

Occurance of *Phytophthora cinnamomi* in Forest and Field Soils of Western North Carolina

by

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Introduction

In western North Carolina, past surveys for *Phytophthora cinnamomi* have been conducted in the rhizosphere beneath woody hosts (2), in old growth forests (4), and in Fraser fir Christmas tree plantations (3). None of these surveys evaluated the presence of *P. cinnamomi* in the soils of open fields, which are commonly used for Christmas tree plantations. The North Carolina Division of Forest Resources, with assistance from the U.S. Forest Service, initiated a survey to determine the occurrence of *P. cinnamomi* in forest and open field soils of western North Carolina.

Methods

The survey of western North Carolina for *P. cinnamomi* began in June and ended in December of 1997. A survey plot was located at each intersection of a 10 by 10-mile grid for a total of 69 plots (Figure 1). At each plot, the nearest forested area and the nearest open field were selected for sampling. Grassy pastures were selected as open fields when ever possible. When a plot fell in a National Forest or Park, an open field without trees was selected. These fields were without signs of having been cut over recently. Plots sampled in this survey did not have a Fraser fir component. A composite soil sample was collected from the highest (upper) and from the lowest (lower) portion of the area sampled. Each composite soil sample consisted of 5 cores. The samples were collected 66 ft apart along a traverse running with the contour of the land to remain in the upper or lower portion of the sample area. Each traverse began 66 ft from the edge of the selected forest or pasture. A soil probe was used to take soil samples to a depth of 6 to 8 in. The soil probe was sterilized between composite samples with antibacterial soap, and flame sterilized with 95% ethanol. In small field openings, such as on National Forest or Park land, there was sometimes not enough room for a 400 ft linear traverse. The core samples were taken 66 ft perpendicular to the

last coring and 66 ft from the edge of the area being sampled. Samples were placed in cold storage for up to 30 days before processing.

The blue lupine bait method (6) was used to determine if *P. cinnamomi* was present in the composite soil samples. This bait method was used so that a larger volume of soil could be tested. A 20 oz container was filled with approximately 12.6" of soil and then flooded with distilled water. The roots of germinated blue lupine seedlings were placed in the soil water for 2-3 days. Roots that developed brown lesions were placed on a medium selective for *Phytophthora* spp. (1). The resulting fungi were transferred to V8 agar (8), incubated for 7-10 days, and then placed in soil water extract for 16 to 24 hours to induce spores for identification (10).

Results and Discussion

Phytophthora cinnamomi was isolated from four composite soil samples (Table 1 and Figure 1) out of 276 total samples. An unidentified *Phytophthora* sp. was also recovered from a forested site. The recovery of *P. cinnamomi* from low areas in forested sites was expected given results from previous surveys in forested areas of the South (2, 4). *Phytophthora cinnamomi* was isolated from open fields located on National Forest and Park land, but not from soils taken in open grassy pastures. Two out of the five soil samples with *Phytophthora* spp. were located in the upper portion of the area sampled.

The season in which samples were collected may have affected the isolation success of this survey. Four out of five isolations of *P. cinnamomi* came from soil collected in June. Several studies have found that inoculum density of *P. cinnamomi* decreases with declining soil temperatures (5, 9). However, Kenerley and Bruck (5) recovered *P. cinnamomi* throughout the winter months, and Otrrosina and Marx (7) found no correlation between the time of sampling and soil populations of *P. cinnamomi*. We attempted to deal with possible seasonal differences by selecting the lupine method of detection so that low populations of *Phytophthora* might be recovered.

Table 1. The species, month, and location of the *Phytophthora* spp. isolated from 5 out of 276 composite soil samples collected in Western North Carolina.

Phytophthora spp.	Month collected	Plot location ¹	Site	Sampling location in a site
<i>P. cinnamomi</i>	June	H 11 ²	Open field	Upper
<i>P. cinnamomi</i>	June	D 11 ²	Open field	Upper
<i>P. cinnamomi</i>	June	I 10 ³	Open field	Lower
<i>P. cinnamomi</i>	October	J 8	Forest	Lower
<i>Phytophthora</i> sp.	June	E12	Forest	Lower

¹Locations on Figure 1. • ²National Forest land • ³National Park land

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The open fields sampled in the National Forests were hard to find and small. A survey of host plants was not conducted; however, hosts of *P. cinnamomi* were noted by the surveyor during the collection of soil in or around these open fields. Various tree species and *Rhododendron* spp. were usually located around the fringe of these open fields. Wild blueberry plants were also noted in some of the open fields located in upper elevations of National Forest land. The recovery of *P. cinnamomi* from open fields on National Forest and Park land was most likely due to the presence of an infected host either in or surrounding the opening. Another possible explanation is that *P. cinnamomi* persisted in the soil long after the hosts were removed. Zentmyer and Mircetich (11) demonstrated that *P. cinnamomi* could persist in soil in the absence of a host for at least 10 years.

Summary

The recovery of *Phytophthora* spp. from western North Carolina in 1997 was relatively low (5 out of 276 soil samples). This survey demonstrated that *P. cinnamomi* can be found in small open fields as well as forested sites. Unfortunately, this survey did not take enough information to determine why *P. cinnamomi* was found in open fields located only on National Forest or Park land. Host plants of *P. cinnamomi* were noted to be common surrounding these small openings. The most probable explanation for the recovery of *P. cinnamomi* from these fields is the presence of an infected host in, or surrounding an opening. *Phytophthora* spp. were not recovered from grassy pastures.

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