



CALIFORNIA OAK MORTALITY TASK FORCE REPORT SEPTEMBER 2009

MONITORING

Another Mendocino County watershed has been confirmed *P. ramorum* positive. At the far eastern reaches of Big River, a hillside above the Orr Hot Springs resort has been found to have infected CA bay laurel and tanoak. The immediate area drains into the South Fork Big River. From an early July investigation conducted by Cal Fire, eight red-crowned tanoaks were symptomatic, and several more dead trees were noted in the area. The other dead trees had an array of pests including Armillaria, flathead borers, Hypoxylon, and ambrosia beetles. Many of the symptomatic tanoaks had symptomatic bay crowns overhanging them.

This new find is 11 miles due north from one of the earliest confirmed Mendocino County infestations found off Peachland Road in the Indian Creek drainage north of Boonville in 2002. Orr Hot Springs is about 10 miles northwest of Ukiah and just east of Montgomery Woods State Park, a popular hiking spot. The lightning fires in the County in 2008 stopped just short of consuming trees in this area. CA bay laurel and tanoak are abundant in the drainage. For more information contact Jack Marshall, Jack.Marshall@fire.ca.gov.

The USDA Forest Service, Forest Health Protection Sudden Oak Death 2009 aerial survey indicates that current sudden oak death mortality rates are reduced. The first flights included Marin, Napa, and Sonoma Counties; parts of Solano County; and Lake and Mendocino Counties. Approximately 6,000 acres of mortality were mapped in these counties, which is about half of what was mapped in 2008 and 1/10 of the acreage mapped in 2007 in the same area. Mortality for tanoak and coast live oak was relatively low, and the number of dead trees per acre has greatly diminished. The north and central coast aerial surveys, including Mendocino, Humboldt, Del Norte, Monterey, Santa Cruz, Santa Clara, and San Mateo Counties also detected less mortality than in previous years. The decreased levels of mortality are attributed to the weather patterns over the last couple of years, which have been relatively dry and not conducive to pathogen activity. To access the flight line, mapped mortality, and links to photos taken in-flight, go to <http://www.fs.fed.us/r5/spf/fhp/fhm/aerial/2009/kmz/index.shtml>. For more information, contact Zachary Heath at zheath@fs.fed.us.

A meeting to develop a community-based monitoring program for invasive *Phytophthora* species in western Washington streams was held in September at Washington State University, Puyallup. The meeting was attended by members of stewardship groups, universities, government agencies, and other interested parties. Outcomes of the meeting included connecting with Pierce College, Puyallup and University of Washington, Tacoma educators who are interested in the educational aspects of stream monitoring and the potential for student projects, as well as with volunteer groups, such as Friends of Clarks Creek and Master Gardeners, that are willing to help monitor streams. Consequently, a pilot study consisting of one or two watersheds



(e.g. Clarks Creek or the Green River) is being planned. A group to identify potential funding and prepare a proposal for this program was also established. Meeting presentations and related documents can be found at http://www.puyallup.wsu.edu/ppo/sod/extension/stream_meeting/index.htm.

NURSERIES

A Montgomery County, Pennsylvania residential site was found to have *P.*

ramorum-positive *Rhododendron bathyphyllum* on 8/17/09. The detection was a result of a trace-forward inspection of rhododendrons shipped from an infested nursery in Lane County, Oregon. A follow-up visit to the site has been scheduled.

A Snohomish County, WA retail nursery was found to have *P. ramorum*-positive

Rhododendron 'President Roosevelt' and 'Purple Passion' on 7/31/09 and *Pieris japonica* 'Valley Rose' on 8/17/09 as a result of an annual compliance agreement inspection. This nursery was also found *P. ramorum* positive in 2004, 2006, and 2007, and does ship interstate; however, the trace-forward list indicates no recent host plant out-of-state shipments.

A sixth Oregon nursery was found *P. ramorum* positive on 8/17/09 during an annual

nursery certification inspection. Located in Marion County, the nursery is primarily a retail outlet that has had some out-of-state sales over the past calendar year. *P. ramorum* was initially detected on *Pieris* 'Flaming Silver'; however, *Camellia* 'Miss Tingley' was also found positive for the pathogen during delimitation. The isolate recovered from the *Pieris* 'Flaming Silver' was unusual in that it sporulated very slowly on PARP and exhibited an aberrant hyphal growth pattern. The isolate has been sent to USDA ARS for genotyping. The nursery was also found positive in 2008.

Update on the salal (*Gaultheria shallon*) native landscape find in Washington

reported in August - On 7/31/09, a second *P. ramorum* detection was made on salal outside of the retail nursery in Gig Harbor (Pierce County), Washington. Salal is an evergreen coastal shrub found from California, through British Columbia and into Alaska. This second find is along the same drainage ditch as the first and across the road from the retail nursery. These salal plants are about 100 meters south of the previously reported salal detection. In order to address the risk of artificial spread, the USDA Animal and Plant Health Inspection Service issued an Emergency Action Notification, preventing plants from being disturbed or moved while delimitation of the infestation is completed.

The Canadian Food Inspection Agency (CFIA) has almost completed its 2009

national survey for *P. ramorum*. Of the 178 nurseries sampled throughout Canada, *P. ramorum* was detected at two retail nurseries and one wholesale production nursery in the greater Vancouver area. Each of the nurseries had tested positive for the pathogen in 2008; therefore, the samples were taken as part of follow-up surveillance. The infested material at each site has been incinerated under CFIA supervision and follow-up



sampling is underway. All soil and water samples at all sites were negative. The infected plants included *Rhododendron*, *Pieris* and *Camellia*.

MANAGEMENT

***P. ramorum* likely kills canyon live oak (*Quercus chrysolepsis*) according to a recent** investigation by Ted Swiecki and Elizabeth Bernhardt (Phytosphere Research). The study of recent mortality among large canyon live oaks at the Midpeninsula Regional Open Space District's Los Trancos Preserve was conducted in cooperation with Kamyar Aram and Elizabeth Fichtner (UC Davis, Rizzo lab) in a forest dominated by canyon live oak and California bay laurel, a species mix unlike most stands where SOD studies have been conducted. *P. ramorum* has been isolated from symptomatic bay and coast live oak at the Los Trancos Preserve, and positive PCR results (tested by the UC Berkeley, Garbelotto lab) were obtained from internal bole canker tissue in two sampled canyon live oaks, indicating that *P. ramorum* DNA was present in the symptomatic host tissues. The canyon live oak SOD diagnosis is further supported by symptom and epidemiological data; however, *P. ramorum* has not yet been isolated from canyon live oak trunk cankers. Field observations to date suggest that *P. ramorum* trunk cankers in canyon live oak may not develop the initial bleeding symptoms seen in other canker hosts. Invasion by secondary organisms including ambrosia beetles and *Hypoxylon thouarsianum* may be the first visible evidence of the canker, and *P. ramorum* is typically difficult to isolate from cankers at this late stage of degradation.

Because SOD in canyon live oaks is closely associated with *P. ramorum*-infected bay, removal of bay foliage within at least 5 m (16 ft) of the oak trunk should significantly reduce disease risk. Application of phosphite (e.g., Agri-Fos[®]) may also provide disease protection, but no studies to test these management techniques have been initiated. Further studies are also needed to characterize early infection symptoms. Inoculation studies on logs are currently in progress at the Rizzo lab. For more information on the study findings, contact Ted Swiecki at phytosphere@phytosphere.com.

Clorox[®] Regular-Bleach (EPA Reg. No. 5813-50) was officially registered for use against *P. ramorum* in California forests by the California Department of Pesticide Regulation on 8/5/09. The label states, "When used as directed, this product is effective in controlling the spread of the invasive pathogen *Phytophthora ramorum* in forests. *P. ramorum* causes a fatal canker disease of several tree species and damages many other plant species. Water is commonly drafted from streams and fire ponds within forested areas to use in dust abatement on forest roads, equipment cleaning and fire suppression. The use of infested water sources can spread *P. ramorum* to uninfested areas. Treating water prior to use helps control the spread of this pathogen. Directions for use: Add 1 gallon of this product to 1000 gallons (~50 ppm available chlorine) of drafted water. Prepare the mixture at least 5 minutes prior to application for dust abatement, fire suppression, and cleaning vehicles and logging, road building, and maintenance equipment." For more information on the Clorox[®] registration, contact Fidel Perez at (916) 445-4360 or fperez@cdpr.ca.gov.

**RESEARCH**

Roubtsova, T.V. and Bostock, R.M. 2009. Episodic abiotic stress as a potential contributing factor to onset and severity of disease caused by *Phytophthora ramorum* in *Rhododendron* and *Viburnum*. Plant Disease 93:912-918.

Abstract: *Phytophthora ramorum* attacks many forest and nursery species, primarily causing trunk or stem cankers, foliar blight, and dieback, and in some species root infection has been demonstrated. However, the abiotic and edaphic factors that influence infection and disease development are unresolved. Root infection by *P. ramorum* and the potential for mild abiotic stress in disease predisposition was examined with *Rhododendron* hybrid Cunningham's White and *Viburnum tinus* cv. Spring Bouquet. To impose water stress in a uniform and synchronous manner, osmotic stress induced with 0.2 M NaCl was selected. Roots were exposed to NaCl for 16 to 24 h in modified hydroponic culture or standard potting soil, removed from the NaCl, and then inoculated with zoospores. In the hydroponic regime, disease symptoms developed in *Rhododendron* and *V. tinus* plants within 1 week after inoculation of salt-stressed roots, whereas symptom development was delayed in nonstressed, inoculated plants. Microscopic examination of roots from both species revealed that their apices were covered with sporangia of *P. ramorum*. On potted *Rhododendron* plants inoculated by applying zoospores directly to the soil, stem lesions developed rapidly in salt-stressed plants, with death of the plant occurring within 4 weeks after inoculation. Nonstressed plants survived for 6 to 8 weeks before succumbing to disease, and symptom development in these plants was delayed by 1 to 2 weeks relative to the inoculated, salt-stressed plants. A postinfection episode of salt stress to inoculated roots in the hydroponic regime resulted in significantly faster development of stem lesions in *Rhododendron* relative to nonstressed, inoculated plants.

Tooley, P.W.; Browning, M.; Kyde, K. L.; and Berner, D. 2009. Effect of temperature and moisture period on infection of *Rhododendron* 'Cunningham's White' by *Phytophthora ramorum*. Phytopathology 99:1045-1052.

Abstract: We investigated the temperature and moisture conditions that allow *Phytophthora ramorum* to infect *Rhododendron* 'Cunningham's White'. Most experiments were performed with a single *P. ramorum* isolate from the NA1 clonal lineage. For whole plants incubated in dew chambers at 10 to 31°C, the greatest proportion of diseased leaves, 77.5%, occurred at the optimum temperature of 20.5°C. Disease occurred over the entire range of temperatures tested, although amounts of disease were minor at the temperature extremes. For whole plants exposed to varying dew periods at 20°C and then incubated at 20°C for 7 days, a dew period as short as 1 h resulted in a small amount of disease; however, at least 4 h of dew were required for >10% of the leaves to become diseased. Moisture periods of 24 and 48 h resulted in the greatest number of diseased leaves. In detached-leaf, temperature-gradient-plate experiments, incubation at 22°C resulted in the greatest disease severity, followed by 18°C and then 14°C. In detached-leaf, moisture-tent experiments, a 1-h moisture period was sufficient to cause disease on 67 to 73% of leaves incubated for 7 days at 20°C. A



statistical model for disease development that combined the effects of temperature and moisture period was generated using nonlinear regression. Our results define temperature and moisture conditions which allow infection by *P. ramorum* on Cunningham's White rhododendron, and show that *P. ramorum* is able to infect this host over a wide range of temperatures and moisture levels. The results indicate that *P. ramorum* has the potential to become established in parts of the United States that are outside its current range.

Yakabe, L.E.; Blomquist, C.L.; Thomas, S.L.; and MacDonald, J.D. 2009.

Identification and frequency of *Phytophthora* species associated with foliar diseases in California ornamental nurseries. *Plant Disease* 93:883-890.

Abstract: Numerous ornamental nurseries in 32 California counties were surveyed for leaf spots as part of the California Department of Food and Agriculture mandated surveys targeting *Phytophthora ramorum*. Tissue collected during the 2005 and 2006 surveys was initially screened by a *Phytophthora*-specific enzyme-linked immunosorbent assay. All positive samples were further tested using polymerase chain reaction to determine if *P. ramorum* was present. *P. ramorum* was detected in 1% of the total number of samples taken during the surveys. A total of 377 isolates were identified as species of *Phytophthora* other than *P. ramorum*, and their identity was determined by internal transcriber spacer (ITS) sequences. Subsets of the putative ITS-species were further verified using accepted morphological characters. Thirteen species of *Phytophthora* were found: *P. cactorum*, *P. cambivora*, *P. citricola*, *P. citrophthora*, *P. cryptogea*, *P. foliorum*, *P. gonapodyides*, *P. hibernalis*, *P. nemorosa*, *P. 'Pgchlamydo'*, *P. pseudosyringae*, *P. syringae*, and *P. tropicalis*. *P. syringae* and *P. citricola* made up 55% of the total number of isolates. Species thought to be strictly forest pathogens, *P. nemorosa* and *P. pseudosyringae*, each made up less than 4% of the isolates. To test pathogenicity of acquired isolates, subsets of different species of *Phytophthora* were inoculated onto leaves of selected host plant genera. Of the 66 pathogen-host genera combinations tested, 44 resulted in lesion formation. Disease symptoms appeared as dark, water-soaked lesions with irregular margins and were similar among *Phytophthora* species.

MEETINGS

The Continental Dialogue on Non-Native Forest Insects and Diseases Fifth meeting

will be held October 27 – 28, 2009 at the Fort Mason Center in San Francisco. The intention of the meeting is to cultivate collaborations that will address the threat of non-native forest insects and diseases, link state and local actions to Continental Dialogue efforts to enhance national policies and strategies, and enlist communities in the fight against non-native insects and diseases. The meeting will include concurrent field trips the morning of the 27th – one focusing on SOD issues, with a visit to the National Ornamental Research Nursery at Dominican University of CA in San Rafael and to forested areas in Marin County, and the other to the Port of Oakland to learn about inspections and handling of wood packaging. The remainder of the meeting will be dedicated to panel sessions on the impacts of firewood movement, interstate movement of SOD, preventing and slowing the spread of pests of non-quarantine significance, solid



wood packaging as a pathway for invasives, and outreach and education challenges. The meeting is open to anyone interested in getting involved. Registration is required. For more information, see the Calendar of Events below or go to www.continentalforestdialogue.org.

REGULATIONS

USDA APHIS Plant Protection and Quarantine posted a new proposed rule online in July to establish the new “plants for planting” import category (plants whose importation is not authorized pending pest risk analysis). The foundation document that provides the justification and economic analysis for the rule are also online. To comment, go to <http://www.regulations.gov/search/Regs/home.html#docketDetail?R=APHIS-2006-0011>. Comments are due by 10/21/09.

RELATED ISSUES

Last year during a survey of Cannock Chase, Staffordshire County (England) for *P. ramorum* and *P. kernoviae*, swathes of symptomatic bilberry were found. Consequently, a management program was implemented that included destroying the symptomatic plants. Since discovery of the symptoms, it has been determined that the Chase bilberry infection is actually being caused by *P. pseudosyringae*. This is the first time the pathogen has been found in ground-covering bilberry. Recently 14 new outbreak sites have been identified in the Chase, including some in open heathland.

As the pathogen can be spread via footwear, bikes, and animal paws, public access restrictions are being implemented and those visiting accessible areas are being asked to stay on main paths. In an attempt to stop disease spread, herbicide use is also being considered for areas that are of “special scientific interest.”

Cannock Chase is a mixed area of countryside. It is the largest lowland heath area (a scarce and threatened wildlife habitat) left in the Midlands. It is comprised of natural deciduous woodlands, coniferous plantations, and open heathlands, and has several species of *Vaccinium*. While only 26 square miles, Cannock Chase is home to fallow deer as well as less common and endangered birds.

RESOURCES

Presentations from the Fourth Sudden Oak Death Science Symposium are now posted to the Symposium website. To access the slideshows and accompanying audio files, go to <http://nature.berkeley.edu/comtf/sodsymposium4/schedule.htm>. For presenters who have not yet submitted their files for posting, please contact Janice Alexander at jalexander@ucdavis.edu.

CALENDAR OF EVENTS

9/23 - SOD Treatment Workshop; meet at oak outside of Tolman Hall, UC

Berkeley Campus; 1 – 3 p.m.; Pre-registration is required. This class is free and will be held rain or shine. To register, email SODtreatment@nature.berkeley.edu, and provide your name, phone number, affiliation and license number (if applicable), and



the date for which you are registering. For more information, go to <http://nature.berkeley.edu/garbelotto/english/sodtreatmenttraining.php> or contact Katie Palmieri at (510) 847-5482 or palmieri@nature.berkeley.edu.

10/7 - SOD Treatment Workshop; meet at oak outside of Tolman Hall, UC

Berkeley Campus; 1 – 3 p.m.; Pre-registration is required. For more information, see the 9/23 listing above.

10/27 – 10/28 –Continental Dialogue on Non-Native Forest Insects and Diseases

Fifth Meeting; Fort Mason Center, San Francisco; For more information on the meeting, or to register, go to <http://www.continentalforestdialogue.org/events/dialogue/2009-10-27/index.html> or contact Dana Goodson at dgoodson@resolv.org or (202) 965-6209. For more information about the Dialogue, go to: www.continentalforestdialogue.org.

11/4 - SOD Treatment Workshop; meet at oak outside of Tolman Hall, UC

Berkeley Campus; 1 – 3 p.m.; Pre-registration is required. For more information, see the 9/23 listing above.

11/17 – 11/18 - 58th Annual Meeting of the California Forest Pest Council, What's

Ailing California's Forests?; Heidrick Ag History Center; 1962 Hays Lane, Woodland, CA 95776; For more information, contact Kim Camilli at 805-550-8583 or kim.camilli@fire.ca.gov or go to the CA Forest Pest Council website at <http://caforestpestcouncil.org/>.

12/9 - SOD Treatment Workshop; meet at oak outside of Tolman Hall, UC

Berkeley Campus; 1 – 3 p.m.; Pre-registration is required. For more information, see the 9/23 listing above.

3/7/10 – 3/12/10 - 5th IUFRO *Phytophthora* in Forest Trees and Natural Ecosystems

Conference; Rotorua, New Zealand; For more information or to register, go to <http://www.phyto2010.com/registration.html>. Early registration discounts are available until 10/31/09.