From Forest Nursery Notes, Summer 2009

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Propagule Production by *Phytophthora ramorum* on Lilac (*Syringa vulgaris*) Leaf Tissue Left on the Surface of Potting Mix in Nursery Pots

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ABSTRACT

Shishkoff, N. 2009. Propagule production by *Phytophthora ramorum* on lilac (*Syringa vulgaris*) leaf tissue left on the surface of potting mix in nursery pots. Plant Dis. 93:475-480.

Lilac leaf tissue infected with *Phytophthora ramorum* was placed on top of potting mix in pots and exposed to different watering regimes or different temperatures to determine if it could serve as a source of inoculum. If pieces of infected leaf were placed in pots containing healthy lilac plants kept under constantly moist conditions or under twice-a-day trickle irrigation for 1 month, inoculum production from infected tissue declined for the first 4 days but declined significantly less steeply under constantly moist conditions. At the end of the experiment, 28% of plants exposed to moist conditions developed root infections, whereas only 6% exposed to trickle irrigation did. If infected leaf pieces were placed on the surface of potting mix in pots containing lilacs and watered for 5 min one, two, or three times a day, inoculum production in the first 4 days declined but declined significantly more slowly in pots watered three times a day. If 0 to 16 leaf pieces were placed on the surface of potting mix in pots containing healthy lilacs under constantly moist conditions, leaf number significantly influenced the incidence of root infection. The effect of temperature was more difficult to quantify. At 10 or 15°C, propagules included zoospores whereas, at 20 or 25°C, they were predominantly sporangia. These results confirm the importance of detached leaves as inoculum producers under greenhouse conditions.

Phytophthora ramorum causes stem cankers on oak and foliar lesions and stem dieback on a number of plants (3,26). Although the distribution of *P. ramorum* in U.S. forests is currently limited to parts of California and Oregon, there is potential for spread with the movement of water, soil, plants, and plant products. To avoid such spread, all stages of the life cycle of the organism need to be understood. *P. ramorum* shows adaptation to aboveground spread, most notably in its caducous sporangia, which can be spread by wind, rain, or stream water (4). However, the organism also has a soil phase, having been shown to survive in buried leaf tissue in forest soils for up to 24 weeks (5) and over a year under greenhouse conditions (20). Roots became infected under laboratory or greenhouse conditions (16,19–22) and under natural conditions (15). Fallen leaves may serve as a conduit by which inoculum might travel from aboveground parts to belowground parts or from belowground parts to aboveground parts.

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Accepted for publication 5 January 2009.

doi:10.1094/PDIS-93-5-0475

Fallen plant material frequently has been mentioned as an inoculum sources for the aerial phase of Phytophthora diseases. In 1923, Petri reported on the ink disease of chestnuts in Italy, noting that the pathogen (*P. cambivora*) sporulated in leaf mold and that such inoculum could be disseminated short distances during rainfall, and warned against mulching orchard trees with colonized leaf material (18). Newhook and Jackson (14), observing that fallen cocoa leaves could become infected with *P. palmivora,* felt that the presence of leaf litter on the ground in cocoa plantations would not protect pods from inoculum splashed up from soil but might serve as an alternative source of inoculum. In apple orchards affected by *P. syringae*, fallen leaves were heavily colonized and considered the principal means of inoculum accumulation in orchards and, therefore, along with soil, a source of inoculum infecting fruit on the tree by rain splash (8). In Florida, fallen fruit of citrus acted as a "trap" to move *P. palmivora* to the aerial phase from the soil phase (7). *P. parasitica* could survive at most 18 to 22 days in air-dried rhododendron tissue but, if such tissue was kept under moist conditions, sporangia were produced, particularly under flooded conditions after 24 to 48 h (10). Analysis of splash dispersal in a naturally infested nursery suggested that plants became infected from inoculum in or on the container base on which the pots were placed (10). *P. parasitica* in infected rhododendron leaf tissue overwintered in a North Carolina nursery when buried 5 cm deep in a layer of pine bark used as a container base (11).

It is less common to see fallen plant material implicated as a vector for a pathogen to pass from the aerial phase to the soil phase. For example, if abscised leaves of *Pieris japonica* infected by *Phytophthora citrophthora* were left in pots, they caused crown rot and rot of feeder roots (6).

On some hosts, notably *Camellia* spp., *P. ramorum* causes severe defoliation of diseased leaves (19,24). This article examines the behavior of *P. ramorum* on fallen leaves of lilac. Although *P. ramorum*-infected lilac plants do not defoliate as quickly as camellia, heavily diseased leaves will drop (21), and *P. ramorum* is known to sporulate heavily on infected lilac leaves (1), making it a good test subject. Although nursery conditions could not be replicated in a greenhouse containment facility, the effect of diseased leaves placed on the surface of potting mix in pots containing uninfected plants could be studied. Experiments examined the effect of different numbers of fallen, infected leaves, different types of irrigation, and different temperatures on sporulation of *P. ramorum* on infected lilac leaves.

MATERIALS AND METHODS

Isolate. The pathogen isolate (5-C) used in these experiments was recovered originally from *Camellia sasanqua* 'Bonanza' in California in 2003. It contained the same single nucleotide polymorphism profile as known isolates of U.S. clonal lineage NA1 typically found in California forests and nurseries (9). This isolate caused significant disease on a wide array of lilac cultivars (21). It was maintained in sterile water culture or on pimaricin-ampicillin-rifampicin-pentachloronitrobenzene agar selective medium P_5ARP (12,23) and inoculated onto and reisolated from *Rhododendron* or *Camellia* spp. every 6 months to maintain pathogenicity. The culture is also maintained at –80°C as part of the international collection of plant pathogens at the National Cancer Institute's Central Repository in Frederick, MD.

Production of infected leaf material. Lilacs (*Syringa vulgaris*) were inoculated with a sporangial suspension (approximately 2,000 sporangia/ml of water) and incubated in a dew chamber for 7 days at 20°C. Very large black lesions were pres-