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INTRODUCTION

Postharvest losses of citrus fruit are mainly caused by fungal diseases. Treatments with conventional chemical fungicides applied alone or within synthetic waxes are commonly used to reduce fruit decay. However, health and environmental problems are associated to the repeated application of synthetic fungicides. Therefore, new research prioritizing the development of safer and eco-friendly alternative strategies to control postharvest diseases and reduce losses is needed. Such alternatives include natural edible coatings (ECs) with antifungal properties

OBJECTIVES

- To evaluate the antifungal activity of essential oils (EOs) and natural extracts against *Penicillium digitatum* (PD), *P. italicum* (PI), and *Geotrichum citri-aurantii* (GC) in in vitro studies.
- To determine the curative activity of pectin-based ECs formulated with selected natural antifungal agents against green mold (caused by PD) and sour rot (GC) on artificially inoculated 'Valencia' oranges incubated at 20 °C.
- To evaluate the physicochemical quality of coated oranges during cold storage.

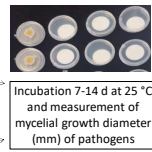
MATERIALS AND METHODS

IN VITRO ANTIFUNGAL ACTIVITY

The fungal pathogens *P. digitatum*, *P. italicum*, and *G. citri-aurantii* were inoculated in the center of PDA Petri dishes

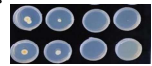
- 1) Exposure to volatiles
- *Satureja montana* EO (SM)
 - Cinnamon EO (CN)
 - Lemongrass EO (LG)
 - Eugenol (EU)
 - Geraniol (GE)

Doses
 10, 20 and 40 µL in the lid of PDA dishes



Incubation 7-14 d at 25 °C and measurement of mycelial growth diameter (mm) of pathogens

Concentrations ranging 0.062-2% w/w in PDA



- 2) Agar dilution method
- Green tea dry extract (GT)
 - Propolis dry extract (PRO)
 - Pure vanillin (VA)
 - Myrrh EO (MY)

IN VITRO ANTIFUNGAL ACTIVITY

Mycelial growth inhibition (%) after 7 d of incubation at 25 °C		
Essential oil	dose (µL)	
SM	10	98.2 a
	20	100.0 a
	40	100.0 a
CN	10	55.7 b
	20	98.6 a
	40	100.0 a
LG	10	0.0 c
	20	1.9 c
	40	49.6 b
EU	10	91.2 a
	20	92.1 a
	40	94.7 a
GE	10	48.2 b
	20	89.1 a
	40	89.1 a

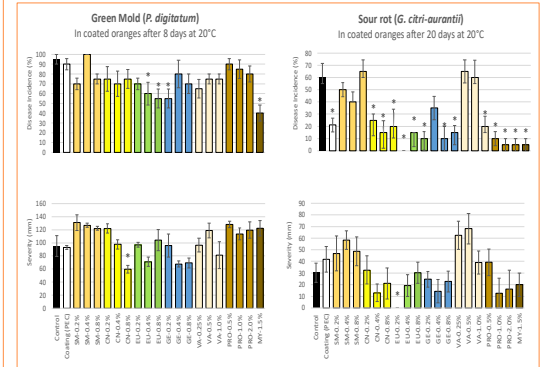
Agar dilution assay		
Natural extract	flow/w	
GT	0.50	25.6 f
	1.00	58.1 d
	2.00	76.2 c
PRO	0.50	100.0 a
	1.00	100.0 a
	2.00	100.0 a
VA	0.062	82.9 b
	0.125	100.0 a
	0.25	100.0 a
MY	0.125	42.3 e
	0.25	41.6 e
	0.50	53.6 e

Different letters indicate significant differences (p<0.05)

✓ CN, SM, EU, and GE (at a dose of 20 µL) inhibited the radial growth of all the pathogens by 90-100%, whereas VA, PRO, and MI extracts were effective at concentrations of 0.125-0.5% (w/w).

RESULTS

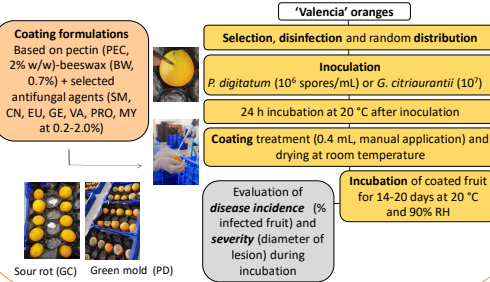
EFFECT OF ANTIFUNGAL COATINGS ON INOCULATED ORANGES



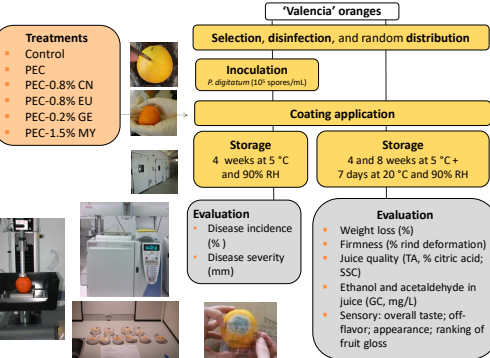
* significantly lower compared to control (p<0.05)

✓ PEC-BW coatings containing 0.2% GE, 0.8% EU, or 1.5% MI EOs reduced green mold incidence after 8 days by more than 40%, while the highest reduction in disease severity was observed with 0.8% CN. In the case of sour rot, the most effective coatings were those amended with EU (0.2-0.4% w/w), with 100% reduction of both disease incidence and severity.

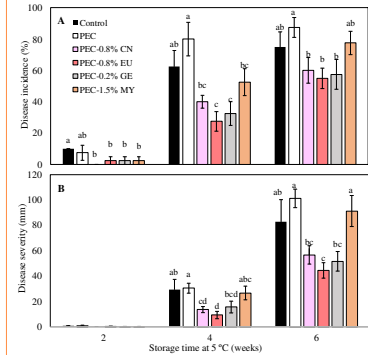
CURATIVE EFFECT OF ANTIFUNGAL COATINGS ON ORANGES



DECAY AND QUALITY OF COLD-STORED ORANGES



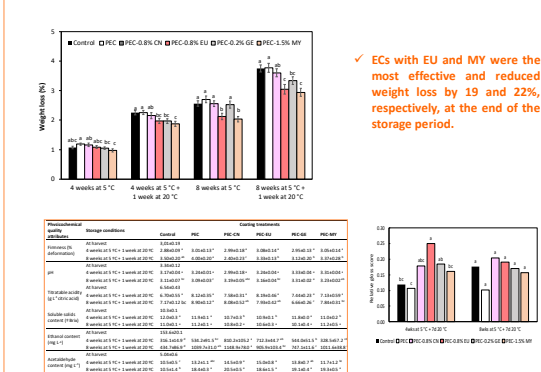
GREEN MOLD CONTROL OF COLD-STORED ORANGES



✓ After 4 weeks at 5°C, AECs formulated with EU and GE significantly reduced GM incidence by more than 50%.

✓ AEC formulated with EU inhibited fungal growth, with severity reductions of 70 and 46% after 4 and 6 weeks, respectively.

QUALITY OF COLD-STORED ORANGES



✓ ECs with EU and MY were the most effective and reduced weight loss by 19 and 22%, respectively, at the end of the storage period.

✓ Antifungal ECs significantly increased the content of ethanol and acetaldehyde in juice, without negatively affecting sensory properties or the rest of the physicochemical quality parameters evaluated.

✓ The PEC-0.8% EU coating improved fruit gloss after 4 weeks of cold storage plus the shelf-life period.

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CONCLUSION. The PEC-BW edible coating containing 0.8% EU could be a promising treatment to reduce green mold and maintain postharvest quality of 'Valencia' oranges, providing a safe alternative to conventional waxes amended with synthetic chemical fungicides

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