Compartmentalization Of Decay In Trees

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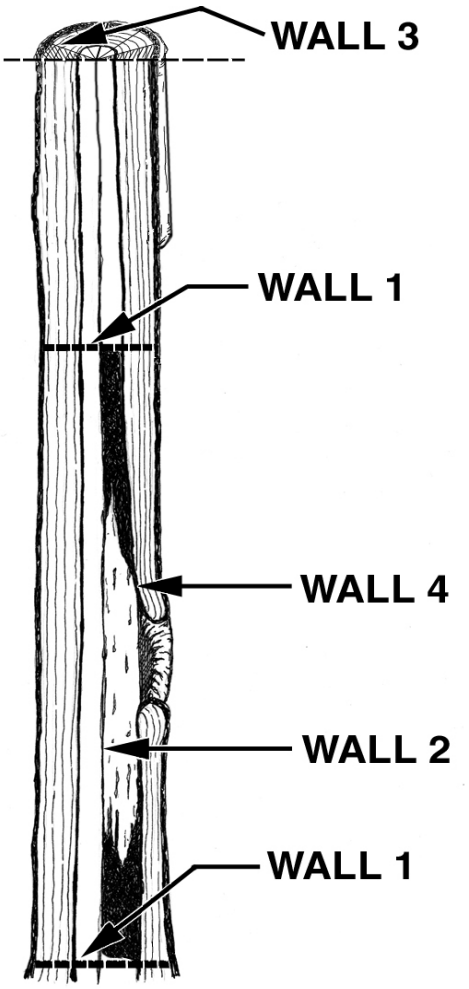
The traditional concept of wood decay in living trees was developed late in the 19th century by Robert Hartig, a German forester who pioneered modern forest pathology. The traditional view maintained that wood decay is caused by fungi that **C**ompartmentalization **O**f **D**ecay **I**n **T**rees. The CODIT system illustrates four lines or walls of defense against decay in woody portions of the plant. Walls 1, 2, and 3 are present in healthy plants or form immediately following injury. Wall 4 is formed by the cambium when new growth is initiated following wounding (Figure 1).

enter through wounds in the bark. Once introduced into the tree, decay fungi will move unchecked throughout the stem, because wood is primarily a dead, non-responsive tissue.

This concept was accepted until recently, when Dr. A. L. Sigo, Plant Pathologist with the United States. Forest Service, and colleagues presented an expanded concept of decay. The expanded concept still maintains that wounds provide and entrance for wood decay organisms; however, a succession of many microorganisms including bacteria, non-decay fungi and decay fungi are involved. The expanded concept also takes into account tree response to wounding and infection whereby affected tissues are compartmentalized or walled off from healthy tissue. The expanded concept of decay has considerable influence on many arboricultural practices.

CODIT

To illustrate tree response to wounding and invasion by decay organisms, a model was developed known as CODIT -



Wall 1 inhibits movement of decay organisms in a vertical direction. This wall is formed in the vertical vascular system above and below the wound by gums, resins, tyloses, etc., produced by the vascular elements. Wall 1 is the weakest wall, which allows decay organisms to spread farthest in a vertical direction.

Wall 2 is the tangential wall, which inhibits movement of decay organisms inward toward the pith. This wall is formed by the last cells in each growth ring and is continuous around each growth ring except where rays pass through. Wall 2 is the second weakest wall.

Wall 3 is composed of ray cells, which inhibit the movement of decay in a radial direction (around the stem). Wall 3 is the strongest wall present at the time of wounding.

Wall 4 is a new protective wall formed by the cambium after the tree is wounded. This wall represents a barrier zone that restricts movement of decay into tissues formed after wounding. The cells comprising this barrier zone are thick-walled and contain chemicals that are toxic to decay organisms. Wall 4 is the strongest wall, capable of confining decay to tissues formed prior to wounding as long as the wall is not broken by another wound.

Compartmentalization of decay is partially controlled by the genetic makeup of the tree. Research indicates that certain species and individuals within species vary greatly in their ability to compartmentalize injuries and decay. This will allow breeding of urban trees that are strong compartmentalizers of decay. Compartmentalization also is controlled to some degree by tree vigor, whereby healthy trees are stronger compartmentalizers than those in a weakened condition. Maintaining vigor of urban trees through periodic fertilization, proper pruning of deadwood, and competing and conflicting limbs, irrigating during dry periods and controlling insects and diseases is essential in helping trees to compartmentalize decay.

PRACTICAL CONSIDERATIONS

The CODIT model is a natural defense system, which prevents decay organisms from spreading throughout the wood, and

ensures survival of the tree. The CODIT model must be taken into consideration in many arboricultural practices to ensure that this natural defense system is not overridden.

WOUND TREATMENT

Fresh wounds should be shaped into an ellipse to speed wound closure. Do not injure callus tissue that may have formed at wound margins as this would break the barrier zone (Wall 4) and increase the amount of decay. Cultural practices designed to increase tree vigor will aid compartmentalization of injured tissues and increase wound closure. Apply a thin coat of an asphalt-based paint to the wound for cosmetic purposes only.

CAVITY TREATMENT

When excavating decayed wood from cavities, do not injure the healthy wood on the inside of the tree, as this will break wall 4 and allow decay to rapidly spread to healthy tissues formed after wounding. Cavities can be filled or capped for aesthetic reasons and to form a base for callus growth. Consult Standard Practices for the recommended method of filling cavities.

DRAIN TUBES

Water collects in cavities and decayed wood due to the formation of protective tissues (Wall 4) around the rim of the cavity, which restrict water movement. Drainage holes drilled into decayed wood or cavities in the tree will break the barrier zone (Wall 4) and allow decay to spread into healthy tissues. Drainage holes drilled into wetwood will not spread decay, because wetwood is a disease caused by bacteria and is not decayed wood.

INJECTION WOUNDS

Wounds created by injection of chemicals (fertilizers, insecticides, fungicides, etc.) are usually compartmentalized. To minimize decay, injection holes should be as small in diameter, as shallow and as clean-edged as possible. Avoid repeated (annual) injections as this will cause columns of decay to coalesce, resulting in severe internal injury. Following injection, do not plug holes with any substance (wood dowels, mastic, etc.) as this could increase decay or interfere with wound closure.

CABLING AND BRACING

When hardware for cabling and bracing is installed into healthy wood, the resulting wounds are compartmentalized and the anchors (eyebolts, lang hooks, rods) will be held securely in place. If hardware is installed in decayed wood, the decay will break out into surrounding tissue and limit the support capacity of the anchor. When hardware must be placed in decayed wood, the rods or eyebolts must pass completely through the trunk or limb and be held in place with washers and nuts. Do not use lag-bolts in decayed wood.