

Role of Herbivorous Insects on California Bay Laurel in Sudden Oak Death Disease Dynamics¹

Kerry E. Wininger² and Nathan Rank²

Abstract

In California, leaves of California bay laurel (*Umbellularia californica*) are considered the primary naturalized source of inoculum for the devastating forest disease sudden oak death (caused by *Phytophthora ramorum*), and yet this plant and insects associated with its leaves remain understudied. Previous studies have considered the role of insects as synergistic factors on trees that die of *P. ramorum* such as oaks, but none have related disease prevalence to insect presence on bay laurel. Indeed, joint effects of insects and pathogens on plants have been investigated surprisingly rarely, and to our knowledge this is the first such study on bay laurel and *P. ramorum*. Insect attack may prime bay laurel leaves for *P. ramorum* infection by damaging the leaf surface to allow entry of pathogen hyphae. On the other hand, literature on aphids suggests that plant defenses against aphids are similar to those against pathogens. Thus, aphid attack may activate the plant's immune response and suppress susceptibility to a pathogen. In addition, infestation by plant enemies may occur when a plant's defenses are reduced due to environmental stress.

We studied interactions between insects, *P. ramorum*, and bay laurel in a region that has been a hotbed of sudden oak death infection since the early 2000s. In two observational studies, we documented the abundance of scale insects and aphids on bay laurel trees. The first study showed that abundance of the armored scale insect *Aspidiotus nerii* (oleander scale, family Diaspididae) on bay laurel leaves at Fairfield Osborn Preserve related negatively to disease expression of *P. ramorum*. The second study sampled trees across a broad geographic area in eastern Sonoma County. Here, we found that the most abundant insects belonged to the suborder Sternorrhyncha, which includes aphids, scale, whiteflies, and other sessile insects. Across this region, abundance of the California laurel aphid (*Euthoracaphis umbellulariae*) was negatively related to *P. ramorum* disease expression. These studies suggest that plant defense was primed by the insects and that they may have reduced disease levels in nature.

¹ A version of the paper was presented at the Seventh Sudden Oak Death Science and Management Symposium, June 25-27, 2019, San Francisco, California.

² Sonoma State University, Department of Biology and Center for Environmental Inquiry, Rohnert Park, CA. Corresponding author: K. Wininger, winingek@sonoma.edu.

In spring 2016, we conducted an insect-removal study on trees in multiple localities in Fairfield Osborn Preserve. We compared the progress of insect population change and disease expression for leaves on undisturbed control branches and branches that were subjected to three different removal treatments. The most abundant insects were the same sessile insects that we had discovered in our observational field studies. California laurel aphid and oleander scale abundance increased with increasing leaf age. Aphid abundance showed a negative relationship with pretreatment disease levels at the outset of data collection. Insect abundance on control branches peaked early in the season, and disease expression increased just as insect abundance declined in the third month of the experiment. Throughout the season, control branches showed statistically significantly larger numbers of insects present than branches that underwent insect removal treatments. Data analysis of the season-long relationship between insect abundance and *P. ramorum* prevalence is still underway. Results suggest that insects play a role in dynamics of disease expression in oak woodlands.