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Subject: Sudden Oak Death - a critical issue for the U.S. Nursery Industry

4/1/04: Posting to 'pest-managers' listserv courtesy of Kathy Kimble Day, USDA.

This posting includes:

- What is SOD
- Descriptive information about the U. S. Nursery Plant Production Industry
- What is the status of SOD in the United States Nursery Industry?
- What is the status of USDA Funding addressing Sudden Oak Death?
- Additional Information Sources about Sudden Oak Death in the US Nursery Industry
- List of USDA CSREES and ARS funded research projects related to *Phytophthora ramorum* in nursery crop production

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Sudden Oak Death – a critical issue for the U.S. Nursery Industry

What is Sudden Oak Death (SOD)? *Phytophthora ramorum* is the causal agent of sudden oak death (SOD, also know as Phytophthora canker disease), *Phytophthora ramorum*, was first identified in 1993 in Germany and The Netherlands on ornamental rhododendrons. *P. ramorum* was isolated in June 2000 from dying trees in California. Since its discovery in North America, *P. ramorum* has been confirmed in forests in California and Oregon and in nurseries in California, Oregon, Washington, and British Columbia. There are programs addressing *Phytophthora ramorum* in forests settings and in production nurseries.

P. ramorum causes two types of diseases, bark cankers that may kill the host and foliar blights that may serve as a reservoir for the pathogen. There are two known strains of the pathogen; to date, it seems that there is no significant difference in the degree of *in vitro* pathogenicity between American A2 and European A1 mating type strains of the pathogen.

At present, the entire host range of this pathogen is unknown. However, *Phytophthora ramorum* does naturally infect and kill or injure at least 28 host species and has been recovered from an additional 30 plant species.

Within nurseries and garden centers there is a high risk of *P. ramorum* spreading to alternative potential hosts. The inoculum might spread from nurseries and garden centers to natural vegetation either through direct transmission or through transplanted infected plants (http://www.apsnet.org/online/sod/Papers/Moralejo_Descals/default.htm). The broad plant host range and the potential for widespread distribution of the pathogen in the nursery industry and nationwide through transportation and marketing of nursery plants make this a critical issue.

Descriptive information about the U. S. Nursery Plant Production Industry:

According to the Economic Research Service of the **U.S. Department of Agriculture** http://www.anla.org/links/USGov.htm, the nursery and greenhouse industry comprises the fastest growing segment of U.S. agriculture. The U.S. is the world's largest producer and market for nursery and greenhouse crops and these crops represent an important and unique segment of agriculture whose impact is felt on the national, state, and community level.

- In terms of economic output, nursery and greenhouse crops represent **the third most important sector in US crop agriculture**, ranking seventh among all commodities in cash receipts, and **among the highest** in net farm income. U.S. production of nursery crops was estimated at $8.9 billion in 2002 (http://www.ers.usda.gov/publications/flo/jun03/flo2003s.txt).
- Nursery and greenhouse crops are the **top five** commodities in 27 states, and the **top 10** commodities in 42 states.
- Seven states account for almost two-thirds of all nursery-crop output in the United States: California

(24%), Texas (11%), Florida (9%), North Carolina (9%), Oregon (7%), Ohio (4%) and Maryland (3%).

Eighty-five million U.S. households spent $39.6 billion at lawn and garden retail outlets in 2002, according to the National Gardening Association and Harris Interactive, while more than 24.7 million households spent $28.9 billion on **professional landscape, lawn and tree care services** http://www.anla.org/pdffiles/LandscapeLawnTree.pdf(PDF format 74KB). Additional descriptive information of the US nursery industry is provided by the American Nursery and Landscape Association at http://www.anla.org/industry/index.htm. Per-household purchase of nursery plants was $84 in 2002 (http://www.ers.usda.gov/publications/flo/jun03/flo2003s.txt).

What is the status of SOD in the United States Nursery Industry?

- There are currently 12 infested counties in California, and 28 types of host plants including Douglas-fir, coast redwood, coast live oak, tan oak, camellia, rhododendron, etc. and there are 20 associated host plants.
- On February 24, 2004 CDFA initiated a statewide California nursery survey outside of the12-regulated counties.
- Currently sixty nurseries have been surveyed in San Diego, Orange, Los Angeles, Ventura, Santa Barbara and San Luis Obispo counties.
  - o 2,357 samples were collected
  - o PCR testing and confirmation for *P. ramorum* by culturing and isolation of the pathogen are used for diagnosis.
  - o Statewide survey will continue in the San Joaquin Valley and Northern California in late March and early April.
- Current Survey Results
  - o Two positive nurseries identified by culturing
    - § Monrovia Nursery, Azusa, Los Angeles County. Note: Monrovia Nursery – California in the month of March 2004 (March 1-17) has destroyed over 200,000 plants valued at $4.3 million. Specialty Plants, Inc, San Marcos, San Diego County
  - o During initial screening thirteen (13) nurseries were found positive by PCR testing
  - o All PCR positive nurseries have agreed to not ship host or associated host plants out of state. USDA and CDFA will be placing a hold on host and associated host plants at these positive PCR nurseries on Thursday March 18, 2004.
  - o Culturing and isolation of the pathogen is in progress for PCR positive nurseries.
  - o PCR cultures were read March 17, 2004, however not enough growth has occurred to make a determination. Based on culture growth results may not be available until Monday (3/22/04) of next week.
- Trace-forward & Trace-backs
  - o Monrovia Trace-forward information submitted to USDA on March 12, 2004
    - § Approximately 330 shipments (5,540 host plants) were sent to 4 provinces in Canada and 8,450 shipments (292,450 host plants) sent to 39 U.S. states.
  - o Specialty plants, Inc. trace-forward information is expected on March 18, 2004
- · Florida and Georgia have closed their borders to all California Nursery stock.
- · Mississippi has closed their border to regulated articles.
- · CDFA is working with USDA and other state departments of agriculture to resolve this issue.

Additional Information Sources about Sudden Oak Death in the US Nursery Industry:

Concise information is presented in SOD fact-sheet produced by the *North Central Region Pest Management Center, http://www.ncpmc.org/sod/* .

Extensive information, continually updated on Sudden Oak Death is maintained at: http://nature.berkeley.edu/comtf (Sudden Oak Death and the California Oak Mortality Task Force, COMTF) and at http://oda.state.or.us/plant/ppd/path/SOD (Oregon Department of Agriculture).

Excellent educational information and programs for nursery growers are being delivered by the Cooperative

Extension Service in several states. USDA CSREES Smith-Lever formula funds support such efforts. *Information for nursery growers on Phytophthora ramorum on ornamentals is available on the Web:*

- *Phytophthora ramorum, A Guide for Oregon Nurseries. J. Parke, J. Pscheidt, and R. Linderman, Oregon State University Extension Service, http://cropandsoil.oregonstate.edu/people/faculty/parke/OSUPramorum.pdf.*
- *Nursery Guide for Diseases of Phytophthora ramorum on Ornamentals. Diagnosis and Management. S. Tjosvoid, k. Buermeyer, C. Blomquist, S. Franke. http://nature.berkeley.edu/comtf/ or http://www.suddenoakdeath.org/pdf/NurseryGuideJan04.pdf .*

What is the status of USDA Funding addressing Sudden Oak Death?

Summary. **The federal government is providing $7.4 million in funding for Sudden Oak Death in 2004.** $1.5 million will be allocated to the USDA Agricultural Research Service (ARS) for research on horticultural aspects of *P. ramorum*, including $250,000 for a new genomics research program at the UC Davis ARS laboratory for analysis of resistance to the pathogen. The USDA Animal Plant Health Inspection Service (APHIS) received $2 million for *P. ramorum* quarantine enforcement, inspection, and monitoring. In addition, the USDA Forest Service Research received $2 million for Sudden Oak Death research and $1.7 million was awarded to the USDA Forest Service, State and Private Forestry for Sudden Oak Death management, monitoring, and education. http://www.suddenoakdeath.org/ .

Funding from the USDA CSREES to facilitate research at partner institutions includes Hatch Formula Funds as well as specific grants.

List of USDA CSREES and ARS funded research projects related to *Phytophthora ramorum* in nursery crop production:

- Dr. M. D. Coffey (Plant Pathologist, University of California – Riverside, Hatch Project No. CA-R*-PPA-5201-H, states, " P. ramorum has emerged as a threat to ornamental plant production worldwide."
- Dr. James Macdonald (Plant Pathologist, University of California – Davis, Hatch Project No. CA-D*-PPA-3633-H) is doing research on the survival and spread of P. ramorum in ornamental crops; he is seeking to determine propagule survival in container media and possible modes of spread within ornamental crops.
- Dr. B. Tyler (Plant Pathologist, University of California – Davis, Hatch Project No. CA-D*-PPA-5250-H,) is focusing on decoding the genome of P. ramorum to provide insights into the mechanisms of attack by the pathogen and to identify gene targets for new chemical and genetic control measures.
- Dr. D. M. Rizzo (Plant Pathologist, University of California - Davis, Hatch Project No. CA-D*-PPA-6738-H) is determining the spatial distribution of Sudden Oak Death at local and regional scales. Information gathered has played a significant role in development of management and regulatory practices for this disease.
- D. M. Rizzo (Plant Pathology, University of California – Davis) and M. Garbelotto (Environmental Science, Policy and Management, UC Berkeley). Special Grant () FY 2001-2004). Spatial Distribution and Hosts of the Fungus Causing Sudden Oak Death in California. Dr. Herb Bolton (hbolton@csrees.usda.gov or 202-401-4201), USDA CSREES, is managing the grant.
- Dr. G. Adams' (Plant Pathology, Michigan State University, Hatch Project No. MICL01843) research to design, test and utilize species-specific DNA oligonucleotide probes for detection of *Phytophthora ramorum* fungal DNA in symptomless plant tissues is being used for detection of disease levels in symptomless nursery stock prior to interstate or intrastate sale and distribution to protect from importation of the pathogen in symptomless nursery plants.
- Dr. Mike Benson (Plant Pathology, North Carolina State University, Hatch Project No. NC06364) developed a survey and diagnostic procedures for detection of *Phytophthora ramorum*. Their extensive survey conducted in 2003 determined that P. ramorum had not been introduced and was not present in imported nursery stock tested; plants in natural forest transects likewise were negative.
- Drs. Jennifer Parke, Fred Crowe, and Joyce Loper (Plant Pathology, Oregon State University, Hatch Project Number ORE00249A) are investigating the ability of *Phytophthora ramorum* to survive and the potential of organic amendments to suppress growth of the pathogen in soil and potting mixes.
- Dr. C. X. Hong (Plant Pathologist, Virginia Polytechnic Institute, Hatch Project No. VA-135618) applied his research on development of detection systems and mapping changes in Phytophthora species in surveys of commercial nurseries and forest samples to certify that Virginia was currently free of *Phytophthora ramorum*.

- Drs. M. E. Gram and S.T. Ratcliffe (Crop Sciences, University of Illinois, CSREES Special Grant) recently developed the National Pest Alert of Sudden Oak Death (see: http://www.ncpmc.org/NewsAlerts/index.html).
- Dr. P.W. Tooley (University of Rhode Island, USDA Cooperative Agreement) determined that the growth range of *Phytophthora ramorum* extended to near freezing temperatures which suggests it may survive and be active in cool environments in the US. This indicates the potential to move the fungus on ornamental host plants to new areas.
- USDA ARS – Identification and characterization of emerging foreign plant pathogenic fungi: *Phytophthora ramorum* was one of the emerging issues and ARS researchers screened Eastern Oak species and plant species of importance to the nursery industry to evaluate their susceptibility and symptomology. DNA-based detection assays are being developed.
- USDA ARS – Biology and management of soilborne diseases and beneficial soil and root-inhabiting microorganism. is one focus of this research. Phytophthora ramorum compared to other Phytophthora species, depending upon host species, is one of the most aggressive of the eight species of Phytophthora evaluated. Plant host effects on sporulation and biological controls are also being evaluated.
- USDA ARS – Alternatives to pesticides for enrolling pathogens in strawberry & vegetable production systems. One facet of this program was the development of markers for identification of *Phytophthora ramorum* or other species of the genus Phytophthora.

List of USDA Forest Service funded research projects related to *Phytophthora ramorum* forests and other "natural" plant communities

- Dr. K. L. O'Hara (Ecosystem Sciences, University of California, McIntire-Stennis Project, is developing research-based guidelines for management of forests affected by *Phytophthora ramorum*.
- Dr. R. Dodd (Ecosystem Sciences, Univ. of California, McIntire-Stennis Project) has developed an *in vitro* assay for susceptibility of coast live oak to the disease organisms, *Phytophthora ramorum*. This may have significance in identifying resistance to sudden oak death.
- Dr. N. H. Pillsbury (Natural Resources Management, Cal Polytechnic State University, McIntire Stennis Project) is assessing the state-wide economic impact of loss of oak woodlands from sudden oak death.
- Drs. R.B. Standford, B. Allen-Diaz, and N.M. Kelly (Ecosystem Sciences, Univ of California – Berkeley, CSREES Congressionally-directed Special Grant) are evaluating changes in vegetation composition from the introduction of Sudden Oak Death into the California coastal forest environment. Prior to this grant, the researchers developed a detailed account of the progression of symptoms for Sudden Oak Death in coast liveoaks and tanoaks, including the association of insects and decay fungi with the disease. Dr. Catalino Blanche, 202-401-4190, cblanche@csrees.usda.gov, USDA CSREES Natural Resources and Environment, is managing the grant.
- Dr. R. B. Standford (Center for Forestry, U.C. Berkeley) and N.M. Kelly (Ecosystem Science, U.C. Berkeley). Evaluation of Sudden Oak Death Incidence in Forest Types of Coastal California. Dr. Herb Bolton, 202-401-4201, hb0lton@csrees.usda.gov, USDA CSREES Plant and Animal Systems, is managing the grant.
- Dr. J. Lyons (University of California – Oakland, CSREES Congressionally-directed Special Grant) is determining the spatial distribution and host associations of *Phytophthora ramorum*: Spores produced on foliar host are the main source of spores infecting liveoaks and tanoaks.
- Drs. M. I. Haverty, P.J. Shea, and J. M. Davidson (USDA Forest Service, Pacific Southwest Research Station, Albany, CA). Biology, ecology and impact of Sudden Oak Death. Research of this project is focused on the biology, hosts, and epidemiology of *Phytophthora ramorum* with priority given to understanding potential impacts on Douglas-fir and coastal redwood. Spatial analysis of infection related to stand structure/composition and vertebrate and insect populations is being determined and management strategies for infected and uninfected trees are being developed.
- Dr. G. A. Reams (USDA Forest Service, Forest Science Lab – Research Triangle, Asheville, NC). Develop key element, improve existing systems, and develop new sampling and survey designs, measurement techniques and estimation procedures. One facet of this diverse research program is to provide theoretical and applied statistical assistance in development of sudden oak death surveys.

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