FUNGAL STRATEGIES OF WOOD DECAY IN TREES

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In 1878, in Germany, as I learned in Forestry 101, the modern science of tree care was born with the publication of Robert Hartig's text on tree disease, which described the parasitic mode of life of Armillaria on Scots pine and documenting the breakdown of cell walls by Phellinus pini. In 1863, Schacht had described the invasion of cell walls by fungal hyphae. Lacking the tools necessary for a closer analysis, but building on Schacht's work, Hartig postulated that enzymes secreted by fungal hyphae dissolved lignin and caused secondary cell walls to collapse. As a result, wood would become worthless, and trees would fall down.

In 2000, in Germany, the science of tree care took a great leap forward. Building on the work of Hartig, Shigo and many others, Francis W.F.M.R. Schwarze, Julia Engels and Claus Mattheck published *Fungal Strategies of Wood Decay in Trees.* Now available worldwide, and made readily accessible to English speakers thanks to the superlative translation work of William Linnard, this book shows the reader an entirely new way of looking at decay in trees. By understanding fungus-tree interaction more completely, the tree manager can make decisions about how to handle infected trees with more certainty.

More certainty is certainly needed today. Many authorities tell tree managers that infections by *Armillaria, Ganoderma, Inonotus* and other fungi are considered sufficient cause for immediate removal of the tree for fear of failure. Based on over ten years of research, Schwarze tells us "…the mere occurrence of a fungus fruit body on a tree does not indicate the extent of the decay…Degradation processes, host differences and environmental conditions are too diverse…decays often affect only a small amount of wood in the tree, so that stability and safety are not impaired."

The book begins with a review of wood anatomy, focusing on the layered structure of the cell wall. Readers of Mattheck's earlier work will recognize the hedgehog demonstrating the mechanical stresses within the tree. Listening to this "body language" spoken inside the tree, the diagnostician "hears" the decay spread--and sometimes stop. With magnification up to 1000x, the reader is able to see clearly the action of the fungus in the cells, and the reaction of the trees to the attack.

Fungal pathology is reviewed next; the brown, white and soft rots. Much advanced information on soft rots, which were first described by Schacht in 1863, is presented. For instance, research by Schwarze et al prove what Sinclair, Lyon and Johnson saw indications of in 1987—that Hypoxylon deustum (a.k.a. Ustulina deusta) causes a soft rot in the sapwood of various trees. This is just one example of a pathogen shifting strategies, from saprophyte to parasite, or

from enzyme-secreting to hyphae-growing, that the authors note, especially on moisture-stressed trees.

Chapter Three, the heart of the book, is devoted to Fungus-Host Combinations. For a diagnostician of limited understanding, such as the reviewer, the illustrations here tell the tale of fungal pathology better than a thousand words. First, electron micrographs take the eye into intercellular and intracellular space, where the chemical battles take place. Then, three-dimensional anatomic drawings paint a distinct picture of the disease and the defense. Finally photographs, of standing trees and cross-sections, show what we all see in real life when a rotting tree is cut down and cut up.

By pulling the eye and the mind from the inside of the tree to the outside and back again, the book allows the reader to exhaustively examine what takes place when fungus and tree combine. Still, as Schwarze says, "it requires an effort to understand these…'trials of strength'…the only sensible approach to predicting the future expansion of a decay…" Or termination of a decay process; for he has observed, as have many others, "many trees, old and young, in which a decay has been successfully compartmentalized". The authors note why "stress treatment" fertilization of struggling trees often backfires—decay fungi thrive on excess nitrogen.

Chapter 4 begins with the compartmentalization model, and verifies that theory with microscopic assessment. Since most fungi which endanger trees' stability work from the inside out, the ways that trees resist that outward spread are reviewed at some length. Xylem rays are the trees' Achilles Heel, the path of least resistance for the pathogen. Similarly, xylem cracks produced by rapid drying after removal of a branch, are "motorways" for infection, so the authors suggest that "the use of wound sealants could be quite successful against wound parasites. However there is still a great need for research here." When large branches must be removed, experimenting with sealants seems preferable to opening the heartwood to decay.

Throughout the book, we are reminded that the tree's vitality and its energy reserves are the most important factors in making a prognosis. Since fungus is present throughout the air, soil and water that surrounds the tree, it is the arborist's first and constant task to make trees stronger and more resistant, to any attack. If fungus gets a foothold in a tree, following the discoveries within Fungal Strategies of Wood Decay in Trees can lead to a program for managing the tree to resist decay and retain and increase its value.