



Impact of Cinnamon essential oil against postharvest fungal pathogens

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Abstract:

Recently, there has been an increasing interest in biologically active principles of essential oils which are derived from medicinal plants as a substitute to synthetic fungicides. As well edible fruits are the most important food of mankind as they are nutritive and indispensable for the maintenance of health.

Fruits are rich source of vitamins. They are generally susceptible to rapid post harvest degradation due to higher respiration rates and microbial spoilage.

Fungal spoilage is more severe in postharvest. Several studies have been shown that fungal spoilage may be controlled by using biologically active essential oils of certain medicinal plants.

Therefore, the present study reveals the effect of essential oils of cinnamon, clove and cumin against fruit rot pathogens to show its potential as alternative to synthetic fungicides.

Introduction:

Decaying fruits affects the quality and shortens the shelf life

of fruits and vegetables(Litcher,et.al.2002; Wachaitanawton, et.al.2009) causes heavy economic losses. Worldwide postharvest losses of perishables due to fungi is between 10% and 50%(Shahi et.al.2012).

Harvested fruits and vegetables are attacked by microorganisms because of their high moisture content and rich nutrients(Simmonds,1963).

Generally, synthetic fungicides are applied to control postharvest decays. However, now it is noticed that the frequent use of such fungicides creates several problems such as health hazards and environmental pollution.

Now a days researchers have focussed the natural products as an alternative to such synthetic fungicides and pesticides(Shahi, et.al.2012). Many plant extracts and essential oils isolated from plants have been shown to possess biological activity *in vitro* and *in vivo*, which proved the antimicrobial activity of these plants(Shinde,et.al.2011).

Such compounds being biodegradable and selective in their toxicity and are considered valuable for controlling some plant diseases. The presence of antifungal compounds being in lower and higher plants has long been recognized as an important factor in their disease resistance.

Material and Methods:

Cinnamon bark(*Cinnamom zeylanicum L.*) was dried and stored at room temperature in dark until distillation.

Samples were then subjected to hydrodistillation for 3-4 hrs. using Soxhlet Extractor. The obtained essential oil were collected and dried over anhydrous sodium sulphate and stored at 4°C until further use.

In vitro antifungal assay:

The agar dilution method was followed with some modifications of (1%v/v) tween-20(Sigma-Aldrich) was incorporated into the agar medium after autoclaving to enhance oil solubility.

The concentration of cinnamon oil were prepared at 0.5,1.0, 1.5, 2.0,2.5,ul/ml in PDA plates with 1%(v/v) Tween 20.

Plates were dried at 35°C for 30 min. prior to spot inoculation with 2ul of spore suspension of each fungal pathogen.

PDA with1%(v/v) tween-20, but no oil was used as a positive growth control.

Inoculated plates were incubated at 27°C for 72 hrs.

In vivo antifungal assay:

Papaya (*Carica papaya* L.) and Mango (*Mangifera indica* L.) fruits were harvested at the mature stage and sorted in size and absence of physical injuries or disease infection. Before treatments, the fruits were surface disinfected with 2% sodium hypochlorite for 3 min., rinsed with tap water and then air dried. The fruits were randomly distributed into groups each with 50 fruits and three replicates were used for each treatment. Similar to *invitro* antifungal assay, 0.0, 0.5, 1.0, 1.5, 2.0 & 2.5 of cinnamon oil concentrations were taken for *in vivo* experiment

against *Rhizopus stolonifer*, *Aspergillus niger*, *Penicillium digitatum*. The method of *in vivo* antifungal assay of cinnamon oil in wounded fruit described here was developed by Badaway and Rabea, 2009. The fruits were wounded 3mm deep and 3mm wide with sterile nail, with 3 wounds per fruit. Then, 20 ul of conidial suspension(1.0×10^5) conidia of *Rhizopus stolonifer*, *Aspergillus niger*, *Penicillium digitatum* were added to each wound, respectively. The treated fruits were put in 200 mm, 130mm, 50 mm plastic boxes and put five filter papers with 25 ml of sterile water in each box in order to maintain high relative humidity(90-95%). The fruits were stored at 25°C for 3 days respectively. After storage the number of wounds that showed disease incidence(%) was calculated.

Disease incidence(%) = $\frac{\text{No. of infected wounds}}{\text{Total wounds per replicate}} \times 100$

Total wounds per replicate

Results and Discussion:

Essential oils of cinnamon had previously demonstrated high fungicidal activity against *F.moniliforme*(Paran et.al.1996). Cinnamaldehyde, linalool, eugenol, and 1,8 cineol have been reported as active compounds in inhibiting the growth of *Monilia*, *Botrytis*, *Mucor*(Gourban and Holmes, 1993).

The oils with high levels of eugenol are usually strong antimicrobials(Davidsons & Naidu,2000). As reported by Tzortzakis(2009), *invitro*, Cinnamon oil reduced spore germination and germ tube length in *C.coccoides*, *B.cinerea*, *Cladosporium herbarum* & *Rhizopus stolonifer*, with the effects being dependent on oil concentration. Cinnamon and Clove oils have been reported by many researchers as good source of antifungal compounds(Barata et.al 1998; Montes and Carvajal 1998; Delespaul et.al2000). Cinnamon oil also exhibits a good potential of inhibition against crown rot and Anthracnose pathogens isolated from banana(Ranshing L.et.al 2002).

The fungicidal activity of Cinnamon oil against postharvest pathogens is very effective. The type and optimal concentration of essential oil depend on the product use and against which species of bacteria or fungi is to be used. These essential oils if properly formulated and applied, can be used directly as a synthetic fungicide replacement. So, a possibility exists to develop effective treatment system to control postharvest diseases of various fruits. The results of this research work are formulated in Table-1 & Table-2.

Table-1:Effect of cinnamon oil on growth of fruit rot pathogens

Sr.no.	Essential oil (μ l)	Zone of Inhibition in mm		
		<i>P.digitatum</i>	<i>A.niger</i>	<i>R.stolonifer</i>
1	0.0	12.52	14.23	17.22
2	0.5	11.50	13.12	17.22
3	1.0	9.8	12.57	17.20
4	1.5	7.5	11.98	16.35
5	2.0	5.0	10.66	16.0
6	2.5	2.0	10.46	15.88

Table-2 Disease incidence on fruits treated with different concentrations of Cinnamon oil

Sr.no.	Essential oil (μ l)	Disease incidence(%)		
		<i>P.digitatum</i>	<i>A,niger</i>	<i>R.stolonifer</i>
1	0.0	100	100	100
2	0.5	84.5	88.9	96.7
3	1.0	62.5	75.1	85.1
4	1.5	43.5	53.5	74.5
5	2.0	24.5	51.2	65.4
6	2.5	20.5	32.5	50.5

References:

- Barata, M.T., Dorman,H.J.D., Deans S.G., Figueiredo A.C., Borroso J.G. and Ruberto G.(1998) Antimicrobial and antioxidant properties of some commercial essential oils. *Flavour and Fragrance* 13, 235-244.
- Delespaul Q., Bellerbeck V.G., Roques, C.G., Michel G., Vinaules C.M. and Bessiere J.M.(2000). The antifungal activity of essential oils as determined by different screening methods. *Journal of Essential oil Research* 12, 256-266.
- Gourban F.H. and Holmes R J(1993). *The Development of Alternative Fungicides from Essential Oils* Victoria, Australia: Institute for Horticultural Development, Knoxfield, Department of Agriculture.
- Lichter, A., Zutchy, Y.Sonego, L., Dvir, O., Kaplunov, T., Sarig, P. and Ben-Arie, R. 2002. Ethanol controls postharvest decay of table grapes. *Postharvest Biol. Technol.*24, 301-308.
- Mimica-Dukie N., Bozin B. Sokovic, M.Mihajlovic B. and Matavulj M.(2003). Antimicrobial and antioxidant activities of three *Mentha* species essential oils. *Planta Med.* 69, 413-419.
- Montes B.R. and Carvajal M. 1998. Control of *Aspergillus flavus* in Maize with essential oils and their components. *J.Food Prot.*61,616-619.
- Paran B.,Sharma R.K.,Singh, R.S., Ghosh, A.C., and Baruah P.(1996). Fungicidal activity of some naturally occurring essential oils against *Fusarium moniliforme*.*Journal of Essential oil research* 8 (4), 411-412.
- Parangama P.A.(1991). *Analysis of Srilankan essential oils by Gas Chromatography and Mass Spectroscopy* Colombo, Srilanka:ITI
- Ranshing L., Jayawardena B. and Abeywickrama K.(2002). Fungicidal activity of essential oils of Cinnamon zeylanicum(L.) and *Syzygium aromaticum*(L.) Merr et.L.M. Perry against Crown rot and Anthracnose pathogens isolated from banana. *Lett.Appl.Microbiol.*35,208-211.
- Tzortzakis, N.G. 2009.Impact of Cinnamon oil enrichment on microbial spoilage of fresh produce. *Innov.Food Sci. Emerg.Technol.*10,97-102.
- Wanchartanawong,P.,Chaungwanit,P.,Poovarodon, N.and Nitisnprasert, S. 2005.In vitro antifungal activity of Thai herb and Spice extracts against food spoilage fungi. *Kasetsari J. (Nat.Sci)*39,400-405.