

## **Understanding lab results: The implications of *Phytophthora* detections in native plant nursery sites and restoration areas**

Between January and June 2015, thirty-three *Phytophthora* species were identified from 800 samples submitted from native plant nurseries and restoration sites to the California Department of Food and Agriculture (CDFA) laboratory. Of the 20 nurseries that submitted samples, 15 (or 75%) had at least one *Phytophthora* species detected from container stock. *Phytophthora cactorum* was most commonly isolated, accounting for 34% of the *Phytophthora* detections. To better understand lab results and the implications of *Phytophthora* species detections in native plant nurseries and restoration areas, we answer some common questions below.

### **Where can I learn more about a particular *Phytophthora* species?**

Many *Phytophthora* species have been identified in water, soil and associated with plants. There are over 120 named *Phytophthora* species and, due to improvements in diagnostic techniques, new species are continually being identified. With ongoing research, concepts about the effects of these microorganisms in ecosystems continue to evolve. Many *Phytophthora* species are serious pathogens with wide host ranges. However, information about potential host range and pathogenicity may be lacking for more recently-described species. The following resources listed below may be helpful in understanding the current status of many *Phytophthora* species. Note that new information about host ranges and pathogenicity of some species may not yet be available at these websites.

- Profiles are available for the following species at <http://forestphytophthoras.org/>: *P. alni*, *P. arenaria*; *P. austrocedrae*; *P. cactorum*; *P. cambivora*; *P. cinnamomi*; *P. katsurae*; *P. kernoviae*; *P. lateralis*; *P. megakarya*; *P. palmivora*; *P. pinifolia*; *P. ramorum* and *P. siskiyouensis*. This website also has helpful “*Phytophthora* basics”, photos and a glossary. Note, however, that descriptions of disease in wildlands for some species lack recent information from California, and may not reflect known or potential impacts. Also, other species of importance in California and elsewhere are not included.
- The *Phytophthora* Database (<http://www.phytophthoradb.org/species.php>) includes all known *Phytophthora* species but the information about each species is rather technical and geared toward scientists. *Phytophthora* species profiles include associated diseases and reported geographic distribution, based on published data.
- The California Oak Mortality website, [www.suddenoakdeath.org](http://www.suddenoakdeath.org), includes Nursery Best Management Practices, information on *Phytophthora tentaculata*, and other information.

For assistance in managing *Phytophthora* species and other pests in nurseries, contact Kathy Kosta, CDFA at [kathy.kosta@cdfa.ca.gov](mailto:kathy.kosta@cdfa.ca.gov) or 916-403-6634. The CDFA Best Management Program for Ornamental and Native Plant Nurseries provides onsite visits to assess spread pathways and critical control points in nursery operations and provides guidance in clean stock production practices customized to each nursery. Follow-up visits and ongoing contact with nursery operators provide continued guidance through the year.

**Are some *Phytophthora* species more damaging than others?  
When do I need to be concerned?**

Concern is warranted for all *Phytophthora* detections in native plant nurseries because the presence of *Phytophthora* spp. indicates additional management practices are needed by the nursery to exclude waterborne plant pathogens. Species of greatest concern include *Phytophthora tentaculata* and other “new to the USA pathogens” that are known to cause damage in other parts of the world but are not widely distributed in California or the US. For some of these pathogens, regulations may be implemented to prevent further spread. *Phytophthora ramorum*, a federally and state quarantined pathogen, is also particularly significant because it is known to move from nurseries to cause irreversible damage in forests. New *Phytophthora* hybrids and species may cause significant damage to native plants and need immediate attention to prevent spread.

Although some *Phytophthora* species are considered widely distributed in CA, including *P. cinnamomi*, *P. cambivora*, and *P. cactorum*, they can be particularly damaging to a wide variety of native and non-native host plants adapted to our Mediterranean climate. When outplanted directly into wildlands and landscapes, including sensitive habitats, these *Phytophthora* species can cause progressive and irreversible habitat degradation. Introducing *Phytophthora*-infected plants into native habitats violates the “first do no harm” principle and can permanently prohibit the establishment of a healthy ecosystem in restored sites.

**What does the letter rating (Q, A, B, C, D or Z) on my CDFA lab results mean?**

A CDFA pest rating is given to any plant pathogen detected at the CDFA lab. Ratings are primarily for regulatory officials at the county level to aid them in deciding if regulatory action needs to be taken at the location the detection was made. Ratings are determined by a pest risk analysis where the distribution, risk of environmental damage, potential for economic loss and quarantine status for each pathogen are evaluated. Many serious pathogens are rated C because they are widespread in CA and cannot be successfully eradicated. This does not mean that a C-rated pathogen will **not** cause economic or environmental damage. It means that a regulatory official will not require plant destruction in response to its detection.

In short the ratings are:

**Q** – Pest thought to be of significant economic detriment but status is often uncertain because of incomplete knowledge. New pest detections, such as *P. tentaculata*, are often first given a “Q” rating until an assessment is made and a permanent rating is assigned.

**A** – Pest with known economic or environmental detriment that is either not fully established in California or is limited and can be successfully eradicated.

**B** – Pest with known economic and environmental detriment but usually is with limited distribution in California

**C** – Pest with known economic and environmental detriment that is widespread in California and cannot be effectively eradicated.

**D** – Low to no risk or may be beneficial (such as a microbe that is used for biological control)

**Z** – A temporary rating for a previously unrated organism of known economic and /or environmental detriment but generally distributed in California. This is a temporary rating and most will become “C” rated.

Additional information on CDFA pest ratings may be found at

[http://cdfa.ca.gov/plant/regs\\_pestrating.html](http://cdfa.ca.gov/plant/regs_pestrating.html) and

<http://cdfa.ca.gov/plant/pestratings/docs/3162-ApprovedText-final.pdf>

### **What do negative results (“not detected”) mean?**

A “not detected” result from a laboratory may indicate that a *Phytophthora* species is not present or it may mean a *Phytophthora* is present but the test used was negative (false negative). False negative results may arise for a number of reasons. All testing methodologies (ie. immunoassay (ELISA), culture) have limits in sensitivity and are subject to factors that can interfere with the test. The quality, quantity, size and condition of the sample as well as the training of the sampler are also important. Examples of situations that can result in false negative results include:

- sample size is too small to capture detectable levels of the pathogen;
- infection levels in the sampled plants are below the level of detection, e.g., because plants were recently infected;
- sampled plant(s) or roots are not infected, even though other infected plants are present in the block;
- infected roots are too decayed by secondary organisms that interfered with detection;
- pathogen growth is being suppressed by fungicides applied to the plant or potting soil;
- improper sample handling has degraded the pathogen to undetectable levels.

Because of the potential for false negatives, a single negative test or set of tests should not be considered as definitive and representative of the entire batch of plants or the nursery as a whole. Negative results can be viewed with greater confidence if potential interfering factors have been ruled out, the most suspicious or symptomatic plants are sampled, fungicides have not been applied, and multiple tests conducted over time are all negative.

In contrast, even a single positive result is a cause for concern if detected using a protocol that does not produce false positives (such as baiting, isolation, and PCR). Immunoassay tests can provide false positives because they cross-react with closely related *Pythium* and *Phytophthora* species, which may or may not be pathogenic.

### **Prevention is key!**

Experts agree on one important point: it is critical to prevent the introduction of *Phytophthora* species into wildlands, from nurseries and all other sources. Prevention of introduction into habitats where rare or sensitive plants are being grown is critical. Container plant movement can spread *Phytophthora*s long distances and facilitate their proliferation across landscapes. Once an area is contaminated, it is difficult or impossible to eradicate the pathogen and restore lands.

**For questions or more information contact** Janice Alexander ([jalexander@ucanr.edu](mailto:jalexander@ucanr.edu) or 415-473-3041).

**Prepared by the “Working Group for Phytophthoras in Native Plant Habitats”. Participating organizations: California Department of Food and Agriculture, Golden Gate National Parks Conservancy, Presidio Trust, USDA Forest Service – Pacific Southwest Research Station, California Native Nursery Network, California Native Plant Society, University of California Cooperative Extension, Marin Municipal Water District, San Francisco Public Utilities Commission, Santa Clara Valley Water District, National Ornamentals Research Site at Dominican University of California and others.**