers reviewed provide another example of how it may be possible to explain the action(s) of folk medicines in terms of conventional biochemistry and pharmacology. Ginger and many of its chemical constituents have strong anti-oxidant actions. As several metabolic diseases and age-related degenerative disorders are closely associated with oxidative processes in the body, the use of either ginger or one or more of its constituents as a source of anti-oxidants to combat oxidation warrants further attention , and post- operative vomiting and vomiting of pregnancy. It maybe worth while investigating the effect of ginger on vomiting during cancer chemotherapy, as the crude drug and its constituents have themselves anti-cancer actions. Ginger is considered a safe herbal medicine with only few and insignificant adverse side effects (Badreldin, H.A. *et al*. 2007).

CHAPTER THREE

MATERIAL AND METHODS

This study was conducted in the laboratory of plant pathology, department of plant protection, College of Agricultural Studies (CAS), Sudan University of Science and Technology (SUST) during July 2017. The study was done to Lengthen the shelf life of tomato fruits by using ethanolic extract of ginger (*Zingier officinale*)under the laboratory conditions where the temperature around 250C.

3.1Collection of samples

Healthy tomato fruits were collected from Khartoum central market.

3.2 Materials, tools and equipment used in the study

Gloves – Labcoat - shaker – filter paper – flask - paper poster- medical cotton.

3.3 Preparation of extracts

Extracts from the ginger roots (*Zingiberofficinale)*,were obtained or collected from local market in Khartoum "Shambat" , Sudan and tested for their efficacy in reducing the mycelial growth of *A. solani in vitro* using the poisoned food technique (Schmitz, 1930).

Powdered plant materials were sequentially extracted with different solvents ina**Soxhelt** apparatus for 8h according to the method described by (Pandey, 2007).The solvents used for extraction in clude dpetroleum ether (PE), ethanol(ET).There spective extracts were filtered and dried under reduced pressure, using rotary evaporator toyield solid/ semisolid residues. Theres idues were lyophilized to get drysolidmass.

3.4 The Experiment: -

In this experiment, the tomato was coated with gingerethanolic extract for a period of a few seconds.Three different concentrations (100%, 50% , 25%) were used. The treated tomatoes were then kept under the laboratory condition for a week and readings were recorded daily.

3.7. Experimental design:

The experiment was arranged in a Complete Randomized block Design.

3.8. Statistical analyses:

The obtained data was statistically analyzed according to analysis of variance (ANOVA) Duncan's Multiple Range Test (DMRT) was used for means separation using Mstat-C statistical package.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1Evaluation of gingerrhizomes(*Zingiber officinale*) ethanolicextractson the quality of stored tomato fruits (shelf life)

This study was conducted in the laboratory of plant pathology, department of plant protection, College of Agricultural Studies (CAS), Sudan University of Science and Technology (SUST) during September – October 2017. The study was conducted to Lengthen the shelf life of tomato fruits by using ethanolic extract of ginger (Zingier officinale) tomato collected from the market , and to explore the method of control under laboratory condition where around 25C.

The results (Table 1) showed that the ethanol extract of all plants tested in addition to different concentration had effects to the shelf age of tomato .

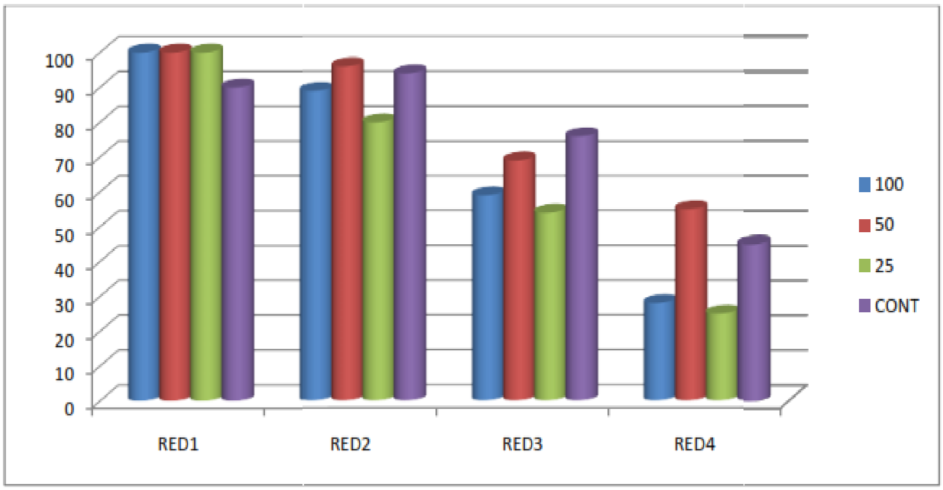
The zingier was more effective of the growth dome of shelf age , the highest concentration of the ethanol extract (50%) gave significantly higher protract to shelf age of tomato , onthe other hand the concentration (25% , 100%) of ethanol extract didnotaffectthe tomato fruits shelf life .

Generally ,all the ethanol extract of ginger (*Zingier officinale*) in different concentration is affecting of shelf life of tomato fruits.

Table 1. ***The*** effect of ethanolic extract of Ginger on the shelf life of the tomato fruits compared to the untreated ones

TREATMENTS	DAY 1	DAY 2	DAY 3	DAY 4
100%	100^{a}	89^{a}	59^{b}	28^{b}
50%	100^{a}	96^{a}	69^{ab}	55^{a}
25%	100^{a}	80^{b}	54^{b}	25^{b}
CONTROL	90^{a}	94^{a}	76^{a}	45^{a}
CV	0	5.29	13.71	18.16
LSD	0	8.9641	16.735	5.7349
SE	O	3.8873	7.2572	13.225

-Means with the same letter in the same column are not significantly different (P< 0.05)



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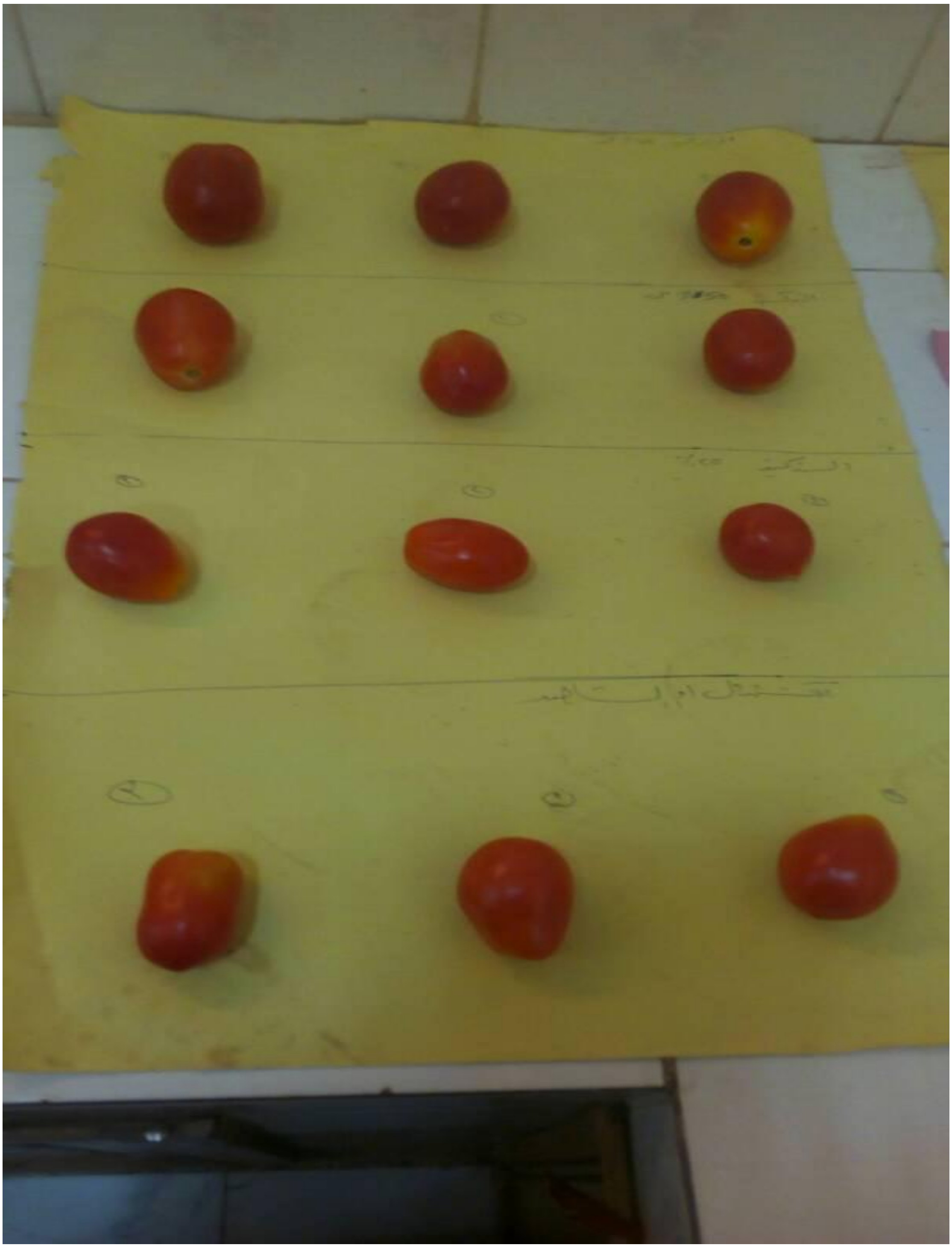
Images

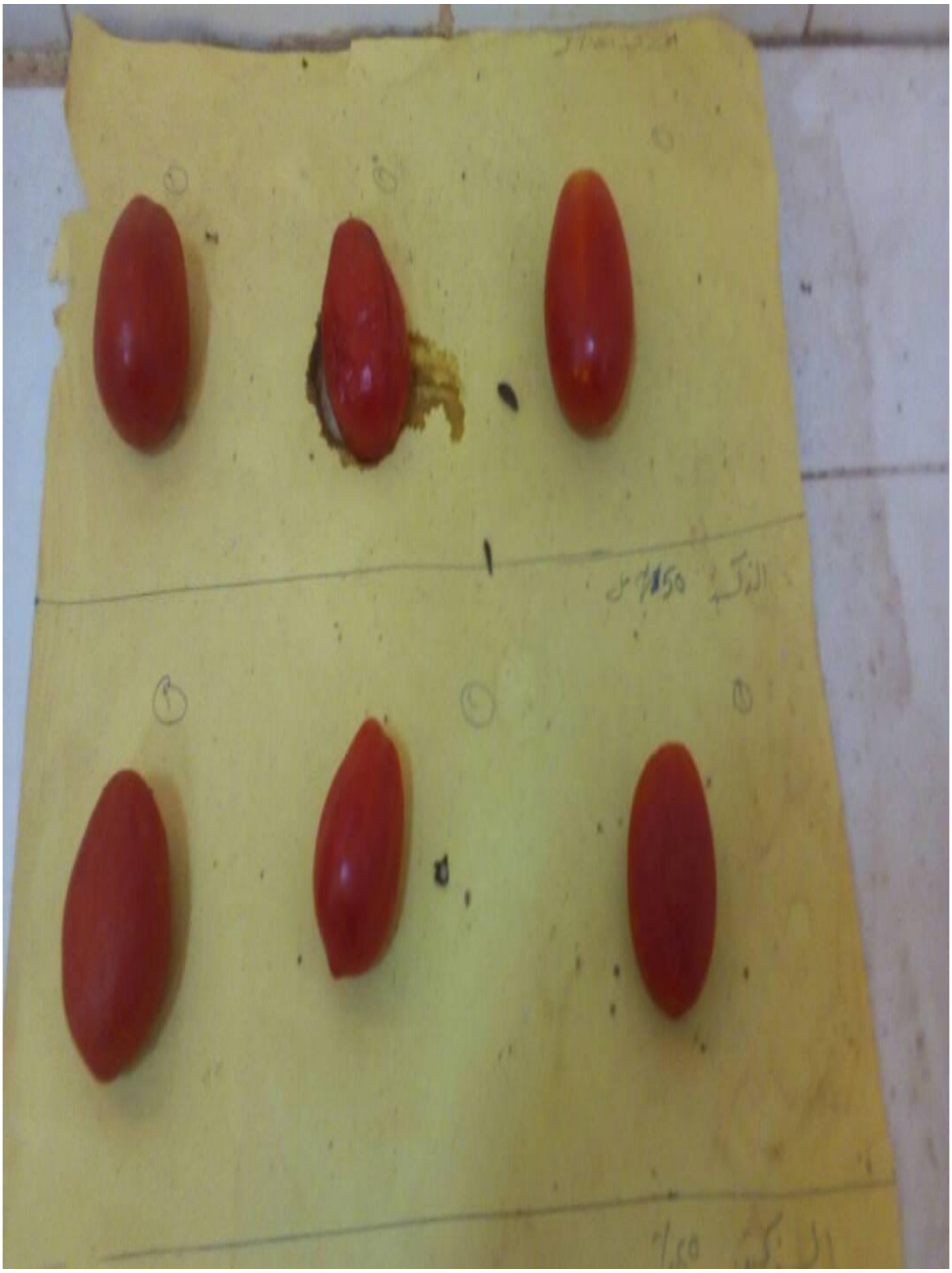
Ethanol Extract of Ginger

Covering Tomato with Ethanol Extracted Ginger

Covering Tomato with Ethanol Extracted Ginger



Tomato after the experiment



Readings

Readings

Readings

Appendices

Statistix 8.0 10/22/2017,
6:43:49 AM

Completely Randomized AOV for RED1

Source	DF	SS	MS	F	P
TREM	2	0.00000	0.00000	M	M
Error	6	0.00000	0.00000		
Total	8	0.00000			

Grand Mean 100.00 CV 0.00

WARNING: The total sum of squares is too small to continue.

The dependent variable may be nearly constant.

Completely Randomized AOV for RED2

Source	DF	SS	MS	F	P
TREM	2	418.667	209.333	7.25	0.0251
Error	6	173.333	28.889		
Total	8	592.000			

Grand Mean 88.667 CV 6.06

	Chi-Sq	DF	P
Bartlett's Test of Equal Variances	8.32	2	0.0156

Cochran's Q 0.9692

Largest Var / Smallest Var 63.000

Component of variance for between groups 60.1481

Effective cell size 3.0

TREM	Mean
80.000	25
96.667	50
89.333	100

Observations per Mean 3

Standard Error of a Mean 3.1032

Std Error (Diff of 2 Means) 4.3885

Completely Randomized AOV for RED3

Source	DF	SS	MS	F	P
TREM	2	363.556	181.778	6.29	0.0337
Error	6	173.333	28.889		
Total	8	536.889			

Grand Mean 60.889 CV 8.83

	Chi-Sq	DF	P
Bartlett's Test of Equal Variances	1.02	2	0.5992
Cochran's Q	0.5692		
Largest Var / Smallest Var	5.2857		

Component of variance for between groups 50.9630

Effective cell size 3.0

TREM	Mean
54.000	25
69.333	50
59.333	100

Observations per Mean 3

Standard Error of a Mean 3.1032

Std Error (Diff of 2 Means) 4.3885

Completely Randomized AOV for RED4

Source	DF	SS	MS	F	P
TREM	2	1622.22	811.111	12.9	0.0067
Error	6	376.00	62.667		

Total   8   1998.22

Grand Mean 36.444   CV 21.72

Chi-Sq   DF   P

Bartlett's Test of Equal Variances   1.10   2   0.5780

Cochran's Q   0.4752

Largest Var / Smallest Var 5.1538

Component of variance for between groups   249.481

Effective cell size   3.0

TREM   Mean

25.333 25

55.333 50

28.667 100

Observations per Mean   3

Standard Error of a Mean   4.5704

Std Error (Diff of 2 Means) 6.4636

Statistix 8.0 10/22/2017,
6:49:59 AM

LSD All-Pairwise Comparisons Test of RED2 by TREM

TREM Mean Homogeneous Groups

96.667 50A

94.000 0A

89.333 100

80.000 25B

Alpha 0.05 Standard Error for Comparison 3.8873

Critical T Value 2.306 Critical Value for Comparison 8.9641

There are 2 groups (A and B) in which the means

are not significantly different from one another.

LSD All-Pairwise Comparisons Test of RED3 by TREM

TREM Mean Homogeneous Groups

76.667 0A

69.333 50AB

59.333 100B

54.000 25B

Alpha 0.05 Standard Error for Comparison 7.2572

Critical T Value 2.306 Critical Value for Comparison 16.735

There are 2 groups (A and B) in which the means

are not significantly different from one another.

LSD All-Pairwise Comparisons Test of RED4 by TREM

TREM Mean Homogeneous Groups

55.333 50A

45.333 0A

28.667 1O0B

25.333 25B

Alpha 0.05 Standard Error for Comparison 5.7349

Critical T Value 2.306 Critical Value for Comparison 13.225

There are 2 groups (A and B) in which the means

are not significantly different from one another.