CALIFORNIA OAK MORTALITY TASK FORCE REPORT
JULY 2011

MONITORING

To date in 2011, the U.S. Forest Service, Pacific Southwest Region Forest Health Protection Aerial Detection Survey has flown over a million acres in six counties: Yolo, Solano, Napa, Marin, Sonoma, and Mendocino. The primary damage agent this year has been Sudden Oak Death (SOD), with almost 4,000 acres mapped, up from 800 acres mapped in the same area in 2010. The number of trees killed by *P. ramorum* has also increased dramatically. The majority of mortality was mapped in Sonoma County, with little mapped in Mendocino County. For more information, contact Zachary Heath at zheath@fs.fed.us or go to http://www.fs.fed.us/r5/spf/fhp/fhm/aerial/index.shtml.

Washington had two new and one repeat *P. ramorum*-positive waterway detections in June. One of the new positives was detected upstream from a 2010 positive site. The positive stream feeds into the Sammamish River. The other new positive was detected in a watershed sub-basin adjoining the Sammamish River. The repeat detection site has been positive since 2010 and is in a stream that feeds into the Sammamish. While the exact source of the inoculum remains unknown, genetic evidence points toward previously positive nurseries in the associated watershed.

The UK has confirmed a new *P. ramorum*-infected Japanese larch site in the previously uninfested region of Derbyshire County, central England. The site is a small, 10-acre woodland within the Peak District National Park, approximately 80 miles from the nearest confirmation (which is also considered an isolated outbreak in northern Wales). Infected rhododendron had previously been confirmed on a nearby property.

The Forestry Commission's 2011 UK *P. ramorum* aerial surveys for infected larch trees have identified fewer and smaller suspect locations than in 2009 and 2010. Almost all of the new sites in question are close to, or contiguous with, existing known areas of infection. It is unknown if the dry spring weather throughout the country delayed symptom expression or if infection rates are down; therefore, larch woodlands will continue to be monitored for the remainder of the year.

NURSERIES

California had two *P. ramorum*-positive nurseries identified in June. The first was a production facility in Fort Bragg (Mendocino County) that was confirmed on June 6th. The positive sample originated from a Camellia plant that was found during a general inspection. The nursery was also found positive in 2008 and 2010. It is not under compliance and does not ship interstate. The Nursery Stock Standards of Cleanliness protocol has been implemented. The second confirmation was made on June 23rd at a production facility in Lodi (San Joaquin County). The positive sample was taken from a 5-gallon, *Camellia sasanqua* 'Showa No Sakae' during a trace-back inspection from a Santa Clara County site. The nursery was also positive for *P. ramorum* in 2010. The Confirmed Nursery Protocol has been implemented. The nursery is under compliance and does ship interstate. An interstate trace-forward list will be provided to the USDA in the near future.

The Oregon Department of Agriculture began surveying Christmas tree plantations for *P. ramorum* in late May. The last Christmas tree survey took place in 2006. To date, the more than 60 plantations surveyed have tested free of the pathogen.

REGULATIONS

Effective June 27th, the USDA Animal and Plant Health Inspection Service (APHIS) updated regulations governing international trade in plants used in gardening and landscape design. The new rules implement systems that allow imported material to be judged by invasive potential rather than just non-native status in an effort to prevent invasive pest issues rather than respond to them once established in the US. The rule change creates a new category, "Not Authorized for Importation Pending Pest Risk Assessment (NAPPRA), which allows APHIS to quickly restrict the importation of plants suspected of being invasive or carrying pests until possible risks are understood and protective measures are put in place. For more information, go to http://www.aphis.usda.gov/import_export/plants/plant_imports/Q37_nappra.shtml.

RESEARCH

European Food Safety Authority (EFSA) Panel on Plant Health (PLH). 2011. Scientific Opinion on the Pest Risk Analysis on *Phytophthora ramorum* prepared by the FP6 project RAPRA. European Food Safety Authority Journal, 9(6):2186. 107 pp. DOI: 10.2903/j.efsa.2011.2186. Available online at www.efsa.europa.eu/efsajournal.

Abstract: The Panel on Plant Health was asked to deliver a scientific opinion on the Pest Risk Analysis on *Phytophthora ramorum* prepared by the FP6 project RAPRA, taking into account comments by Member States and additional information since RAPRA. *P. ramorum* is the oomycete causing sudden oak death in the USA and leaf and twig blight/dieback on a range of ornamental species in North America and Europe. Currently *P. ramorum* is not listed as a harmful organism in Council Directive 2000/29/EC, but the Commission adopted in 2002 provisional emergency measures to prevent introduction into and spread within the EU. Recent large-scale outbreaks in Japanese larch (*Larix kaempferi*) plantations in the UK and Ireland have worsened the potential consequences in the risk assessment area. However, the Panel concludes that the broad narrative in the RAPRA report stands and supports its conclusion that "*There is a risk of further entry (of known or new lineages and/or mating types), establishment and […] impact*". It is advisable to avoid introductions of different lineages because of inherent phenotypic differences and the potential for sexual recombination. The Panel supports the management options proposed in the RAPRA report and adds further measures for consideration. Uncertainty remains over the extent to which the association between control measures and gradual reduction in the number of cases in nurseries is causal. The emergency measures have not prevented outbreaks occurring in the natural environment. The many other remaining uncertainties (fitness of progeny, hybridization with other *Phytophthora* species, host range and epidemiological role of new hosts, early detection

of new outbreaks, understanding of long-range dispersal, structure of plant trade networks, origin of the pathogen) call for further research on *P. ramorum* across Europe. Regulatory work should keep updated with research results on *P. ramorum* and further development of the Japanese larch outbreaks.

Chimento, A.; Cacciola, S.O.; and Garbelotto, M. 2011. Detection of mRNA by reverse-transcription PCR as an indicator of viability in *Phytophthora ramorum*. Forest Pathology, 41: no. DOI: 10.1111/j.1439-0329.2011.00717.x.

Summary: In the last few decades, the use of molecular tools has greatly improved the efficiency of plant disease diagnosis. However, one of the major setbacks of most molecular diagnostic approaches is their inability to differentiate between dead and viable pathogens. We propose a new strategy for the detection of plant pathogens, based on the use of mRNA as a viability marker, on the basis that mRNA degradation in dead cells is significantly more rapid than that of DNA. A real-time reverse-transcription PCR (RT-PCR) assay targeting the mRNA of the subunit I of the *cytochrome oxidase* gene was designed for *Phytophthora ramorum*, the causal agent of sudden oak death and ramorum blight. In controlled laboratory tests, the developed RT-PCR assay did not detect the target mRNA a week after the pathogen had been killed by rapid lyophilization, while DNA of the pathogen could still be detected 3 months after the pathogen had died. The RT-PCR assay was then compared with a traditional culturing approach using PARP selective medium and two nested real-time PCR techniques on symptomatic California bay laurel leaves. Samples were either collected in three different sites in July, or in the same site but in three different seasons. Overall, RT-PCR results showed less positive samples than DNA-based nested PCR techniques ($p < 0.0001$), but more than culturing ($p = 0.017$). Nested PCR-positive but RT-PCR-negative samples may not be viable. On the other hand, RT-PCR-positive but culture-negative samples may be viable but dormant. A comparative analysis of the results indicated that RT-PCR and culturing provide comparable results when climatic conditions are optimal for the pathogen, but RT-PCR may be the most accurate approach to determine pathogen viability when climatic conditions are less than optimal for the pathogen.

Julich, S.; Riedel, M.; Kielpinski, M.; Urban, M.; Kretschmer, R.; Wagner, S.; Fritzsche, W.; Henkel, T.; Moller, R.; and Werres, S. 2011. Development of a lab-on-a-chip device for diagnosis of plant pathogens. Biosensors and Bioelectronics 26, 4070–4075.

Abstract: A lab-on-a-chip system for rapid nucleic acid-based analysis was developed that can be applied for diagnosis of selected *Phytophthora* species as a first example for use in plant pathology. All necessary polymerase chain reaction process (PCR) and hybridization steps can be performed consecutively within a single chip consisting of two components, an inflexible and a flexible one, with integrated microchannels and microchambers. Data from the microarray is collected from a simple electrical measurement that is based on elementary silver deposition by enzymatical catalyzation. Temperatures in the PCR and in the hybridization zone are managed by two independent

Peltier elements. The chip will be integrated in a compact portable system with a pump and power supply for use on site. The specificity of the lab-on-a-chip system could be demonstrated for the tested five *Phytophthora* species. The two *Pythium* species gave signals below the threshold. The results of the electrical detection of the microarray correspond to the values obtained with the control method (optical grey scale analysis).

Lamsal, S.; Cobb, R.C.; Cushman, J.H.; Meng, Q.; Rizzo, D.M.; and Meentemeyer, R.K. 2011. Spatial estimation of the density and carbon content of host populations for *Phytophthora ramorum* in California and Oregon. Forest Ecology and Management. In press.

Abstract: Outbreak of the emerging infectious disease sudden oak death continues to threaten California and Oregon forests following introduction of the exotic plant pathogen *Phytophthora ramorum*. Identifying areas at risk and forecasting changes in forest carbon following disease outbreak requires an understanding of the geographical distribution of host populations, which is unknown. In this study, we quantify and map the population density and carbon contents of five key host species for *P. ramorum* in California and Oregon, including four hosts killed by the pathogen (*Notholithocarpus densiflorus*, *Quercus agrifolia*, *Quercus kelloggii*, and *Quercus chrysolepis*) and the foliar host *Umbellularia californica* which supports high sporulation rates. We integrate multiple sources of vegetation data, assembled from sparsely distributed (regional-scale) forest inventory and analysis (FIA) plots and more densely distributed (landscape-scale) plots for monitoring sudden oak death, and develop spatial prediction models based on correlation with environmental variables and spatial dependencies in host abundance. We estimate that 1.8 billion *N. densiflorus* trees (68 Tg C) and 2.6 billion Quercus host trees (227 Tg C) occur across 3.9 and 17.7 million ha of their respective habitat. A total of 436 million *U. californica* trees (14 Tg C) occur across 4.2 million ha which frequently overlap with *Quercus* and *N. densiflorus* host populations. Combination of landscape-scale data with FIA data resulted in more accurate estimation of host populations and their carbon contents. Forests of northern California and southwest Oregon have the highest concentration of the most susceptible hosts along with climatic conditions that favor pathogen spread. This study represents the first spatially-explicit estimate of *P. ramorum* host populations and their carbon contents which exceed previously published estimates. Our results will inform landscape- to regional-scale models of disease dynamics and guide management decisions regarding ecosystem impacts including risk of C release following widespread tree mortality.

The following 21 abstracts on *P. ramorum* are being presented at the 2011 APS Annual Meeting in Honolulu, HI, August 6 – 10, 2011.

Aram, K. and Rizzo, D.M. 2011. *Phytophthora ramorum*'s trophic nature suggests that it cannot utilize dead leaf litter in aquatic systems. Phytopathology 101:S8.

Aram, K.; Swiecki, T.; Bernhardt, E.; and Rizzo, D.M. 2011. Canyon live oak (*Quercus chrysolepis*) is susceptible to bole infection by *Phytophthora ramorum*. Phytopathology 101:S8.

Bonants, P.J.; Gaszczyk, K.; Mendes, O.; Verstappen, E.; and Schoen, C.D. 2011. Multiplex detection of *Phytophthora*: Padlock probe based Universal detection Multiplex Array (PUMA). Phytopathology 101:S18.

Brasier, C.M. 2011. Flaws in international protocols for preventing entry and spread of plant pathogens via "plants for planting." Phytopathology 101:S218.

Campbell, F.T. 2011. Progress and pitfalls in developing policies for reducing risks of introductions of exotic forest insects and pathogens. Phytopathology 101:S218.

Chastagner, G.; Coats, K.; and Elliott, M. 2011. Spread of *Phytophthora ramorum* to water, soil, and vegetation outside a nursery in Pierce County, Washington. Phytopathology 101:S32.

Chastagner, G.; Coats, K.; Omdal, D.; Ramsey-Kroll, A.; and Elliott, M. 2011. Mystery on the Sammamish: What are the sources of *Phytophthora ramorum* infesting this Washington State waterway? Phytopathology 101:S32.

Colburn, G. and Jeffers, S. 2011. Use of real-time and nested PCR to detect *Phytophthora ramorum* in infested nursery container mixes and soils. Phytopathology 101:S38.

Elliott, M.; Chastagner, G.; Coats, K.P.; DeBauw, A.; and Riley, K. 2011. Volunteer stream monitoring for invasive *Phytophthora* species in western Washington. Phytopathology 101:S48.

Espindola, A.S.; Stobbe, A.H.; Daniels, J.; Fletcher, J.; Garzon, C.D.; and Schneider, W.L. 2011. Design and validation of queries for the detection of *Phytophthora ramorum* in simulated metagenomes. Phytopathology 101:S50.

Hong, C.; Richardson, P.; Kong, P.; Edgerton, T.; Asaro, C.; and Oak, S. 2011. *Phytophthora* species identified from streams in Virginia. Phytopathology 101:S74.

Johnson-Brousseau, S.; Henkes, M.; Kosta, K.L.; Suslow, K.; Posadas, A.; Bulluck, R.; and Ghosh, S. 2011. *Phytophthora ramorum* research at the National Ornamentals Research Site at Dominican University of California. Phytopathology 101:S85.

Kong, P.; Lea-Cox, J.D.; Moorman, G.W.; and Hong, C. 2011. Survival of three quarantine pathogens in a simulated aquatic system at different levels of pH. Phytopathology 101:S93.

Oak, S.; Hwang, J.; and Jeffers, S. 2011. An in vitro baiting assay for recovery of *Phytophthora ramorum* from waterways. Phytopathology 101:S131.

Osterbauer, N.; Trippe, A.; Lane, S.; and S. Lewis, S. 2011. First report of *Phytophthora ramorum* infecting *Trachelospermum jasminoides* in Oregon. Phytopathology 101:S134.

Parke, J.L.; Britton, K.O.; and Frankel, S.J. 2011. Historical pathways of introduction for non-indigenous forest pathogens. Phytopathology 101:S137.

Preuett, J.A.; Collins, D.J.; Luster, D.G.; and Widmer, T.L. 2011. The effects of salinity on *Phytophthora ramorum* viability and infectivity. Phytopathology 101:S146.

Shishkoff, N. 2011. Risk analysis of native and ornamental plants for root infection and inoculum production from roots by *Phytophthora ramorum*. Phytopathology 101:S166.

Tjosvold, S.; Chambers, D.; and Mori, S. 2011. Effect of environmental conditions and lesion age on sporulation of *Phytophthora ramorum* on California bay, rhododendron, and camellia. Phytopathology 101:S177.

Vannini, A. 2011. Did *Phytophthora ramorum* already invade Italian forests? A possible answer by mass sequence approach. Phytopathology 101:S182.

Widmer, T.L.; Johnson-Brousseau, S.A.; and Ghosh, S. 2011. Management of *Phytophthora ramorum*-infested nursery soil with *Trichoderma asperellum*. Phytopathology 101:S191.

FUNDING

The USDA is allocating $50 million in fiscal year 2011 Farm Bill funding for projects that prevent the introduction or spread of plant pests and diseases that threaten U.S. agriculture and the environment. Of those funds, nearly $2 million will be provided to *P. ramorum* efforts, including survey and analysis of nurseries in 17 participating states, safeguarding nursery systems, and enhanced mitigation through monitoring the efficacy of treatments in wildland areas. To access the FY 2011 funding plan and list of projects, go to http://www.aphis.usda.gov/section10201.

RESOURCES

The COMTF website has a new and improved Sudden Oak Death/*P. ramorum* bibliography page. Now you can browse and search an online database of over 600 references. The original PDF is also available for easy download and printing. For questions or comments, contact Janice Alexander at jalexander@ucdavis.edu.

RELATED TOPICS

Browne, G.T.; Prichard, T.L.; Schmidt, L.S.; and Krueger, W.H. 2011. Evaluation of phosphonate treatments for control of *Phytophthora* crown rot of walnut. Plant Health Progress. June.

Meadows, I.M.; Zwart, D.C.; Jeffers, S.N.; Waldrop, T.A.; and Bridges Jr, W.C. 2011. Effects of fuel reduction treatments on incidence of *Phytophthora* species in soil of a southern Appalachian Mountain forest. Plant Disease, Vol. 95: 7, 811-820. DOI: 10.1094/PDIS-07-10-0505.

Mills, P.; Dehnen-Schmutz, K.; Ilbery, B.; Jeger, M.; Jones, G.; Little, R.; MacLeod, A.; Parker, S.; Pautasso, M.; Pietravalle, S.; and Maye, D. 2011. Integrating natural and social science perspectives on plant disease risk, management and policy formulation. Philosophical Transactions of the Royal Society, Biological Sciences, 366, 2035–2044. DOI: 10.1098/rstb.2010.0411.

Pilbeam, R.A.; Howard, K.; Shearer, B.L.; and St J. Hardy, G.E. 2011. Phosphite does not stimulate a wounding response in *Eucalyptus marginata* seedlings. Australian Journal of Botany, 59, 393–398.

Potter, C.; Harwood, T.; Knight, J.; and Tomlinson, I. 2011. Learning from history, predicting the future: the UK Dutch elm disease outbreak in relation to contemporary tree disease threats. Philosophical Transactions of the Royal Society, Biological Sciences, 366, 1966-1974. DOI: 10.1098/rstb.2010.0395.

Wilkinson, K.; Grant, W.P.; Green, L.E.; Hunter, S.; Jeger, M.J.; Lowe, P.; Medley, G.F.; Mills, P.; Phillipson, J.; Poppy, G.M.; and Waage, J. 2011. Infectious diseases of animals and plants: an interdisciplinary approach. Philosophical Transactions of the Royal Society, Biological Sciences, 366, 1933–1942. DOI: 10.1098/rstb.2010.0415.

The following 16 abstracts on related research topics are being presented at the 2010 APS Annual Meeting in Charlotte, NC August 7-11th.

Dalio, R.; Fleischmann, F.; and Osswald, W. 2011. Localization of *Phytophthora plurivora* effector protein citricolin in *Fagus sylvatica* roots by light and fluorescence laser scanning microscopy. Phytopathology 101:S40.

Dalio, R.; Fleischmann, F.; and Osswald, W. 2011. Potassium phosphite protects European beech (*Fagus sylvatica*) seedlings against *Phytophthora plurivora*. Phytopathology 101:S40.

Grunwald, N.J.; Werres, S.; Goss, E.M.; Taylor, C.R.; and Fieland, V.J. 2011. *Phytophthora obscura* sp. nov. defines a novel *Phytophthora* subclade 8d. Phytopathology 101:S65.

Hadwiger, L.A.; Druffel, K.; Humann, J.; and Holloway, C. 2011. Non-host plant defense against multiple genera of fungal pathogens - initiated with DNase signals released by the pathogen. Phytopathology 101:S68.

Hao, W.; Vinatzer, B.; and Hong, C. 2011. Effect of temperature on survival of *Phytophthora* and bacterial species in irrigation water. Phytopathology 101:S69.

Hong, C.; Richardson, P.; Ghimire, S.; Kong, P.; Hu, J.; Moorman, G.; Lea-Cox, J.; and Ross, D. 2011. Diversity of *Phytophthora* species identified in a nursery irrigation runoff water containment basin of eastern Virginia. Phytopathology 101:S74.

Kilbourne, K.; Mmbaga, M.T.; and Harrison, R. 2011. Severity risk spatial model for *Phytophthora* diseases in woody ornamental nurseries in southern middle Tennessee. Phytopathology 101:S90.

Levesque, C. 2011. Deployment of DNA arrays in plant pathogen detection. Phytopathology 101:S214.

Liu, Z.; Rappaport, K.; Bowman, H.; Twieg, E.; Mavrodieva, V.; and Levy, L. 2011. Evaluation and adaptation of CANARY technology for rapid detection of plant pathogens. Phytopathology 101:S106.

Loyd, A.; Benson, D.M.; and Ivors, K. 2011. Identifying *Phytophthora* species isolated from nursery irrigation water throughout North Carolina. Phytopathology 101:S110.

Mathews, D.M.; Gu, D.; Johnston, B.S.; and Coffey, M.D. 2011. Screening of the world *Phytophthora* collection for viruses. Phytopathology 101:S116.

Meadows, I.M. and Jeffers, S.N. 2011. Evaluation of commercial algaecides to mitigate *Phytophthora* spp. in naturally-infested water. Phytopathology 101:S119.

Parke, J.L.; Eberhart, J.E.; Hansen, E.M.; and Frankel, S.J. 2011. Forest *Phytophthoras* of the world website. Phytopathology 101:S137.

Ristaino, J.B. 2011. A lucid key to the common *Phytophthora* species. Phytopathology 101:S153.

Widmer, T.L. 2011. Sporulation potential of *Phytophthora kernoviae* compared to *P. syringae* and *P. cactorum* on selected hosts. Phytopathology 101:S191.

PERSONNEL

Bonnie Nielsen has been hired as the new COMTF webmaster, replacing Franny Healey who retired last month. She will work with Janice Alexander at the UC Cooperative Extension, Marin County office in Novato. Bonnie can be reached at banielsen@ucdavis.edu or (415) 499-3261.

CALENDAR OF EVENTS

7/13 – 7/14 - California Forest Pest Council Summer Weed Tour; Murphys, Calaveras County. To register or for more information, go to http://caforestpestcouncil.org/2011/04/2011-cfpc-weedinsectdiseaseanimal-damage-tour-and-golf-tournament/. For questions, contact Tim Collins at tcollins@spi-ind.com or (530) 272-2297, or Patricia Raggio at praggio@parks.ca.gov or (209) 795-8270.

7/26 - California Forest Pest Council Summer Insect, Disease, and Animal Damage Tour; Fort Bragg, Mendocino County; For more information, contact Tom Smith at (916) 599-6882 or tom.smith@fire.ca.gov.

7/31 – 8/5 – Disease and Insect Resistance in Forest Trees: Fourth International Workshop on the Genetics of Host-Parasite Interactions in Forestry; Valley River Inn; 1000 Valley River Way; Eugene, OR 97401; To register, or for more information, go to http://ucanr.org/sites/tree_resistance_2011conference/. For questions, contact Richard Sniezko at rsniezko@fs.fed.us; Katie Palmieri at (510) 847-5482 or kpalmieri@berkeley.edu; or Janice Alexander at (415) 499-3041 or jalexander@ucdavis.edu.

9/15 – 9/17 - California Urban and Community Forests Conference; Crown Plaza Hotel in Palo Alto; For more information, go to http://www.caufc.org/Annual%20Conference.

10/5 – 10/6 – The Seventh Meeting of the Continental Dialogue on Non-Native Forest Insects and Diseases; Boulder, Colorado; To register, go to: https://www.energymeetings.com/calendar/register.asp?CalendarID=11333. For more information, contact Debbie Lee at dlee@resolv.org or (202) 965-6381 or Beth Weaver at bweaver@resolv.org or (202) 965-6211. For more information about the Dialogue go to www.continentalforestdialogue.org.

10/10 – 10/14 - The 59th Western International Forest Disease Work Conference; Enzian Hotel, Leavenworth, WA. This meeting is intended for forest pathologists from western North America (and beyond); For more information, go to www.fs.fed.us/foresthealth/technology/wif/index.htm. For questions, contact Greg Filip at gmfilip@fs.fed.us or (503) 808-2997.

11/8 – 11/11 - 2011 IUFRO Forest Protection Joint Meeting, Research Groups 7.02 – 7.03; Colonia del Sacramento, Uruguay; More information will be forthcoming. For questions, contact Alina Greslebin at agreslebin@ciefap.org.ar.

6/18 – 6/22/12 – Sudden Oak Death Fifth Science Symposium; More information will be forthcoming.

9/9 – 9/14/12 – Sixth Meeting of the International Union of Forest Research Organizations IUFRO Working Party 7-02-09 "*Phytophthora* in Forests and Natural Ecosystems;" Colegio Mayor Universitario Nuestra Señora de la Asunción, Avd. Menéndez Pidal s/n, 14004 Córdoba, Spain; For more information, contact Mª Pérez Sierra at aperesi@eaf.upv.es.