



CALIFORNIA OAK MORTALITY TASK FORCE REPORT NOVEMBER 2014

MONITORING

Humboldt County Update – Sudden oak death (SOD) was confirmed in October approximately 13 miles northwest of Garberville (and 2 ¼ miles from the nearest known infestation in Mattole Canyon Creek watershed) along Grindstone Creek on private property that appears to have been a previous marijuana grow site. Infested vegetation was confirmed within, and up to a few hundred yards from, an area where 50 standing dead tanoaks were identified during the USDA Forest Service July 2014 aerial surveys. This infestation represents the westward march of the pathogen towards the Lost Coast. Based on a Google Earth scan for suspect areas of mortality in May 2014, SOD has also been confirmed along the Mad River, approximately 1.75 miles south of vegetation positives previously confirmed in December 2013. Additionally, SOD was found approximately 18 miles southeast of Eureka on private property along the N. Fork of the Yager Creek watershed. The site is just over 2 miles southwest of a known infestation along the Mad River and at least 10 miles north of considerable pathogen activity along portions of Larabee Creek. For more information, contact Yana Valachovic at yvala@ucanr.edu.

United Kingdom Update - The UK has completed its 2014 larch *Phytophthora ramorum* aerial survey for early detection and rapid response. Unlike 2013, which had significant increases in infection rates (2012 was wet and windy), 2014 has limited confirmations at new locations (2013 and 2014 were much drier). New areas, especially in England, seem to be associated with infected *Rhododendron ponticum* and bilberry (*Vaccinium myrtillus*). Most confirmations are in close proximity to previously established outbreaks on larch or *Rhododendron ponticum* and are on individual or small groups of trees. Findings indicate that where clearance action has been completed quickly and completely, the rate of new outbreaks is reduced. However, where there are contiguous areas of infection of hundreds or thousands of acres, completion of clearance within the optimal treatment window has been challenging, often leading to work not being completed before disease activity increases. Sites where previously infected larch stands have been felled continue to have high *P. ramorum* inoculum levels, causing mortality of Douglas-fir, noble fir, western hemlock, and beech. These species are terminal hosts which pose no risk of sporulation, and therefore require no statutory



Sweet chestnut death and dieback from *P. ramorum*, southwest England. 2014. Photo by England Forestry Commission.



felling action. Death and dieback of sweet chestnut (*Castanea sativa*) has also been observed in southwest England, and because this species is a sporulating host, felling of symptomatic trees is required. Generally, though, *P. ramorum* has not been a serious issue on broadleaved species in the UK.



Ongoing death and dieback in 2014 adjacent to an infected larch stand felled in 2010 from southwest England. Photo by England Forestry Commission.

British bark producers have developed a heat treatment protocol for *P. ramorum*-infected larch bark (56° C for 30 minutes of composting) which will allow producers to apply for licenses to treat larch bark for sale into low-risk end uses such as playground bark, landscaping, and amateur gardening. It is hoped that this will help to address issues created by the oversupply of larch bark to the bio-fuel industry as a result of the large amount of larch material coming on to the market following sanitation felling. For more information, go to www.forestry.gov.uk/pramorun.

U.S. NURSERIES

From January 1 to October 28, 2014, *P. ramorum* was reported in 18 nurseries. Ten facilities are in regulated states (CA-1, OR-7, and WA-2) and eight are in non-regulated states (ME-1, NY-2, TX-1, and VA-4). Eight of the 18 positive nurseries were interstate shippers (CA1; OR-4; WA-1; TX-1; VA-1) and 10 did not ship interstate. The Confirmed Nursery Protocol was conducted in all nurseries. The TX interstate shipping nursery was positive due to plants received from a positive CA nursery; measures were adopted to mitigate the risk. Trace investigations are complete for the eight interstate shippers; positive plants due to trace investigations were detected in three residential locations in three states (CT, MA, OR). *Phytophthora ramorum* was detected in *Camellia* (20), *Pieris* (8), *Rhododendron* (27), *Viburnum* (32), *Gaultheria* (14), *Prunus* (1), *Syringa* (2), and *Vaccinium* (1) as well as potting media (2), soil baits (6), and water baits (15).

**National Plant Board (NPB) Systems Approach to Nursery Certification (SANC)**

Initiative Update - The SANC workgroup, made up of NPB members, industry representatives, and the USDA Animal and Plant Health Inspection Service (APHIS), Plant Protection and Quarantine (PPQ) officials continues to research the feasibility of a volunteer audit-based approach to certification of plant material for interstate shipping. Eight nurseries and greenhouses have agreed to participate in a pilot project to test the processes and procedures developed by the SANC program to implement a systems approach to nursery stock certification. The grower facilities and state regulatory staffs from Pennsylvania, New Jersey, Georgia, Oklahoma, Wisconsin, Missouri, Washington, and Oregon will be participating along with support staff from Extension, AmericanHort, and the Society of American Florists. The first facility, Conard Pyle Company, a greenhouse grower located in West Grove, PA, will begin the risk assessment and best management practice identification phase of this project in early November. A second nursery, Forrest Keeling Nursery, Elsberry, MO, will begin participation soon thereafter.

To support this pilot effort, the SANC Education and Outreach Subcommittee has revised the SANC website (www.sanc.nationalplantboard.org) with many templates, resources, and background materials to assist growers and regulatory staffs. The Training Subcommittee, in cooperation with industry and university representatives, recently conducted a training for regulatory staffs from the eight participating states. Cooperative agreement templates have been developed and numerous guidance documents and forms drafted to facilitate this pilot effort. The SANC workgroup anticipates that this pilot effort will take at least 3 years to complete with evaluation and adjustments taking place along the way. During this 3-year process, the Pilot Subcommittee anticipates that there may be additional facilities added to this evaluative program.

The goal of the SANC initiative is to develop an efficient interstate and intrastate certification system that reduces pest risk and produces better quality nursery stock. For more information, go to www.sanc.nationalplantboard.org.

“Critical Control Points and Best Management Practices for Nurseries” workshops were offered in three Washington locations in October: Puyallup, Spokane, and Vancouver. Critical control points and methods for growing clean plants were addressed through topics such as sanitation, with a demonstration of steaming for growing media, nursery beds, and pots; water treatments such as chlorination, slow sand filtration, and biofiltration; and symptom identification on incoming nursery plants. Workshop participants also learned how to use Agdia test strips to determine whether a plant is infected with *Phytophthora*.

Steaming to Eliminate *P. ramorum* from Soil - As part of the multi-state (CA, OR, and WA) steaming project, soil, pots, and debris piles were steamed at a Washington nursery from August to September. Soil temperature and moisture were monitored at three depths (5, 15, and 30 cm) on all plots and soil samples were collected on three of the eight plots that were steamed. Samples to be analyzed for soil physical properties were also collected. Two days of steaming were required to heat the soil to 50° C at 30



cm, but once the soil had reached the temperature, it continued to heat for several hours and cooled off more slowly than the 5 cm depth once the steamer was turned off. Most sensors reached 50° C, but in a few cases this temperature was never reached at the 30 cm depth. This variation may be due to differences in soil composition. Particle size analysis of the soil samples collected will provide further information, but an impermeable clay layer was observed at 20-30 cm in the NE and SE portions of the plot where this occurred, which may have affected steam penetration into the deeper layers of soil.

Oomycetes have been isolated from soil baits pre- and post- steaming. Preliminary data suggest that some species can survive long exposure to high temperatures. These are most likely the ones that form thick-walled oospores, such as *Phytophthora plurivora*. No *P. ramorum* was detected in the post-steaming samples. *Phytophthora* sp. was isolated from one pot (out of 30) in pre- steaming samples and none in post-steaming samples.

A biofiltration system was installed at a Washington nursery to deal with *P. ramorum*-contaminated pond water and improve drainage. It serves as a demonstration for other growers and nursery customers. Components of the biofiltration system include slow sand filtration, media filtration, a sedimentation ditch, and a constructed wetland. For more information, contact Gary Chastagner at chastag@wsu.edu.

REGULATIONS

On Oct 15-16, representatives from USDA APHIS PPQ, as well as California, Oregon, and Washington regulatory agencies, met with National Plant Board (NPB), National and Regional Leadership representatives in Sacramento, CA, to discuss the implementation of the January 2014 Federal Order in regulated nurseries. APHIS and the state regulatory agencies updated the NPB on the implementation status of surveys, sampling, critical control point assessments, and mitigation protocols in both regulated and non-regulated states. Feedback was provided to APHIS as to how to improve communication about program implementation and the trace investigation process. Criteria for establishing quarantined and non-regulated areas, overview of the FY15 program goals, and the status of the nationwide stream monitoring program was also discussed.

RESEARCH

Gagnon, M.C.; Bergeron, M.J.; Hamelin, R.C.; Grünwald, N.J.; and Bilodeau, G. J. 2014. Real-Time PCR Assay to Distinguish *Phytophthora ramorum* Lineages Using the Cellulose Binding Elicitor Lectin (CBEL) Locus. Canadian Journal of Plant Pathology. 36(3): 367-376. DOI: 10.1080/07060661.2014.924999.

Abstract: *Phytophthora ramorum* is a pathogenic oomycete that causes sudden oak death in the Western USA and sudden larch death in the UK. Until recently, three genetically divergent clonal lineages of *P. ramorum* were known (EU1, NA1 and NA2), named according to the continent on which they were first detected. In 2009, a fourth lineage named EU2 was discovered in the UK. Sequencing and microsatellite genotyping revealed that the EU2 lineage is genetically distinct from all other lineages. Allele-



specific oligonucleotide-PCR (ASO-PCR) assays using real-time PCR were developed in this study, allowing for the identification of the EU2 lineage. Also, a combination of ASO-PCR assays targeting the cellulose binding elicitor lectin (CBEL) locus was validated to rapidly identify all four lineages. Sequencing of the CBEL locus revealed eight single nucleotide polymorphisms (SNPs) that distinguished EU2 from the other three lineages. Two ASO-PCR assays were developed from these SNPs, providing the ability to rapidly identify EU2 individuals relative to EU1, NA1 and NA2 individuals. These new assays were combined with two existing assays targeting the same locus to allow rapid and simple identification of all four lineages. Blind tests performed on a panel of representative samples revealed diagnostic profiles unique to each lineage. These markers can be used with diseased field samples, making them well suited for routine procedures in diagnostic laboratories to identify *P. ramorum*.

Vitale, S.; Luongo, L.; Galli, M.; and Belisario, A. 2014. First Report of *Phytophthora hydropathica* Causing Wilting and Shoot Dieback on *Viburnum* in Italy. Disease Notes. 98(11): 1582. <http://dx.doi.org/10.1094/PDIS-03-14-0308-PDN>.

The genus *Viburnum* comprises over 150 species of shrubs and small trees such as Laurustinus (*Viburnum tinus* L.), which is one of the most widely used ornamental plants in private and public gardens. Furthermore, it commonly forms stands of natural woodland in the Mediterranean area. In autumn 2012, a survey was conducted to determine the presence of *Phytophthora ramorum* on *Viburnum* in commercial nurseries in the Latium region where wilting, dieback, and death of twigs were observed on 30% of the Laurustinus plants. A *Phytophthora* species was consistently recovered from soil rich in feeder roots from potted Laurustinus plants showing symptoms. Soil samples were baited with rhododendron leaves. Small pieces of leaf tissue cut from the margin of lesions were plated on P₅ARPH selective medium (4). Pure cultures, obtained by single-hypha transfers on potato dextrose agar (PDA), were petaloid. Sporangia formation was induced on pepper seeds (3). Sporangia were almost spherical, ovoid or obpyriform, non-papillate and non-caducous, measuring 36.6 to 71.4 × 33.4 to 48.3 μm (average 53.3 × 37.4 μm) with a length/width ratio of 1.4. Chlamydospores were terminal and 25.2 to 37.9 μm in diameter. Isolates were considered heterothallic because they did not produce gametangia in culture or on the host. All isolates examined had 30 to 35°C as optimum temperatures. Based on these morphological characteristics, the isolates were identified as *Phytophthora hydropathica* (2). Morphological identification was confirmed by internal transcribed spacer (ITS), and mitochondrial partial cytochrome oxidase subunit 2 (*CoxII*) with BLAST analysis in the NCBI database revealing 99% identity with ITS and 100% identity with *CoxII*. The sequences of the three isolates AB234, AB235, and AB236 were deposited in European Nucleotide Archive (ENA) with the accession nos. HG934148, HG934149, and HG934150 for ITS and HG934151, HG934152, and HG934153 for *CoxII*, respectively. Pathogenicity tests were conducted in the greenhouse on a total of six 1-year-old shoots cut from *V. tinus* plants with two inoculation points each. Mycelial plugs cut from the margins of actively growing 8-day-old cultures on PDA were inserted through the epidermis into the phloem. Controls were treated as described above except that sterile PDA plugs replaced the inoculum. Shoots were



incubated in test tubes with sterile water in the dark at $24 \pm 2^\circ\text{C}$. After 2 weeks, lesions were evident at the inoculation points and symptoms were similar to those caused by natural infection. *P. hydropathica* was consistently re-isolated from the margin of lesions, while controls remained symptomless. In the United States in 2008, *P. hydropathica* was described as spreading from irrigation water to *Rhododendron catawbiense* and *Kalmia latifolia* (2). This pathogen can also attack several other horticultural crops (1), but to our knowledge, this is the first report of *P. hydropathica* causing wilting and shoot dieback on *V. tinus*.

References: (1) Hong, C.X. et al. Plant Dis. 92:1201, 2008. (2) Hong, C.X. et al. Plant Pathol. 59:913, 2010. (3) Ilieva, E. et al. Eur. J. Plant Path. 101:623, 1995. (4) Jeffers, S.N. and Martin, S.B. Plant Dis. 70:1038, 1986.

RELATED RESEARCH

Man in 't Veld, W.A.; Rosendahl, K.; van Rijswijk, P.; Meffert, J.; Westenberg, M.; van de Vossen, B.; Denton, G.; and van Kuik, F. 2014. *Phytophthora terminalis* sp. nov. and *Phytophthora occultans* sp. nov., Two Invasive Pathogens of Ornamental Plants in Europe. Mycologia. 12-371. Early view. DOI: 10.3852/12-371.

EDUCATION AND OUTREACH

A new "THANQs - FAQ" web page dedicated to fielding questions about tree health, disease, and management has been launched by the UC Berkeley Forest Pathology and Mycology Lab. By going to www.thanqs.org, professionals and lay people can get their tree-related questions answered by an expert. Answers will be posted to the FAQ page as a resource for others looking for similar information. The more questions received, the more information that can be posted to share, so participation is encouraged.

Tree health care experts working in education, research, or government are invited to join the list of professionals that will be called upon to help answer THANQs - FAQ tree health questions. Expert members will receive a tally at the end of the year summarizing the number of questions they answered so that the time and effort dedicated to FAQs can be quantified and acknowledged by each member's organization. To register as a THANQs Tree Care Expert, go to the bottom of the www.thanqs.org page and click on the link.

CALENDAR OF EVENTS

11/3 – 11/6 - 7th California Oak Symposium: Managing Oak Woodlands in a Dynamic World; Visalia Convention Center, Visalia; For more information, go to <http://ucanr.edu/sites/oaksymposium/>.

11/7 – SOD and the Mattole Watershed Community Meeting; Honeydew School, 1 Wilder Ridge Rd, Honeydew; 11:00 a.m.-3:00 p.m.; The session includes a SOD status update and symptom identification and sampling field training. Participants may bring suspect bay leaf samples from their property for lab testing. For more information, contact Dan Stark at stark@ucanr.edu.



- 11/10 – 11/14 - Seventh meeting of the IUFRO Working Party 7.02.09 “*Phytophthora* in Forests and Natural Ecosystems;”** Esquel, Argentina. For more information, go to <http://www.iufrophytophthora2012.org/>.
- 11/12 – 11/13 - 2014 Annual Meeting of the California Forest Pest Council (CFPC);** USDA Forest Service, Wildland Fire Training & Conference Center; 3237 Peacekeeper Way; McClellan; For information, go to the CFPC website at <http://caforestpestcouncil.org/> or contact Katie Palmieri at kpalmieri@berkeley.edu.
- 11/20/14 – SOD Workshop and Update for North Coast California and Southern Oregon;** Gasquet Forest Service Office, 10600 Highway 199, Gasquet, CA; 10:00 a.m. – 12:00 noon; The workshop is jointly hosted by UCCE-Humboldt/Del Norte Counties and the Del Norte County Agricultural Department, and is intended for forest professionals and the general public. For more information, contact Dan Stark at stark@ucanr.edu.
- 1/13/15-1/17/15 – California Native Plant Society Conservation Conference;** “Celebrating 50 Years of Progress and Promise;” Hilton DoubleTree; San Jose; For more information, go to <http://www.cnps.org/cnps/conservation/conference/2015>.