

The developmental process of xylem embolisms in pine wilt disease of *Pinus thunbergii* seedlings

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In pine wilt disease (PWD), embolized tracheids abruptly arise in a pine stem, after pine wood nematodes (PWNs), *Bursaphelenchus xylophilus* migrate through resin canals. In the advanced stage of the disease with the invasion of virulent PWNs, a number of tracheids are embolized, PWNs multiply in the pine stem, and the water potential of leaves abruptly decreases. Finally, the host trees will die of the complete blockage of water conduction. However, important details how this process develops are not clarified yet. In this study, we used a 0.3T compact magnetic resonance imaging (MRI) to visualize the developmental process of xylem embolisms in the main stem of 3-year-old *Pinus thunbergii* seedlings from inoculation to death. We analyzed the relationship between the occurrence of the embolisms and leaf water potential.

After inoculation of PWN, a massed embolism was observed around inoculation site, and rapidly enlarged to all directions. This expansion of the embolism occurred under the water potential of -0.5 to -0.8 MPa, *i.e.* without water stress. Patchy embolisms were observed around resin canals. The number of the patches increased in all cross-sections as time passed, but their area rarely expanded on a cross-section. The rapid increase of the embolized tracheids in the whole stem occurred just after the most part of xylem was embolized in one of cross-sections. This phenomenon seemed to be related to the death of living cells in the xylem at that height.

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