



## CALIFORNIA OAK MORTALITY TASK FORCE REPORT OCTOBER 2007

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### RESEARCH

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**Fichtner, E.J.; Lynch, S.C.; and Rizzo, D.M. 2007. Detection, distribution, survival, and sporulation of *Phytophthora ramorum* in a California redwood-tanoak forest soil. *Phytopathology* 97:1366-1375.**

**Abstract:** Recovery of *Phytophthora ramorum* from soils throughout sudden oak death-affected regions of California illustrates that soil may serve as an inoculum reservoir, but the role of soil inoculum in the disease cycle is unknown. This study addresses the efficacy of soil baiting, seasonal pathogen distribution under several epidemiologically important host species, summer survival and chlamydospore production in soil, and the impact of soil drying on pathogen survival. The efficacy of rhododendron leaves and pears as baits for detection of soilborne propagules were compared. Natural inoculum associated with bay laurel (*Umbellularia californica*), tanoak (*Lithocarpus densiflorus*), and redwood (*Sequoia sempervirens*) were determined by monthly baiting. Summer survival and chlamydospore production were assessed in infected rhododendron leaf disks incubated under bay laurel, tanoak, and redwood at either the surface, the litter/soil interface, or in soil. Rhododendron leaf baits were superior to pear baits for sporangia detection, but neither bait detected chlamydospores. Most inoculum was associated with bay laurel and recovery was higher in soil than litter. Soil-incubated inoculum exhibited over 60% survival at the end of summer and also supported elevated chlamydospore production. *P. ramorum* survives and produces chlamydospores in forest soils over summer, providing a possible inoculum reservoir at the onset of the fall disease cycle.

**Garbelotto, M.; Schmidt, D.J.; and Harnik, T.Y. 2007. Phosphite Injections and Bark Application of Phosphite + Pentrabark Control Sudden Oak Death in Coast Live Oak. *Arboriculture & Urban Forestry* 33(5): 309-317.**

**Abstract:** In each of seven fully controlled experiments, potted California, U.S. coast live oak trees were artificially inoculated with *Phytophthora ramorum*, the agent of a tree disease commonly referred to as sudden oak death. Phosphites were applied to trees using a range of application approaches either as preventive or therapeutic treatments. Soil drenches and bark application of phosphites were ineffective; foliar application of phosphites amended with surfactants were effective only at times and always caused phytotoxicity. On the other hand, injections of phosphites and bark applications of phosphites + the organosilicate surfactant Pentrabark™ (Agrichem, Medina, OH, U.S.) were consistently effective in suppressing bark colonization by this pathogen without causing phytotoxicity. This is the first study describing the use of a chemical treatment amended with an organosilicate surfactant for topical bark applications.



**Husson, C.; Delatour, C.; Frey, P.; Marçais, B.; Saurat, C.; Schenck, N. 2007. First Report of *Phytophthora ramorum* on Ornamental Plants in France. Plant Disease Vol. 91, No. 10: 1359-1359. DOI: 10.1094/PDIS-91-10-1359B.**

Abstract: In April 2002, *Phytophthora ramorum* was associated with twig blight and brown spots on *Rhododendron* spp. leaves from a nursery in France. The isolate was identified by its morphological characters on V8 agar: slow growth, deciduous and semipapillate sporangia, and abundant production of large chlamydospores. The identification was confirmed by ITS rDNA sequencing. During 2002, *P. ramorum* was also isolated from diseased *Viburnum tinus* and *V. × bodnantense* plants exhibiting symptoms of wilting and stem base discoloration. Subsequently, repeated surveys for *P. ramorum* were carried out in nurseries and areas surrounding nurseries throughout France. Since 2004, a large range of known hosts were investigated in approximately 2,000 nurseries and 200 other sites each year. *P. ramorum* was detected exclusively in nurseries at 29 locations in 2002, 9 in 2003, 23 in 2004, 17 in 2005, and 19 in 2006. *Rhododendron* spp. and occasionally *V. tinus* were the major hosts. In addition, the pathogen was detected for the first time on *Pieris japonica* in two nurseries in 2005 and on *Camellia* sp. in one nursery in 2006 from plants exhibiting leaf and twig blight. In both cases, *P. ramorum* had already been detected on *Rhododendron* spp. in the same nurseries. Most of the infected plants were found in northwestern France (Bretagne and Pays-de-la-Loire), or came from this region, which is the main rhododendron-growing area in France. In some cases, plants were imported from Belgium or the Netherlands. *P. ramorum* was also detected in a nursery in soil close to diseased *Rhododendron* spp. plants and pond water used for irrigation by using a combination of baiting with *Rhododendron* spp. leaves and PCR assay with species-specific primers. Overall, approximately 1% of the investigated nurseries were found positive each year, and this ratio was quite stable from 2004 to 2006. To date, *P. ramorum* has not been detected outside of nurseries, although many surveys were conducted on the west coast of France where the risk is considered to be high because of a favorable mild and humid climate and the presence of suitable hosts. In addition, 78 isolates of *P. ramorum* collected between 2002 and 2004 on *Rhododendron* spp. and *V. tinus* were found to be of A1 mating type based on pairings with *P. cryptogea* A1 and A2 mating types.

**Linderman, R.G.; de Sá, P.B.; and Davis, E.A. 2007. Comparative susceptibility of plants native to the Appalachian range of the United States to inoculation with *Phytophthora ramorum*. Online. Plant Health Progress DOI: 10.1094/PHP-2007-0917-01-RS.**

Abstract: *Phytophthora ramorum*, cause of sudden oak death of trees or *ramorum* blight of other plant species, has an ever-increasing host range. Some geographic regions are considered to be at high risk of becoming infested with the pathogen, possibly causing plant mortality such as seen in native habitats of California and Oregon. One such region is the Appalachian range of the eastern United States, where known susceptible plants occur and climatic characteristics appear favorable for infections by this pathogen. We collected foliage of a range of plant species native to Appalachia in Kentucky during two



summer seasons, and the foliage was shipped to Oregon for inoculation with *P. ramorum* to determine relative susceptibility. Leaves were needle-wounded and inoculated with either mycelium agar plugs or sporangia of a North American (A2 mating type) or European (A1 mating type) isolate. After 14 days incubation at 20°C in moist boxes, lesions caused by either inoculum type or isolate generally were comparable using digital photos and ASSESS software. Some genera, species, and cultivars within species were highly susceptible, while others were moderately susceptible or not susceptible. These results provide a basis for regional surveyors to select target hosts and to generate survey and management practices for nursery and forest areas.

**Parke, J.L., and Lewis, C. 2007. Root and stem infection of rhododendron from potting medium infested with *Phytophthora ramorum*.** Plant Dis. 91:1265-1270.

Abstract: *Phytophthora ramorum* has been detected in soil and potting media, but the potential for root infections is not fully understood. To determine whether the root system could become infected and transmit disease, rhododendron 'Nova Zembla' plants grown from rooted cuttings and native Pacific rhododendron (*Rhododendron macrophyllum*) plants grown from seed were transplanted into a potting medium artificially infested with *P. ramorum*. Inoculum consisted of V8-brothvermiculite cultures of *P. ramorum*, chopped infected leaves, or zoospores. Plants were watered from the bottom to prevent splash dispersal of inoculum onto stems and foliage. Both infested amendments and applications of zoospores resulted in plant mortality within 3 to 7 weeks. *P. ramorum* was isolated from hair roots, large roots, and stems above and below the potting medium surface. Noninoculated control plants remained healthy and did not yield *P. ramorum*. Epifluorescence microscopy of tissue culture plantlets inoculated in vitro revealed attraction of zoospores to wounds and root primordia, and colonization of the cortex and vascular tissues of roots and stems, including the xylem. Transmission of *P. ramorum* from infested potting media to stems via infected, symptomless root tissue demonstrates the need to monitor potting media for presence of the pathogen to prevent spread of *P. ramorum* on nursery stock.

**Shishkoff, N. 2007. Persistence of *Phytophthora ramorum* in soil mix and roots of nursery ornamentals.** Plant Dis. 91:1245-1249.

Abstract: Although most *Phytophthora* species have a soilborne phase that is crucial for infection of roots and for survival away from the host, the details of the soil phase of *Phytophthora ramorum* are not yet fully understood. As mycelium ages, it becomes resistant to sterilization by acidic electrolyzed water (AEW), a product of the electrolysis which can be used as a disinfectant. Colonies of *P. ramorum* could be recovered from moist potting mix or sand for many months, whether buried as infected plant leaf tissue or as mycelium bearing chlamydospores, and the buried material was also resistant to treatment by AEW. There was no significant difference in recovery over time among treatments (sand or potting mix; infected plant tissue or mycelium); after approximately a year, colonies could be recovered at 0.8 to 14.3%. When excised roots were inoculated with *P. ramorum* sporangia and buried in mesh bags in potting mix, the pathogen was



recovered from buried roots for at least 8 to 11 months, but it was not clear whether it was surviving as mycelium or chlamydospores. The roots of living plants of *Acer macrophyllum*, *Buxus sempervirens*, *Camellia oleifera*, *C. sinensis*, *C. sasanqua*, *Lonicera hispidula*, *Taxus baccata*, *Umbellularia californica*, *Vaccinium macrocarpon*, *Viburnum davidii*, *V. tinus*, *V. × pragense*, *Rhododendron* 'Gloria', and *Syringa vulgaris* were drenched with a sporangial solution of *P. ramorum* and incubated for a month; the pathogen could be recovered from roots of all plants except those of *Buxus sempervirens* and *Lonicera hispidula*. Recovery on selective agar medium (P5ARP) was from both washed and surface-sterilized roots, suggesting that the roots were internally infected. When chlamydospores were placed near roots and observed directly, they were seen to germinate, forming sporangia. Nearby roots became infected, the tips covered with sporangia. Therefore, *P. ramorum* appears to have a soil phase, at least under greenhouse and nursery conditions.

## REGULATIONS

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### **Changes to EU legislation on *Phytophthora ramorum* were introduced on 3/27/07.**

The Decision (2007/201/EC) amends the list of plants, wood and bark susceptible to *P. ramorum*, increases from one to two the number of official inspections of specific species of susceptible plants in places of production and extends eradication measures to cover growing media and plant debris as well as sanitizing the surface upon which infected plants have been standing. These changes have been implemented in England through the Plant Health (*Phytophthora ramorum*)(England)(Amendment) Order 2007 which came into force on 8/15/07.

For more information on the updated regulations, go to the Department for Environment, Food, and Rural Affairs website at <http://www.defra.gov.uk/planth/pramorom.htm> or contact David Slawson at [David.Slawson@defra.gsi.gov.uk](mailto:David.Slawson@defra.gsi.gov.uk).

## EDUCATION

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**Five *P. ramorum* nursery training sessions for industry professionals are being** offered throughout California this fall. The sessions are designed to provide the revised USDA *P. ramorum* regulations as well as scientific and management updates. Sessions are free of charge, though online pre-registration is required. For more information on registration, dates, and locations, see the Calendar of Events below.

A comprehensive cd of the training sessions has been produced, and will be posted online at the COMTF website ([www.suddenoakdeath.org](http://www.suddenoakdeath.org)) in the near future. The training sessions and the cd are sponsored by the California Oak Mortality Task Force, the California Department of Food and Agriculture, the California Association of Nurseries and Garden Centers, the USDA Animal and Plant Health Inspection Service (APHIS), and the USDA FS Pacific Southwest Research Station.

**A Santa Rosa Sudden Oak Death (SOD) community informational meeting will be** held 10/20 at the Finley Community Center in Santa Rosa. Information on pathogen biology, symptoms, management and treatment options, and the potential for SOD-



related mortality to affect fire behavior will be presented. A panel of experts will also be available to discuss concerns and answer questions from the audience. For more information, see the “Calendar of Events” below.

**The Oregon Department of Agriculture (ODA), along with the Oregon Association of Nurseries and Oregon State University Extension Service,** is poised to begin implementing the “Best Management Practices for Nurseries Pilot Project” within the next few months. The ODA was fortunate to receive a grant from the USDA Natural Resources Conservation Service (NRCS) to help build the infrastructure needed to audit effectiveness of the best management practices within participating nurseries. To meet the requirements of the USDA NRCS grant, particular emphasis will be placed on management of *Phytophthora* species in irrigation water, soil, and potting media. To date, seven nurseries have agreed to participate in the pilot project. ODA plans to include another 18 nurseries in the effort. For more information, contact Nancy Osterbauer at [nosterba@oda.state.or.us](mailto:nosterba@oda.state.or.us).

#### COMMUNITY FOCUS

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**Warm spring rains in 2005 and 2006 brought *P. ramorum* sporeloads to a new high** in Marin County, causing scores of new oak and tanoak infections. According to Marin Municipal Water District personnel, tanoak mortality is now greater than during the initial Sudden Oak Death outbreak of 1999-2001. In response to increased disease levels in the County, key Marin County agencies met in April 2007 to share observations and discuss future plans; Fire Safe Marin released the “Marin on Fire: Preparing for the Next Urban Wildfire” video ([www.firesafemarin.org](http://www.firesafemarin.org)); the Public Works Department began removing hazardous trees in west Marin; and various departments began alerting the Marin County Board of Supervisors to the need for funding for additional hazard tree removals. Consequently, County Supervisor Judy Arnold is now reaching out to Sacramento lawmakers for assistance in dealing with the hazard tree removals in the County, and Agricultural Commissioner Stacy Carlsen is seeking support from fellow county Agricultural Commissioners impacted by *P. ramorum*.

Concerns among landowners and homeowners throughout the County are also increasing, with Mill Valley and Novato residents requesting information on the disease and how they can prevent it, and ranchers in Chileno Valley (NE Marin) asking for technical assistance as more of their oaks appear to be infected. Responding to Mill Valley needs, County Supervisor Charles McGlashan, UC Cooperative Extension (UCCE), Marin, and the California Oak Mortality Task Force (COMTF) held a community meeting in September, which drew close to 50 homeowners hoping to learn more about managing Sudden Oak Death on their property. UCCE Marin Environmental Horticultural Advisor Steven Swain will continue this management message in 2008 with Forest Stewardship workshops that incorporate Sudden Oak Death into a larger framework of maintaining forest health.

For more information on Marin County *P. ramorum* outreach activities, contact Janice Alexander at [Jalexander@ucdavis.edu](mailto:Jalexander@ucdavis.edu).





### **OTHER OAK PESTS**

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**While heavy infestations of California oak worm (*Phryganidia californica*) have been** observed in coastal areas of Santa Cruz and Monterey Counties as well as the San Francisco Bay Area this year, it is important to note that healthy and well-cared for oaks tolerate extensive defoliation without serious harm. Infestations can be identified by the larvae hanging from silk-like threads throughout the canopy as well as the accumulation of frass on the ground below the canopy.

In many cases this year, the first generation larvae (this past spring) were so heavy that widespread defoliation of live oaks were observed in the summer, resulting in entire woodlands of leaf-less live oaks in some areas. The second generation larvae emerged this past summer, but in many cases there was little foliage available for them to eat. Consequently, the larvae began to migrate from trees in search of food. Since the host range of these larvae is limited to oak, they will eventually die if they do not find oak leaves to eat. Sometimes they can be found eating other hosts in a futile attempt to get nutrition, but they do not feed for long, and will subsequently die.

For more information on oakworms, their lifecycle, and management options, access the California Oakworm UC Pest Note at <http://www.ipm.ucdavis.edu/PMG/PESTNOTES/pn7422.html>. For photos and additional oakworm information, access page 14 of the USDA Field Guide to Insects and Diseases of California Oaks at [http://www.fs.fed.us/psw/publications/documents/psw\\_gtr197/psw\\_gtr197.pdf](http://www.fs.fed.us/psw/publications/documents/psw_gtr197/psw_gtr197.pdf).

### **RESOURCES**

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**“Vivero de Demostración Virtual Oomycete,”** a Spanish version of the “Virtual Oomycete Demonstration Nursery,” has been posted to the Washington State University Puyallup education resource website at <http://www.puyallup.wsu.edu/ppo/resources.html>.

### **PERSONNEL**

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**John H. Bowers has been hired as the new USDA APHIS National Survey** Coordinator for the Plant Protection Quarantine’s Pest Detection program. Bowers formerly served with the Maryland Department of Agriculture (MDA) where he was responsible for the state Plant Pathology Laboratory which housed a plant diagnostic clinic in support of MDA’s nursery inspectors and industry, and also conducted APHIS-certified molecular diagnostics for *Phytophthora ramorum* as well as other pathogens of regulatory and economic concern.

As the National Survey Coordinator, John is responsible for national leadership and policy for the Cooperative Agricultural Pest Survey (CAPS). The CAPS program consists primarily of cooperative agreements with the states to fund and conduct surveys to detect pests, pathogens, noxious weeds, mollusks, and other invasive species. *P. ramorum* was one of many species on the CAPS 2007 survey list, allowing surveys for *P. ramorum* to be funded through the Program. There is no requirement to survey for *P.*



*ramorum*, but is an option available to the states. In 2007, 19 states have chosen to survey for *P. ramorum*. John Bowers can be reached at (301) 734-3658 or via email at [john.bowers@aphis.usda.gov](mailto:john.bowers@aphis.usda.gov).

#### CALENDAR OF EVENTS

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- 10/15 – 10/18 - XVI International Plant Protection Congress 2007, Glasgow, UK;**  
Meeting details are available at <http://www.bcpc.org/IPPC2007>.
- 10/20 - Santa Rosa Sudden Oak Death Community Informational Meeting; Finley Community Center, Valley Oak Room, 2060 West College Avenue, Santa Rosa;**  
For more information, contact Lisa Bell at 707-565-2050 or [lkbell@ucdavis.edu](mailto:lkbell@ucdavis.edu), or Caerleon Safford at 707-565-6070 or [csafford@sonoma-county.org](mailto:csafford@sonoma-county.org).
- 10/20 – Woodside Homeowner Agri-Fos® Treatment Training; Mounted Patrol Grounds, 521 Kings Mountain Rd., Woodside; 2:00 p.m.;** For more information, contact Katie Palmieri at (916) 435-3230 or [palmieri@nature.berkeley.edu](mailto:palmieri@nature.berkeley.edu).
- 10/25 – Hillsborough Sudden Oak Death Community Informational Meeting;**  
Hillsborough Town Hall, 1600 Floribunda Avenue, Hillsborough;  
6:00 – 8:00 p.m.; For more information, contact Elizabeth Cullinan at (650) 375-7411 or [ECullinan@HILLSBOROUGH.NET](mailto:ECullinan@HILLSBOROUGH.NET).
- 10/29 – Free Fresno County *P. ramorum* Nursery Industry Training for Professionals;** Veterans' Memorial Building, Clovis; 1:00 - 5:30 p.m.; Pre-registration is required and can be done online at [Nursery Online Registration](#). For more information, contact Katie Palmieri at (916) 435-3230 or [palmieri@nature.berkeley.edu](mailto:palmieri@nature.berkeley.edu).
- 11/06 – Free Ventura County *P. ramorum* Nursery Industry Training for Professionals;** Government Center, Ventura; 12:00 - 4:30 p.m.; Pre-registration is required and can be done online at [Nursery Online Registration](#). For more information, contact Katie Palmieri at (916) 435-3230 or [palmieri@nature.berkeley.edu](mailto:palmieri@nature.berkeley.edu).
- 11/13 – Free San Diego County *P. ramorum* Nursery Industry Training for Professionals;** Escondido Farm Bureau, Escondido; 12:00 - 4:30 p.m.; Pre-registration is required and can be done online at [Nursery Online Registration](#). For more information, contact Katie Palmieri at (916) 435-3230 or [palmieri@nature.berkeley.edu](mailto:palmieri@nature.berkeley.edu).
- 11/14 – Free Orange County *P. ramorum* Nursery Industry Training for Professionals;** South Coast Research and Extension Center, Irvine; 7:30 a.m. – 12:00 p.m.; Pre-registration is required and can be done online at [Nursery Online Registration](#). For more information, contact Katie Palmieri at (916) 435-3230 or [palmieri@nature.berkeley.edu](mailto:palmieri@nature.berkeley.edu).
- 11/15 – Free Sacramento County *P. ramorum* Nursery Industry Training for Professionals;** Ag Extension Auditorium, Sacramento; 12:00 - 4:30 p.m.; Pre-registration is required and can be done online at [Nursery Online Registration](#). For more information, contact Katie Palmieri at (916) 435-3230 or [palmieri@nature.berkeley.edu](mailto:palmieri@nature.berkeley.edu).