

Survival of *Phytophthora* Species and Other Pathogens in Soilless Media Components or Soil and Their Eradication With Aerated Steam¹

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Abstract

Phytophthora ramorum, while thought to be primarily an aerial pathogen, can be introduced into soilless potting media in the nursery industry as sporangia or chlamydospores and be disseminated widely without being detected. Inoculum of this pathogen, both North American (A2) and European (A1) isolates were used to infest potting media components or soil as sporangia or chlamydospores produced in vermiculite culture or in infected rhododendron leaves. Vermiculite chlamydospore/oospore inoculum of *P. citricola*, *P. cactorum*, and *P. citrophthora* were included for comparison. Survival was determined by monthly sampling by baiting (B) or direct plating (DP) on selective medium. Results indicated that *P. ramorum* can survive in most media components for up to 6 months, whether introduced as sporangia or chlamydospores. Experiments were also conducted to determine the lethal temperature needed to eradicate *P. ramorum* from infested potting medium or contaminated plastic containers (over a range of 45 to 70 °C for 30 min using aerated steam mixtures). Other soilborne pathogens included for comparison were *Pythium irregulare*, *Thielaviopsis basicola*, *Cylindrocladium scoparium*, and their survival was determined by baiting methods. All pathogens were killed by temperature treatments of 50 °C or greater. These results show that *P. ramorum* can survive in potting media if introduced as sporangia or chlamydospores, and infested media or contaminated containers can be sanitized by aerated steam treatment.

Key words: *Phytophthora ramorum*, sudden oak death, Ramorum blight, soil pasteurization, eradication, soilless potting media

¹ A version of this paper was presented at the Sudden Oak Death Second Science Symposium: The State of Our Knowledge, January 18-21, 2005, Monterey, California

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Introduction

Phytophthora ramorum on nursery crops, thought to be largely a foliar pathogen, could be incorporated into container soilless potting media and thus become soilborne. Also, nursery containers from which infested media or infected plants were removed could be contaminated, as is true with other soilborne fungal pathogens. Inoculum from either source may initiate infections on subsequent crops grown in infested media or contaminated containers. Pathogens could be eradicated from soilless media by heat from steam, composting, or solarization; or by chemical fumigation. Growers currently attempt to decontaminate used containers by pressure washing and/or chemical sanitization. Many simply apply fungicides during the production cycle to prevent infections or to respond to occurrence of diseases. Thus our objectives were to: (1) determine the capacity of *P. ramorum* (NA genotype isolate 2027, A2 mating type; and European genotype isolate D12A, A1 mating type), compared to *P. cactorum*, *P. citricola*, and *P. citrophthora*, to survive in potting media components, and (2) determine the efficacy of heat from aerated steam mixtures to eradicate *P. ramorum* and other pathogens (as colonized vermiculite) from potting medium in containers.

Materials and methods

For objective (1), the soilless media components used were river sand, Douglas-fir (DF) bark, coir, sphagnum peat, redwood (RW) sawdust, a bark-peat-pumice potting mix (40:30:30 by volume), a dairy compost, and a garden soil. Inocula for the survival study were sporangia (*P. ramorum* only), infected dry rhododendron leaf pieces containing chlamydospores or oospores, or chlamydospore or oospore inoculum produced in culture on vermiculite. Survival of *Phytophthora* species was determined monthly by baiting (B) or direct plating (DP) on selective agar medium. For objective (2) we used heat from aerated steam mixtures to sanitize plastic containers filled with infested potting medium. Varied temperatures were established, from 4°C to 70 °C for 30 min at °C increments, by changing the air/steam ratio (1). The pathogens used were *Phytophthora ramorum*, *Pythium irregulare*, *Thielaviopsis basicola*, and *Cylindrocladium scoparium*. Pathogen mortality was determined by DP or B.

Results and discussion

P. ramorum was detected for 6 months by B or DP from all substrates amended with sporangia or chlamydospores in vermiculite, but was not detected by either B or DF

from infected leaf inoculum. *P. ramorum* sporangia survived best in peatmoss, potting mix, coir, and DF bark, and poorest in sand or soil. By comparison, *P. cactorum* was recovered after 5 to 6 months from infected leaf inoculum in all media. *P. citricola* was recovered by B for only 3 months in coir, potting mix, sand and soil, but not at all from compost, DF bark, peatmoss, or RW sawdust. *P. citrophthora*, as with *P. ramorum*, was never recovered from leaf inoculum in any material at any time. All pathogens were killed by aerated steam treatments of infested medium at 50° C or higher.

These results indicate (a) that *P. ramorum* can survive very well in potting mix components or soil as culture-produced sporangia or chlamydo spores, but was not detected from infected leaf pieces compared to other *Phytophthora* species that were, and (b) that aerated steam pasteurization is an effective means of eradicating *P. ramorum* as well as other pathogens from infested media and contaminated containers without destroying the containers.

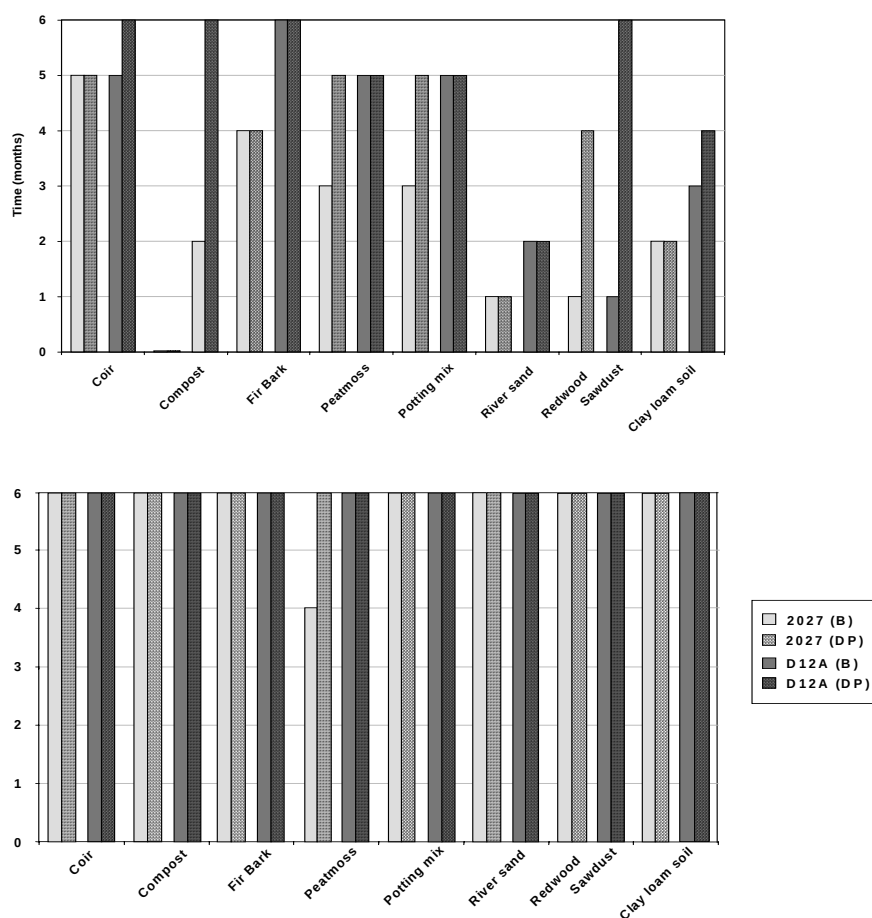


Figure 1—Survival of *Phytophthora ramorum* introduced into soilless media or soil as sporangia (top) or chlamydo spores (bottom) in vermiculite.

References

Baker, K.F. (ed) 1957. **The U. C. System for Producing Healthy Container-grown Plants Through the Use of Clean Soil, Clean Stock, and Sanitation.** Manual 23. California Agricultural Experiment Station, Extension Service.