# Compression Wood in Weeviled Northern White Pine

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**It has often been assumed that straightened weeviled white pine stems are as satisfactory for saw logs as unweeviled stems. The present paper points out that besides such obvious defects as cross-grain and large knots in such stems, the occurrence of compression wood is a serious defect.**

THE white pine weevil (*Pissodes strobi* Peck), by killing the leader, causes a number of defects in the bole of the tree which degrade the lumber sawn from the affected section. The more conspicuous of these defects are cross-grain and large knots. Another form of defect, compression wood, is also present but this has received little attention.

Compression wood is brittle, checks badly, and causes boards containing it to warp excessively. Lumber containing it is undesirable for practically all uses. It has been shown (*2, 6*) that compression wood may occur on the lower sides of non-vertical trunks or portions of trunks of conifers. The physiological causes of compression wood formation are not yet clearly understood. The reactions involved are very complex; compression, gravity stimulus, and hormonal activity probably being among the causal factors (*1, 2, 3, 4, 5, 6*).

In weeviled white pine (*Pinus strobus* L.), distortion of the trunk results from attempts of the tree to recover normal form after the leader has been killed by the weevil. In the majority of cases one of the lateral branches of the uppermost healthy whorl assumes a more or less vertical position and takes over the function of the lost leader. This actual upward swing of the lateral partly but never completely straightens the bole. Above the "weeviled node," from which the new leader originates, the stem arches with the concavity toward the side of the original killed leader. Below the "weeviled node" the stem bends slightly toward the same side. This is clearly illustrated by a longitudinal section taken through the pith line of a tree many years after weevil attack (Fig. 1).

As a result of this process, two regions of stress are formed in the bole. One, and by far the more significant, is at the weeviled node and on that side of the pith line opposite the original killed leader. The other is above the weeviled node and on the side of the pith line toward the killed leader. Inasmuch as the actual swing of the new leader to a more or less perpendicular position practically ceases within two or three years after the weevil attack, the subsequent reduction of the crook in the bole is accomplished by eccentric radial growth at the two regions of stress. It is at these regions of stress that compression wood develops, but inasmuch as this is formed to only a negligible extent in the arch above the weeviled node, the lower region only is of importance.

The development of compression wood was studied in 19 sections taken from 14 white pine trees cut at the Yale Forest near Keene, New Hampshire, in the summer of 1938. These trees were 39 to 45 years old, 37.6 to 49.5 feet high, and 4.2 to 7.7 inches d.b.h. The weeviled nodes occurred at heights of 3 to 14 feet except one case at a height of 26.3 feet. The offset, at the time of cutting, of the arch above the weeviled node from the line of the bole below varied from 0.2 to 1.7 inches on the side opposite the killed leader (left side as illustrated in Fig. 1). The mean offset was $0.9 \pm 0.11$ inches. The original offset before the occurrence of appreciable eccentric growth, as measured by deviation of the pith line of the new leader from the line of the pith below, varied from 0.6 to 3.1 inches. The mean pith offset was $1.88 \pm 0.17$ inches.

It is assumed that, in the final crop, these trees would be considered straight; that is, the recovery from weevil injury would be practically complete superficially, because of the small offset at the present diameter. As no weevil control by pruning dead leaders had been practiced in this stand, the straightening of the bole was not affected by any artificial treatment.

The sections were cut about 6 feet in length with the weeviled node approximately in the center. A board was then sawn from the middle of the log and in the plane of the greatest offset. This board was then planed and shaved down until the pith was visible. The result was a longitudinal section through the pith line (center of growth) of the log showing both the maximum external offset and the maximum pith offset. The latter, which represents the limit of actual upward swing of the new leader after weevil attack, was always greater than the former (Fig. 1).

Compression wood was present to such an extent in most of these logs as to cause a serious defect in the lumber sawn from the center of them. On the average, marked compression wood extended 1.9 inches in a horizontal direction from the pith outward on the new leader side of the weeviled node and 9.4 inches in a vertical direction.

A correlation was noted between the pith offset and the horizontal extent of the compression wood. This correlation is expressed by the formula:

$$Y = -0.19 + 1.14X$$

where $Y$ is the horizontal extent of compression wood and $X$ is the pith offset. The correlation coefficient was calculated to be 0.813 which was very highly significant when tested by the $t$ test (7). This indicates that the horizontal extent of the compression wood formed will roughly equal the pith offset. No significant correlation could be obtained between the vertical extent of compression wood and the pith offset.

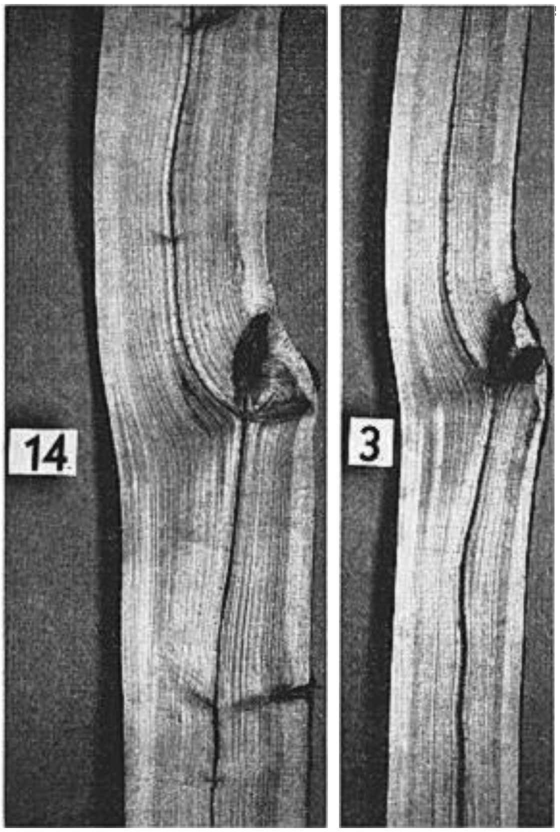


Fig. 1.—Longitudinal sections through the pith line of two weeviled white pines. Compression wood is clearly shown at the "weeviled node," opposite the numbers.

The formation of compression wood in the trunks of weeviled white pines simply emphasizes the fact that the more rapidly the bole straightens after weeviling, the less is the defect. It is much more desirable to have the crook overcome by the actual upward swing of the lateral branch which assumes the function of the leader than by eccentric radial growth over a period of many years.

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