

Study on the antifungal effect of mint extracts on postharvest life of navel orange and comparison its effect with Karbandazim fungicide

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ABSTRACT: In order to investigate the antifungal effect of medicinal plant extract on postharvest life of navel orange and comparison its effect with chemical treatment, this experiment was conducted in Complete Randomized Design (CRD) with 7 treatments and 4 replications. Treatments consists: control (inoculated with penicillium fungi without any treatments), dipping in solution Karbandazim at three concentrations range (1000, 1500, 2000 mg.lit⁻¹) for 5 min and medicinal plant extract Mint 150, 300 and 450 mg.lit⁻¹. Treated fruits were stored under ambient storage for 3 month. At the end of experiment decay amount, TSS juice, total acid (TA), pH, vitamin C, TSS/TA ratio, weight loss was measured. Results showed that quality and quantity of navel orange changed during storage, but this change was different depending on treatment type. Data showed that minimum percentage of weight loss and decay, high value of, TSS/TA ratio was in mint treatment(450 mg.lit⁻¹). As level of Mint extract were increased the percentage of weight loss and decay, were decreased and TSS amount was increased. The maximum of TSS amount was recorded in Mint extract (150 mg.lit⁻¹). karbandazim 1500 mg.lit⁻¹ and mint extract 300 mg.lit⁻¹ has no significant differences in control of decay percent.

Keywords: *postharvest life, mint extract, Karbandazim, navel orange, Biological control*

INTRODUCTION

Postharvest decay is the most important factor limits the longevity of the juicy products harvested (Eckert ., 1998). Postharvest diseases due to fungal infections cause significant economic losses for the citrus industry during storage transport and marketing (Solaimani., 2009). Fungi and bacteria have also unfavorable effects on quality, safety and preservation of agricultural products. Green and blue mould caused by *Penicillium digitatum* and *P. italicum*, respectively, are the most important postharvest disease of fruits worldwide (Ladaniya, 2008). Synthetic chemicals are widely used in the control of plant diseases. However, these chemicals may cause toxic residues in treated products (Barnard., 1997; Isman, 2000). Synthetic chemicals can also cause environmental pollution owing to their slow biodegradation (Barnard., 1997; Misra., 1997). In order to reduce the pre-harvest and post-harvest treatments of horticultural products with chemical fungicides, new research efforts, focus on this subject (Bus., 1991, Dubey., 1998, Mironescu., 2008). For this reason, it is important to use natural ingredients instead of chemicals. Undoubtedly, the use of a suitable alternative herbal extracts and essential oils instead of chemical compounds can be useful. Plant extracts contain substances that can be used against many microorganisms (Arras., 2001,

Ramezani, 2009). There are many studies demonstrating postharvest disease control of different fruit species by using biological agents including essential oils (Arras., 2001, Baratta., 1986, Feng., 2007, Liu., 2009, Pramila., 2004, Tripathi., 2004).

The purpose of this study was to compare the antifungal effect of mint extract to chemical fungicide Karbandazim to increase postharvest life of navel orange.

MATERIALS AND METHODS

Preparing of fruits and antifungal activity assay

Orange fruits (Washington Navel type) were harvested from commercial garden located in Darab (Fars Province, Iran) and immediately move to laboratory. The fruits were selected free of wounds and rots and as much as possible homogeneous in physiological maturity stage and size. Fruits washed with distilled water and surface-disinfected by spray of ethanol (70%). Surface of fruits were dried by below in lab. Before treatment, four points on the fruits was holed by sterile nail in 2 mm depth. And then spray with a solution containing 500 spores per ml *Penicillium*. After that fruits kept during 4 hr for establishing of fungus spore in holes.

Suspension preparing

Penicillium spores were isolated from an infected navel orange trees were diagnosed in the Department of Horticulture, Islamic Azad University of Jahrom. At first, *Penicillium digitatum* and *P. italicum* separately in medium PDA (potato dextrose agar) for four days had been cultivated. By sterile lob, spores at Petridis were moved in to 100 ml sterile distilled water. For separating spore from each other and spreading them in to water, was added 2-3 drops of mixed NPX. After 5 min, it's located on shaker set. Number of cells in one milliliter of suspension was determined by hemacytometer. From present suspension, 10^5 (spore/ml) densities were prepared.

Preparing of fruits and antifungal activity assay and Statistical analysis

This experiment was conducted in Complete Randomized Design (CRD) with 7 treatments and 4 replications. Data analysis by MSTAT-C software and the means were compared by Duncan test. Treatments consists: control (inoculated with *penicillium* fungi without any treatments), dipping in solution Karbandazim at three concentrations range (1000, 1500, 2000 mg.lit⁻¹) for 5 min and medicinal plant extract (Mint) 150, 300 and 450 mg.lit⁻¹. The fruit for each treatment included 100 fruits per treatment. After removing the fruits from the solution, in order to dry the surface water put those in the open air for 2 hours. Each fruit is put into a plastic bag, And 25 pieces of fruit per treatment were placed in a box. After weighing all the boxes of fruit packaging were stored under storage room temperature (8-12 ° C) for 3 month. At the end of experiment decay amount, TSS juice, total acid (TA), pH, vitamin C, TSS/TA ratio, weight loss was measured. Natural essential oils of mint were prepared from Darab Golab Saghar Company.

To determine the percentage of weight loss, once before the start of the storage period and again after the 90 days of storage oranges measured with digital scale. And By subtracting the initial weight from a secondary one, weight loss is determined. To measure the amount of vitamin C, the titration method with (KI.I) by 1% reagent of starch was used. To measure the total acid, titration method with 0.3 normal NAOH was used. Total TSS was measured by using a drop of juice with refractometer. Juice pH measured with pH meter

RESULTS AND DISCUSSION

According to Table 1, type of treatment has a significant difference at the level of 1% in the weight loss, percent of decay, TSS/TA ratio and TSS according to Duncan test. Total acid (TA) has a significant difference at the level of 5% by Duncan test. Type of treatment had no significant difference in pH, vitamin c.

According to table 2, percent of weight loss was significantly increased during the storage period, resulting loss of water due to evaporation and transpiration in fruits. The results corresponded with Sin (1989), which found the weight loss increased with increasing storage period. The maximum amount of weight loss (74%) and decay amount (98%) was in control treatment. The minimum amount of weight loss and decay amount was in mint treatment (450 mg.lit⁻¹). Also weight loss in fruits treated with mint extract was less than chemical fungicide karbandazim. Mint extract create waxy layer on the fruits that covered pores and reduces evapotranspiration (Kader, 1985). Wound is necessary for *penicillium* activities, leading to the decay rate increases. The results corresponded to ports (2002), which shows the effect of lesions at increasing the percentage of decay in citrus fruits. Minimum amount of TSS and TA was in mint treatment (150 mg.lit⁻¹) and (450 mg.lit⁻¹) respectively. Maximum amount of TSS/TA was in mint treatment (450mg.lit⁻¹). With increasing concentrations of mint extract TSS and TSS/TA amount was increased.

Conclusions

The results of this study showed the quantitative and qualitative characteristics of navel orange, affected with treatment types and changed. Type of treatment has a significant difference at the level of 1% in the weight loss, percent of decay, TSS/TA ratio and TSS according to Duncan test. Total acid (TA) has a significant difference at the level of 5% by Duncan test. Mint extract 450 mg.lit⁻¹ was the best treatment. It's a plant material and according to the other factors examined and the global approach to the organic products it is actually desirable.

Table 1. Analysis of variance (MS) FOR Related traits

Sources of change	Vitamin c	TSS	TA	TSS/TA	Weight Loss%	%decay	pH
Treatment	2.996 ^{ns}	1.915 ^{**}	0.021 [*]	3.007 ^{**}	0.524 ^{**}	2202.4 ^{**}	0.002 ^{ns}

^{ns} No significant differences, ^{*} Significant at the 5% level, ^{**} Significant at the 1% level

Table 2. Comparing the mean effect of treatment on decay amount (%), Weight Loss (%), TSS, TA, TSS/TA

Treatment	decay%	Weight Loss%	TSS	TA	TSS/TA
Control	74a	0.98b	12cd	1.42ab	8.69bcd
Karbandazim(1000mg.lit)	66b	0.76c	12.4abcd	1.42ab	8.72bcd
Karbandazim(1500mg.lit)	12e	0.73c	11.9d	1.36ab	9.29abc
Karbandazim(2000mg.lit)	38c	0.77c	12.2bcd	1.41ab	8.54cd
Mint extract(150mg.lit)	26d	0.60de	10.9a	1.44ab	7.60d
Mint extract(300mg.lit)	13e	0.49ef	11.2e	1.36ab	8.42cd
Mint extract(400mg.lit)	0f	0.28g	12.6abc	1.20c	10.51a

Means with the same letters has no significant differences at the level 5%

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