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Forest Service

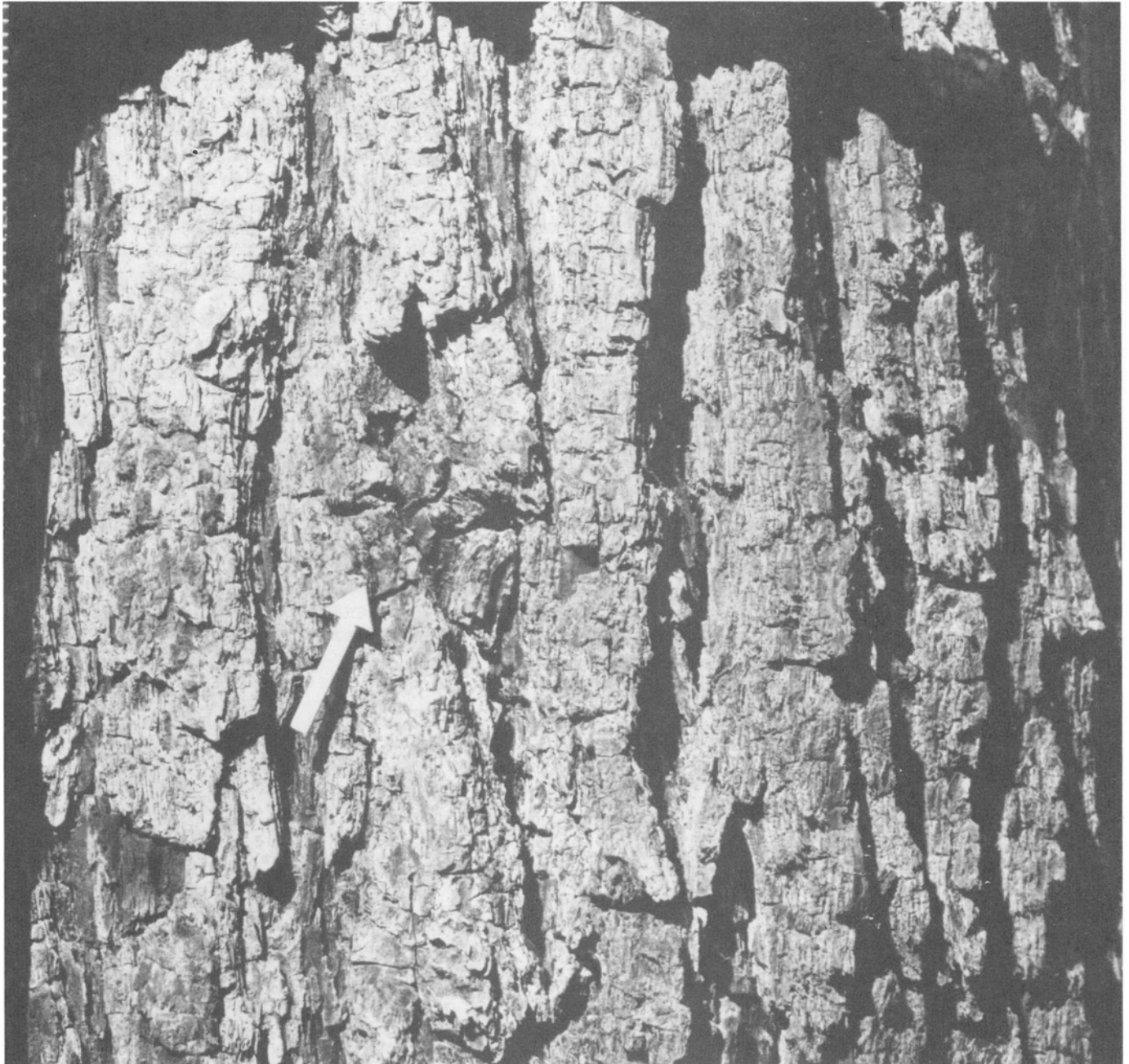
Northeastern
Forest Experiment
Station

Research Paper NE-617



Photographic Guide to Selected External Defect Indicators and Associated Internal Defects in Black Walnut

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John A. Beaton
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Abstract

To properly classify or grade logs or trees, one must be able to correctly identify defect indicators and assess the effect of the underlying defect on possible end products. This guide aids the individual in identifying the surface defect indicator and also shows the progressive stages of the defect throughout its development for black walnut. It illustrates and describes 10 types of external defect indicators and associated defects that are particularly difficult to evaluate.

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Introduction

This photographic guide on black walnut is the third in a series to aid in the understanding of the relationship between exterior defect indicators and the underlying defect. This study, unlike the two previous studies - northern red oak (Rast 1982) and black cherry (Rast and Beaton 1985)-was conducted at the Forest Products Laboratory in Madison, Wisconsin. Also in this publication we provide a stereo pair of photographs of the defect indicator to give the user a more realistic view.

Procedure

Thirteen black walnut trees located on Tar Hollow State Forest in south-central Ohio were selected, felled, and bucked into thirty 4-foot bolts containing the defects selected to be studied. Many of the bolts contained two or more defects. The bolts were carefully transported to a warehouse to be photographed. This controlled environment enabled us to take quality defect indicator photographs and provided a good storage area for the bolts until the initial film was developed and checked.

The ends of the bolts were marked off in quadrants using the geometric center as the midpoint. The quadrants were aligned to keep all the defects in quadrant 1 or 2 if possible. A 1-inch groove was routed along the 3-4 quadrant line, providing an identification mark in the rotary-cut veneer for clipping. By clipping at this point, each sheet of veneer was one complete revolution of the log. This provided a method for identifying the correct defect corresponding to the surface defect indicator that was photographed.

Prior to slicing, the bolts were heated in water and then debarked by hand. The bolt was then chucked and rotary sliced into 1/10-inch-thick veneer. Before getting a continuous sheet of veneer, the round-up pieces of veneer were

counted and those necessary for photographing were saved. Once the veneer started coming off in a continuous sheet, it was clipped at the notch in the small end and stacked by bolts. The bolt number was put on the first and last sheet of veneer of each bolt. Only 10 to 15 bolts were sliced at a time so the defects could be photographed the same day to prevent stain or discoloration. Then the veneer was put in cold storage before drying.

Discussion of Defects

The defect indicators reported in this publication are suppressed bud; suppressed bud cluster; open and occluded bird peck; light, medium, and heavy distortions; sound wound; hole (woodpecker); and gun shot wound (slug). We feel that these are often difficult to identify and evaluate in terms of their effect on end-product quality. Graders normally have little difficulty recognizing and evaluating the obvious grading defects such as limbs, forks, bumps, or butt scars.

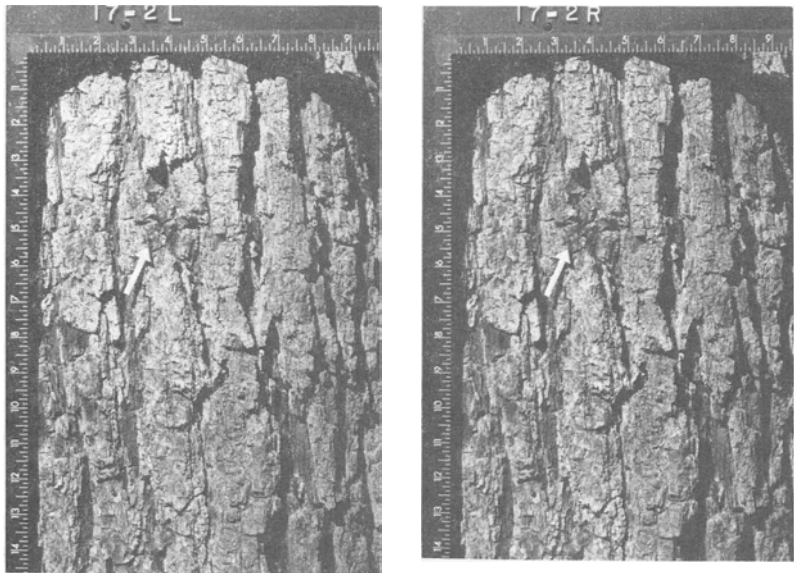
The photo format utilized in this publication for each evaluated defect is a pair of stereo photographs of the defect indicator on the log surface and next an enlarged set of prints, first of the defect indicator then a series of prints of the actual defect as it appears at different depths below the log surface. Below the photo of the defect indicator (Fig. 1) is a list that describes the size of the defect in terms of length (along the grain), width (across the grain), and height (above the normal bark contour); log diameter, inside-the-bark at the defect; round-up thickness; core diameter; and distance of defect above the stump. The information listed below the interior defect (Fig. 1) indicates distance below the log surface (inside the bark-ib) as well as the distance from the first slice of veneer to that particular photographed defect. The last photograph in each defect series also lists total veneer thickness, which is the distance from the initial slice of usable veneer to the veneer core.

Suppressed Buds

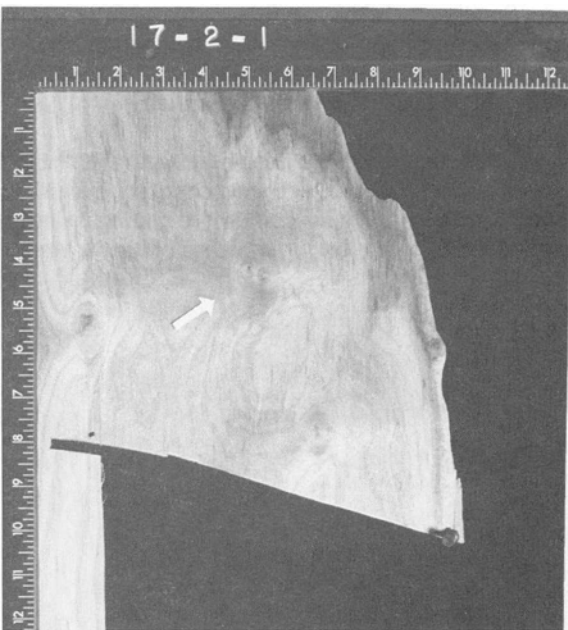
Epicormic branches develop from two types of buds: suppressed or dormant buds and adventitious buds (Kormanik and Brown 1969 and Shigo 1986). Suppressed buds (Fig. 1) can persist for many years just as a bud trace or can sprout suddenly after some stimulus such as thinning or damage

to the tree. Adventitious buds, on the other hand, form anew from the cambium usually following some injury to the tree. The defect indicator is normally associated with a slight break in the bark pattern with a small protuberance in the center.

Figure 1.-Suppressed bud and associated internal defects.

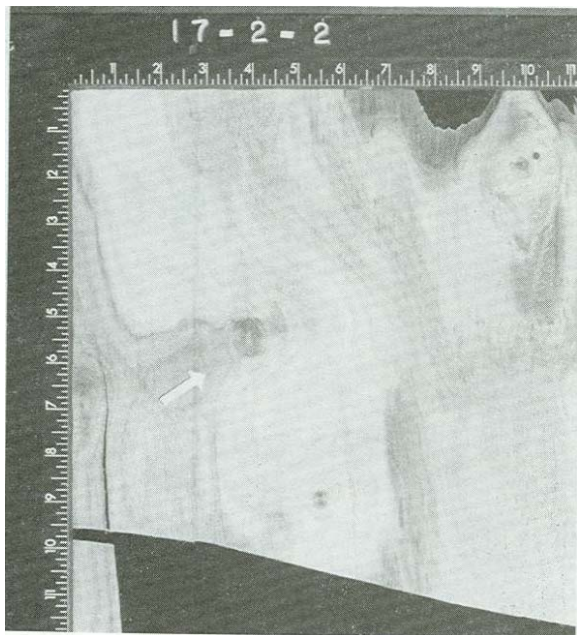


Stereo view of defect indicator



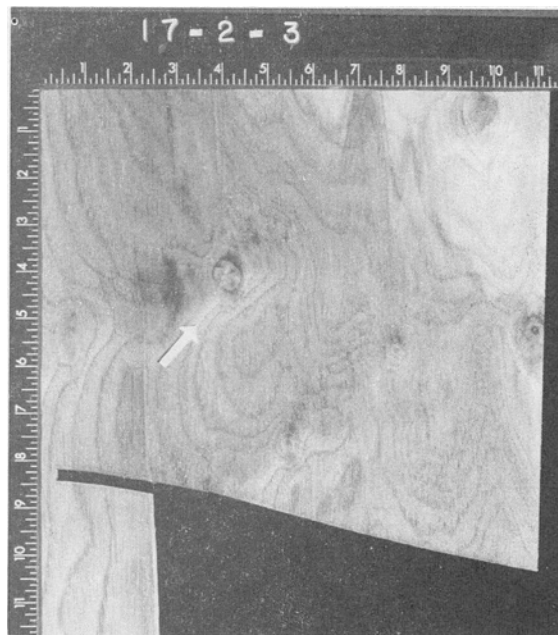
Defect size ½ x ½ inch
Log diameter at defect (ib) 14.3 inches
Round-up thickness 0.1 inch
Core diameter 6.3 inches
Defect distance above stump 4.0 feet

Depth below
Log surface.1.6 inches
First sheet of veneer.1.5 inches



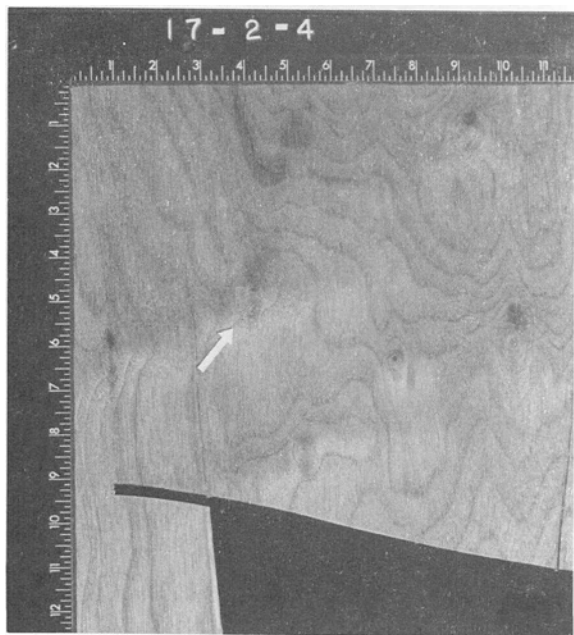
Depth below

Log surface 2.1 inches
 First sheet of veneer. 2.0 inches



Depth below

Log surface. 2.6 inches
 First sheet of veneer. 2.5 inches



Depth below

Log surface. 3.1 inches
 First sheet of veneer. 3.0 inches



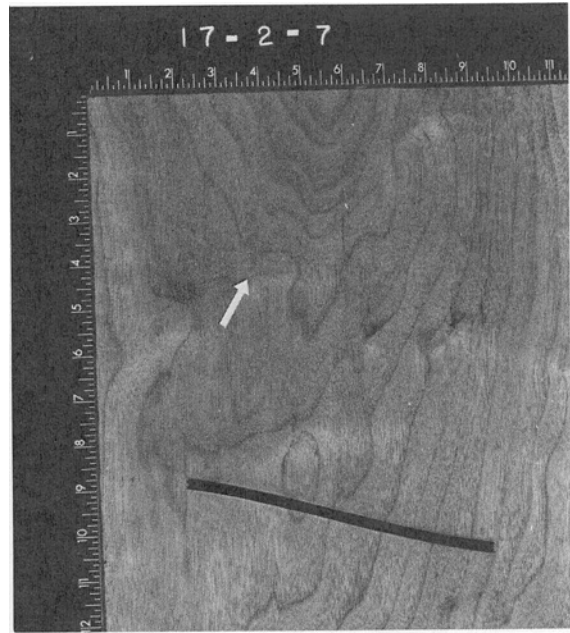
Depth below

Log surface. 3.6 inches
 First sheet of veneer. 3.5 inches



Depth below

Log surface. 4.1 inches
First sheet of veneer. 4.0 inches



Depth below

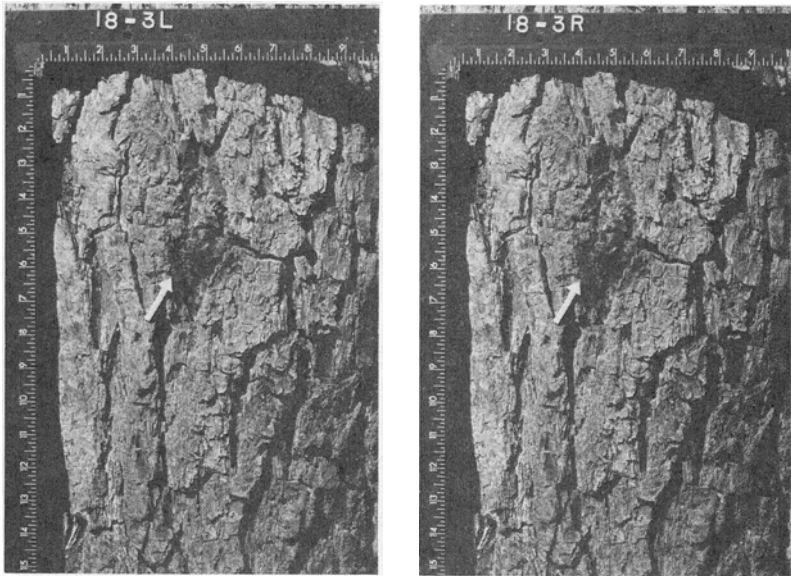
Log surface. 4.6 inches
First sheet of veneer. 4.5 inches
Total Veneer Thickness. 4.5 inches

Suppressed Bud Cluster

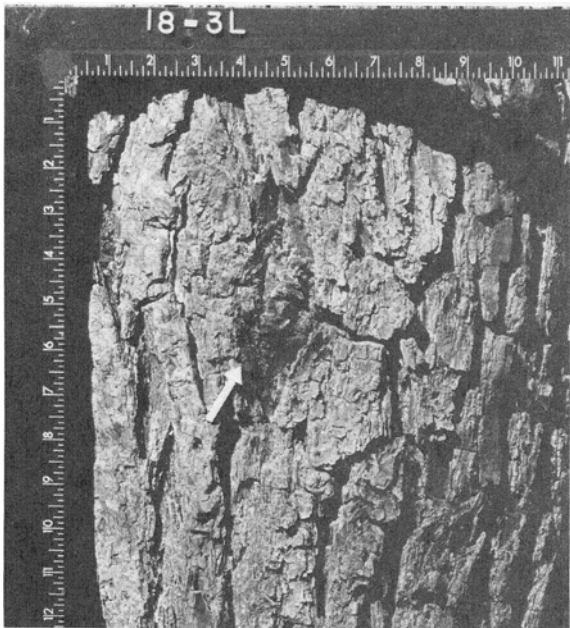
As the name implies, a suppressed bud cluster is a group of suppressed buds (3 to 20) tightly clustered in a small area, normally less than 2x2 inches in size. Usually, but not always, there is evidence of concentric rings around the defect indicator.

Figure 2 shows the faint lines of the concentric rings around the defect indicator and evidence of several individual buds. Also, the many adventitious knots are visible in the first defect photo.

Figure 2.-Suppressed bud cluster and associated internal defects.



Stereo view of defect indicator



Defect size	1 ½ x 2 x ½ inches
Log diameter at defect (ib)	13.7 inches
Round-up thickness	0.5 inch
Core diameter.	6.2 inches
Defect distance above stump.	8.0 feet

Depth below	
Log surface.	.21 inches
First sheet of veneer.	1.6 inches



Depth below

Log surface. 2.5 inches
 First sheet of veneer. 2.0 inches



Depth below

Log surface. 3.0 inches
 First sheet of veneer. 2.5 inches



Depth below

Log surface. 3.5 inches
 First sheet of veneer. 3.0 inches

Total Veneer Thickness - 4.7 inches

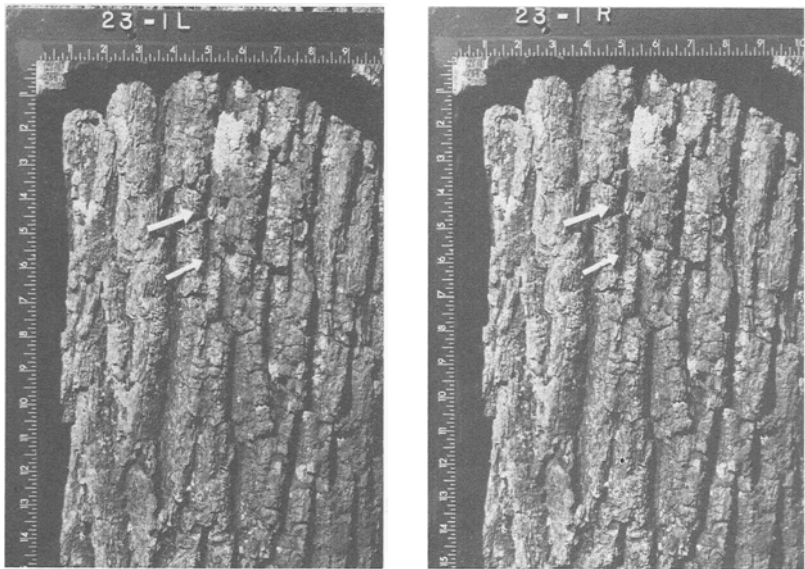
Bird Peck

Bird peck is evaluated by determining whether callus tissue is formed in the peck holes (Rast et al. 1973). If the peck holes are open, the pecks did not reach the cambium layer and there will be no damage; but, if the peck holes are closed, there will be damage to the tree. Sometimes bird pecks are called old or new. However, this classification should not be used except to say that new bird pecks, whether or not they reach the cambium layer, can be disregarded in grading because if the tree is cut shortly afterwards, the peck defects

will be removed during the initial stages of primary processing of the log (debarking, slabbing, or round-up).

Figure 3 shows a bird peck that is not occluded and, therefore, can be disregarded. No additional veneer photographs were taken because there were no indications of defects in the wood below.

Figure 3. - Open bird peck.



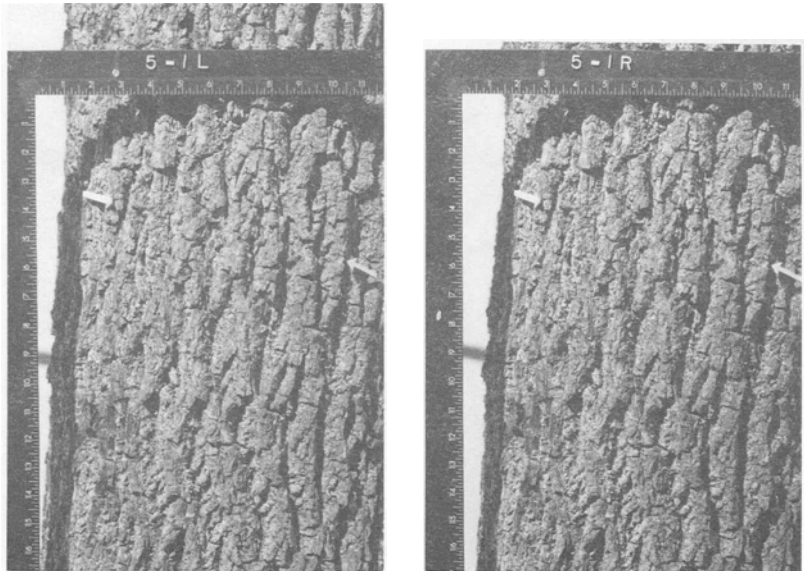
Stereo view of defect indicator



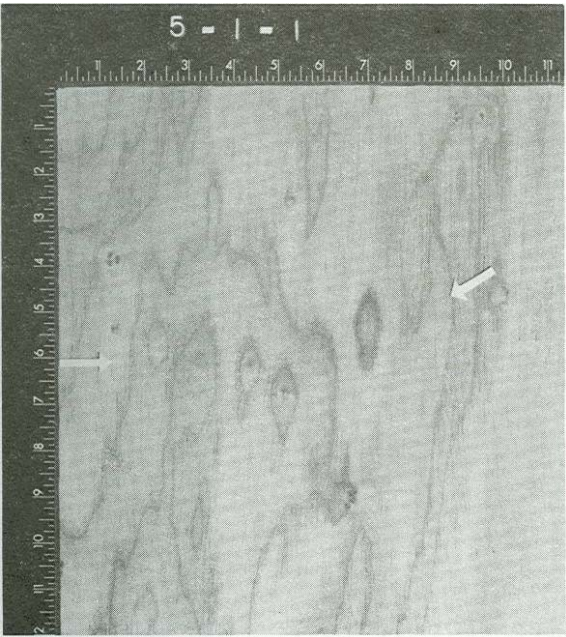
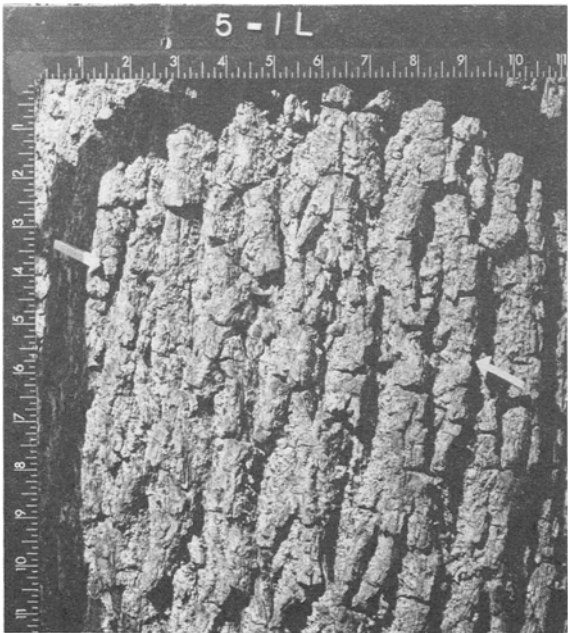
Defect size	2 x ½ inches
Log diameter at defect (ib).	12.9 inches
Round-up thickness.	0.0 inch
Core diameter.	6.2 inches
Defect distance above stump.	23 feet

In contrast, Figure 4 shows very clearly the occluded callus material that has formed in the pecked holes, and the defects are clearly visible in the underlying wood.

Figure 4. - Occluded (closed) bird peck and associated internal defects.



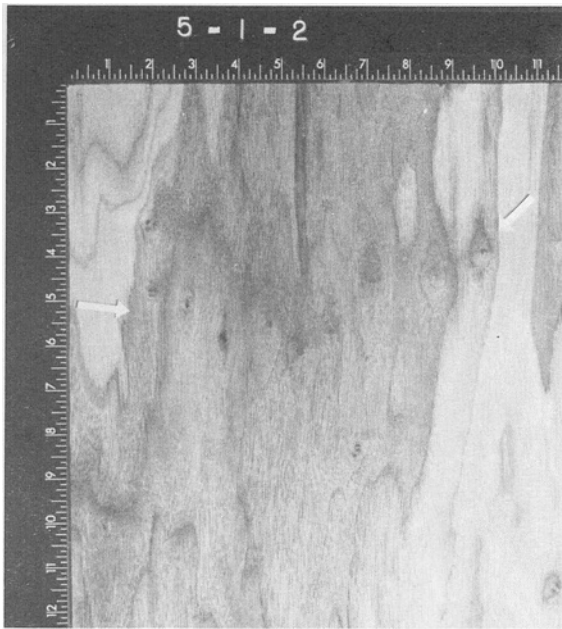
Stereo view of defect indicator



Depth below

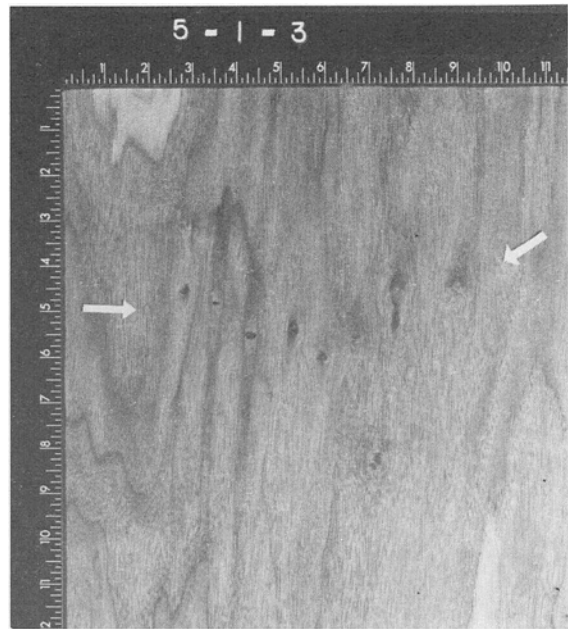
Defect size.	1 x 10 inches
Log diameter at defect (ib).	13.1 inches
Round-up thickness.	0.5 inch
Core diameter.	6.4 inches
Defect distance above stump.	5.0 feet

Log surface.	2.0 inches
First sheet of veneer.	.15 inches



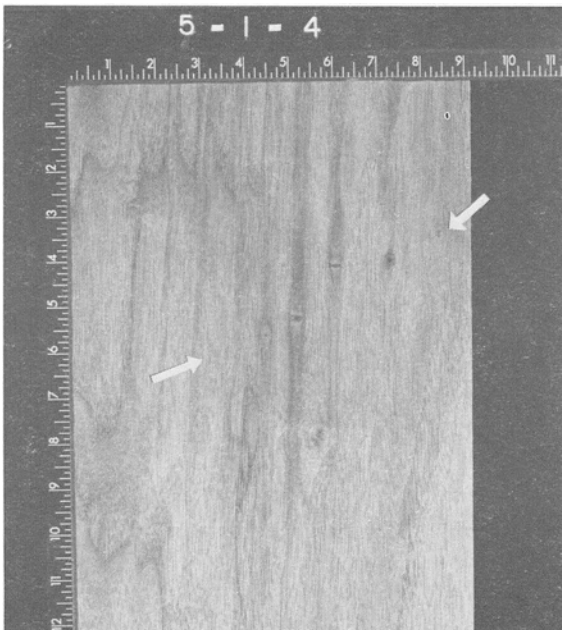
Depth below

Log surface. 2.5 inches
 First sheet of veneer. 2.0 inches



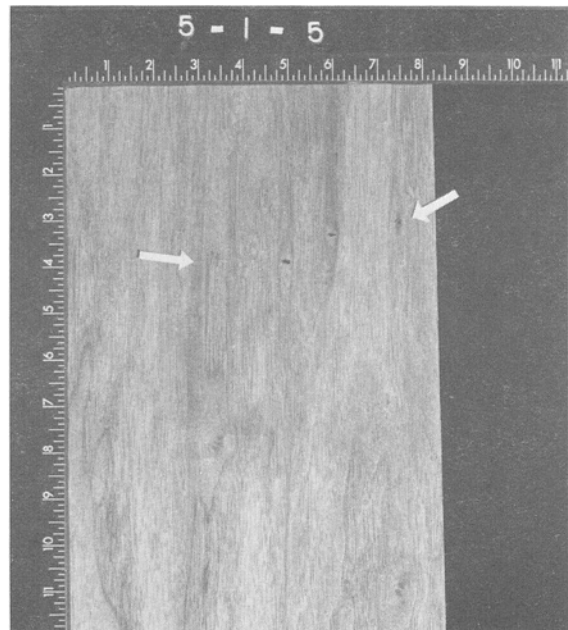
Depth below

Log surface. 2.7 inches
 First sheet of veneer. 2.2 inches



Depth below

Log surface. 3.0 inches
 First sheet of veneer. 2.5 inches



Depth below

Log surface. 3.2 inches
 First sheet of veneer. 2.7 inches

Total Veneer Thickness - 3.3 inches

Bark Distortions

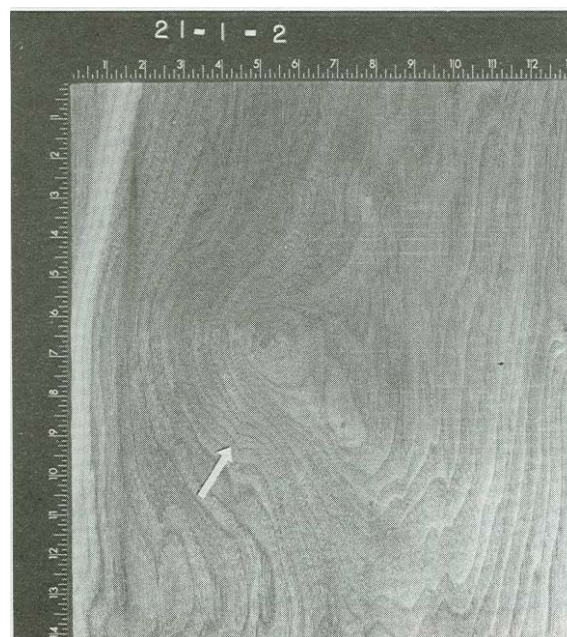
Bark distortions normally indicate, but not necessarily, an overgrown knot and are old enough that they exhibit no height measurement (flush with the normal contour of the bark). They are classified as light, medium, and heavy. A light bark distortion (Fig. 5) shows a slight amount of curvature in the surrounding bark plates, and the bark pattern varies only slightly from normal. Because of these features, light bark distortions are very inconspicuous and often over

looked. Medium bark distortions (Fig. 6) show more signs of the concentric circles, but they are broken in several areas by flat bark plates or the regular bark pattern. Also, there is usually a well-defined break in the bark pattern in the center of the defect indicator. Heavy bark distortions (Fig. 7) are normally identified by the characteristic pattern of concentric circles encompassing the defect indicator.

Figure 5.-Light bark distortion and associated internal defects.



Stereo view of defect indicator



Defect size.	3 x 3 inches
Log diameter at defect (ib)	13.6 inches
Round-up thickness.	0.5 inch
Core diameter.	6.3 inches
Defect distance above stump	14.0 feet

Depth below

Log surface.	3.5 inches
First sheet of veneer.	3.0 inches



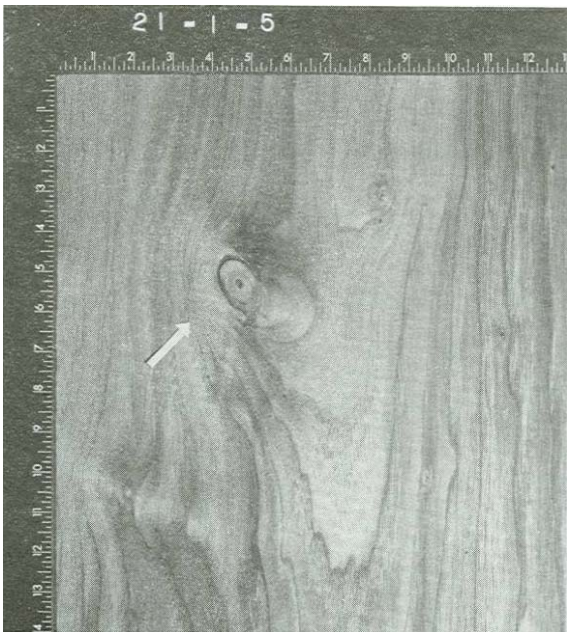
Depth below

Log surface. 4.0 inches
 First sheet of veneer. 3.5 inches



Depth below

Log surface. 4.5 inches
 First sheet of veneer. 4.0 inches

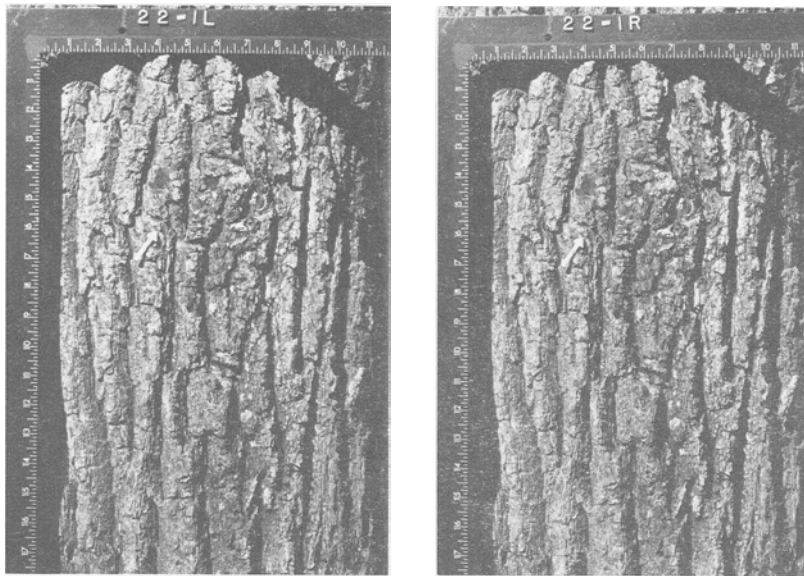


Depth below

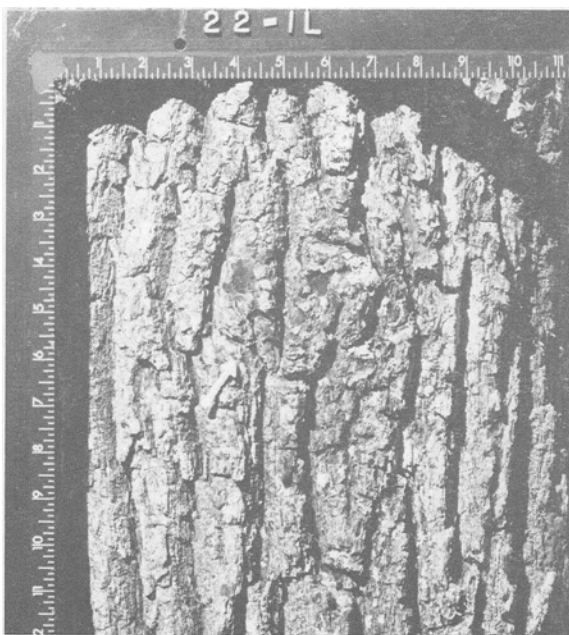
Log surface. 5.0 inches
 First sheet of veneer. 4.5 inches

Total Veneer Thickness - 4.5 inches

Figure 6.-Medium bark distortion and associated internal



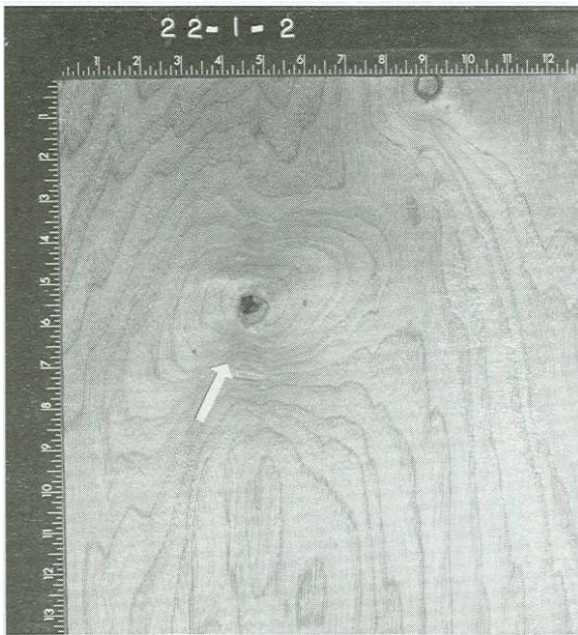
Stereo view of defect indicator



Defect size.....	3 x 3 inches
Log diameter at defect (ib)	13.5 inches
Round-up thickness	0.5 inch
Core diameter	6.3 inches
Defect distance above stump	21.0 feet

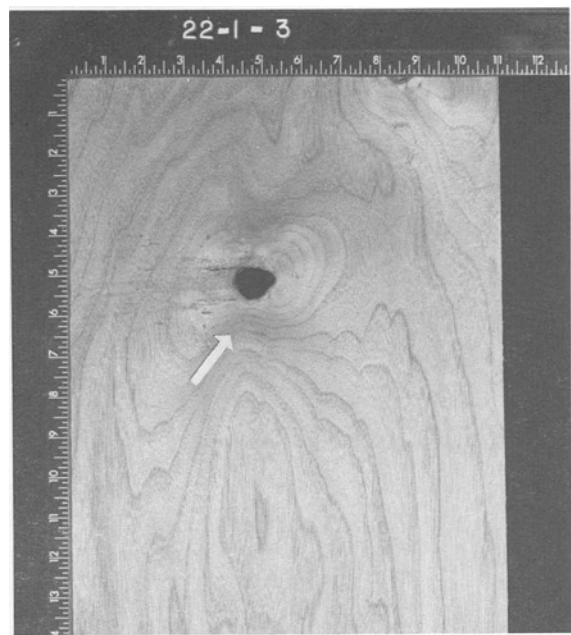
Depth below

Log surface.	2.0 inches
First sheet of veneer.	1.5 inches



Depth below

Log surface. 3.0 inches
 First sheet of veneer. 2.5 inches



Depth below

Log surface. 3.5 inches
 First sheet of veneer. 3.0 inches



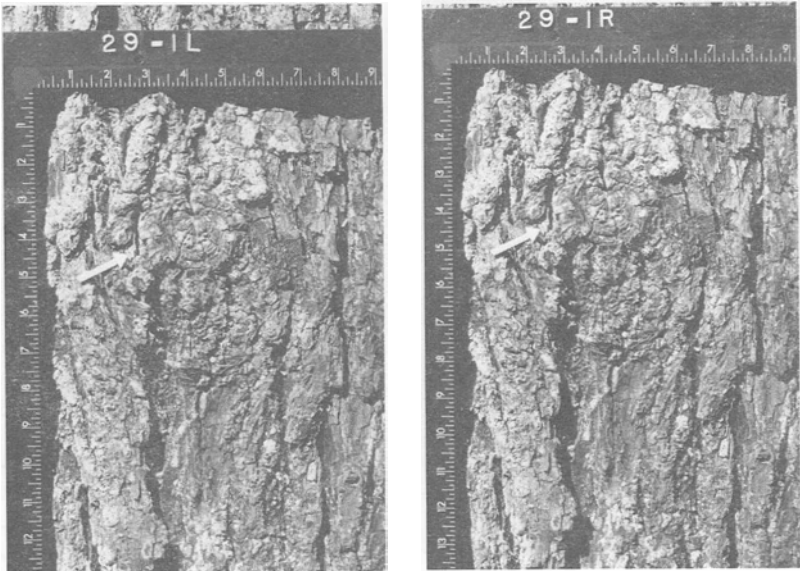
Depth below

Log surface. 4.2 inches
 First sheet of veneer. 3.7 inches
 Total Veneer Thickness - 3.7 inches

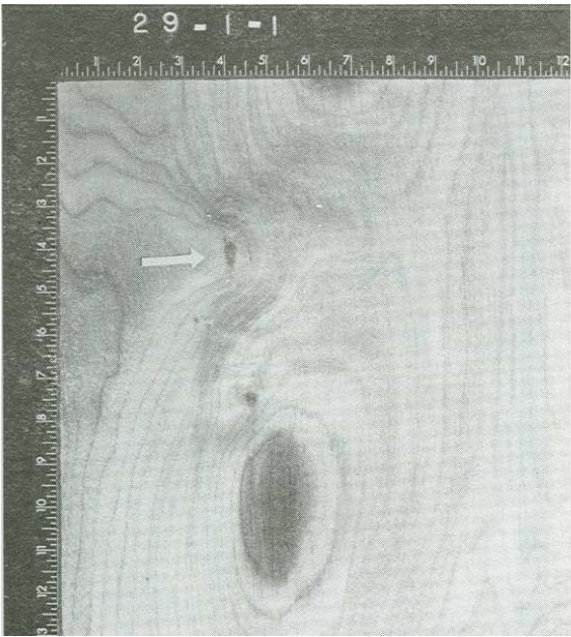
All bark distortions will result in some product degrade, but the amount of degraee-will decrease as the depth to the initial defect below the log surface increases. Light bark distortions are not considered defects in grading factory lumber logs, but medium and heavy distortions are. Likewise, many of the grading systems for veneer logs disregard light bark distortions. If we increase the log diameter for the light and medium distortions (Figs. 5 and 6) so they

are equal to the diameter of the heavy distortion (Fig. 7), then the depth below the log surface to the first sign of the defect would be approximately 5.0 inches, 3.5 inches, and 1.5 inches, respectively. This clear area between the log surface and the defect is very important in determining product suitability and, therefore, the log's economic value.

Figure 7.-Heavy bark distortion and associated internal defects.

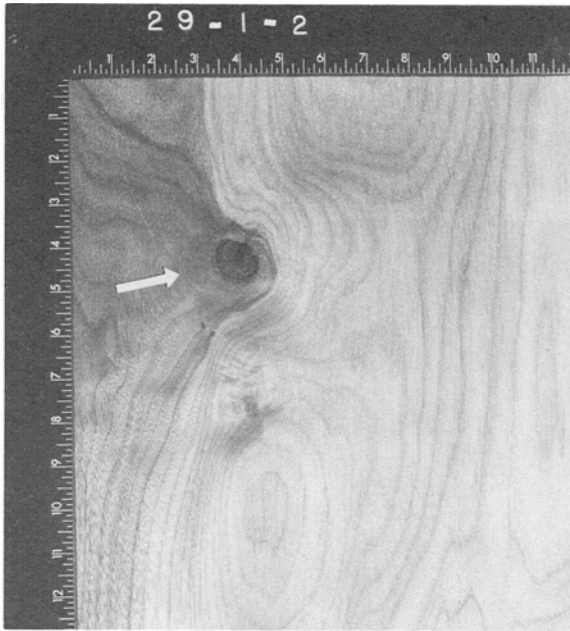


Stereo view of defect indicator



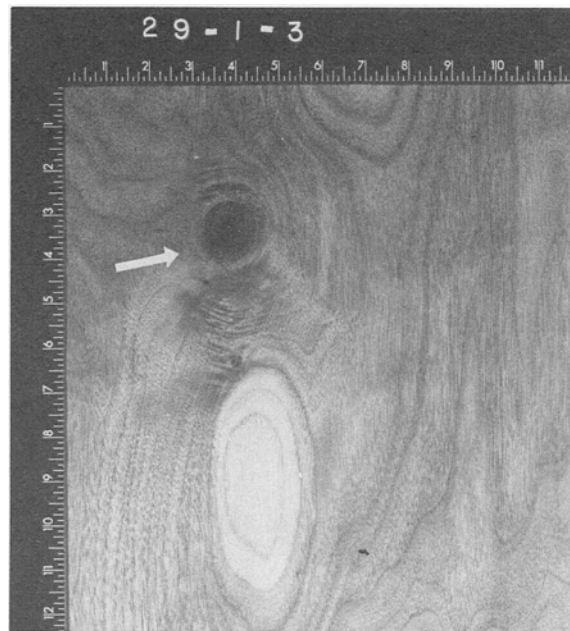
Defect size	2 x 2 inches
Log diameter at defect (ib)	16.5 inches
Round-up thickness	0.0 inch
Core diameter	6.2 inches
Defect distance above stump	10.0 feet

Depth below	
Log surface.	1.5 inches
First sheet of veneer.	1.5 inches



Depth below

Log surface. 3.0 inches
 First sheet of veneer. 3.0 inches



Depth below

Log surface. 4.0 inches
 First sheet of veneer 4.0 inches



Depth below

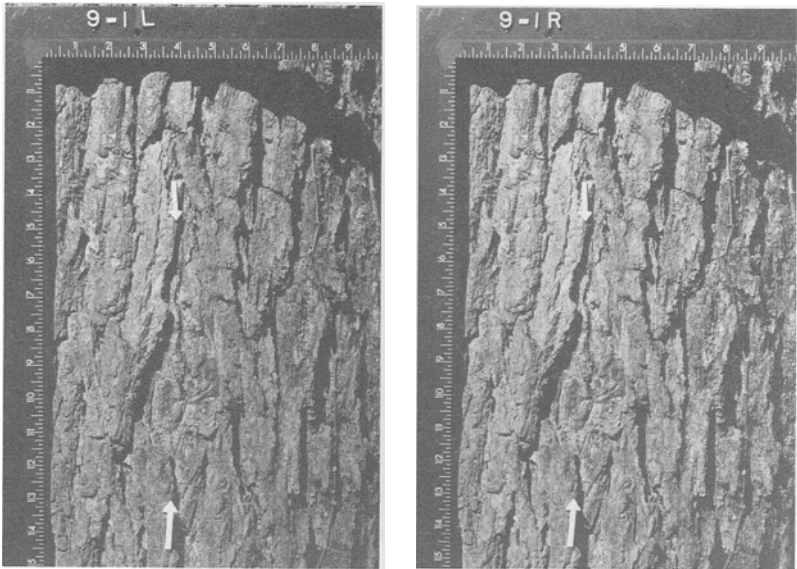
Log surface. 6.0 inches
 First sheet of veneer. 6.0 inches
 Total Veneer Thickness - 6.0 inches

Sound Wound

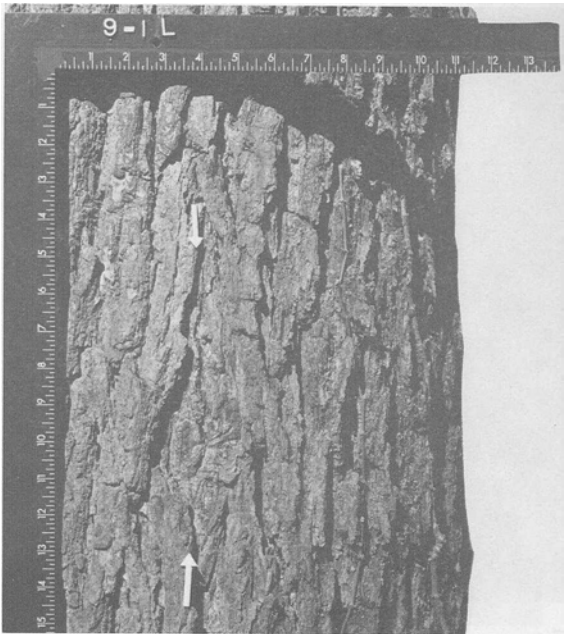
Wounds can originate from a wide range of causes-from the individual with a hatchet to a limb or another tree falling against the tree. Wounds are classified into two categories: sound and unsound. Sound wounds may or may not be grade defects depending on their age and depth. If a wound is recent and can be slabbed off during sawing or if it is very deep and falls in the heart center of the log (Rast et al. 1973), then it results in very little degrade. Whether a

wound becomes unsound depends on the type, severity, time of year of occurrence, and tree vigor. The defect in Figure 8 was probably a clean, smooth removal of the bark and possibly some wood on a fast-growing tree because the first and last evidence of the defect in the veneer is contained within one-half inch. The major distinction between the defect indicators of overgrown knots and wounds is the lack of concentric circles associated with wounds.

Figure 8.-Sound wound and associated internal defects.



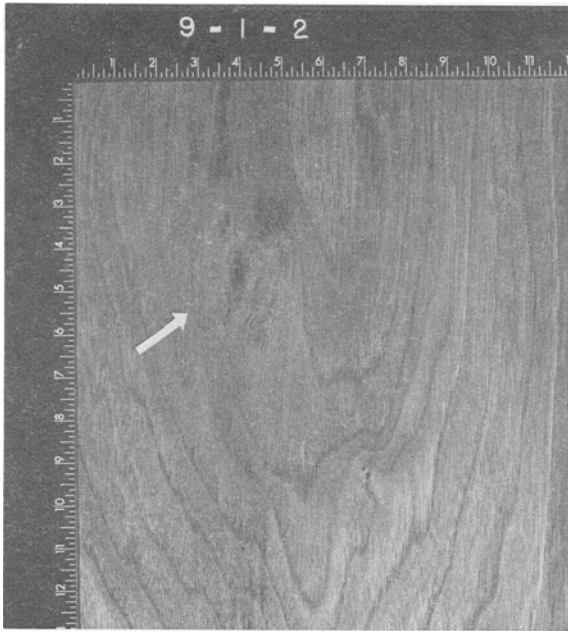
Stereo view of defect indicator



Depth below

Defect size	4 x 2 inches
Log diameter at defect (ib)	18.3 inches
Round-up thickness	0.5 inch
Core diameter	6.5 inches
Defect distance above stump	6.0 feet

Log surface.	4.0 inches
First sheet of veneer.	3.5 inches



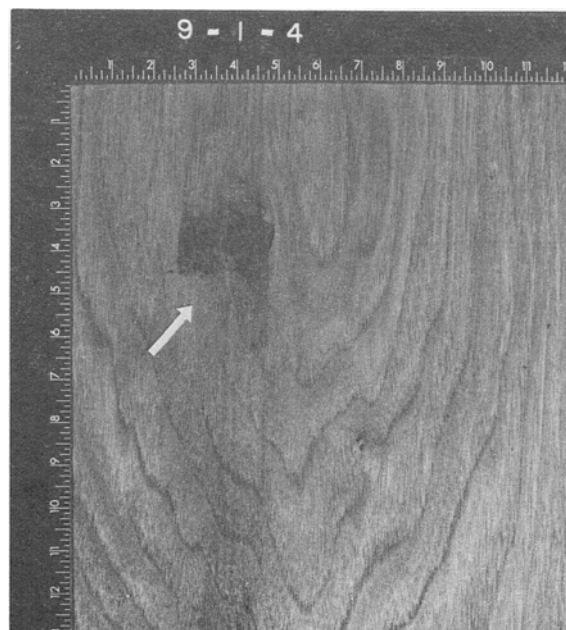
Depth below

Log surface. 4.3 inches
 First sheet of veneer. 3.8 inches



Depth below

Log surface. 4.4 inches
 First sheet of veneer. 3.9 inches



Depth below

Log surface. 4.5 inches
 First sheet of veneer. 4.0 inches

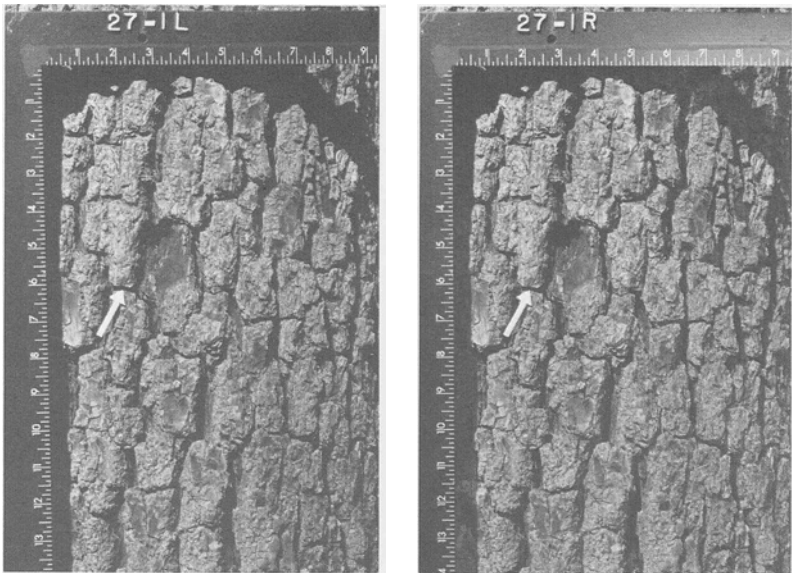
Total Veneer Thickness - 6.0 inches

Hole

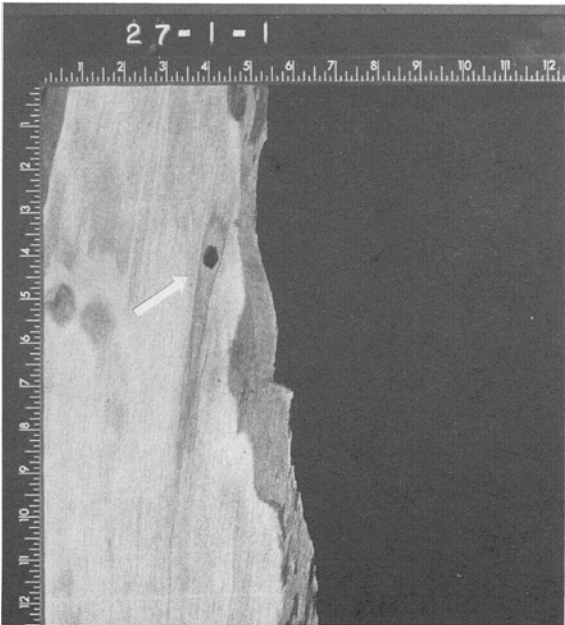
Holes caused by woodpeckers can be very serious to all trees or logs, but they usually occur only on trees that have serious decay problems. When woodpeckers attack healthy trees and make only an abortive attempt of producing a large hole (Fig. 9), then the physical damage is usually minimal. As this example shows, the hole only

penetrated seven tenths of an inch into the wood. Even though this was a fairly recent attack, stain has already begun to spread both above and below the hole. These holes make an excellent entrance for insects and pathogens.

Figure 9.-Hole (woodpecker) and associated internal defects.

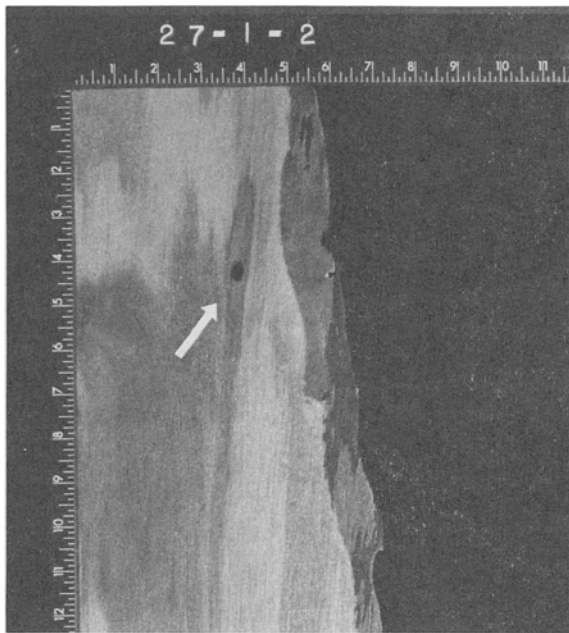


Stereo view of defect indicator



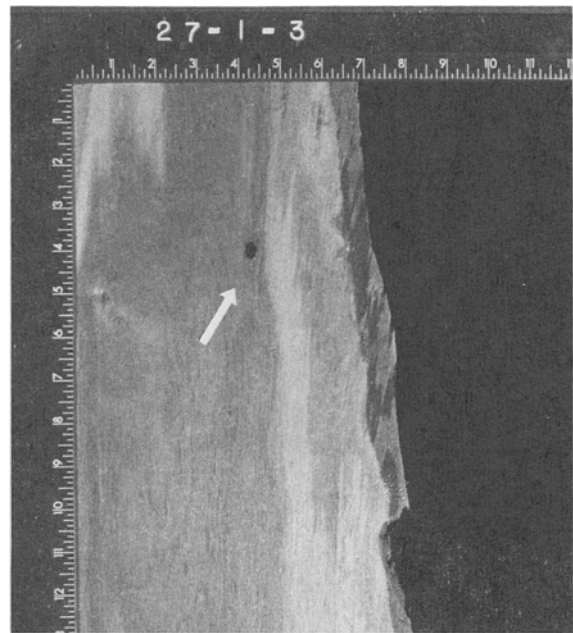
Defect size	1 x 1 inch
Log diameter at defect (ib)	15.2 inches
Round-up thickness	0.0 inch 6.5
Core diameter	inches 10.0
Defect distance above stump	feet

Depth below	
Log surface.	0.3 inch
First sheet of veneer.	0.3 inch



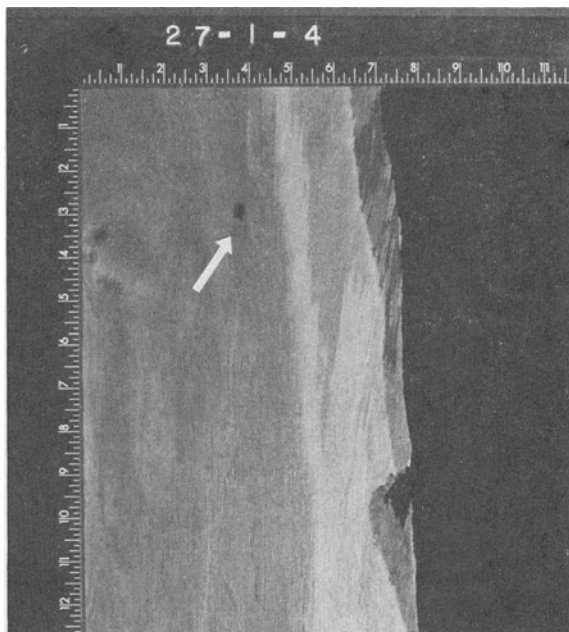
Depth below

Log surface. 0.4 inch
First sheet of veneer. 0.4 inch



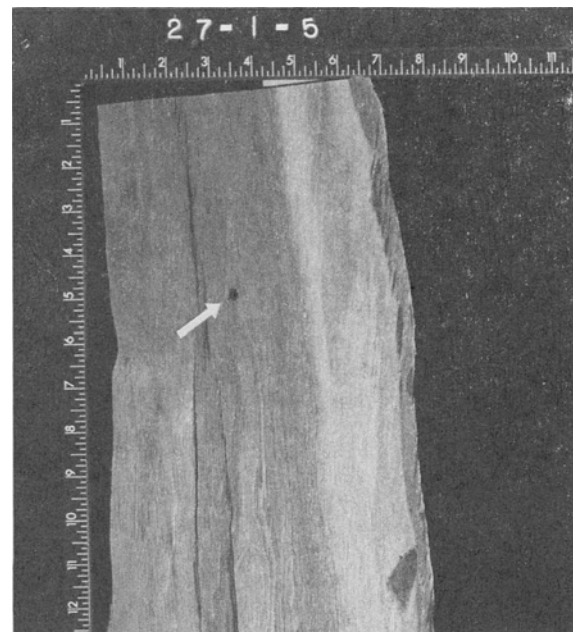
Depth below

Log surface. 0.5 inch
First sheet of veneer. 0.5 inch



Depth below

Log surface. 0.6 inch
First sheet of veneer. 0.6 inch



Depth below

Log surface. 0.7 inch
First sheet of veneer. 0.7 inch

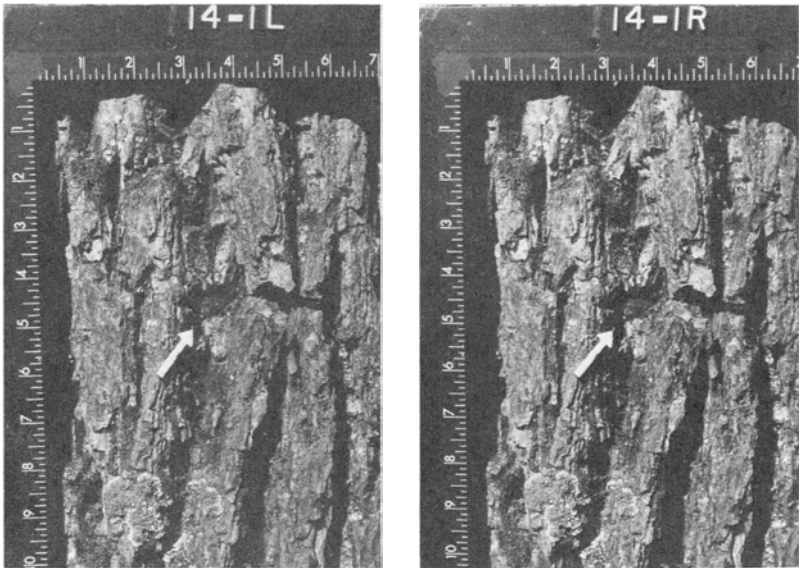
Total Veneer Thickness - 4.2 inches

Gunshot (Slug) Damage

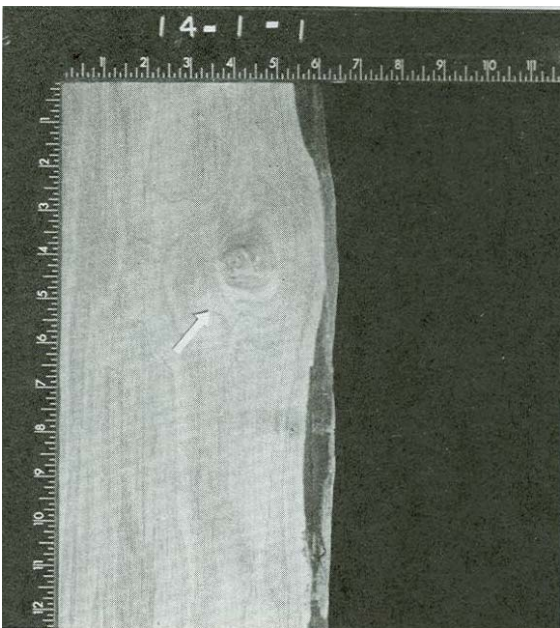
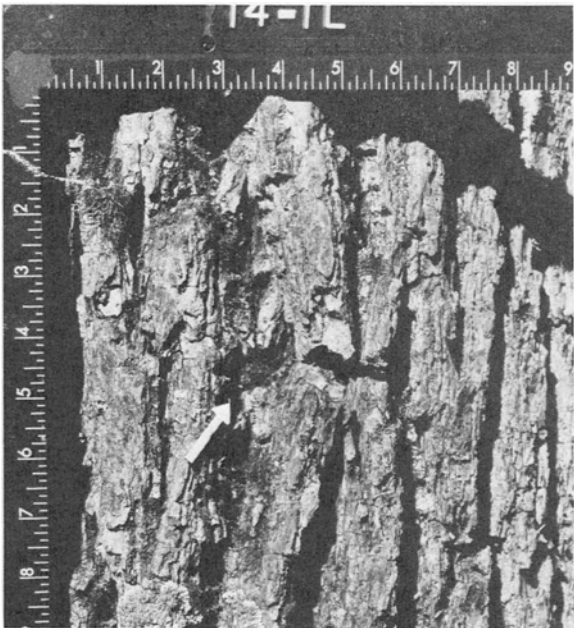
This defect indicator is very similar in appearance to certain insect attacks. The gunshot indicator (Fig. 10) is nearly circular and has an almost smooth surface, whereas insect defect indicators that have healed over are larger in size, and more oblong in shape with a ripply surface and a seam-like line running through the center of the defect indicator. Gunshot wounds have very little stain if the bullet is lead.

Also, the hole closes fairly rapidly and is not kept open for a period of time like those of insects. Gunshot wounds can be doubly damaging particularly in veneer logs. As in this example, the defect affected 1 % inches of veneer and also can be potentially damaging to the veneer knife depending on the type of bullet.

Figure 10.-Gunshot (slug) and associated internal defects.

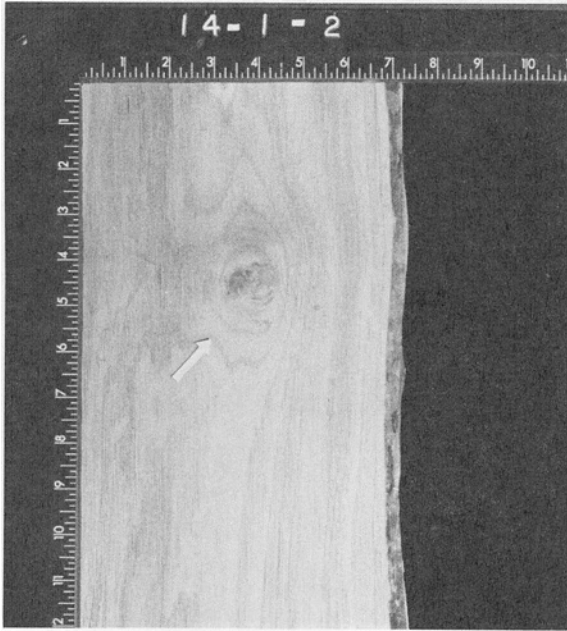


Stereo view of defect indicator



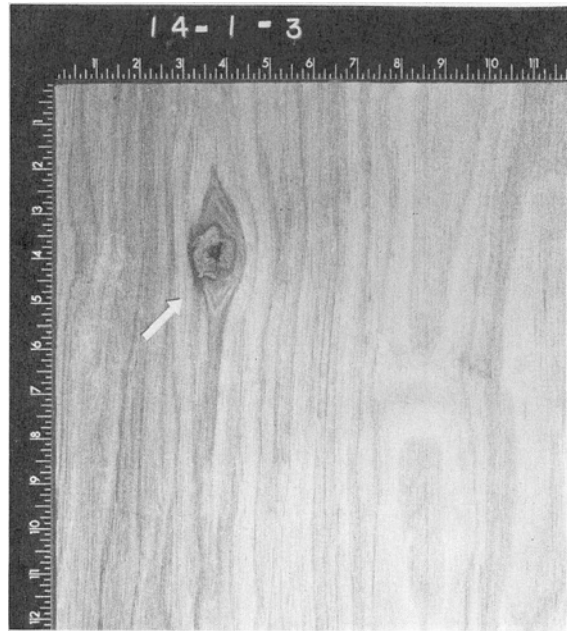
Defect size 1 x 1 inch
Log diameter at defect (ib) 18.0 inches
Round-up thickness 0.0 inch
Core diameter 6.6 inches
Defect distance above stump 4.5 feet

Depth below
Log surface. 0.5 inch
First sheet of veneer. 0.5 inch



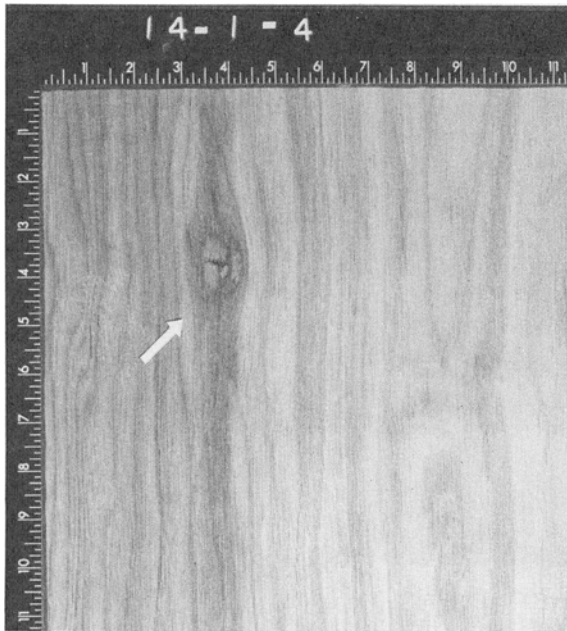
Depth below

Log surface. 1.0 inch
First sheet of veneer. 1.0 inch



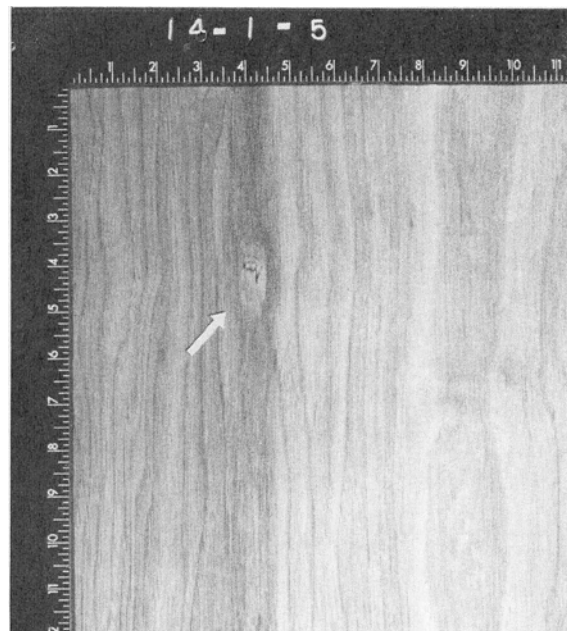
Depth below

Log surface. 1.5 inches
First sheet of veneer. 1.5 inches



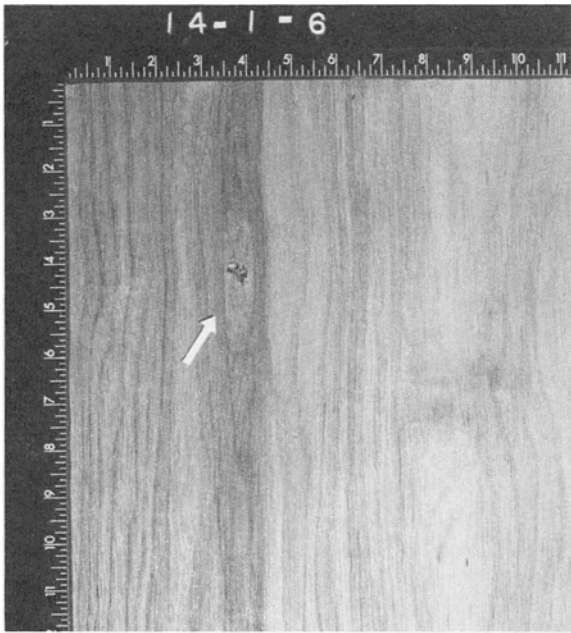
Depth below

Log surface. 1.6 inches
First sheet of veneer. 1.6 inches



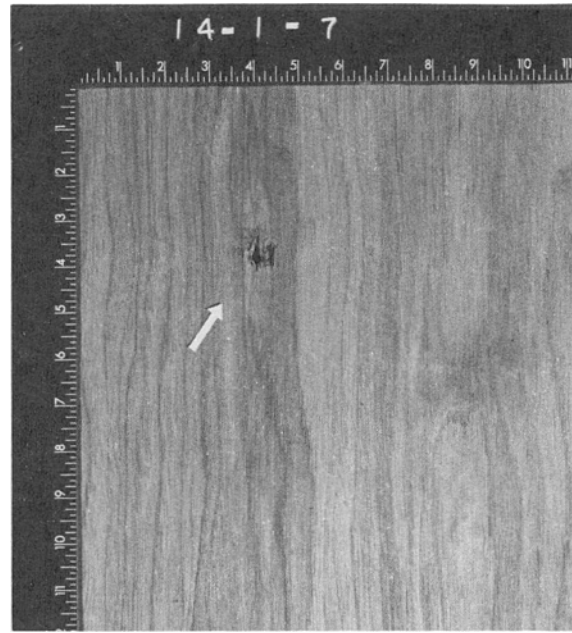
Depth below

Log surface. 1.7 inches
First sheet of veneer. 1.7 inches



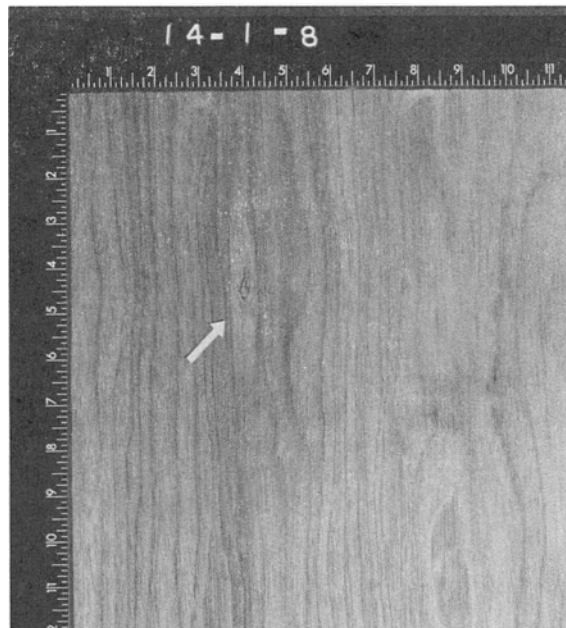
Depth below

Log surface. 1.8 inches
 First sheet of veneer. 1.8 inches



Depth below

Log surface. 1.9 inches
 First sheet of veneer. 1.9 inches



Depth below

Log surface. 2.0 inches
 First sheet of veneer. 2.0 inches

Total Veneer Thickness - 6.0 inches

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To properly classify or grade logs or trees, one must be able to correctly identify defect indicators and assess the effect of the underlying defect on possible end products. This guide aids the individual in identifying the surface defect indicator and also shows the progressive stages of the defect throughout its development for black walnut. It illustrates and describes 10 types of external defect indicators and associated defects that are particularly difficult to evaluate.

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Keywords: Defect identification; photo guide; black walnut; quality assessment.

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