

Knowing your *Phytophthora*

It's difficult, but important, to distinguish between different species of the deadly plant pathogen



Not all *Phytophthoras* are created equal — but many have symptoms that are very similar in appearance. This rhododendron plant with necrotic leaves is infested with *Phytophthora syringae*.

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By *Niklaus J. Grunwald*

Phytophthora pathogens are among the most devastating plant killers known to man.

Two particularly notorious pathogens are *P. infestans* — the culprit in the Irish potato famines of the 1840s — and *P. ramorum* — cause of the sudden oak death disease that affects woody ornamentals and trees.

Phytophthora pathogens are fungal-like in nature, but most closely related to brown algae. They are also known as water molds, because they require water for dispersal and infection.

Until the emergence of sudden oak death in Oregon nurseries and forests, *Phytophthora* diseases were thought of mostly as root rot or dieback pathogens. Today, we distinguish between two major classes of symptoms caused by *Phytophthora* species on ornamentals (Table 1).

The first class includes root, stem or crown rots most often caused by species that have been extensively studied, including *P. cinnamomi*, *P. cactorum*, *P. citrophthora* and *P. plurivora*. These often result in wilting once the root system is compromised. ►

Table 1. *Phytophthora* diseases observed in Oregon nurseries have two distinctly different symptom classes.

Disease class	Symptoms	Species
Root disease	• Root rot	<i>P. cinnamomi</i>
	• Crown rot	<i>P. cactorum</i>
	• Dieback	<i>P. citrophthora</i>
	• Wilting	<i>P. plurivora</i>
Foliar disease	• Leaf spot	<i>P. plurivora</i>
	• Stem dieback	<i>P. ramorum</i>
		<i>P. syringae</i>

A second class includes *Phytophthora* species that cause foliar leaf lesions or stem diebacks. This second disease class is less studied. It gained prominence after the emergence of sudden oak death, which causes distinct foliar symptoms on ornamentals such as *Camellia* and *Rhododendron*. Several species, including *P. plurivora*, *P. ramorum* and *P. syringae*, also cause foliar symptoms on nursery crops.

Foliar *Phytophthora* pathogens are easily recognized by their symptoms (Figure 1), but other organisms might cause similar symptoms. Furthermore, one cannot distinguish symptoms caused by different foliar *Phytophthora* species. Most importantly, lesions caused by *P. ramorum* cannot be distinguished from any other species of *Phytophthora*.

We recently investigated the diversity of *Phytophthora* species observed on *Rhododendron* by intensively sampling seven nurseries in Oregon. We specifically sampled foliage with classical symptoms of foliar infection by *Phytophthora* (Figure 1; Table 2).

We noticed that *P. syringae* and *P. plurivora* were found in most nurseries and were the two commonly observed species. At one nursery, the species *P. hibernalis* was found in high abundance, but this species was not observed in any other nursery.

Several other *Phytophthora* species were also found, but only occasionally, and we currently consider these of minor importance in nursery production.

Both *P. plurivora* and *P. syringae* are species that can infect many ornamentals, but the full host range is poorly



Figure 1. Symptoms typical for foliar *Phytophthora* infection. Shown here is an infection of *P. nemorosa* on *Camellia*. Note that it is impossible to tell what species is infecting the plant. For example, the sudden oak death pathogen *P. ramorum* will cause lesions with the same symptoms. PHOTO BY NIKLAUS GRUNWALD

Table 2. Frequency of most commonly observed species found in seven Oregon nurseries sampled in fall and winter. Eleven other *Phytophthora* species were sampled but occurred rarely.

<i>Phytophthora</i> species	Nursery						
	A	B	C	D	E	F	G
<i>P. hibernalis</i>	–	71	–	–	–	–	–
<i>P. plurivora</i>	16	21	52	3	–	13	15
<i>P. syringae</i>	49	15	6	37	2	21	46

understood. *P. syringae* likes cool seasons and is most active in fall, winter and spring. *P. plurivora*, in contrast, prefers warm temperatures and is most active in summer. *P. syringae* is also known as an important stem canker pathogen in ornamental and fruit production of apples and pears. *P. plurivora* is also an important root pathogen.

Foliar *Phytophthora* diseases are economically important and should be managed carefully in nurseries for the following reasons.

First, the sudden oak death pathogen *P. ramorum* causes the same symp-

toms (Figure 1), and this pathogen is subject to federal regulation for nurseries shipping out of state. Given that there is zero tolerance for finding *P. ramorum* in nurseries, this pathogen is a serious threat to all nurseries.

Second, plants with foliar symptoms have lower market value, since the lesions are quite striking. Thus, growers should avoid foliar epidemics.

Foliar *Phytophthora* species can be managed using systems approaches as described in the *Safe Procurement and Production Manual*, which is available from the Oregon Association of

Nurseries (<http://www.oan.org/default.asp?page=861>), and the *Phytophthora* online course from Oregon State University (<https://courses.ecampus.oregonstate.edu/phytophthora/index.html>).

These approaches rely on implementing best management practices that use a combination of cultural controls and fungicide applications following the guidelines provided in the *Pacific Northwest Plant Disease Management Handbook*. Fungicides should be used judiciously and in rotations emphasizing changes in modes of action as well as rotating contact and systemic fungicides.

Development of an appropriate water management plan is perhaps the best cultural practice. Recycled water should be disinfested before application, using the treatment options described in the manual and handbook.

Growers should avoid watering foliage as much as possible. Drip irrigation will help minimize periods of leaf wetness that help the pathogen get established and infect leaves.

Good sanitation is also important. Growers should attempt to reduce sources of infection. Plants can get infected by foliage that comes in contact with the ground when plants fall over or by splash dispersal of soil onto foliage during irrigation or rain events.

Water puddles can also be a source of infection; therefore, good drainage should be implemented. Clean gravel beds will minimize the potential for splash dispersal. ©

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