

Population Genetic Analyses of Four *Phytophthora* Species Recently Described in California Forests Reveal They Are All Introduced¹

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Abstract

Four *Phytophthora* species have recently been described in California natural ecosystems: *Phytophthora ramorum*, *P. ilicis*, *P. pseudosyringae*, and *P. cinnamomi*. The first three species are of recent description, while the last one is a well-known pathogen associated with agricultural crops in the Western USA and in many areas world-wide. *P. ramorum* and *P. cinnamomi* are both causing significant mortality in native California hosts, while the other two species are associated with limited mortality of affected plant hosts. We have used both AFLP and microsatellite analyses to unravel the population genetic structure of all four species. All display a population structure typical of introduced species, independent of the symptoms they are causing. This finding indicates that as long as an ecological niche is available, aggressive and non-aggressive microbes can be introduced in novel environments. While the origin of *P. ilicis* remains a mystery, a perfect match was found between *P. ramorum* and *P. cinnamomi* isolates from the wild with isolates from agricultural situations. In the case of *P. pseudosyringae*, California isolates were nested within European isolates suggesting that the California population originated from Europe. It should be noted that these analyses evidentiate possible pathways of introduction, but not the actual origin of these exotic microbes. An analyses of hundreds of California bay laurel and tanbark oak leaves collected during a time-span of over one hundred years and deposited in the Jepson's herbarium at UC-Berkeley indicated that the symptoms caused by *P. ramorum*, *P. ilicis*, and *P. pseudosyringae* were absent in historical collections, also supporting the exotic origin of these three pathogens.

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