CALIFORNIA OAK MORTALITY TASK FORCE REPORT
SEPTEMBER 2007

RESEARCH

Dart, N.L., and Chastagner, G.A. 2007. High recovery rate of *Phytophthora* from containerized nursery stock pots at a retail nursery highlights potential for spreading exotic oomycetes. Plant Health Progress DOI: 10.1094/PHP-2007-0816-01-BR. Online at: http://www.plantmanagementnetwork.org/php/default.asp.

Summary: *P. ramorum* has been detected in nursery soils under symptomatic and asymptomatic known hosts as well as asymptomatic non-host containerized plants, raising several questions: (i) are containerized non-host asymptomatic plants likely to transport inoculum of *P. ramorum* if sold to the public; (ii) if these plants are carriers of *P. ramorum*, where is the pathogen present; and (iii) what is the occurrence and distribution of other *Phytophthora* species on containerized nursery stock? To elucidate these questions, *Phytophthora* species samples were collected from asymptomatic host and non-host containerized nursery stock from a western Washington state nursery where soil had tested positive for *P. ramorum* during Washington State Department of Agriculture (WSDA) nursery surveys conducted during the fall of 2005.

Of the samples taken, *Phytophthora* was recovered from the soil collected below 90% of the containerized plant pots, the side of 10% of the pots, the bottom of 5% of the pots, and 8% of the root balls. The most frequently recovered species included *P. citricola, P. drechsleri, P. gonapodyides*, and *P. ramorum*.

P. ramorum was recovered from the soil collected directly below 6 (12%) of the containerized plants, including 1 dogwood, 1 wood fern, and 4 crape myrtles. *P. ramorum* was repeatedly recovered from the soil associated with the lower and middle regions of the root ball of a single crape myrtle; however, no *P. ramorum* was recovered from rinsed or surface sterilized crape myrtle roots. The asymptomatic non-host crape myrtle was from an out-of-state production nursery. It is estimated the containerized plant had been on site for five to 10 years. It is not clear whether the pathogen was introduced into the crape myrtle pot after it was brought on site or if chlamydospores in infested potting mix were able to survive over the past several years. Although initial attempts failed to isolate *P. ramorum* from the crape myrtle plant roots, additional attempts are underway to recover the pathogen via baiting from rinsed and surface-sterilized roots and conducting root inoculation experiments of healthy plants to determine if *P. ramorum* is capable of causing asymptomatic infection of crape myrtle roots.

Giltrap, P.M.; Hughes, K.J.D.; Barton, V.C.; Hobden, E.; Barber, P.; and Izzard, K. 2007. *Phytophthora ramorum* on three new hosts detected using on-site diagnostics. Plant Pathology 56, 728. DOI: 10.1111/j.1365-3059.2007.01590.x.

Phytophthora ramorum causes dieback of *Rhododendron* and *Viburnum.* In the UK, this pathogen has been reported on a range of ornamentals from different plant families e.g. *Pieris* (Inman *et al*., 2003) and *Hamamelis* (Giltrap *et al*., 2004).

Hughes *et al.* (2005) reported successful on-site testing for *P. ramorum* by real-time (TaqMan) PCR using a Cepheid Smart Cycler. Identical onsite testing also identified *P. ramorum* on *Magnolia stellata*, *M. loebneri,* and *Griselinia littoralis*. The pathogen caused leaf infections on the *Magnolia* spp. and *Griselinia*. Lesions were usually brown to black, typically occurring at the tip or leaf margins but able to spread over the whole leaf. Replicate material was sent to CSL, York, UK for further testing and *P. ramorum* was consistently isolated from stem and leaf tissue following surface decontamination and isolation onto semi-selective medium (Lane *et al*., 2003). The ITS sequences for the *P. ramorum* isolated (*M. stellata* DQ376175, *M. loebneri* DQ376176 and *Griselinia* AY924256) was identical to other *P. ramorum* isolates recorded on the GenBank database.

Pathogenicity of each isolate was confirmed by wound-inoculating healthy plants of *M. stellata*, *M. loebneri,* and *G. littoralis*, and incubating these in a damp chamber at room temperature (-20° C) for six days. Control healthy plants were either wounded or wound-inoculated with agar alone. The latter did not develop symptoms, whereas extensive lesions developed on the pathogen-inoculated leaves: *P. ramorum* was re-isolated from the leading edge of infection, thereby completing Koch's postulates.

This is the first report of *P. ramorum* on these three hosts in the UK. The plants were destroyed and measures were taken to eradicate the pathogen according to European Union phytosanitary legislation.

Kox, L.F.F.; van Brouwershaven, I.R.; van de Vossenberg, B.T.L.H.; van den Beld, H.E.; Bonants, P.J.M.; and de Gruyter, J. 2007. Diagnostic values and utility of immunological, morphological, and molecular methods for in planta detection of *Phytophthora ramorum*. Phytopathology 97:1119-1129.

Abstract: In this study, six methods for the detection of *Phytophthora ramorum* in planta were compared using naturally infested rhododendron plant material. The methods included two immunological methods, one an enzyme-linked immunosorbent assay (ELISA) and the other using a lateral flow format (LFD). Three molecular tests based on the polymerase chain reaction (PCR) using TaqMan chemistry also were assessed, including two assays designed for specific detection of *P. ramorum* and one designed for genus-level detection of *Phytophthora*. Isolation followed by morphological identification also was assessed. The diagnostic values of each of the methods, evaluated based on diagnostic sensitivity, diagnostic specificity, positive predictive value, and

negative predictive value, were calculated based upon the test results from 148 field samples. The "gold standard" used for the calculations was the final diagnosis, which was based on either a positive PCR result or successful isolation of *P. ramorum*. The *Phytophthora* spp. TaqMan PCR, ELISA, and LFD had higher sensitivities than the *P. ramorum*-specific methods, which make them useful as prescreening methods, where positive results must be confirmed by PCR or isolation. The article discusses practical advantages and disadvantages of each of the methods and how they are valuable in the diagnostic process, according to the circumstances of use (that is, diagnosis or surveillance) and in relation to the prevalence of *P. ramorum* infestation in the population to be tested.

Linderman, R.G., and Davis, E.A. 2007. Comparative host susceptibility and sporulation potential of *Phytophthora ramorum* on species, cultivars, and hybrids of camellia. Online. Plant Health Progress DOI: 10.1094/PHP-2007-0822-02-RS.

Abstract: *Phytophthora ramorum*, causal agent of *ramorum* blight of woody shrub species, has caused serious damage to cultivars and species of camellia in commercial nurseries. Reports of relative susceptibility of camellia to *P. ramorum* have indicated a range from high to low susceptibility, both in nurseries and under experimental conditions. We inoculated a series of cultivars of camellia to determine their relative susceptibility to infection, and then compared lesion size to the capacity of the pathogen to produce sporangia on the lesions. We found, as did others, a wide range of susceptibility among cultivars, but lack of correlation between susceptibility (lesion size) and potential to produce sporangia that might spread the pathogen within the nursery. These results indicate that on some cultivars the pathogen might produce small or inconspicuous lesions, yet still produce copious numbers of sporangia that could spread the disease, both within the nursery and from nursery to nursery.

Linderman, R.G., and Davis, E.A. 2007. Evaluation of *Phytophthora ramorum* in nursery crop tissue culture propagation. Online. Plant Health Progress DOI: 10.1094/PHP-2007-0822-01-RS.

Abstract: *Phytophthora ramorum*, cause of *ramorum* blight on numerous woody ornamental shrubs, is a regulated pathogen in the US and internationally. Currently, nurseries are inspected to detect infected plants; however, many plants are propagated by tissue culture nurseries and the behavior of *P. ramorum* in this system is unknown. Pathogen growth and sporulation in propagation vessels containing different multiplication and rooting media, with a range of plants and without plants, was evaluated with regard to pathogen visibility and induction of disease symptoms.

Meentemeyer, R.K.; Rank, N.E.; Anacker, B.L.; Rizzo, D.M.; and Cushman, J.H. Influence of land-cover change on the spread of an invasive forest pathogen. Ecological Applications. In Press.

Human-caused changes in land use and land cover have dramatically altered ecosystems worldwide and may facilitate the spread of infectious diseases. To address this issue, we examined the influence of land-cover changes between 1942 and 2000 on the establishment of an invasive pathogen, *Phytophthora ramorum*, which causes the forest disease known as Sudden Oak Death. We assessed effects of land-cover change, forest structure, and understory microclimate on measures of inoculum load and disease prevalence in 102 15 x 15 m plots within a 275 km² region in northern California. Within a 150 m radius area around each plot, we mapped types of land cover (oak woodland, chaparral, grassland, vineyard, and development) in 1942 and 2000 using detailed aerial photos. During this 58-year period, oak woodlands significantly increased in area by 25%, while grassland and chaparral decreased by 34% and 51%, respectively. Analysis of covariance revealed that vegetation type in 1942 and woodland expansion were significant predictors of pathogen inoculum load in bay laurel (*Umbellularia californica*), the primary inoculum-producing host for *P. ramorum* in mixed evergreen forests. Path analysis showed that woodland expansion resulted in larger forests with higher densities of the primary host trees (*U. californica, Quercus agrifolia, Q. kelloggii*) and cooler understory temperatures. Together, the positive effects of woodland size and negative effects of understory temperature explained significant variation in inoculum load and disease prevalence in bay laurel; host stem density had additional positive effects on inoculum load. We conclude that enlargement of woodlands and closure of canopy gaps, likely due largely to years of fire suppression, facilitated establishment of *P. ramorum* by increasing the area occupied by inoculum-production foliar hosts and enhancing forest microclimate conditions. Epidemiological studies that incorporate land-use change are rare but may increase understanding of disease dynamics and improve our ability to manage invasive forest pathogens.

The Fourth Meeting of the International Union of Forest Research Organizations (IUFRO) Working Party 7.02.09 "*Phytophthoras* in Forests & Natural Ecosystems" was held August 26 – 31 at the Asilomar Conference Center in Pacific Grove, CA. Meeting highlights included a report from Ramsfield and others that *Phytophthora kernoviae* was first recorded in New Zealand (as *Phytophthora* sp.) in the 1950s; Renaud Ioos' analysis of nuclear and mitochondrial genes to revise the origin of the interspecific hybrid *P. alni*; and a poster on the production of viable oospores by *P. ramorum* in a laboratory in Belgium. The presentation and poster abstracts are available on the "Programme" page of the conference website at http://nature.berkeley.edu/IUFRO2007/phytophthora/programme.html.

REGULATIONS

Effective September 7, 2007, *Garrya elliptica* and *Mahonia aquifolium* will be regulated by the USDA Animal and Plant Health Inspection Service (APHIS) for *P. ramorum*. Nurseries operating under a compliance agreement may continue to ship hosts

and associated plants, including the newly listed plants. However, all other nurseries containing these newly listed plants must be properly inspected, sampled, tested, and placed under a Compliance Agreement by September 7, 2007 in order to be able to move regulated plants interstate.

For more information on the August 22, 2007 State Plant Regulatory Official (SPRO) letter, go to "Regulatory Updates" on the APHIS website at http://www.aphis.usda.gov/plant_health/plant_pest_info/pram/regulations.shtml.

USDA APHIS published a proposed rule August 28, 2007 to update the list of select agents, which includes the addition of *P. kernoviae*. Select agents are defined as pathogens or biological toxins which have been declared by the US Department of Health and Human Services or by the USDA to have the "potential to pose a severe threat to public health and safety." Administered by the Centers for Disease Control, the Select Agent Program regulates the laboratories which may possess, use, or transfer select agents within the US. If approved, this will be the first US regulation for *P. kernoviae*.

For more information on the proposed rule or to comment on it, go to "Agricultural Bioterrorism Protection Act of 2002; Biennial Review and Republication of the Select Agent and Toxin List" at http://www.regulations.gov/fdmspublic/component/main. The comment period ends October 29, 2007.

EDUCATION

A Los Altos Hills Sudden Oak Death community informational meeting will be held September 12th at the Town Council Chambers in Los Altos Hills. Pathogen background information, local and statewide disease status, symptoms, and management and treatment options will be discussed. This is the second community-based Sudden Oak Death meeting to be held in Santa Clara County this summer. For more information, see the "Calendar of Events" below.

RESOURCES

An updated "Understanding *Phytophthora ramorum* Key Findings from UK Research" pamphlet has been posted to the Department for Environment, Food, and Rural Affairs website at: http://www.defra.gov.uk/planth/pestnote/2006/pramres.pdf. Information covered includes susceptible host species found in the UK, disease development, spore production and spread, pathogen survival, and control and management of the disease in the UK.

CALENDAR OF EVENTS

9/12 – Los Altos Hills Sudden Oak Death Community Meeting; Town Hall; 26379 W Fremont Rd; Los Altos Hills, CA 94022; 7:00 – 9:00 p.m.; For more information, contact Katie Palmieri at (510) 847-5482 or palmieri@nature.berkeley.edu.

10/15 – 10/18 - XVI International Plant Protection Congress 2007, Glasgow, UK;
Meeting details are available at http://www.bcpc.org/IPPC2007.