

Epidemiology of *Phytophthora ramorum* Infecting Rhododendrons Under Simulated Nursery Conditions¹

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Abstract

The current understanding of diseases caused by *Phytophthora ramorum* and their dynamics in nursery crops is almost entirely derived from casual field observations. The objectives of the study are to help understand basic biological factors such as, inoculum viability, dispersal, and infectivity that influence disease occurrence and severity in a rhododendron nursery. The experiments were conducted under conditions that simulate a commercial containerized rhododendron nursery regime in the central coast of California. This extended abstract presents information on the findings of the first year of a two-year study.

Key words: *Phytophthora ramorum*, epidemiology, inoculum, irrigation, soil

Stream Water Inoculum

We need to know whether naturally-infested stream water could infect nursery hosts if the water is used for irrigation. Stream water in Lompico creek (Felton, California) has been monitored regularly since December 2003 and viable inoculum has consistently been detected (with pear baiting) during rainy winter and early spring conditions (December 2003 to April 2004), and only later in dry conditions when infected California bay (*Umbellularia californica*) leaves were blown into the stream by strong winds (June, 2004). Rhododendron stock (*Rhododendron* ‘Cunninghams White’) was irrigated, beginning February 24, 2004 until the present, with water pumped from the stream. When viable inoculum was detected in the stream, inoculum was also detected in irrigation water at several points along the irrigation-water distribution system, including at the irrigation sprinkler heads. Infectivity of stream water was evaluated under drip and sprinkler irrigation techniques. To date, no infection has been detected in rhododendron stock.

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Soil Inoculum

We need to know the conditions that soil-borne inoculum could be important in infecting rhododendron stock. The surface 1 cm of container soil in rhododendron stock was mixed with 100 infected rhododendron leaf disks (5 mm diameter). Each inoculated container was surrounded by non-infested container stock at nursery-block spacing. Observations were made to determine if soil-borne propagules could be dispersed and cause disease. Evaluation occurred in winter (with rainfall) and later with drip or sprinkler irrigation. Infection only occurred on leaves touching soil that contained infected leaf disks. In an associated inoculum viability experiment, 100 infected leaf disks were placed in sachets (to facilitate removal) and buried to 1 cm depth in the container soil planted with rhododendron. The monitored soil/plants were placed in the field or in a greenhouse. The sachets were periodically removed and leaf disk viability was assessed by plating with selective media. In the field, viability of recovered disks declined from 100 percent (week 0) to 0 percent in 38 weeks and has produced zoospores (with soil flooding) for up to 12 weeks. In the greenhouse, leaf disks began to disintegrate at 28 weeks but those that could be recovered nearly all remained viable at each evaluation (up to 38 weeks). See *Figure 1*.

Aerial Inoculum

The dynamics of aerial dispersal from infected plants to adjacent and nearby plants needs to be understood. Experiments were designed to evaluate “long” distance dispersal (up to 4 meters) and “short” distance dispersal, within a pot-to-pot spacing in a nursery block. From December 2003 to the conclusion of this experiment in June 2004 (at the end of the rainy season), new infections were only detected on plants in the “short” distance experiment, immediately next to and up to about 30 cm away from a centrally-located artificially-infected plant, and on other parts of an artificially infected plant. In the “long” distance experiment, no infections were detected, and no inoculum was detected in rain traps located 1 to 4 meters away from the infected plant during rain events. The presence and relative concentration of the propagules were detected on inoculated leaves following rain events by washing leaves with deionized water in the early morning and collecting the wash. Detection occurred in the early spring (February, 2004) but not during or following March, 2004, when extraordinarily warm and dry conditions existed. At this writing (January, 2005) a new dispersal experiment has been established and inoculum has been collected in rain traps up to 0.5 meters away from inoculated plants during a series of four strong storms in a two-week period.

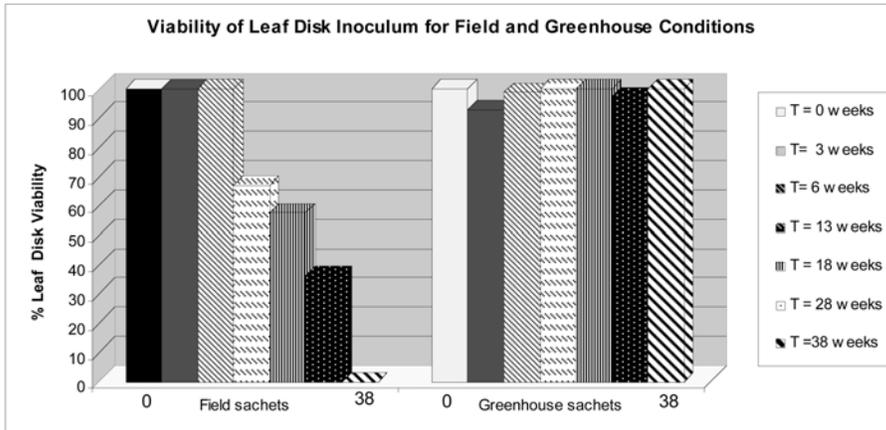


Figure 1. Viability of leaf disk inoculum based on recovery on selective media. Inoculum mixed in top 1 cm of soil in containerized rhododendron stock growing in field and greenhouse conditions.