



California Oak Mortality Task Force October 2004 Monthly Report

Nurseries

The USDA Animal Plant Health Inspection Service, Plant Protection and Quarantine confirmed *P. ramorum* at two production areas owned by a large, wholesale shipping nursery in Washington County, OR, as well as at a bark supply company in Columbia County, OR.

Delimitation surveys, in addition to trace-back and trace-forward investigations, are underway at the nursery's two production areas. Both sites are currently under emergency action notices (EAN), prohibiting the movement of host and associated host materials off-site. The positive finds were detected during the annual inspection required for participation in Oregon's *P. ramorum*-free program. Further testing of plant materials at the bark supply facility did not detect *P. ramorum*. Per USDA, the EAN on this facility was lifted, allowing normal business activities to resume. However, plant materials at the facility must be sampled and tested every two weeks for the next six months to verify that the facility remains *P. ramorum*-free. For more information, contact Nancy Osterbauer, Oregon Department of Agriculture, at nosterba@oda.state.or.us.

The Washington State Department of Agriculture (WSDA) is testing plants coming into the state before unloading shipments in an effort to prevent new *P. ramorum* introductions on host nursery stock.

Inspectors will take samples from symptomatic and asymptomatic plants from trucks before they are delivered to WA nurseries. The objective is to determine if *P. ramorum* is present, but symptoms are suppressed with fungicides. For more information, contact Jennifer Falacy, WSDA plant pathologist, at: jfalacy@agr.wa.gov.

Currently the total number of APHIS-confirmed positive sites from the trace-forward, national, and other survey finds is 160 in 21 states.

The breakdown per state is: AL (3), AR(1), AZ (1), CA(53), CO(1), FL(6), GA(18), LA(5), MD(2), NC(9), NJ(1), NM(1), NY(1), OK(1), OR(13), PA(1), SC(3), TN(2), TX(11), VA(2), and WA (25).

APHIS PPQ *P. ramorum* National Survey activities are complete in the Western Region states of AK, AR, AZ, CA, IA, ID, LA, MO, NE, ND, OK, SD, MT, and WY, as well as the Eastern Region states of CT, FL, KY, ME, MI, MN, MS, NC, NJ, OH, PA, PR, WI. As of September 23, 2004, participating States throughout the nation have surveyed 2,215 sites and have collected 39,878 samples; 15 national survey sites have been confirmed positive.

Management

On 9/21/04 the Department for the Environment, Food, and Rural Affairs (DEFRA), along with the Forestry Commission, announced that the disease eradication program already in place for *Phytophthora ramorum* would be extended to cover a new *Phytophthora* species. While surveying for *P. ramorum*, the new species of *Phytophthora* was found in Cornwall causing *P. ramorum*-like symptoms on beech trees and rhododendrons. This new species is not known from any other country, and is temporarily known as "*Phytophthora taxon C*." There is some evidence that it may kill beech trees more rapidly than *P. ramorum* under UK conditions. DEFRA and the Forestry Commission are collaborating with landowners to conduct experiments to see whether woodlands in the affected area can be safeguarded through removal of rhododendrons.

For more information on *Phytophthora taxon C*, including pictures and further descriptions of symptoms and a summary pest risk analysis, go to the DEFRA and Forestry Commission websites at www.defra.gov.uk/planth/pramorun.htm and www.forestry.gov.uk/pramorun.

Regulations

The *Phytophthora ramorum* nursery crop Science Advisory Panel for the California Department of Food and Agriculture (CDFA) met September 1 – 2. Chaired by James MacDonald (UC Davis), the meeting was open to the public, and included a number of participants from the nursery industry. After receiving background information on nursery detections, regulatory actions, and *P. ramorum* sampling and diagnostic methods, as well as feedback from audience members during the public session, the Panel addressed nine key questions. Responses to these questions will be in the final report, and include such topics as the risk of pathogen spread via nursery stock on various host plants; disease transmission and conditions necessary for disease development; determining host status of a particular plant species or cultivar; determining if the A1 and A2 populations cause disease on all the same species; pathogen transmission via potting media and water under natural conditions; fungicide applications masking symptom development despite pathogen survival; testing protocol for *P. ramorum*; and natural pathogen migration from plant to plant within a nursery outside of an infested area. Once the Panel addresses these key issues and completes its final report, it will be provided to CDFA Secretary A.G. Kawamura, under whose authority the Panel was appointed. Following the Secretary's review, the report will be published on the CDFA website at: http://www.cdfa.ca.gov/phpps/pe/sod_survey/.

On August 12, 2004, the National Plant Quarantine Service, Ministry of Agriculture and Forestry, Republic of Korea (NPQS), modified its "Tentative phytosanitary measures to prevent the introduction of Sudden Oak Death (SOD) Disease." Updates to the regulation included the

addition of Nassau County, NY, as well as 22 new plant species. Effective September 9, 2004, these emergency measures prohibit the importation of any propagative host material, such as nursery stock and cuttings, as well as wood (with bark) and growing media from the prohibited areas. For more information, go to the NPQS website at: <http://www.npqs.go.kr/english/index.asp>.

Education

The USDA-Cooperative State Research, Education, and Extension Service (CSREES) National Integrated Pest Management (IPM) Centers and the National Plant Diagnostic Network are assembling a national Master Gardener information campaign to identify and sample plants recently purchased and planted in yards and gardens that are potentially infected with *P. ramorum*. The program objective is to locate plants shipped from *P. ramorum*-positive nurseries sold prior to nursery trace-forward investigations. A national Master Gardener *P. ramorum* training session is scheduled on October 26, 2004. The USDA Forest Service is providing funding for this cooperative effort between the above agencies and USDA-APHIS, the National Plant Board, State Agriculture Departments, Master Gardeners, State Foresters, and many others. For more information, contact Janice Alexander, COMTF Educational Outreach Coordinator, at (415) 499-3041; or Katie Palmieri, COMTF Public Information Officer, at (510) 847-5482; or go to the CSREES website at: www.ncipmc.org/sod.

Research

The Center for Plant Health Science and Technology (CPHST) in Raleigh, North Carolina, provides scientific and technological support for USDA APHIS PPQ *Phytophthora ramorum* regulatory programs and policies, in cooperation with PPQ Emergency Programs and Eastern and Western Regions. Researchers at the center have provided valuable scientific support for molecular diagnostics and biotechnology, including developing and evaluating science-based *P. ramorum* detection and isolation methods, as well as treatment protocols. They have also facilitated the development of *P. ramorum* scientific-based nursery sampling protocols and sample processing in California, as well as DNA extraction protocols in Oregon. Additionally, diagnostic protocols and molecular diagnostic tools now used at the National Plant Germplasm and Biotechnology Laboratory in Beltsville, MD were validated at the center. In June, CPHST also hosted the National *Phytophthora ramorum* Science Panel.

Assisting with integrated pest management and eradication issues, CPHST scientists have worked on the development of quarantine treatment methods and fungicide options. Currently scientists are also working on a project designed to obtain improved delimitation and mitigation of *P. ramorum* in nursery facilities. Staff has helped with quarantine and inspection processes through field and nursery inspections, as well as investigations. General risk analysis,

environmental modeling, and risk mitigation analysis for wood products and nursery stock have helped in survey area selection, early detection, and regulatory decisions. Additionally, cooperators with North Carolina State University, Center for Integrated Pest Management and the North Carolina Department of Agriculture play an important role in data analysis and research into *P. ramorum* and diseases caused by the pathogen. For more information on CPHST, visit the website at: <http://www.cphst.org>, or contact David Kaplan, USDA APHIS, at: david.t.kaplan@aphis.usda.gov or Russ Bullock, USDA APHIS, at: Russ.Bulluck@aphis.usda.gov.

The third International Union of Forest Research Organizations, Phytophthora in Forests and Natural Ecosystems meeting was held in Freising, Germany September 11 – 18, 2004. Abstracts of the nine papers and 10 posters presented on *P. ramorum* will be posted to the meeting website at <http://www.phytophthora-freising-2004.de/>. Also posted are photographs of Phytophthoras and the symptoms they cause on alder, oak, beech, and horse chestnut.

Resources

The US Forest Service has posted a new *P. ramorum* report, “Sudden Oak Death: Protecting America’s Woodlands from *Phytophthora ramorum*” to its website at:

http://www.fs.fed.us/foresthealth/publications/SOD_Report.pdf. The report addresses the USDA Forest Service’s comprehensive six-part strategy to allocate resources for managing Sudden Oak Death, as well as provides up-to-date pathogen information and colorful illustrations.

The Nature Conservancy (TNC) has posted a "Gallery of Pests" to its website at: <http://tncweeds.ucdavis.edu/products/gallery/gallery.html>.

Pathogens such as *Phytophthora ramorum* can be found by regions threatened. General information is available for the pest, along with photos and useful website references.

The Oregon Department of Agriculture (ODA) Plant Division has posted a list of 119 nurseries and 287 Christmas tree growers that are participating in Oregon’s *P. ramorum*-free program. To be posted to the list, nurseries and Christmas tree growers must have been inspected, tested, and found *P. ramorum*-free, and must have signed a compliance agreement with the state. The compliance agreement requires the grower to take certain precautions to prevent the introduction of *P. ramorum* to their production areas. To view the current list of qualified participants, go to http://egov.oregon.gov/ODA/PLANT/sod_free.shtml. For more information on the program, contact Gary McAninch, ODA Nursery/Christmas Tree Programs Supervisor, at gmcaninc@oda.state.or.us.

Calendar of Events

10/15 – Submission deadline for second Sudden Oak Death Science Symposium abstracts for proposed papers or posters. For more information, contact Joni Rippee, UC Berkeley Center for Forestry, at rippee@nature.berkeley.edu or <http://nature.berkeley.edu/forestry/sodsymposium>.

10/26 – USDA CSREES National IPM Centers and the National Plant Diagnostic Network national Master Gardener *P. ramorum* training session. For more information, contact Janice Alexander, COMTF Educational Outreach Coordinator, at (415) 499-3041; or Katie Palmieri, COMTF Public Information Officer, at (510) 847-5482; or go to the CSREES website at: www.ncipmc.org/sod.

11/4 – Eureka, CA “*Phytophthora ramorum* (Sudden Oak Death) Issues in Nurseries” one-day training session for nursery managers and staff, landscape contractors, arborists, and others; Humboldt County Agricultural Center; 5630 South Broadway, Eureka; \$15 registration for lunch and materials; For more information, or to register for the training, call Chris Lee, UC Cooperative Extension, at (707) 445-7351.

11/30 – Department for Environment, Food, and Rural Affairs (DEFRA) second annual *Phytophthora ramorum* meeting for government and industry representatives; Emmanuel Centre, London; The focus of the meeting will be to discuss progress since last year’s meeting. Speakers from the USA, Europe, and industry representatives will talk about their experiences. Space is limited. To register, contact the UK Plant Health Headquarters at planthealth.info@defra.gsi.gov.uk.

1/18 – 21/05 - Second Sudden Oak Death Science Symposium, Marriott Hotel, Monterey, CA. For Symposium program content, contact Rick Standiford, UC Berkeley Center for Forestry, at standifo@nature.berkeley.edu or Pat Shea, USDA Forest Service Pacific Southwest Research Station, at pjshea@davis.com. Updates on the meeting will be posted at <http://nature.berkeley.edu/forestry/sodsymposium>.

Featured Research

Two papers are featured this month. The first, authored by Dodd and colleagues at UC Berkeley, has been published in *New Phytologist*, and the second, authored by Sweicki and Bernhardt, has been filed as a report for the USDA FS Pacific Southwest Research Station.

Richard S. Dodd, Daniel Huberli, Vlad Douhovnikoff, Tamar Y. Harnik, Zara Afzal-Rafii, and Matteo Garbelotto. Is variation in susceptibility to *Phytophthora ramorum* correlated with population genetic

structure in coast live oak (*Quercus agrifolia*)? *New Phytologist* (2004) doi: 10.1111/j.1469-8137.2004.01200.x

California coastal woodlands are suffering severe disease and mortality as a result of infection from *Phytophthora ramorum*. *Quercus agrifolia* is one of the major woodland species at risk. This study investigated within- and among-population variation in host susceptibility to inoculation with *P. ramorum* and compared this with population genetic structure using molecular markers.

Susceptibility was assessed using a branch-cutting inoculation test. Trees were selected from seven natural populations in California. Amplified fragment length polymorphism molecular markers were analyzed for all trees used in the trials.

Lesion sizes varied quantitatively among individuals within populations, with up to an eightfold difference. There was little support for population differences in susceptibility. Molecular structure also showed a strong within-population, and weaker among-population, pattern of variation.

Our data suggest that susceptibility of *Q. agrifolia* to *P. ramorum* is variable and is under the control of several gene loci. This variation exists within populations, so that less susceptible local genotypes may provide the gene pool for regeneration of woodlands where mortality is high.

Swiecki, T. J.; Bernhardt, E. 2004. *Phytophthora ramorum* canker: Factors affecting disease progression and failure potential. 2003-2004 Contract Year Annual Report. Prepared for USDA Forest Service, Pacific Southwest Research Station, Berkeley, CA. 35 pp.

We have completed four years of observations in a case-control study examining the role of tree and site factors on the development of *Phytophthora ramorum* stem canker (sudden oak death) in coast live oak (*Quercus agrifolia*) and tanoak (*Lithocarpus densiflorus*). In September of each year from 2000 through 2003, we collected data on *P. ramorum* symptoms, tree condition, stem water potential, and various other factors in 150 circular plots (8m radius) in areas where *P. ramorum* canker was prevalent in 2000. Each plot is centered around a case (symptomatic) or control (asymptomatic) subject tree. Plots were established at 10 locations in Marin County, and 1 location each in Sonoma and Napa Counties.

Since September 2000, the percentage of symptomatic coast live oak trees in the plots has increased from 22.9% to 24.4%. Two-thirds of this increase in disease incidence occurred between September 2002 and September 2003, following the first relatively wet spring of the study. Between 2000 and 2003, the incidence of *P. ramorum* canker in tanoak has increased from 33% to 39%. For tanoak, increases in disease incidence were approximately equal in each observation interval, about a 2% increase in disease incidence per year.

Mortality due to *P. ramorum* among all monitored coast live oak increased from 3% to 8% between 2000 and 2003. Over the same period, *P. ramorum*-related mortality in all monitored tanoak has increased from 12% to 22.5% in 2003.

Between September 2000 and September 2003, substantial failures occurred in 32% of coast live oaks with *P. ramorum* symptoms but only 2% of coast live oaks lacking *P. ramorum* symptoms. Over this time interval, 73% of trees that were dead as a result of *P. ramorum* canker in 2000 have failed, and 65% of the trees with late *P. ramorum* symptoms in 2000 (cankers with beetle boring and/or *Hypoxylon thouarsianum*) had failed. In contrast, only 10.5% of the coast live oaks with early *P. ramorum* symptoms (bleeding cankers only) in 2000 had failed by 2003 and less than 1% of healthy asymptomatic trees failed over this period. Bole failures were most common overall (58% of all failures) and root failures were the least common failure type (1.7% of the failures).

Because *P. ramorum* primarily causes a bark canker in coast live oak, we initiated a study to determine whether observable bark characteristics are related to *P. ramorum* canker occurrence or progress. In 2003, we evaluated both bark thickness at 1m height and a variety of morphological bark characteristics in a subset of study trees. In this sample, we found that *P. ramorum* canker was more likely to occur in trees with greater bark thickness. We also observed that coast live oak bark thickness increases in a nonlinear manner as tree diameter increases, which suggests that relationships between tree diameter and disease could be related to bark thickness. Only one of the bark morphological characteristics we assessed, the presence of unweathered bark in bark furrows, was positively correlated with disease. This characteristic seems to be associated with faster rates of tree radial growth, and is consistent with other analyses indicating that faster-growing coast live oaks have a greater risk of developing *P. ramorum* canker than slow-growing trees.

Based on four successive years of stem water potential (SWP) measurements on the same set of trees, it appears that SWP values measured in September are mainly influenced by rainfall over the three preceding rainy seasons. SWP readings for individual trees in all three years are also highly correlated. SWP readings indicate that water stress is not a significant predisposing factor for the development of *P. ramorum* canker in coast live oak. Most coast live oaks with *P. ramorum* canker symptoms have maintained relatively high SWP levels and do not show progressive increases in water stress as disease develops. We hypothesize that SWP levels in many of these trees with advanced symptoms of disease remain high because of the progressive diffuse canopy dieback that develops in trees with advanced *P. ramorum* canker symptoms. Leaf area loss resulting from branch dieback reduces evapotranspiration while roots continue to function, which allows trees to maintain high SWP levels.

The full report PDF can be downloaded from http://phytosphere.com/publications/Phytophthora_case-control2004.htm

Host of the Month

***Calluna vulgaris* – Scotch Heather (Ericaceae)** – Added to the USDA APHIS associated host list in August, *Calluna vulgaris* is native to much of Europe. It is a low-growing evergreen groundcover, growing 2 – 3' tall and equal in spread. Branching is upright, forming thick, compact, dense mats. The evergreen leaves range from .05" - .1" long, are scale-like, and are 4-ranked with opposite arrangement, making shoots look square-like. Foliage is medium green during the summer, turning bronze, yellow, reddish, or silvery in autumn depending on the cultivar. Scotch Heather flowers range in color from rosy to purplish pink, and are .25" long and clustered.

Infested *Calluna vulgaris* was identified in Polish container-ornamental nurseries. Symptoms were observed on plants near the nursery road, and included cankers on 2 – 4 cm shoots, as well as shepard crook tips. Koch's postulates have not been completed.

Although this first report of *P. ramorum* in Poland on *Calluna vulgaris* nursery stock is preliminary, it does raise concern that heathlands in the UK and other parts of Europe may be impacted by this pathogen. Heathlands composed of *Calluna vulgaris*, *Vacciniums* and other plants support many rare wildlife species and are ecological valuable. For more information on the heathlands and the importance of this natural resource, go to the European Heathlands homepage at: <http://www.english-nature.org.uk/heathlands/default.htm>.

Resources:

- University of Connecticut; UConn Plant Database of Trees, Shrubs, and Vines <http://www.hort.uconn.edu/plants/c/calvul/calvul1.html>
- Floral Images; UK <http://www.floralimages.co.uk/>
- Personal communication, Leszek Orlikowski, Research Institute of Pomology and Floriculture; <http://www.insad.pl/ang/indexang.htm>