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Extent of Decay Associated With *Fomes Igniarius* Sporophores in Colorado Aspen

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The most destructive decay of aspen (*Populus tremuloides* Michx.) is caused by *Fomes igniarius* var. *populinus* (Neu.) Camb. This fungus accounted for 59 percent of the decay found in a recent study of aspen in Colorado (5).[2] It is almost impossible to find stands of any age that are not damaged to some degree by *F. igniarius*, and trees with advanced stages of decay usually bear numerous sporophores (2) or conks (Fig. 1).

The abundant fruiting of *F. igniarius* on aspen and closely related trees has led to a number of attempts to relate decay cull to the number, size, and distribution of conks as an aid to cruising and scaling. In one phase of a general investigation of heartwood decays in poplars on the Petawawa Forest Experiment Station Reserve, Ontario, Riley and Bier (7) found that decay extended a variable distance (1 to 6 feet) above and below *F. igniarius* conks. Since only 11 trees were studied in this phase, the authors did not attempt to develop rules for culling. In Minnesota aspen, Horton and Hendee found that the length of decay, which ranged from 2 to 5 1/2 feet above and below fruiting bodies, was related to both the size and number of the fruiting bodies (6). In another Minnesota study, Brown concluded that the extent of *F. igniarius* decay was more closely related to the maximum height than to the number of conks on aspen trunks (3). Christensen et al. (4) state that site index, degree of suppression, rate of growth of the tree, and other factors would make it difficult to establish any general rule for accurately estimating decay cull in aspen from conks or other external indicators.

Despite these conflicting findings, and as a followup of earlier work in Colorado (5), the present study was made to determine the upper and lower limits and volume of decay associated with *F. igniarius* conks on individual trees. Such information would be useful in appraising the merchantability of aspen stands, and might lead to more complete utilization of partially decayed trees that are now considered total losses.

[1] *The author gratefully acknowledges the assistance of Ross W. Davidson, formerly with the Beltsville Forest Disease Laboratory, in identifying numerous decay fungi.*

[2] *Numbers in parentheses refer to Literature Cited at the end of this Note.*

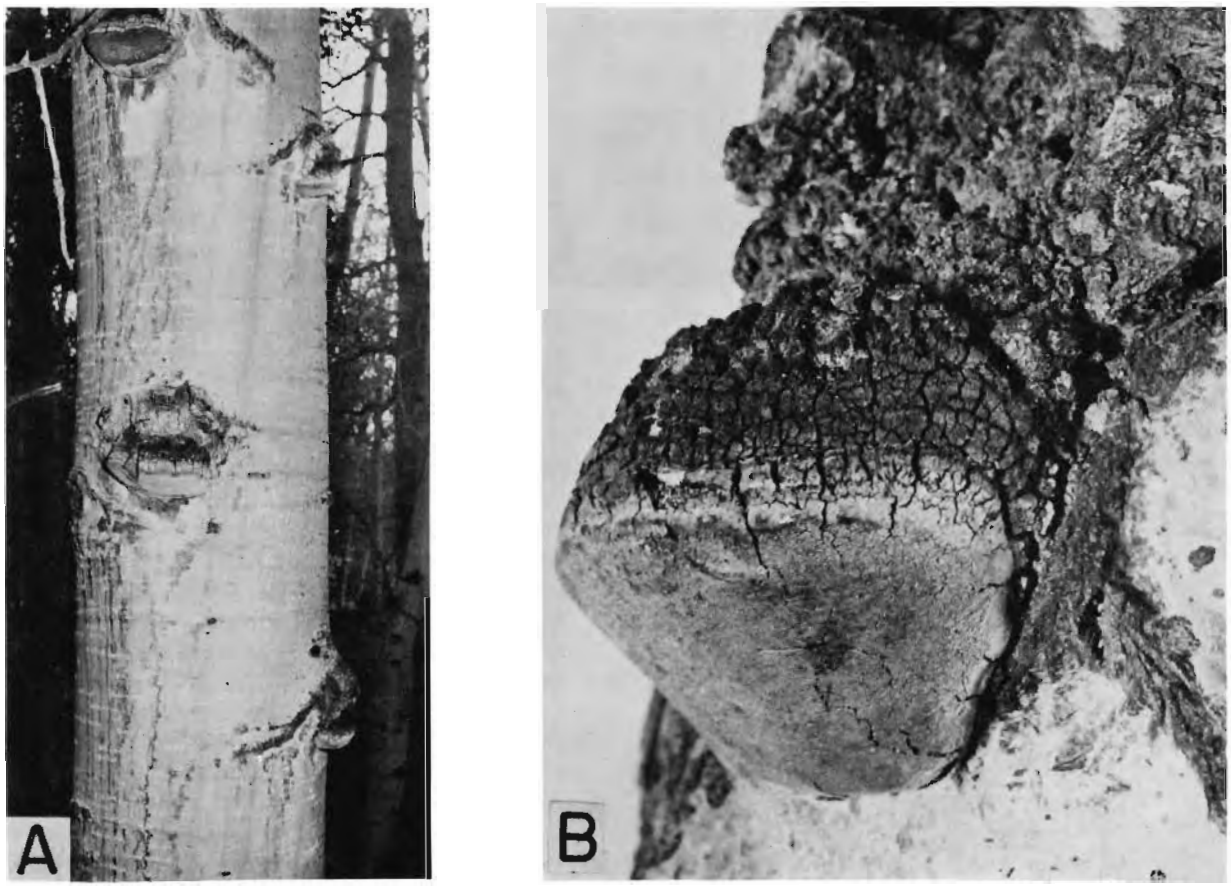

Figure 1.--A, Fomes igniarius sporophores on a 12-inch d.b.h. aspen. B, Sporophore, actual size.

FIELD METHODS

The study was limited to dominant, codominant, and intermediate trees of merchantable size bearing F. igniarius conks. Groups of 5 to 15 such trees were selected in representative aspen stands of apparently uniform site and age class. The elevation, aspect, and slope were recorded for each group. Site class was determined from the age and height of dominant and codominant trees in accordance with Baker's site classification (1).

Diameter at breast height, crown class, tree vigor, approximate location of sporophores and other external decay indicators were recorded on individual tree forms before trees were felled. After felling, total tree height and actual height and size of all sporophores were recorded.

A total of 113 trees were examined on 11 areas in the Grand Mesa - Uncompahgre, Roosevelt, Routt, San Juan, and White River National Forests in Colorado in 1959 and 1960. The sampled stands occurred on sites 1 to 3 and ranged in age from 85 to 175 years. The study trees varied from 8 to 23 inches in diameter at breast height, and all contained F. igniarius decay.

Each tree was cut into 8-foot bolts to a top diameter of 4 inches inside bark. Diameter inside bark and average diameter of visible decay were recorded for each cut. The upper and lower limits of rot columns were determined by further dissection of bolts. Where the identity of the causal fungus was in doubt, field isolations were made and the resulting cultures submitted to the Beltsville Forest Disease Laboratory for determination.

Board-foot volumes to a 6-inch top and cubic-foot volumes to a 4-inch top were calculated by means of the Scribner Decimal C Log Rule and Smalian's formula, respectively. Board-foot defect volumes were calculated according to standard scaling practice. Cubic-foot rot volumes were calculated by Smalian's formula except that, where rot ended within a bolt, it was treated as a cone.

RESULTS

Total cull amounted to 80 percent of the gross board-foot volume (34 percent of the cubic-foot volume) in this study. F. igniarius accounted for 89 percent of the board-foot cull (91 percent of the cubic-foot cull), and the remaining cull attributed to other decays was omitted from the calculations.

Average length of decay above the highest sporophore was 13.0 ± 0.8 feet. Only 27 trees had decay that did not extend to ground level, and the average length of decay below the lowest sporophore was 10.9 ± 0.9 feet for these trees. The average lengths of decay above and below sporophores were not significantly different, so they were combined to give an average of 12.0 ± 0.7 feet.

A summary of the number of sporophores per tree and percentage of cull is shown below:

Total sporophores (No.)	Trees (No.)	Board-foot cull (Pct.)	Cubic-foot cull (Pct.)
1 - 3	35	61 ± 3.6	19 ± 1.9
4 - 9	46	79 ± 2.8	35 ± 1.9
10 +	32	95 ± 1.5	47 ± 2.3

The height of the highest sporophore by 16-foot height classes and percentage of cull is given in the following tabulation:

Height of highest sporophores (Ft.)	Trees (No.)	Board-foot cull (Pct.)	Cubic-foot cull (Pct.)
0 - 16	41	57 ± 3.3	21 ± 1.7
17 - 32	41	74 ± 3.4	31 ± 2.5
33 +	31	87 ± 2.5	44 ± 2.5

There was no apparent relationship between amount of decay and other factors such as age class, aspect, crown class, elevation, linear distribution of sporophores, rot diameter at breast height, site, sporophore size, and tree diameter.

DISCUSSION

In commercial aspen stands in Colorado, any tree bearing F. igniarius sporophores is usually considered to be a cull (that is, at least two-thirds of the board-foot volume lost due to decay). The above results suggest that this practice results in some waste, particularly in trees that have only a few sporophores or when the sporophores are low on the bole. In the 41 trees with sporophores 0 to 16 feet high, although 44 percent of the 119 logs were complete culls, 56 percent were merchantable and 46 percent were completely free of decay. Of the 112 logs in the 35 trees with 1 to 3 sporophores, 46 percent were complete culls, 54 percent were merchantable, and 41 percent were completely free of decay.

There was no significant difference in amount of cull in trees bearing 1 to 3 sporophores at any height and any number of sporophores 0 to 16 feet on the bole. The two classes were combined to give 59 ± 3.2 percent board-foot cull (20 ± 1.6 percent cubic-foot cull). The 52 trees in these two classes contained 156 logs, of which 49 percent were culls, 51 percent merchantable, and 39 percent free of decay. Measurement of tree volumes would be simplified if the cull of the combined classes were used. On a board-foot basis, a tree with 1 to 3 sporophores located any place on the bole or a tree with any number of sporophores not higher than 16 feet on the bole would be classified as merchantable (59 percent cull). A tree with sporophores not in these two classes would be unmerchantable.

Fire wounds are common in aspen stands over 85 years old in Colorado. Some of the old wounds are still open and, no doubt, provided excellent infection courts for decay. In this study, 43 percent of the sample trees had old basal wounds, the result of fire or fallen trees. Because of these basal wounds and subsequent decay, it is not out of the ordinary to find longer decay columns and greater cull than found in the studies mentioned earlier.

Davidson et al. (5) found that decay averaged 25 percent of the cubic-foot volume in trees infected with F. igniarius. This average included incipient infections in young trees, and suggested that decayed wood volumes in older stands where sporophores were present would be somewhat higher. Total cubic-foot volume of decay in the present study amounted to 31 percent of the gross cubic-foot volume.

SUMMARY

A total of 113 commercial-sized aspen bearing Fomes igniarius sporophores were felled and dissected on 11 areas in 5 National Forests of Colorado. Average length of decay above and below the highest and lowest sporophore was 12.0 ± 0.7 feet. Estimated board-foot cull for an individual tree with 1 to 3 sporophores at any height, or any number of sporophores 0 to 16 feet on the bole, is 59 ± 3.2 percent (20 ± 1.6 percent cubic-foot cull). A tree with sporophores not in these two classes should be considered a total cull.

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