

Fungal degradation of wooden pallets used in export of citrus fruit

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INTRODUCTION



- About 1,9 – 2 billion pallets are used daily for various purposes
- In the Citrus industry, fruit are shipped to international markets using pallets
- Exports to long markets are negatively affected by fungal contamination of wooden pallet basis



Wood contamination





Project subdivided into 3 aspects:

- 🍊 Phase 1: Investigating the role played by containers and storage facilities in both SOPP/OPP and fungal contamination
- 🍊 Phase 2: Identifying the fungal contaminants to address phytosanitary concerns
- 🍊 Phase 3: Investigation of alternative chemicals not currently in use for preservation of pallets



PHASE 1: OPP problem

- Fungicides are important in insuring good quality of fruits, mainly in the export market (Palou, 2016)
- Sodium o-phenylphenate (SOPP) and ortho-phenylphenol (OPP) were previously found effective as postharvest treatments to protect fruits against microbial damage (FAO, 1999)
- Environmental contamination and human health risks associated with fungicide residues



Continued...

- 🍊 Withdrawal of the use of SOPP because of chemical residue issues (specifically: number allowed)
- 🍊 OPP residues detected in fruit shipped from South Africa, despite no known application
- 🍊 CRI collaborated with PPECB and the industry to find the source of OPP problems



Cold stores and container depots



Cold stores

SAFT, Stellenpark,
Melpack, Chiltern,
Fruitways and Two a day



Container depots

MSC, UDC and DCP-CPT

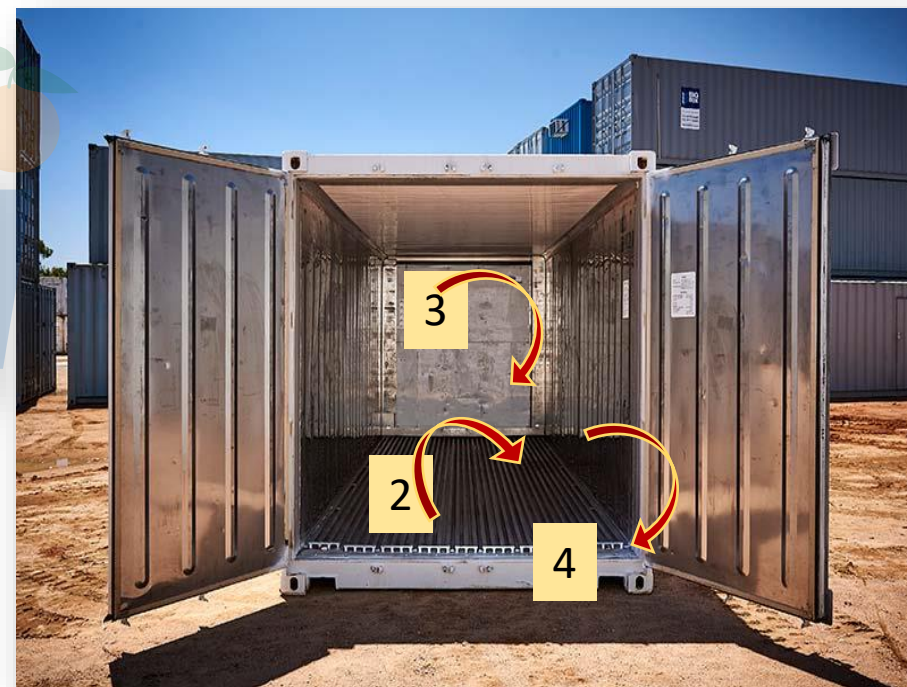
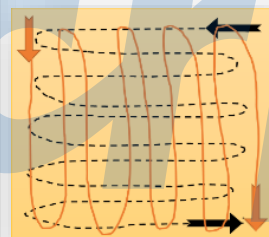


PHASE 1 cont...

- With the support of PPECB, containers were investigated at depots
- Swabs were taken from inside containers, and the drainage trays
- A total of 151 swabs were collected
- Samples were collected of the chemicals that are used to wash the containers
- Wood slivers from pallets used for export also collected



PHASE 1 cont...





Results from cold stores and containers

- Only one swab from a cold store had a positive detection of 0.09 mg/kg OPP
- Zero detection of OPP from 150 other samples
- Results from the chemicals used to wash the containers all came back negative
- Results from pallets indicated these as the source of the contamination



PHASE 2: Molecular identification of isolates from infected wood



- This phase was focused on mycology
- Fungi are the biggest problem in the citrus industry
- Species identification assists in confirmation of appropriate product action
- Identification also reaffirms absence of phytosanitary threats

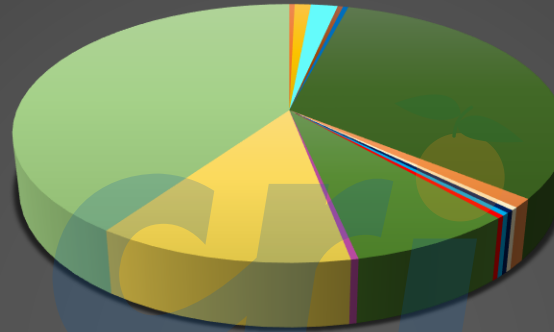


DNA extractions

- DNA techniques are valuable in the identification of fungi
- Fungi without taxonomic characters that form the basis of species description can be identified
- First step is extraction then purification
 - Conventional PCR with 3 different primers
 - Different primers to verify species un-relatedness
- 268 isolates



Results



■ Acervuloseptoria sp.
■ Clonostachys sp.
■ Lecanicillium sp.
■ Neocosmospora sp.
■ Pithomyces sp

■ Alternaria sect Ulocladioides
■ Drechslera sp.
■ Leptosphaerulina sp.
■ Peniophora sp.
■ Trichoderma spp.

■ Cladosporium sp.
■ Fusarium spp.
■ Mucor sp.
■ Penicillium spp.
■ Unknown

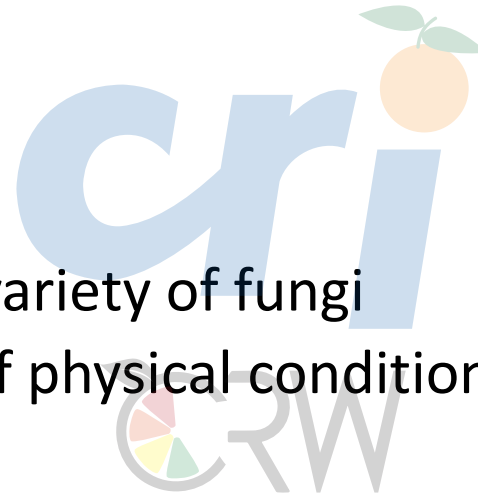


PHASE 3: Chemicals used to treat pallets



Alternatives to treat the pallets should be:

- Readily available
- Inexpensive
- Must penetrate the wood
- Must be able to control a variety of fungi
- Retained under a variety of physical conditions





Materials and Methods

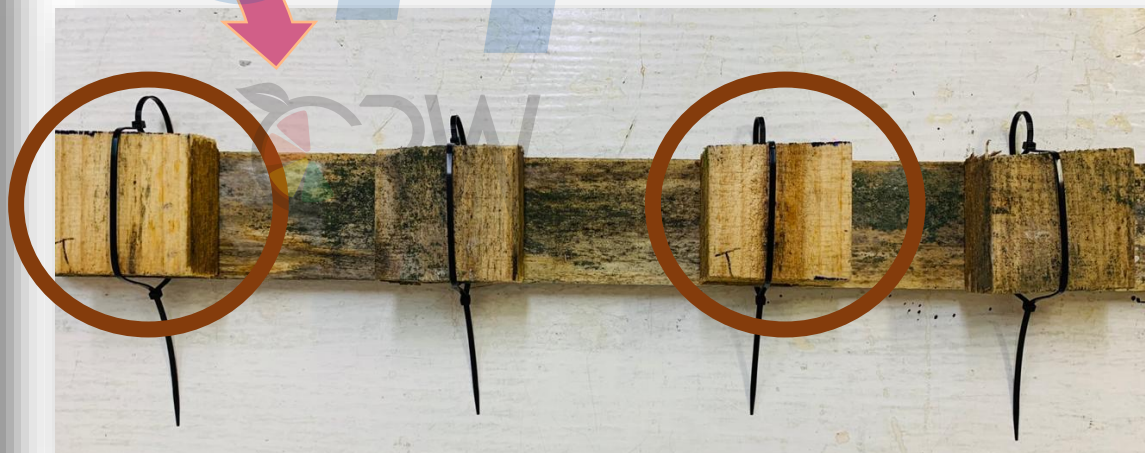


Treatment method



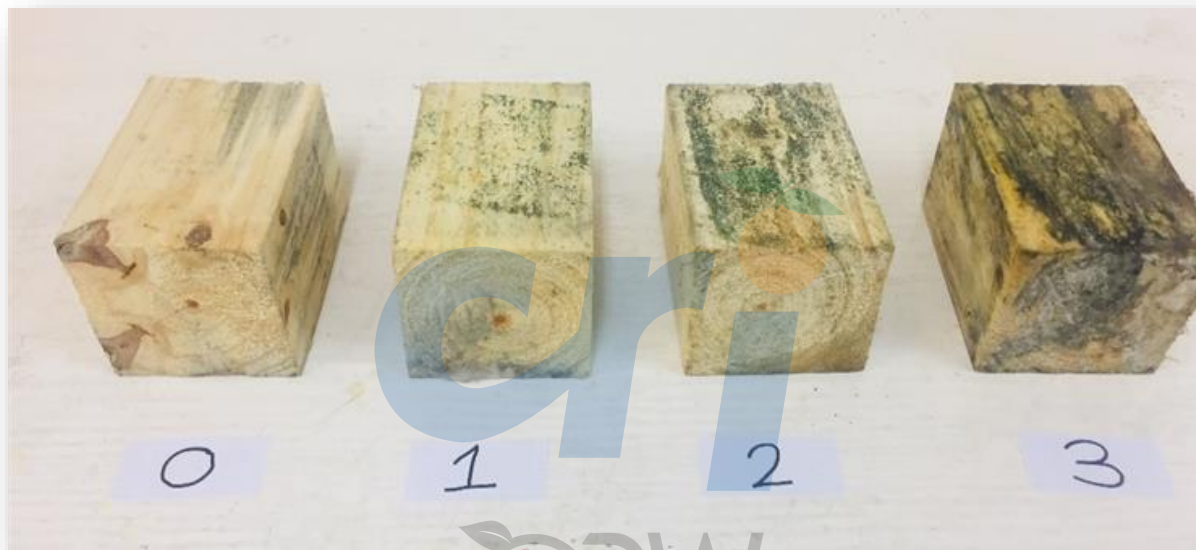
Evaluation of wood treatments

- 4 blocks/treatment = 2 treated, 2 untreated; allowed to air dry
- 3 repeat arrays/treatment; individually placed in new plastic bags
- Incubated at 34°C, Rh = 95-100%





Results



- A subjective scale from 0 – 3 was used (0, 20, 50, >80% growth)
- Results from 2 – 3 were not considered for another round of testing



Product 1: Pal-It

🍊 Outstanding results obtained from this product



- Cost concerns - however, product owner had the product successfully re-formulated to accommodate our industry needs
- No volatility



Product 2: Elementum 17

- 🍊 This product has the same properties as Pal-It
- 🍊 It easily penetrates the wood
- 🍊 Dries quickly
- 🍊 The product showed excellent results in preserving the wood
- 🍊 Both products are food safe



Product 3: Organocide

- Acceptable results at high concentrations (10X)
 - High cationic binding properties – no volatility
 - Excellent binding properties to wood
 - Organocide as a stand-alone product is currently not cost efficient
- Commercial testing currently being done with the three products
- A total of 11 products were tested and found ineffective due to wood complexity
- Some of the products lost efficacy over time



Summary

- ❗ Cold stores and container depots were ruled out as possible source of OPP
- ❗ Concerns regarding phytosanitary risk of fungi have been addressed
- ❗ Three products have shown excellent results in preserving the wood and are being tested at a commercial level



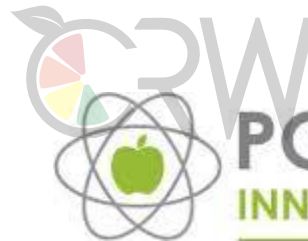
THANK YOU

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PPECB



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