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Forest Tree Diseases of Virginia

October 1971

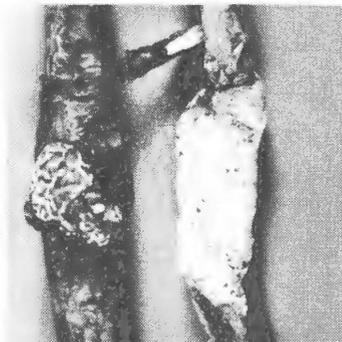
MR-FTD-14

Discoloration and Decay of Hardwood Trees

by

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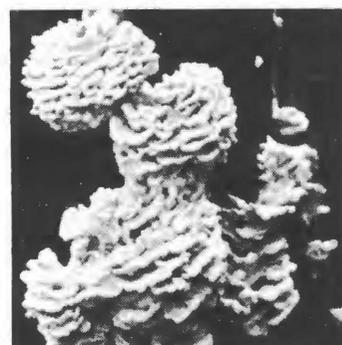
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RUST



DECLINE



DECAY



CANKER

Seventy-five percent of all the timber losses due to disease in the United States is due to decay and discoloration of standing, living trees. This percentage is considered to be of equal proportion in Virginia, particularly in our hardwood forest stands. Approximately 23 percent of the total hardwood growing stock in Virginia is classified as non-merchantable due to its rough and rotten condition. Another large percentage is non-usable for high quality products because of discoloration and/or incipient decay. Such stands of trees are abundant throughout Virginia because previous logging operations selected only the best trees for use, hence the stands have become very downgraded as a group.

Discoloration and decay of living trees occurs through a progression of events which depend upon an initiating wound for the process to begin. Hence, the presence of a large wound caused by any of several factors will initiate a process whereby the entire tree may soon become of little economic value. Most of the resultant loss is unseen by the casual observer due to it being hidden within the tree until felled during harvest. The pattern of decay and discoloration in the tree is more important than the

Figure 1. Ice storms frequently cause large limbs and tops of main stems to break, thus initiating the decay and discoloration process over large areas of timber.



Issued in furtherance of Cooperative Extension work, Acts of May 8 and June 30, 1914, in cooperation with the U. S. Department of Agriculture. W. E. Skelton, Dean, Extension Division, Cooperative Extension Service, Virginia Polytechnic Institute, Blacksburg, Virginia 24061.

amount present in any particular tree, i.e. a hollow, rotten tree may still be of value for veneer stock provided a layer of clear sapwood exists, whereas a solid tree with numerous broken branches and associated stain and decay column will at best make only usable pulp wood. [Any knowledge the timber cruiser may have concerning discoloration and decay indicators will reduce any additional losses to the purchaser through the recognition of damaged trees.]

Suscepts:

All hardwood tree species are susceptible to the discoloration and decay process. The most extensively affected are maple, beech and birch; oak, hickory and ash are less affected. Some trees, such as persimmon, are highly resistant to the decay process.

Cause:

Discoloration and decay of living trees is a dynamic and complex process that begins with a wound. Injuries to branches and trunks from ice or wind storms (Figure 1), fire scars, insect or bird feeding activities, and logging operations are just a few of the possible ways such wounds occur. Chemical changes rapidly take place in the exposed wood and surrounding tissues. These changes extend into the column of wood connected to the wound and will continue to develop until the wound is healed. No organisms such as fungi or bacteria are involved in this discoloration or oxidative stain process. The size and depth of the wound, the vigor of the tree and associated healing time determine the extent of the stain column. New wood formed after wounding does not discolor due to an adjacent barrier of wound initiated cells being formed that resist the processes involved in oxidative stain.

Immediately after the wounding and oxidative stain has begun, bacteria and lower fungi begin to grow and colonize the stained tissues. These pioneer organisms invade only the injured tissues and associated stained column and again do not affect the new tissues laid down after the injury occurred. Ingress by the organisms continues into the stain column and further darkening of affected tissues usually results. At this point little if any of the strength properties of the wood are lost but the wood has been prepared for the decay fungi that follow.

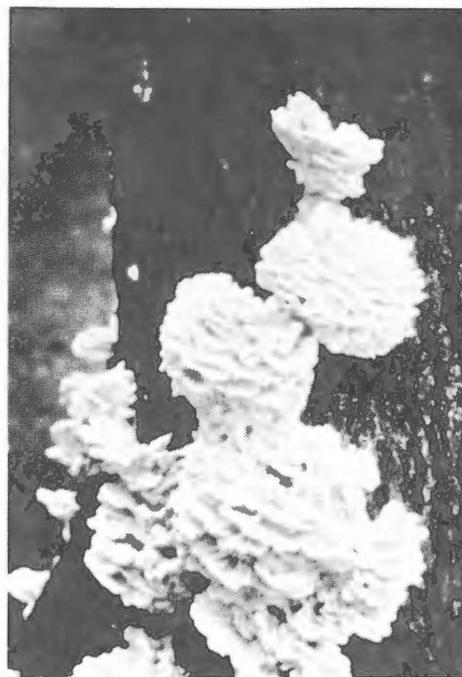


Figure 2. Sporophores of *Polyporus sulphureus*; such fruiting bodies of the decay fungi may indicate extensive internal decay.



Figure 3. Discoloration and decay column associated with two broken branch stubs. Column at top of stem was due to wounds higher up on the trunk.

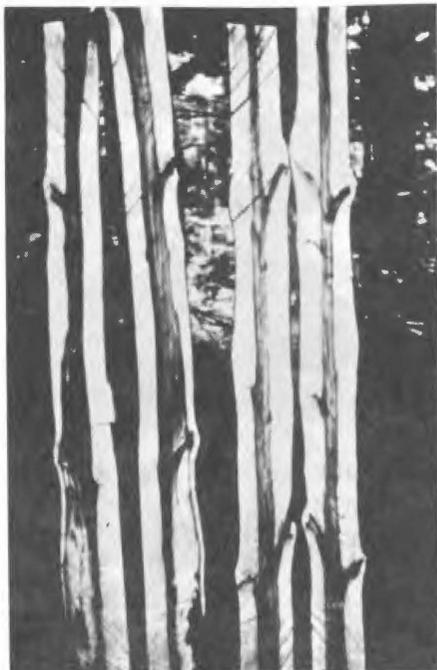


Figure 4. Long columns of decay and discoloration associated with broken branches. Note that healed over branch stubs are now covered with clear wood.

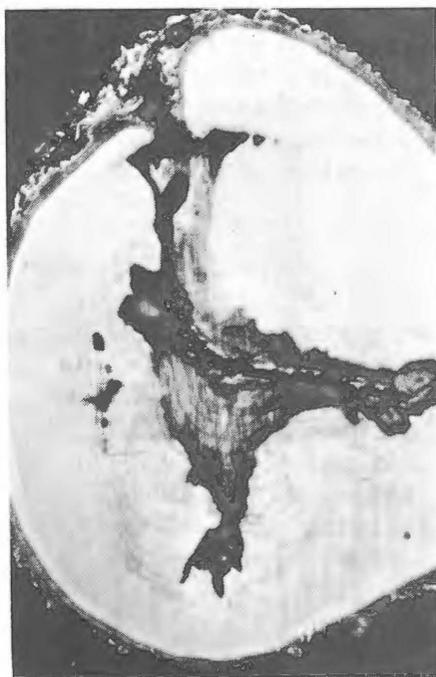


Figure 5. Stain and decay associated with callused over defects caused by bud overgrowths, annual cankers and insect damage.

The final and most destructive stage of the process occurs when the decay fungi enter the "prepared wood" and begin to destroy the wood itself. Once again, newly formed wood is not invaded. The decay fungi advance into the column of affected wood and serious degradation of quality and strength occurs. The decay fungi follow the path of the pioneer organisms and stop only when all tissues are utilized. A hollow tree results after several decades of such a progression.

The process of decay need not go to completion once initiated. Tree vigor, unfavorable conditions for organism development, antagonisms between organisms and other factors may stop the process.

Symptoms and signs:

Decay and discoloration of living trees may be easy or difficult to diagnose depending upon the presence of the indicators that evidence that the process has begun.

The most prominent indicator of extensive (but perhaps localized) decay is the presence of the fruiting bodies of the decay fungi. These are called conks or sporophores and are usually found on or near the wounded areas of decaying trees (Figure 2). The location of the conk, the species of the decay fungus, and host tree involved have been used to predict the extent of decay within the tree. Information on making decay predictions is available in several publications dealing with decay of forest tree species.

Another prominent indicator of the extent of decay within a tree is the size and age of the open wounds. The amount of decay and discoloration present behind a branch stub will depend upon the size and roughness of the stub and the length of time since breakage (Figures 3, 4).

Less prominent but valuable indicators of decay include healed over knots, flat or sunken surfaces on the bark, numerous insect wounds, squirrel or bird damaged areas, open seams or frost cracks, and callused overgrowth of small annual cankers and buds. These types of wounds usually result in less extensive discoloration and decay in the immediate area of the defect but if they are extensive over the entire stem, serious log degrade will result (Figure 5, 6).

It must be pointed out that large trees that may have been wounded very early in the life span may have extensive decay of their heartwood with absolutely no indicators of decay. Such trees may break during wind storms and cause considerable damage (Figure 7).



Figure 6. The extensive heartrot associated with the canker and decay causing fungus *Polyporus hispidus*.

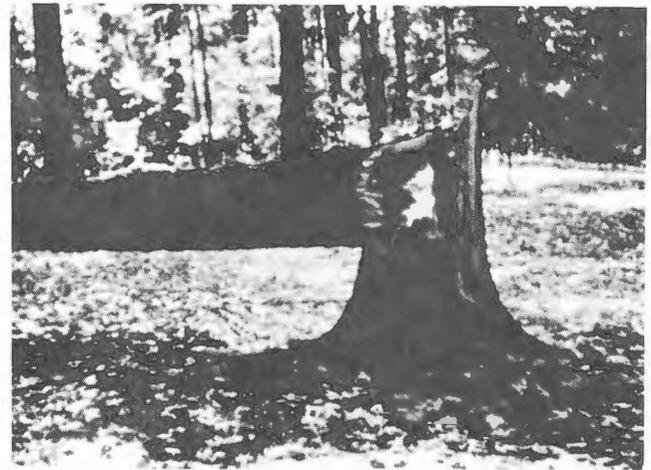


Figure 7. Wind breakage of large trees may occur due to internal rot. No evidence of decay was present prior to tree fall.

Control:

Discoloration and decay in living trees can be reduced through good management and logging practices. Small woodlot owners can enhance the value of their woodlots by removing deformed rough and rotten trees and trees with the indicators of decay as discussed above. Quality trees that are free of decay or discoloration caused defects will then be free to grow at a faster rate.

A reduction in wounding of residual trees during thinning, encouraging sprouts of low origin at the time of regeneration, and harvesting low grade trees along with select trees will result in more valuable stands in the future.

Small woodlot owners can greatly increase the value of their stands by pruning dead and broken branches from species such as birch, maple, tulip poplar, oak, and beech. Such practices are time consuming and are worthwhile only in the case of slack time during winter months. Pruning should be done close to the stem and in a nearly vertical fashion to prevent moisture collection on the cut surface.

Acknowledgement:

Recently, an extraordinary amount of attention has been given to the discoloration and decay process in hardwood species by Dr. Alex L. Shigo of the Northeastern Forest Experiment Station research unit located at Durham, New Hampshire. His work has led to a better understanding of defect indicators. Much of the information and the photographs used in this publication are gratefully acknowledged. For additional information see: Shigo, A. L. 1969. A photo guide to the patterns of discoloration and decay in living northern hardwood trees. U.S.D.A. For. Ser. Res. Paper NE-127. N.E. For. Exp. Station. Upper Darby, Pa. 99 pp.