

Effect of Flooding on Root and Foliar Disease Severity on *Rhododendron* Caused by *Phytophthora ramorum*¹

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Abstract

It is generally thought that extensive periods of flooding can predispose plants to infection by *Phytophthora* pathogens. We evaluated the effect of 0, 1, 3, and 7 days of flooding before infection of *Rhododendron* plants through either wound inoculation of leaves or infestation of the potting mix using two hybrid cultivars 'Catawbiense Boursault' and 'Minnetonka'. Foliage was inoculated with zoospores and potting mix was infested with both zoospores and mycelial agar plugs. Lesion area was quantified using digital imaging. Flooding had no effect on lesion area of foliar infections. Sporangia were retrieved from infected leaves after 10 days of incubation under 20°C ambient containment growth chamber conditions. Root rot developed after about 4 weeks on most plants where the potting mix was infested. Above ground symptoms of potting mix inoculated plants included wilting, yellow or red discoloration, and at times development of lesions similar to those observed in foliar inoculations.

Key words: *Phytophthora ramorum*, flooding, *Rhododendron*.

Introduction

Phytophthora ramorum is a recently emerged oomycete plant pathogen causing a range of diseases including sudden oak death, ramorum shoot dieback and ramorum blight (Rizzo and others 2005; Werres and others 2001). *Phytophthora ramorum* attacks several nursery crops including *Rhododendron*. It is generally thought that extensive periods of flooding predispose plants to infection by *Phytophthora* pathogens (Erwin and Ribeiro 1996). We evaluated the effect of 0, 1, 3, and 7 days of flooding before infection of *Rhododendron* plants through either wound inoculation of leaves or infestation of the potting mix using two hybrid cultivars 'Boursault' and 'Minnetonka'.

Materials and Methods

Two independent experiments were conducted following a randomized complete block design with five replications. Treatments in both experiments were factorial

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and included flooding (0, 1, 3, 7 days), inoculation (non-inoculated control, foliar and potting mix inoculation), and two hybrid *Rhododendron* cultivars (*ponticum* x unknown 'Minnetonka' and *catawbiense* 'Boursault'). Foliage was inoculated with zoospores (40 μ l of 5×10^4 sporangia per ml pipetted onto cotton set in cryovial caps clipped onto wounded leaves) and potting mix was infested with both zoospores and mycelial agar plugs. Leaf lesion area was quantified using digital image analysis using ASSESS software (American Phytopathological Society, St. Paul, MN). After obtaining digital images, lesions were cut out and placed in 15ml centrifuge tubes with 3 ml of 0.1 percent tween in distilled water. Tubes were vortexed for 30 seconds and leaves were removed. Tubes were centrifuged for 5 minutes at 2500 rpm. Sporangia were counted using a hemocytometer. Infection of roots was confirmed by plating root parts on PARP selective medium followed by microscopic analysis of cultures to determine that *P. ramorum* infected roots. Experiments were conducted in an APHIS approved containment growth chamber held at 14 hour days and constant 20° C temperature. Experiments were analyzed using PROC MIXED in SAS 9.1 for Windows (Cary, NC).

Results and Discussion

Flooding or the interaction between flooding and cultivar had no effect on foliar infections (tables 1, 2). It is possible that flooding for 7 days was not long enough to stress *Rhododendron* plants. Cultivar significantly affected sporulation and disease severity (percent lesion area) (tables 1, 2).

Table 1—Effect of flooding on sporulation of *P. ramorum* on infected leaves of *Rhododendron*

Experiment	Factor	F value	Prob > F
1	Block	1.07	0.392
	Flooding	1.66	0.198
	Cultivar	6.00	0.021
	Cultivar × flooding	0.53	0.669
2	Block	0.66	0.627
	Flooding	0.66	0.582
	Cultivar	5.94	0.021
	Cultivar × flooding	0.81	0.499

Table 2—Effect of flooding on disease severity determined as percent lesion area on infected *Rhododendron* leaves

Experiment	Factor	F value	Prob > F
1	Block	1.63	0.195
	Flooding	1.32	0.288
	Cultivar	3.03	0.093
	Cultivar × flooding	1.72	0.185
2	Block	1.88	0.142
	Flooding	2.1	0.123
	Cultivar	42.3	<0.001
	Cultivar × flooding	0.16	0.923

Flooding or cultivar had no effect on infection of plants through roots ($P > 0.05$). Plants infected through inoculation of potting mix developed disease. Root rot developed after about 4 weeks on most plants where the potting mix was infested. Above ground symptoms of potting mix inoculated plants included wilting, yellow or red discoloration, and at times development of lesions similar to those observed in foliar inoculations. Plating of root segments onto selective medium confirmed infection of plants with *P. ramorum*.

Plants get infected and foliage gets blighted through infested potting mix. These results indicate that *P. ramorum* sporulates readily on *Rhododendron* leaves and has potential for a potting media phase in which it can infect roots. However, further investigation is needed to demonstrate that *P. ramorum* can survive in potting mix and can complete the disease cycle in potting mix.

Literature Cited

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