

## Induced Response of Oak Trees to *Raffaelea quercivora* as a Possible Defense against Japanese Oak Wilt Caused by the Ambrosia Fungus Carried by an Ambrosia Beetle

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**Abstract** Japanese oak wilt (JOW) has been recognized in Japan since the 1930s, but in the last fifteen years epidemics of this disease have intensified and spread to western coastal areas. The symbiotic ambrosia fungus *Raffaelea quercivora* is the causal agent of oak dieback, and is vectored by *Platypus quercivorus* (Murayama). This is the first example of an ambrosia beetle fungus that kills vigorous trees. Mortality of *Quercus crispula* Blume was approximately 40%. Necrosis has been observed around the gallery systems in sapwood, and has been attributed to *R. quercivora*. The necrosis stops water conductance, and a tree dies when necrosis completely blocks any cross-section of the tree. We found that many *P. quercivorus* males avoided such necrosis when they tunneled into trees that had attacked in the previous year. Gallic acid was newly produced in necrotic tissue and concentrations of ellagic acid were doubled. A laboratory experiment proved that *P. quercivorus* adults avoided the sapwood with high concentrations of gallic acid or ellagic acid. It is estimated that 0.0456% of gallic acid and 0.0260% of ellagic acid completely prevent insect tunneling. These tannic acids thus have some potential as control tools against Japanese oak wilt caused by the ambrosia fungus.