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Butt Rot of Southern Hardwoods

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Butt rot is the most serious cause of cull throughout the South, and affects all hardwood species. Defined as any decay at the base of a living tree, butt rot accounts for the loss of millions of board feet of southern hardwood timber annually. In one study of loess and alluvial hardwood sites in the Midsouth, butt rot was found in 40 percent of the trees being harvested: 80 percent of the sugarberry, 68 percent of the beech, 39 percent of the red oak, 37 percent of the sweetgum, 29 percent of the white oak, and 33 percent of all other hardwood species (McCracken 1974).

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Butt rot occurs when decay fungi enter sound heartwood through wounds in bark or dead tissues. It is most prevalent in stands that have been heavily and repeatedly damaged by fire and logging. About 65 percent of infections start at fire wounds; most of the rest start at logging injuries. In commercially thinned stands, such as sweetgum, decay frequently spreads from the stump of a cut twin into the heartwood of the remaining stem after about 10 to 13 years. Extensive damage occurs in the heartwood. The decay is usually confined to the woody tissues present when the

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Figure 1.—Butt bulge, an indication of butt rot. F—700037

tree is damaged; wood formed afterward is seldom invaded.

The most certain indication of butt rot is the presence of fungus fruiting bodies, or basidio carps, commonly referred to as "conks." These occur on the lower trunk, butt, or root zone,

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Figure 2.—*Hericium erinaceus* (Bull.) Pers. the hedgehog or bearded fungus.

but may not be noticed if they are small, short-lived, hidden, or produced either infrequently or after tree death. Other reliable indicators are old wounds (see cover)—both open and healed—hollows, and abnormal swellings or butt bulge (fig. 1).

Decayed wood may be soft, white and spongy, stringy, friable, or brown and brittle. The decayed core may be only a few inches in diameter, or it may include the entire heartwood. It may extend vertically from a few inches to many feet above the wound. Diseased trees are structurally weak and may break in wind and ice storms.

Fungal Development

After a tree is wounded, bacteria and nondecay fungi—the first micro-organisms to flourish on the exposed woody tissues—precipitate decay, as their presence is required for the establishment of decay fungi. On infected trees, the vegetative or decaying stage of the rot fungi

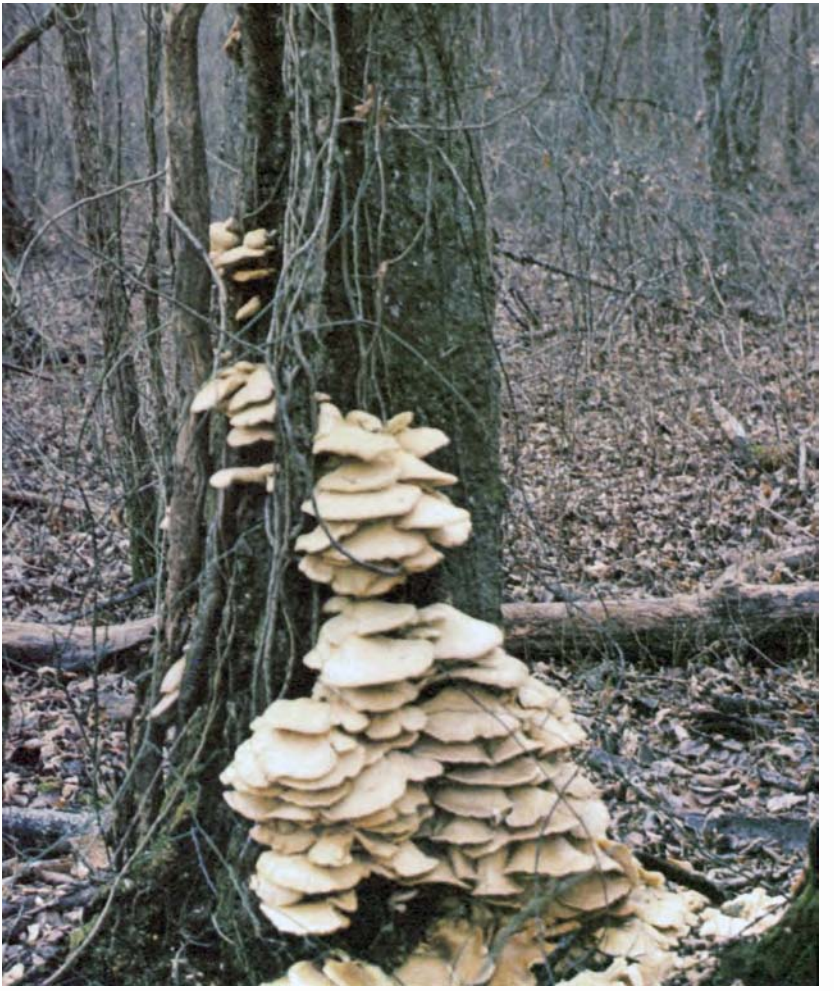

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Figure 3.—*Pleurotus sapidus* Kalchhr.—the oyster mushroom.

gives rise to fruiting bodies. These normally appear in fall and winter in the South. Microscopic spores are released by the conks in great numbers and are released for periods varying from a few days to several weeks, depending on weather conditions. Spores are disseminated radially from the conks and are dispersed outward and downward in all directions. Occasionally spore clouds are visible. The windborne spores infect wood previously exposed by injury and invaded by bacteria and nondecay fungi. The decay fungus penetrates the sapwood, continues into the heartwood, and eventually forms new conks.

Butt-Rot Fungi

Butt-rot fungi fall into two broad groupings: most of those attacking southern hardwoods are white rotters while only a few are brown rotters. Both can rapidly reduce wood strength. White-rot fungi attack both lignin and cellulose; the lignin destruction gives the wood a white appearance. Cell wall layers are sequentially attacked from the lumen outward. Cell wall thinning and lysis occur. The degraded pits and erosion troughs in the cell walls coalesce. Brown-rot fungi decompose cellulose in all areas of the cell walls but do not attack lignin, which remains and gives the wood a brown color.

Rate of decay varies with tree species, fungus, and wound size. Some fungi advance rapidly at first and then abruptly cease spreading. Average scar sizes of various southern hardwoods measured 20 and 40 years after wounding were:

Species	Size of scar	
	20 years	40 years
	Feet (m)	
Overcup and sugarberry	4.1 (1.25)	6.1 (1.86)
Sweetgum and elm	3.6 (1.10)	5.7 (1.77)
Red oak	2.7 (0.82)	5.4 (1.65)
Green ash	3.4 (1.04)	5.1 (1.55)
Water hickory	1.1 (0.34)	4.1 (1.25)

Decay is the most extensive when wounds are large and old. Detectable decay usually does not develop in wounds less than 2 inches (5.08 cm) wide. Regardless of wound size, wood volume loss is minimal when wounds are 4 years old or less.

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Figure 4.—*Polyporus fissilis* Berk. and Curt.

Although numerous fungi cause butt rot in southern hardwoods, only five are responsible for approximately half of the identified cases of decay. Certain fungi tend to occur more frequently on some tree species than on others. Generally, butt rot in the heartwood of an individual tree is due to a single decay fungus, which is typically identified by the characteristics of its conks. The five butt rot fungi most frequently found in southern hardwoods are briefly described here to facilitate identification.

Hericium erinaceus (Bull.) Pers. is commonly called the hedgehog or bearded fungus (fig. 2). It causes a white rot which

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Figure 5.—*Polyporus lucidus* Leys ex Fr. (Ganoderma lucidum (Leys.) Karst.)—commonly called the varnish or lacquer conk.

generally progresses rapidly—6 to 18 inches (15.24 to 45.72 cm) vertically per year—leaving large hollows lined with whitish-yellow mycelium in the advanced stages of decay. Conks are large (4 to 10 inches, 10.16 to 25.40 cm), globular, and occur singly or in clusters; they are white, turning yellow with age, and have tooth-like projections pointing downward. These fungi are found in butt hollows of standing trees and in stump cavities or hollow logs, usually during the fall of the year after felling.

Pleurotus sapidus Kalchhr.—the oyster mushroom (fig. 3)—produces a white flaky rot. The shelf-like conks are white to light grey, or tinted light brown, depending on the light intensity. They are soft, and fleshy and some have a short stout stalk. Gill structures radiate from the point of attachment on the lower surface. Conks are found on standing trees and in slash throughout the South during most of the year but may not appear during dry periods and summer. A good spore deposit has a lilac tint. The closely related form *P. ostreatus* Jacq. with cream colored spores may occur on some hardwood species.

Polyporus fissilis Berk. and Curt. (fig. 4) causes a white rot appearing whitish to red-brown in oak and sweetgum in the South. The shelf-like conks are 3 to 8 inches (7.62 to 20.32 cm) wide, tough and succulent, and turn yellow with age. They usually appear during fall on standing trees and sometimes in logs. Diseased trees become hollow

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Figure 6.—*Polyporus sulphureus* Bull. ex Fr.—the sulphur mushroom.

and contain fungus masses of a soapy consistency.

Polyporus lucidus Leys ex Fr. (*Ganoderma lucidum* (Leys.) Karst.) (fig. 5)—the varnish or lacquer conk—causes a soft spongy white rot with scattered black spots on many southern hardwoods. The conks are 3 to 10 inches (7.62 to 25.40 cm) in size and appear annually during summer; they develop a shiny, hard upper surface of a reddish color and have a short stout stalk and pores on the under surface. The conks have a tough woody consistency and many persist for more than a year.

Polyporus sulphureus Bull. ex Fr., commonly called the sulphur fungus (fig. 6), produces a brown cubical rot in southern hardwoods. The conks are soft, fleshy, and moist and are bright orange-red on the upper surface and red-yellow on the under or pore surface. They become hard, brittle, and white when old and appear on wounds singularly or in clusters, usually during fall.

Control Measures

There are no known measures for direct control of butt rot once injury and infection occur; however, losses can be significantly reduced through judicious stand management. Since all infections occur through bark wounds, injury prevention is the most practical approach to control. Butt rot in sweetgum resulting from the spread of decay from the stump of a cut twin into the remaining stem (fig. 7) can be minimized by early thinning of sprouts to prevent them from fusing together.

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Figure 7.—In sweetgum, decay may spread from a stump of a cut twin to heartwood of the remaining stem after 10 to 13 years.

Badly decayed trees of no value should be deadened so that sound trees will eventually replace them. For infected trees that have value, early salvage should be considered since the lower, most valuable portion of the log is being decayed, making the tree susceptible to insect attack, windthrow, and degrade from stain.

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