CALIFORNIA OAK MORTALITY TASK FORCE REPORT
FEBRUARY 2010

MONITORING

As part of the perimeter survey conducted at a *P. ramorum*-positive retail nursery in Pierce County, Washington last summer, the Washington State Department of Agriculture identified infested salal (*Gaultheria shallon*) plants in the natural landscape (as reported in the COMTF August 2009 Newsletter). Follow-up analysis of the samples by the Chastagner lab at Washington State University has resulted in the isolation of the NA2 lineage from the salal. This is the first detection of the NA2 lineage on native forest vegetation. For more information on this development, contact Gary Chastagner at chastag@wsu.edu.

Findings from the 2009 National *P. ramorum* Early Detection Survey of Forests have resulted in more stream detections outside of nurseries and to the east of the regulated states than in any other year. In 2009, 116 streams were baited in 16 states. Results from the last round of samples are still pending, as heavy rains in much of the southeast during the summer and fall resulted in bait deployment delays that extended surveying into December. As part of the survey, there were also an additional 50 baiting sites installed in the Sammamish River, WA (positive each year since 2007) in an attempt to delineate inoculum sources.

To date for the 2009 season, five new streams have been found positive – three in AL, one in OR, and one in GA. Since the inception of the survey in 2006, 15 positive streams have been identified, nine of which have been outside of the regulated areas in CA and OR. While the pathogen has been detected in streamside plants in MS, no established infections have been found.

Funding for the 2010 survey is expected to be at the 2009 level; therefore, similar level surveys with state cooperators are planned. The only significant program change is that Susan Diehl, Mississippi State University, is no longer conducting PCR diagnostics for the Eastern states. Eastern Regional PCR diagnostics will now be handled by PA Department of Agriculture, Plant Disease Diagnostic Laboratory in Harrisburg managed by Seong Kim.

FUNDING

The USDA Forest Service, Pacific Southwest Research Station (PSW), has issued their 2010 Request for Proposals (RFP) for Sudden Oak Death/*P. ramorum* research. Approximately $500,000 will be awarded through an international competitive process. Multi-year collaborative projects are encouraged. It is anticipated that roughly seven proposals will be funded through this RFP, including one to be conducted at the new National Ornamental Research Site at Dominican University (NORS-DUC).

Proposals must arrive at the PSW Station in Albany on or before 4:00 p.m., Wednesday, March 31, 2010. For more information on the Forest Service Sudden Oak Death Research

Program, see http://www.fs.fed.us/psw/programs/sod/, or contact Susan Frankel, USDA Forest Service, Pacific Southwest Research Station, Sudden Oak Death/*P. ramorum* Research Program Manager at (510) 559-6472 or sfrankel@fs.fed.us.

NURSERIES

A Placer County, California retail nursery was confirmed positive for *P. ramorum* on 12/23/09. The positive sample was collected by the County during a compliance agreement renewal inspection; however, due to the find, the compliance agreement has been suspended. The positive sample was found on a 1-gallon coast redwood. Trace-back sample results are pending, and the Confirmed Nursery Protocol (CNP) is underway. The nursery does not ship host material interstate. The site was previously found positive in 2005 as a result of a positive trace-forward plant.

Washington had two *P. ramorum*-positive locations identified in January. Both sites have previously been found positive for the pathogen. One positive find was in retention pond water at a Pierce County retail nursery. Treatment of the pond (located on nursery property) is optional as it is not used for irrigation or fire suppression. The second site was in a Mason County church landscape where an assumed-positive *Viburnum tinus* was identified as part of a Thurston County nursery trace-forward investigation. Follow-up efforts have determined that the viburnum did not transit through the Thurston County nursery, but rather was sourced from Oregon. It is unknown where the plant potentially became infested. The Oregon nursery from which the plant originated completed the CNP in December (2009). WSDA PCR results on the viburnum were inconclusive; results are pending from Beltsville, MD.

RESEARCH

Harwood, T.D.; Xu, X.; Pautasso, M.; Jeger, M.J.; and Shaw, M.W. 2009. Epidemiological risk assessment using linked network and grid based modelling: *Phytophthora ramorum* and *Phytophthora kernoviae* in the UK. Ecological Modelling 220: 3353–3361.

Abstract: We developed a stochastic simulation model incorporating most processes likely to be important in the spread of *Phytophthora ramorum* and similar diseases across the British landscape (covering *Rhododendron ponticum* in woodland and nurseries, and *Vaccinium myrtillus* in heathland). The simulation allows for movements of diseased plants within a realistically modelled trade network and long-distance natural dispersal. A series of simulation experiments were run with the model, representing an experiment varying the epidemic pressure and linkage between natural vegetation and horticultural trade, with or without disease spread in commercial trade, and with or without inspections-with-eradication, to give a 2×2×2×2 factorial started at 10 arbitrary locations spread across England. Fifty replicate simulations were made at each set of parameter values. Individual epidemics varied dramatically in size due to stochastic effects throughout the model. Across a range of epidemic pressures, the size of the epidemic was 5–13 times larger when commercial movement of plants was included. A key unknown factor in the system is the area of susceptible habitat outside the nursery system.

Inspections, with a probability of detection and efficiency of infected-plant removal of 80% and made at 90-day intervals, reduced the size of epidemics by about 60% across the three sectors with a density of 1% susceptible plants in broadleaf woodland and heathland. Reducing this density to 0.1% largely isolated the trade network, so that inspections reduced the final epidemic size by over 90%, and most epidemics ended without escape into nature. Even in this case, however, major wild epidemics developed in a few percent of cases. Provided the number of new introductions remains low, the current inspection policy will control most epidemics. However, as the rate of introduction increases, it can overwhelm any reasonable inspection regime, largely due to spread prior to detection.

Nettel, A.; Dodd, R.S.; and Afzal-Rafii, Zara. 2009. Genetic Diversity, Structure, and Demographic Change in Tanoak, *Lithocarpus densiflorus* (Fagaceae), the Most Susceptible Species to Sudden Oak Death in California. American Journal of Botany 96(12): 2224–2233.

Abstract: Knowledge of population genetic structure of tanoak (*Lithocarpus densiflorus*) is of interest to pathologists seeking natural variation in resistance to sudden oak death disease, to resource managers who need indications of conservation priorities in this species now threatened by the introduced pathogen (*Phytophthora ramorum*), and to biologists with interests in demographic processes that have shaped plant populations. We investigated population genetic structure using nuclear and chloroplast DNA (cpDNA) and inferred the effects of past population demographic processes and contemporary gene flow. Our cpDNA results revealed a strong pattern of differentiation of four regional groups (coastal California, southern Oregon, Klamath mountains, and Sierra Nevada). The chloroplast haplotype phylogeny suggests relatively deep divergence of Sierra Nevada and Klamath populations from those of coastal California and southern Oregon. A widespread coastal California haplotype may have resulted from multiple refugial sites during the Last Glacial Maximum or from rapid recolonization from few refugia. Analysis of nuclear microsatellites suggests two major groups: (1) central coastal California and (2) Sierra Nevada/Klamath/southern Oregon and an area of admixture in north coastal California. The low level of nuclear differentiation is likely to be due to pollen gene flow among populations during postglacial range expansion.

Tomlinson, J.A.; Dickinson, M.J.; and Boonham, N. 2010. Rapid detection of *Phytophthora ramorum* and *P. kernoviae* by two-minute DNA extraction followed by isothermal amplification and amplicon detection by generic lateral flow device. Phytopathology 100:143-149.

Abstract: A method for nucleic-acid-based detection of pathogens in plant material has been developed which comprises a simple and rapid method for extracting DNA on the nitrocellulose membranes of lateral-flow devices, loop-mediated isothermal amplification (LAMP) of target DNA using labeled primers, and detection of the generically labeled amplification products by a sandwich immunoassay in a lateral-flow-device format. Each of these steps can be performed without specialist equipment and is suitable for on-site

use, and a result can be obtained in just over an hour. A LAMP assay for the detection of plant DNA (cytochrome oxidase gene) can be used in conjunction with pathogen-specific assays to confirm negative results. The use of this method is demonstrated for the detection of *Phytophthora ramorum*, the causal agent of sudden oak death and dieback/leaf blight in a range of tree, shrub, and herbaceous species, and the recently described pathogen *P. kernoviae*.

Vaclavik, T. and Meentemeyer, R.K. 2009. Invasive species distribution modeling (iSDM): Are absence data and dispersal constraints needed to predict actual distributions? Ecological Modelling 220: 3248–3258.

Abstract: Species distribution models (SDMs) based on statistical relationships between occurrence data and underlying environmental conditions are increasingly used to predict spatial patterns of biological invasions and prioritize locations for early detection and control of invasion outbreaks. However, invasive species distribution models (iSDMs) face special challenges because (i) they typically violate SDM's assumption that the organism is in equilibrium with its environment, and (ii) species absence data are often unavailable or believed to be too difficult to interpret. This often leads researchers to generate pseudo-absences for model training or utilize presence-only methods, and to confuse the distinction between predictions of potential vs. actual distribution. We examined the hypothesis that true-absence data, when accompanied by dispersal constraints, improve prediction accuracy and ecological understanding of iSDMs that aim to predict the actual distribution of biological invasions. We evaluated the impact of presence-only, true-absence, and pseudo-absence data on model accuracy using an extensive dataset on the distribution of the invasive forest pathogen *Phytophthora ramorum* in California. Two traditional presence/absence models (generalized linear model and classification trees) and two alternative presence-only models (ecological niche factor analysis and maximum entropy) were developed based on 890 field plots of pathogen occurrence and several climatic, topographic, host vegetation and dispersal variables. The effects of all three possible types of occurrence data on model performance were evaluated with receiver operating characteristic (ROC) and omission/commission error rates. Results show that prediction of actual distribution was less accurate when we ignored true-absences and dispersal constraints. Presence-only models and models without dispersal information tended to over-predict the actual range of invasions. Models based on pseudo-absence data exhibited similar accuracies as presence-only models but produced spatially less feasible predictions. We suggest that true-absence data are a critical ingredient not only for accurate calibration but also for ecologically meaningful assessment of iSDMs that focus on predictions of actual distributions.

Vercauteren, A; De Dobbelaere, I.; Grünwald, N.J.; Bonants, P.; Van Bockstaele, E.; Maes, M.; and Heungens, K. 2010. Clonal expansion of the Belgian *Phytophthora ramorum* populations based on new microsatellite markers. Molecular Ecology 19: 92–107. DOI: 10.1111/j.1365-294X.2009.04443.x.

Abstract: Co-existence of both mating types A1 and A2 within the EU1 lineage of *Phytophthora ramorum* has only been observed in Belgium, which begs the question whether sexual reproduction is occurring. A collection of 411 Belgian *P. ramorum* isolates was established during a 7-year survey. Our main objectives were genetic characterization of this population to test for sexual reproduction, determination of population structure, evolution and spread, and evaluation of the effectiveness and impact of control measures. Novel, polymorphic simple sequence repeat (SSR) markers were developed after screening 149 candidate loci. Eighty isolates of *P. ramorum*, broadly representing the Belgian population, were analyzed using four previously described and three newly identified polymorphic microsatellite loci as well as amplified fragment length polymorphisms. SSR analysis was most informative and was used to screen the entire Belgian population. Thirty multilocus genotypes were identified, but 68% of the isolates belonged to the main genotype EU1MG1. Although accumulated mutation events were detected, the overall level of genetic diversity within the Belgian isolates of *P. ramorum* appears to be limited, indicating a relatively recent clonal expansion. Based on our SSR analysis there is no evidence of sexual recombination in the Belgian population of *P. ramorum*. Metalaxyl use decreased the genetic diversity of *P. ramorum* until 2005, when the majority of the isolates had become resistant. Most genotypes were site-specific and despite systematic removal of symptomatic and neighboring plants, some genotypes were detected over a period of several years at a single site, sometimes discontinuously, indicating (latent) survival of the pathogen at those sites.

MEETINGS

Mark Your Calendar - The 2010 California Oak Mortality Task Force (COMTF) meeting will be held June 9 – 10 in San Rafael, CA. The meeting will feature a visit to the National Ornamental Research Site at Dominican University of California (NORS-DUC) and a wildland field trip to look at the impacts of Sudden Oak Death at several plots that have been monitored for 10 years. The agenda and additional meeting details will be posted to the COMTF website (www.suddenoakdeath.org) soon. For more information, contact Katie Palmieri at (510) 847-5482 or kpalmieri@berkeley.edu.

EDUCATION

Spring 2010 *P. ramorum* Preventative Treatment Training sessions will be offered monthly February through May on the UC Berkeley campus. Each two-hour outdoor session will cover basic Sudden Oak Death information, integrated pest management approaches, how to select candidate trees for treatment, and proper preventative treatment application. CEU credits are being applied for with DPR, ISA, SAF, and California Urban Forestry Council. For more information, see the "Calendar of Events" below.

RELATED RESEARCH

Denman, S. and Webber, J. 2009. Oak declines: new definitions and new episodes in Britain. Quarterly Journal of Forestry, October 2009, Vol. 103, No. 4, RFS, pp. 285–290. This article is available free of charge via a PDF by emailing a request to rfshq@rfs.org.uk.

Desprez-Loustau, M.L.; Vitasse, Y.; Delzon, S.; Capdevielle, X.; Marcais, B.; and Kremer, A. 2009. Are plant pathogen populations adapted for encounter with their host? A case study of phenological synchrony between oak and an obligate fungal parasite along an altitudinal gradient. Journal for Evolutionary Biology 23: 87–97. DOI: 10.1111/j.1420-9101.2009.01881.x.

PERSONNEL

Charla Hollingsworth joined the Center for Plant Health Science and Technology (CPHST) team 11/09 as the new National Science Program Leader for Plant Pathogens and Weeds. In her position, Hollingsworth will support research-driven diagnostic and eradication technologies and analyses about plant pathogens and weed issues in an effort to provide the USDA Animal and Plant Health Inspection Service with the necessary information to make informed decisions about pest regulation issues. *P. ramorum* will be one of many diseases with which she will be working. Prior to CPHST, Hollingsworth held a faculty position with the University of Minnesota as an extension plant pathologist from 2002 to 2009. Hollingsworth can be reached at (919) 855-7406 *office*; (919) 757-4543 *cell*; or via email at Charla.Hollingsworth@aphis.usda.gov.

RESOURCES

The UC Integrated Hardwood Range Management Program (IHRMP) developed an "Oak Planners' Portal, which provides timely, science-based information for use in the development of local or regional conservation plans. The portal offers a "one-stop shop" to existing and future UC-derived sources of information, and includes "A Planner's Guide for Oak Woodlands" as well as "Ask an Oak Expert," which routes inquiries by category to the appropriate UC contact for a timely response.

As part of the ongoing restructuring within the UC Division of Agriculture and Natural Resources, the IHRMP will be phased out as a stand-alone statewide program and will be incorporated into the 5 strategic initiatives for the Division (see http://ucanr.org/vision/anrstrategicvision2025.pdf for more information). As part of this change, the IHRMP website is moving from http://danr.ucop.edu/ihrmp/ to http://groups.ucanr.org/oakrange (which is currently undergoing major revisions).

CALENDAR OF EVENTS

2/10 - 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 kpalmieri@berkeley.edu, and provide your name, phone number, affiliation (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 kpalmieri@berkeley.edu.

3/7 – 3/12 - 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.

3/10 - 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 2/10 listing above.

4/21 - 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 2/10 listing above.

5/12 - 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 2/10 listing above.

6/9 – 6/10 – COMTF-wide meeting; Dominican University; 50 Acacia Avenue; San Rafael, CA 94901-2298; Additional information will be forthcoming. For questions, contact Katie Palmieri at (510) 847-5482 or kpalmieri@berkeley.edu.