MICROBIAL ACROBATS: TRACKING THE WHEREABOUTS OF FOREST *PHYTOPHTHORA* SPECIES

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ABSTRACT

Over the past few years, significant new findings have jolted the forest *Phytophthora* research community; the following is a synopsis of significant developments in our understanding of these adroit and often surprising organisms. Surveys and investigations demonstrate that *Phytophthora* species continue to be introduced into new areas and persist in soil and water. Areas at highest risk to damage from these plant pathogens are urban-wildland interface areas, typically where nursery stock exposes woodland vegetation to new diseases. Once they become established, *Phytophthora* species can be difficult to eradicate so our society would benefit ecologically and economically from prevention of *Phytophthora* introductions.

Despite Federal quarantines, *Phytophthora ramorum* Werres, de Cock & Man in't Veld, cause of sudden oak death and ramorum blight, was detected in 2009 on 10 sites in seven states, adjacent to infested nurseries. The pathogen moved off nursery property in contaminated runoff and was recovered in adjacent waterways. In Pierce County, WA, in summer 2009, regulatory officials reported the first documented case of the pathogen becoming established on native forest vegetation adjacent to a contaminated stream, with the NA2 strain on salal (*Gaultheria shallon* Pursh). This was also the first detection of the NA2 strain in a North American forest; previously this strain had been detected only in a few nurseries in Washington and California.

In the U.K., *P. ramorum* erupted on several new hosts: Japanese larch (*Larix kaempferi* (Lam.) Carrière), western hemlock (*Tsuga heterophylla* (Raf.) Sarg.), and birch (*Betula pendula* Roth). Several years of wet weather provided ideal conditions for disease development on shoots and foliage in mature larch plantations. Large areas of larch are being cut to prevent pathogen spread. Understory Douglas-fir (*Pseudotsuga menziesii* (Mirb.) Franco) and western hemlock have been found with bole cankers. Many confirmed sites have no rhododendron present. Before these findings, tree infection in the U.K. had been identified only in relatively close proximity to infected rhododendron.

In France, *Phytophthora lateralis* Tucker & Milbrath has been identified killing Port Orford cedar (*Chamaecyparis lawsoniana* (A. Murray) Parl.) hedges in the Bretagne region. Previously, *P. lateralis* had only been isolated (in 1996 and 1998) related to an infestation of potted trees in a commercial nursery, itself the result of an introduction from North America. Disease progression in France is similar to our western U.S. infestation, which was first detected associated with a nursery in Washington State in the 1920s; it then moved through landscape hedges along Oregon's Willamette Valley, eventually becoming established in native forests near Coos Bay, OR, in the 1950s. The origin of *P. lateralis* is not known, but Clive Brasier and colleagues reported the detection of *P. lateralis* in an old growth *Chamaecyparis* forest in Taiwan, suggesting that the pathogen may be native there.

In Alaska, *Phytophthora alni* ssp. *uniformis* Brasier (PAU) was detected for the first time in North America.

PAU is one parent of a highly damaging hybrid *P. alni* strain (*P. alni* ssp. *alni* Brasier (PAA)) that has killed thousands of riparian alder trees in Europe. The Alaska detection was in an area with unprecedented dieback and mortality of thinleaf alder (*Alnus incana* (L.) Moench ssp. *tenuifolia* (Nutt.) Breitung), but the *Phytophthora* has not been isolated from symptomatic plants, only from soils, and is not thought to be the cause of the Alaskan alder die-off. PAU was widely distributed, suggesting it may be native to Alaska.

Phytophthora pinifolia Durán, Gryzenh, and M.J. Wingf. was discovered associated with a new needle blight on *Pinus radiata* D. Don in Chile. The disease, Daño Foliar del Pino, defoliated plantation trees over about 60, 000 ha in 2006. Research is underway to fully understand the impact of this new species and to develop management strategies. In 2008 and 2009, weather conditions were less conducive to disease development and the extent of damage decreased.

For more recent developments on *P. ramorum*, sudden oak death, and other forest *Phytophthora* species, go to the California Oak Mortality Task Force Web site at www.suddenoakdeath.org.