

# Effect of coir extracts on growth of *Phytophthora capsici* and *Botrytis cinerea* in vitro

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## Introduction

*Phytophthora* and *Botrytis* are major plant pathogens in nursery and greenhouse production. Coir (coconut mesocarp pith) (Fig. 1) is becoming increasingly popular as a potting medium in containerized nursery production. Qualities of coir that make it a good peat substitute include high water-holding capacity, excellent drainage, physical resilience, and being a renewable resource (2). It has been demonstrated that coir can suppress plant pathogens (1). However, information is lacking on what causes coir to be disease suppressive. The objective of these *in vitro* experiments was to determine the effects of 1) *p*-coumaric acid (a known component of coir), 2) the acetone soluble portion of a methyl alcohol extract of coir, and 3) coir leachate on growth of *Phytophthora capsici* and *Botrytis cinerea*.

## Materials and Methods

**Fungal cultures:** *P. capsici* was isolated from recycled water collected from a nursery in southern California. *B. cinerea* was isolated from a lisianthus (*Eustoma grandiflorum*) plant grown in a greenhouse in southern California. The fungi were maintained on potato dextrose agar at room temperature.

**Experimental design, data collection, and data analysis:** In all experiments, a 7-mm-diameter plug of *P. capsici* or *B. cinerea* was transferred from the edge of an actively growing culture to the center of a 9-cm-diameter Petri plate containing 15 ml of amended potato dextrose agar (PDA). Petri plates were maintained in an incubator set at 22°C and a 12 hour light-dark cycle. Treatments were arranged in randomized complete blocks with three replications. Mycelial diameter was measured and used to calculate mycelial area. Data were analyzed using the general linear models procedure of SAS. Pairs of treatment means were compared using the least significant difference test (LSD) at  $P = 0.05$ .

***p*-Coumaric acid experiment:** *P. capsici* was grown on PDA amended with *p*-coumaric acid at 0, 0.04, 0.08, 0.12, 0.16, 0.20, and 0.24 mg/ml.

**Coir extract experiment:** Sequential Soxhlet extractions (Fig. 2) of coir were conducted using hexane, methylene chloride, and methyl alcohol as solvents. *P. capsici* and *B. cinerea* were grown on ½-PDA amended with the acetone soluble portion of the methyl alcohol extract at 0, 1.2, and 2.4 mg/ml.

**Coir leachate experiment:** Coir was leached for 3, 6, 9, and 12 days by soaking 72 g in 1 L of distilled water. For each leaching period, 300 ml of leachate was collected by filtering through several layers of cheese cloth. One half of the leachate (150 ml) was filter-sterilized using a 0.2 micron filter membrane and the other half was left non-sterilized. *P. capsici* was grown on PDA amended with the leachate at 0.1, 0.2, and 0.4 ml of leachate/ml of PDA. The design of this experiment was a split-split plot with leachate concentrations as the main plots, filter-sterilization treatments (sterilized and non-sterilized) as the subplots, and leaching periods as the sub-subplots.

### Literature cited:

- Candole, B., and Evans, M. 2004. Suppression of soil-borne diseases caused by *pythium* and *phytophthora* species in coconut coir-based substrates. HortScience 39:666(Abstr.)
- Meerow, A.W. 1994. Growth of two subtropical ornamentals using coir (coconut mesocarp pith) as a peat substitute. HortScience 29:1484-1486.

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Fig. 1. Coir.



Fig. 2. Sequential Soxhlet extraction of coir.

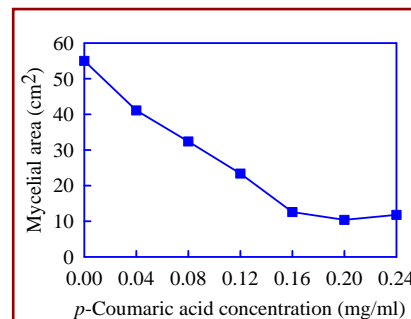


Figure 3. Effect of *p*-coumaric acid on mycelial growth of *P. capsici* on PDA after 8 days.

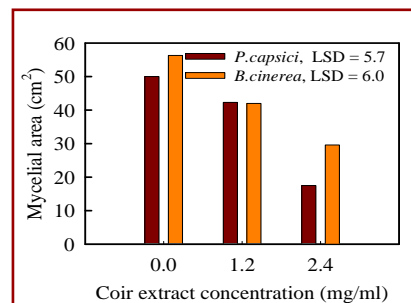


Fig. 4. Effect of an acetone-soluble coir extract on growth of *P. capsici* and *B. cinerea* after 8 and 5 days, respectively.

## Results and Discussion

- p*-Coumaric acid reduced ( $P < 0.05$ ) growth of *P. capsici* on PDA at concentrations of 0.04 to 0.24 mg/ml (Fig. 3).
- The acetone-soluble portion of a methyl alcohol coir extract reduced ( $P < 0.05$ ) growth of both *P. capsici* and *B. cinerea* on PDA; the extract's inhibitory effect was more pronounced on *P. capsici* than on *B. cinerea* (Fig. 4).
- Non-filter-sterilized coir leachate almost completely inhibited growth of *P. capsici* on PDA even after only 3 days of leaching. This inhibition was eliminated when the leachate was filter-sterilized (Figs. 5 and 6), implying the inhibition may have been due to microorganisms associated with the coir. Isolation and identification of these microorganisms is underway.
- Results from these experiments suggest the pathogen suppressive properties of coir may be due to 1) biological antagonists associated with the coir, and 2) chemical compounds in the coir.

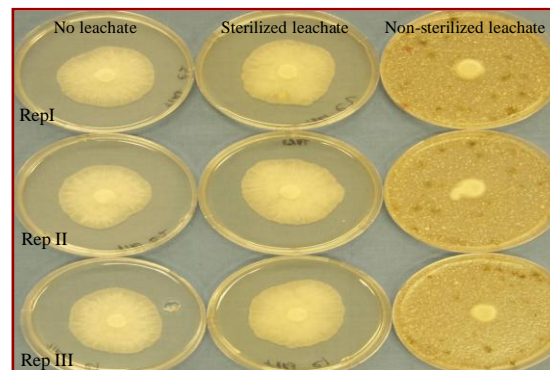


Fig. 5. Four-day old cultures of *P. capsici* on coir-leachate-amended PDA (0.4 ml/ml, 6 days of leaching)

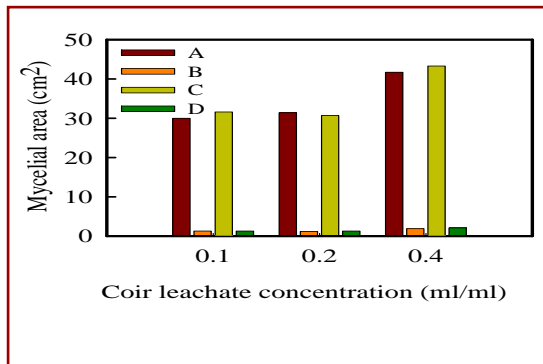


Fig. 6. Growth of *P. capsici* on PDA amended with filter-sterilized and non-filter-sterilized coir leachate. A and C, filter-sterilized experiments 1 and 2; B and D, non filter-sterilized experiments 1 and 2.