

Effect of Environmental Conditions and Lesion Age on Sporulation of *Phytophthora ramorum* on California Bay Laurel, Rhododendron, and Camellia¹

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Abstract

The objective of our research was to determine the environmental conditions and lesion age favorable for *Phytophthora ramorum* sporulation under field conditions. For 2 years, new camellia, rhododendron, and California bay laurel (*Umbellularia californica* (Hook. & Arn.) Nutt.) nursery stock were seasonally inoculated (every 3 months) on foliage. They were covered overhead to prevent rainfall from falling on the plants, but otherwise the plants were completely open to the natural environment. Consistent leaf wetness periods were produced with overhead misting systems and controlling sensors to simulate rainfall, fog, dew, or other conditions that might be supportive of sporulation. For each season, these wetness conditions began when leaf lesions were 3, 6, and 9 weeks old and, at each of these time points, the wetness conditions were maintained for 8 days. Sporulation was evaluated by washing leaf lesions just before the wetness period began (day 0) and at 1, 2, 4, and 8 days during the wetness period. Leaf wetness and temperature were measured near the plants.

Sporulation rate remained relatively high even at the lowest maximum daily temperatures measured (8 °C), but the rate fell quickly when maximum daily temperatures exceeded 33 °C in all species regardless of other measured conditions. For all species, the highest sporulation rate was seen at the end of 4 days of artificial misting. California bay laurel sporulated significantly after the first day, but camellia and rhododendron required 2 days of misting before significant sporulation could be detected. When the actual consecutive hours of leaf wetness above 90 percent were evaluated, then there was a significant logarithmic linear increase of sporulation as leaf wetness hours increased. Lesion size was not a good predictor of sporulation for rhododendron and California bay laurel, and was not statistically significant for camellia. Lesion size was therefore taken out of the final explanatory model. However, lesion age was a much stronger predictor of sporulation. Sporulation increased as lesion age increased from 3 weeks to 9 weeks for California bay laurel and from 3 weeks to 6 or 9 weeks for camellia, but decreased from 3 weeks to 6 or 9 weeks for rhododendron. The fitting for the final models were good. For rhododendron, California bay laurel, and camellia, the fitted covariates explained 45.7 percent, 60.9 percent, and 59.9 percent of the deviance respectively.

With readily available electronic environmental sensors and dataloggers (as those used in this study), nursery operators could monitor environmental conditions (temperature and leaf wetness), and in conditions with high sporulation risk, avoid certain cultural practices such as irrigation, plant handling, or pruning that might increase the chances of sporulation and infection. Preventive fungicides could be applied. The results could help improve existing risk models for sudden oak death in California forests when environmental parameters conducive to sporulation of California bay laurel are incorporated.

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