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EFFECT OF PALM KERNEL AND OLIVE OILS ON THE PRESERVATION OF CASADY'S FOLLY TOMATO (*Solanumlycopersicum*)

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Abstract

The bio-preservative efficiencies of two major edible vegetable oils on stored tomato fruits (Casady' folly) were evaluated in this study. It included 20 fresh Casady's folly tomatoes fruits treated within 4 groups, with 5mls of palm kernel oil, 5mls of olive oil, a mixture of 2.5mls each of palm kernel + olive oil and while group four served as control. They were incubated at room temperature and observed for 8 days. The oils were used to evaluate their effect on parameters such as weight loss, firmness, color, postharvest decay percentage (%) (PDP), shelf life, marketability, relative humidity, temperature and microbial components of the tomatoes during storage. Weight loss in this study ranged from 24.9000-38.1400 during storage. The result, also, showed that the oil did not retain firmness of the tomatoes after treatment relative to the control. The color of Casady's folly progressively changed during the storage period. Postharvest Decay Percentage (%) (PDP) of Casady's folly showed that treated fruits on day eight (8) had the highest number of decay (60%) and control showed the lowest number (40%) on day eight (8) after treatment. Shelf life of Casady's folly tomato fruits progressively decreased during the storage period. Marketability of Casady's folly tomato fruits progressively decreased during the storage period. Relative Humidity of the storage room ranged from 69.0 – 92.5, likewise temperature of the storage room changed between 26˚C – 33˚C during the experimental period. The Microbial constitution found associated with the spoilage of Casady's folly tomatoes fruits included bacteria such as *Staphylococcus spp, Shigellaspp, and Klebsiellaspp, Salmonella spp, Escherichia coli* and fungi such as *Saccharomyces spp, Mucorspp, Aspergilus spp.* The result of this study showed that palm kernel and olive oil could not preserve Casady's folly tomatoes fruits.

KEYWORDS: Bio preservative; Postharvest; Shelf Life; Vegetable Oils; Palm Kernel Oil; Olive Oil; Microbial Constitution; Casady's folly Tomato

Introduction

*Solanumlycopersicum*Mill, commonly called tomato has great relevance in almost every Nigerian, continental and global dishes. Tomatoes are one of the greatest used vegetables globally. Nigeria employs close a million hectares of land area in the cultivation of tomato thereby making it a frequently used vegetable in Nigeria homes (Ogidi*et al*., 2018). For instance, the vegetable is grown all year round in Chile Island (Makurdi) Benue State making it available and accessible and affordable (Liamngee*et al*., 2015).

Tomatoes have a number of bioactive compounds which includes phenolic, vitamin A, C, E and lycopene and phytochemicals which includes carotenoids and polyphenols (Dias, 2012; Juarez-Maldonado *et al*., 2016; Lianmgee*et al*., 2018; Marti *et al*., 2018). Tomato contains high contents of calcium, phosphorus, magnesium, copper, niacin, iron, folate, Vitamin A, B6, Vitamin E, Vitamin B2, Vitamin C, iron and carbohydrates (Wamache, 2005; Klunklin and Savage, 2017; Marti *et al*., 2018). This useful components which are contained inside of it has health and other implication on its consumers.

Buyers evaluate the value of tomato fruit mainly by three parameters namely: Physical appearance (color, size, shape, defects, and decay), firmness, and flavor. These qualities are largely influenced by level of maturity after harvest, frequency of handling or touching, and storing temperature over time. This biodeterioration of tomato may be facilitated by postharvest activities and other parameters such as disease conditions.

Since fresh Casady'sfolly fruits are susceptible to postharvest losses due to mechanical injuries, microbial activities and attack by animal pest among other factors (Ahmed *et al*., 2013; Ewekeye*et al*., 2014). This informed the need to explore natural preservatives such as Palm kernel and olive oils in overcoming the challenges leading to the huge losses experienced during the storage of this tomato fruits (Zakki*et al*., 2018). This research was, therefore, carried out to determine the ability of palm kernel oil and olive oil to preserve fresh Casady's folly fruits.

Materials and Methods

Collection of Tomatoes Sample

A variety of fully ripened fresh *Lycopersicumesculentum* fruits commonly called Casady's Folly were purchased from Wadata Market in Makurdi, the capital of Benue State, Nigeria.

Collection of Plants Oil

Two (2) vegetable oils namely Palm kernel oil.andOlive oil were purchased from D.O Brothers Supermarket in Wadata Market, Benue State, Nigeria and used for this research.

Treatment Design

Group I: Four (4) fresh Casady's folly treated with 5mls of palm kernel oil.

Group II: Four (4) fresh Casady's folly treated with 5mls of olive oil.

Group III: Four (4) fresh Casady's folly treated with mixture (2.5mls each) of olive oil and palm kernel oil.

Group IV: Four (4) fresh Casady's folly not treated (control).

Measurement of physico-chemical parameters

Weight Percentage (g) (WLP)

Casady's folly fruits were weighed on Electronic Compact Scale (Virgo Plastic SF-400A) (Liamngee*et al.,* 2018).

$$WLP = \frac{\text{Initial weight - final weight}}{\text{Initial weight}} \times 100$$

Firmness

This was estimated by hand assessment via a mathematical score scale of 1 - 5. Where 1 = very poor, 2 = poor, 3 = acceptable, 4 = good and 5 = Excellent as described by (*Hosea et al.,* 2017).

Color

Color assay of Casadys folly fruit was done on daily basis using physical appearance aided by a standard color chart as described by Dadzie and Orchar (1997).

Postharvest Decay Percentage (%) (PDP)

The numbers of decaying Casadys Folly fruits under storage were calculated daily by the formula (Liamngee*et al.,* 2018).

PDP = <u>Number of fruits Decaying</u> X 100

Total number of fruits

Shelf life

This was computed on the basis of marketability and eating quality during storage period with appearance of the fruits as guiding factor (Liamngee*et al.,* 2018).

Marketability (%)

This was obtained using features such as amount of physical wounds, level of shrinking, smoothness and glossiness of fruit, with the aid of a as formula reported by (Zakki*et al.,* 2017).

$$\text{Marketability of tomato fruits} = \frac{\text{Number of marketable fruits}}{\text{Total number of fruits}} \times 100$$

Relative Humidity

Relative humidity of the storage room during storage was obtained by means of a hygrometer (Isaac *et al.,* 2015).

Temperature

Temperature of the storage room was estimated morning and evening using a thermometer.

Evaluation of microbial quality

Media preparation

The medium used for isolation and inoculation of organisms (MacConkey, Sabouraud Dextrose Agar, Nutrient Agar and Peptone Water) was prepared aseptically according to the producer's specifications (Zakki*et al.,* 2017).

Preparation of Tomato Concentration

One gram (1g) of the most infected tomato from each sample (Group I-IV) were cut and weighed. They were dissolved into the respective corresponding volumes of sterile distilled water in the various test tubes (Molan, 2011).

Inoculation of Samples

After the preparation (MacConkey, Sabouraud Dextrose Agar, Nutrient Agar and Peptone Water) of the media, they were poured into sterile disposable Petri dishes and spread by swirling; and then allowed to solidify then the media were inoculated with various dilutions of the infected parts of the tomato and they were incubated for between 1 to 3 days for possible growth. (Cheesbrough, 2000).

Isolation of Bacteria

The incubated plates were removed and observed for microbial growth after 24hours to 72 hours and their colonies were counted (Cheesbrough, 2000).

Subculture of Bacteria

The solidified media were streaked with the colonies obtained and incubated for 24hours (Cheesbrough, 2000).

Identification of Bacteria and Fungi isolates

Both macroscopic and microscopic identification of these isolates were carried out to evaluate colony morphology. The gram stain technique was used to evaluate properties of bacteria colony and identified using biochemical test (Cheesbrough, 2000; Ogo-Oluwa and Liamngee (2016).

Data Analysis

The data collected were statistically analyzed using Descriptive Analysis and Analysis of Variance (ANOVA) using Statistical Package for Social Science (SPSS) version 23.0 and mean separation was done using Fisher Least Significant Difference (LSD).

Results

Weight Percentage (g) (WLP)

The effect of palm and olive oils on the weight of Casady's folly over the storage period showed that, the main effect of the oils on the weight of Casady's folly tomatoes fruits on weight before and weight after days 3, 5, 7 was not significantly different at ($p>0.05$). In this study, weight loss of Casady's folly tomato fruits progressively increased during 7 days of the storage period. Weight loss in this study ranged from 24.9000-38.1400 during storage. The highest weight loss was observed on treatment of Olive oil on day seven (7) (27.7400±5.7531) and the lowest weight loss was observed on control on day three (3) (35.5800±6.70637). These agree fully with the findings as reported by Meseretet al. (2012), Hiruet al. (2008) and Hosea et al. (2017). Oladimejiet al. (2014) also reported that mean weight loss increased with increase in the time of incubation

Firmness

The effect of palm and olive oils on the firmness of Casady's folly over the storage period showed that, the main effect of the oils on the firmness of Casady's folly tomatoes fruits on firmness before and after days 2, 4, 6, 8 was not significantly different at ($p>0.05$).

Hence there was a decrease in firmness from the beginning to the end of the storage period

Table 1: Effect of Palm and Olive oils on the Weight of Casady's Folly

Parameters	Treatment	N	Mean±Std. Error
WB	Palm Kernel Oil	5	28.3600±2.21599
	Olive Oil	5	32.0200±6.11207
	Palm Kernel + Olive Oil	5	38.1400±2.93898
	Control	5	35.9400±6.83598
WA 3 days	Palm Kernel Oil	5	27.6800±2.06915
	Olive Oil	5	30.9200±5.77238
	Palm Kernel + Olive Oil	5	37.2600±2.78794
	Contrrol	5	35.5800±6.70637
WA 5 days	Palm Kernel Oil 5		26.2200±2.17656
	Olive Oil	5	29.3800±5.81235
	Palm Kernel + Olive Oil	5	36.7400±2.85808
	Control	5	34.7800±6.40764
WA 7 days	Palm Kernel	5	24.9000±2.18583
	Olive Oil	5	27.7400±5.75314
	Palm Kernel + Olive Oil	5	34.4000±2.63135
	Control	5	32.3800±6.53846

(p? 0.05)
Key:
WB = Weight Before; WA = Weight After

Color

The color of Casady's folly over the storage period showed that, the color progressively changed from pink-light red-red as the number of storage period increases. The color of Casady's folly progressively changed during the storage period. Similar report was given by Tabaestani*et al*. (2013). In their study, coating of tomatoes with gum arabic delayed colour change, which was probably due to an increase in CO2 and decrease in O2 levels.

Table 2: Effect of Palm and Olive oils on the Firmness of Casady's Folly

		Treatment			
		I	II	III	IV
Parameters	Scale	Palm Kernel Oil	Olive Oil	Palm Kernel + Olive Oil	Control
		(%)	(%)	(%)	(%)
FB	4	0	60	20	20
	5	100	40	80	80
FA 2 days	3	0	60	0	20
	4	0	0	20	0
	5	100	40	80	80
FA 4 days	1	0	20	0	0
	2	0	40	0	40
	3	20	0	0	0
	4	40	0	40	20
	5	40	40	60	20
FA 6 days	1	0	20	0	20
	2	0	40	40	20
	3	60	0	0	20
	4	0	0	20	0
	5	40	40	40	40
FA 8 days	1	40	40	20	40
	2	20	40	20	0
	3	0	0	20	20
	4	20	0	40	0
	5	20	40	0	40

(p?0.05)
Key:

FB = Firmness Before; FA = =Firmness After

1 = Very Poor; 2 = Poor; 3 = Acceptable; 4 = Good; 5 = Excellent

Table 3: Changes in the Colour of Casady's Folly

		Treatment			
		I	II	III	IV
Parameters	Scale	Palm Kernel Oil	Olive Oil	Palm Kernel +Olive Oil	Control
CB	Pink	3	4	4	4
	Light Red	2	0	1	1
	Red	0	1	0	0
CA 3 days	Pink	3	3	3	0
	Light Red	2	1	2	4
	Red	0	1	0	1
CA 5 days	Pink	3	2	2	0
	Light Red	2	2	3	4
	Red	0	1	0	1
CA 7 days	Pink	2	2	2	0
	Light Red	1	2	2	4
	Red	2	1	1	1

Key:
CB = Color Before
CA = Color After

Postharvest Decay Percentage (%) (PDP)

The Postharvest Decay Percentage (%) (PDP) of Casady's folly over the storage period showed that the Postharvest Decay Percentage (%) (PDP) of fruits increased as the storage period increased. Postharvest Decay Percentage (%) (PDP) of Casady's folly showed that treated fruits on day eight (8) showed the highest number of decay 3 (60%) and control showed the lowest number 2 (40%) on day eight (8) after treatment. Similar finding was also reported by Dovale-Rosaval*etal*. (2015).

Table 4: Postharvest Decay Percentage of Casady's Folly

	Days			
Treatments	**2**	**4**	**6**	**8**
Palm Kernel Oil	0 (0)	0 (0)	0 (0)	3 (60)
Olive Oil	0 (0)	3 (60)	3 (60)	3 (60)
Palm Kernel + Olive Oils	0 (0)	0 (0)	2 (40)	3 (60)
Control	0 (0)	2 (40)	2 (40)	2 (40)

Shelf life

The Shelf life of Casady's folly over the storage period showed that, the Shelf life of the fruits decreased as the storage period increased. This does not agree with the findings of Hosea *et al*. (2017) who reported that treating tomato fruits with Neem leaf powder significantly increased their shelf life as seen in the number of days it took for complete spoilage of the fruits to occur.

Table 5: Shelf life of Casady's Folly

	Days			
Treatments	**2**	**4**	**6**	**8**
Palm Kernel Oil	5 (100)	5(100)	5 (100)	2 (40)
Olive Oil	5 (100)	2 (40)	2 (40)	2 (40)
Palm Kernel + Olive Oils	5 (100)	5 (100)	3 (60)	2 (40)
Control	5 (100)	3 (60)	3 (60)	3 (60)

Marketability (%)

The Marketability (%) of Casady's folly over thestorage period showed that, the more the storage period increased, the more the decrease in the number of marketable fruits. Marketability of Casady's folly tomato fruits progressively decreased during the storage period. This finding is in agreement with Liamngeeet *al*. (2018) who reported a decrease in marketability quality of tomato fruits during storage.

Table 6: Marketability of Casady's Folly

Treatments	Days 2	4	6	8
Palm Kernel Oil	5 (100)	5 (100)	5 (100)	2 (40)
Olive Oil	5 (100)	2 (40)	2 (40)	2 (40)
Palm Kernel + Olive Oils	5 (100)	5 (100)	3 (60)	2 (40)
Control	5 (100)	3 (60)	3 (60)	3 (60)

Microbial Count

The effect of palm and olive oils on the microbial count of Casady's folly over the storage period showed that the effect of the oils on bacteria on MacConkey Agar and Nutrient Agar media were significant at $p<0.05$ and the effect of the oils on fungi on Sabouraud Dextrose Agar media was not significant at ($p>0.05$). On microbial count on MacConkey Agar and Nutrient agar media, there was significant difference ($p<0.05$) in the growth of bacteria when palm kernel oil and a combination of palm kernel oil with olive oils compared with the controls. In SDA media, there was no significant difference ($p>0.05$) in the growth of fungi. This agree fully with the finding of Alabi*et al*. (2013) who reported that palm kernel oil and olive oil were the poorest preservative oils in their comparative studies on the relative biopreservative efficiencies of major tropical vegetable oils on industrial tomato (Lycopersicumesculentum) paste in storage.

Table 7: Effect of Palm and Olive oils on Microbial Count

Parameters	Treatment	N	Mean±Std. Error
MacConkey Agar	Palm Kernel Oil	5	$8.6667^{a}\pm3.84419$
	Olive Oil	5	$18.6667^{a}\pm5.20683$
	Palm Kernel + Olive Oil	5	$16.6667^{a}\pm2.40370$
	Contol	5	$209.3333^{b}\pm42.30970$
Nutrient Agar	Palm Kernel Oil	5	$19.60442^{a}\pm11.31862$
	Olive Oil	5	$9.29157^{a}\pm5.36449$
	Palm Kernel + Olive Oil	5	$8.50490^{a}\pm4.91031$
	Control	5	$112.34026^{b}\pm64.85968$
Sabouraud Dextrose Agar (SDA)	Palm Kernel Oil	5	199.0000±16.09348
	Olive Oil	5	176.6667±57.50072
	Palm Kernel + Olive Oil	5	248.6667±140.50030
	Control	5	339.3333±57.49203

($p<0.05$) = MacConkey and Nutrient Agar

($p>0.05$) = Sabouraud Dextrose Agar (SDA)

LSD values:

MacConkey Agar = 97.321

Nutrient Agar = 111.900

Means with the same super script are not significantly different.

Key:

N = Number

LSD = Least Significant Difference

Cultural, Morphological and Biochemical Characteristics of Bacteria Isolates

The Cultural, Morphological and Biochemical characteristics of bacteria isolates associated with the spoilage of Casady's folly tomato fruits.

Bacteria Isolates

Bacteria isolates from tomato includes:*Staphylococcus spp, Klebsiellaspp, Escherichia coli, Salmonella spp*and *Shigella spp.* Among the bacteria, *Shigellaspp*was the most prevalent with 37.5%, *Klebsiellaspp*constituted 31.25%, *Salmonella spp*constituted 18.75%, *Staphylococcus spp*constituted 6.25% and *Escherichia coli* constituted 6.25%. These partly agree with the work of Bello *et al*. (2016) who discovered the (*Staphylococcus aureus* and *Basillusspp*) and fungi (*Aspergillus flavus*and *Rhizopusstolonifer*) were responsible for tomato fruits spoilage.

Table 8: Cultural, Morphological and Biochemical Characteristics of Bacteria Isolates

Group	Color of Colony	Shape of Colony	Morphology	Grams Reaction	Catalase Test	Indole Test	Uraese Test	Citrate Test	Bacteria Identified
ICF_1	Pale	Circular	Rod	-	+	-	_	_	*Shigellaspp*
CF_2	Pale	Circular	Rod	-	+	-	_	+	*Salmonella spp*
CF_3	Pale	Circular	Rod	-	+	-	_	+	*Salmonella spp*
CF_4	Mucoid Pink	Irregular	Rod	-	+	-	+	_	*Klebsiellaspp*
$IICF_1$	Pale	Circular	Rod	-	+	-	_	_	*Shigellaspp*
CF_2	Pale	Circular	Rod	-	+	-	_	_	*Shigellaspp*
CF_3	Mucoid Pink	Irregular	Rod	-	+	-	+	_	*Klebsiellaspp*
CF_4	Mucoid Pink	Irregular	Rod	-	+	+	+	_	*Klebsiellaspp*
$IIICF_1$	Pale	Circular	Rod	-	+	_	_	_	*Shigellaspp*
CF_2	Pale	Circular	Rod	-	+	_	_	+	*Salmonella spp*
CF_3	Pale	Circular	Rod	-	+	_	_	_	*Shigellaspp*
CF_4	Pink	Circular	Rod	-	+	+	_	_	*Escherichia coli*
$IVCF_1$	Cream	Circular	Coci	+	+	+	+	+	*Staphylococcus spp*
CF_2	Pale	Circular	Rod	-	+	_	_	_	*Shigellaspp*
CF_3	Mucoid Pink	Irregular	Rod	-	+	_	+	_	*Klebsiellaspp*
CF_4	Mucoid Pink	Irregular	Rod	-	+	+	+	_	*Klebsiellaspp*

Key: ICF = ICasady's folly; IICF = IICasady's folly;
IIICF = IIICasady's folly; IV = IVCasady's folly
+ = positive, - = negative

Table 9: Frequency of Bacteria Isolated from Casady's Folly

Bacteria	Frequency	Parcentage (%)
Klebsiellaspp	5	31.25
Shigellaspp	6	37.5
Salmonella spp	3	18.75
Staphylococcus spp	1	6.25
Escherichia coli	1	6.25
Total	16	100

(p? 0.05)

Macroscopic and Microscopic Characteristics of Fungi Isolates

The macroscopic and microscopic characteristics of fungi isolates associated with the spoilage of Casady's folly tomato fruits.

Table 8: Cultural, Morphological and Biochemical Characteristics of Bacteria Isolates

Group	Color of Colony	Shape of Colony	Morphology	Grams Reaction	Catalase Test	Indole Test	Uraese Test	Citrate Test	Bacteria Identified
ICF$_1$	Pale	Circular	Rod	-	+	-	_	_	*Shigellaspp*
CF$_2$	Pale	Circular	Rod	-	+	-	_	+	*Salmonella spp*
CF$_3$	Pale	Circular	Rod	-	+	-	_	+	*Salmonella spp*
CF$_4$	Mucoid Pink	Irregular	Rod	-	+	-	+	_	*Klebsiellaspp*
IICF$_1$	Pale	Circular	Rod	-	+	-	_	_	*Shigellaspp*
CF$_2$	Pale	Circular	Rod	-	+	-	_	_	*Shigellaspp*
CF$_3$	Mucoid Pink	Irregular	Rod	-	+	-	+	_	*Klebsiellaspp*
CF$_4$	Mucoid Pink	Irregular	Rod	-	+	+	+	_	*Klebsiellaspp*
IIICF$_1$	Pale	Circular	Rod	-	+	_	_	_	*Shigellaspp*
CF$_2$	Pale	Circular	Rod	-	+	_	_	+	*Salmonella spp*
CF$_3$	Pale	Circular	Rod	-	+	_	_	_	*Shigellaspp*
CF$_4$	Pink	Circular	Rod	-	+	+	_	_	*Escherichia coli*
IVCF$_1$	Cream	Circular	Coci	+	+	+	+	+	*Staphylococcus spp*
CF$_2$	Pale	Circular	Rod	-	+	_	_	_	*Shigellaspp*
CF$_3$	Mucoid Pink	Irregular	Rod	-	+	_	+	_	*Klebsiellaspp*
CF$_4$	Mucoid Pink	Irregular	Rod	-	+	+	+	_	*Klebsiellaspp*

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IIICF = IIICasady's folly; IV = IVCasady's folly
+ = positive, - = negative

Bacteria Isolates

Bacteria isolates from tomato includes:*Staphylococcus spp, Klebsiellaspp, Escherichia coli, Salmonella spp*and *Shigella spp*. Among the bacteria, *Shigellaspp*was the most prevalent with 37.5%, *Klebsiellaspp*constituted 31.25%, *Salmonella spp*constituted 18.75%, *Staphylococcus spp*constituted 6.25% and *Escherichia coli* constituted 6.25%. These partly agree with the work of Bello *et al*. (2016) who discovered the (*Staphylococcus aureus* and *Basillusspp*) and fungi (*Aspergillus flavus*and *Rhizopusstolonifer*) were responsible for tomato fruits spoilage.

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Shigellaspp	6	37.5
Salmonella spp	3	18.75
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Escherichia coli	1	6.25
Total	16	100

(p? 0.05)

Macroscopic and Microscopic Characteristics of Fungi Isolates

The macroscopic and microscopic characteristics of fungi isolates associated with the spoilage of Casady's folly tomato fruits.

Table 10: Macroscopic and Microscopic Characteristics of Fungi Isolates

Macroscopic	Microscopic	Isolated Fungi
Velvety filament which sporulate into black powdery spores	Long septate hyphea with conidiophores bearing brown spores and phialide at it apex	*Aspergilusspp*
Long hyphe which sporulate within two days and turned to black spore	Non septate branch mycelium with round shaped sporangia	*Rhizopusspp*
White and wool aeria growth that darken as it sporulate	Non septate hypae with straight sporangiosphere with many spherical spores	*Mucorspp*

Fungal Isolates

Fungi isolates from tomato included: *Aspergillus spp, Mucorspp, Saccharomyces spp*and *Rhizopus spp.* Among the fungal, *Aspergillus spp*was the most prevalent with 37.5%, had 31.25% and *Rhizopusspp*had 31.25%. These agree partly with the reports of Mbajiuka, (2014) that discovered that species of fungi associated with deterioration of tomato include:*Rhizopusstolonifer, Botrytis cineria, Peniciliumnotatum, Saccharomyces spp, Rhodotorulaspp, Aspergillus fumigates, Aspergillus flavus.*Ogo-Oluwa and Liamngee, (2016) isolated and identified *Aspergillus niger*and *Fusariumspp*from decayed tomato fruits as well.

Table 11: Frequency of Fungal Isolates from Casady's Folly

Fungal	Frequency	Percentage (%)
Aspergilusspp	6	37.5
Mucorspp	5	31.25
Rhizopusspp	5	31.25
Total	16	100

(p?0.05)

Conclusion

The study on the biopreservative efficiencies of two major edible vegetable oils a single and combination ratios on stored tomato fruits (Casady' folly) over a storage period of eight (8) days at room temperature revealed the results for various parameters tested. The research revealed that there was significant weight loss, loss of firmness and color, increased postharvest decay percentage (%) (PDP), decrease in shelf life and marketability. The microbial components of the tomatoes during storage showed a spectrum of microorganisms which may have contributed to the spoilage of the tomatoes. The study therefore revealed that Palm kernel oil and olive oil lacked potent preservative abilities and may not be used as a successful bio-preservative and useful alternative to synthetic preservatives.

Recommendations

Based on the findings of this research, the following recommendations are made:

1. Palm kernel oil and olive oil should not be used in the preservation of Casady's folly.

2. Casady's folly preserved using palm kernel oil and olive oil should be sold as soon as possible, as the quality and marketability of the fruits decreased with time.

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