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DECAY CAUSES LITTLE LOSS IN HICKORY

Abstract.—A study of 600 hickory trees indicated that heart-rot fungi cause little economic loss in species of the genus *Carya*. More than half of the decay volume for which a fungus could be identified was caused by *Poria spiculosa*, one of seven species of heart-rot fungi associated with decay in hickory that were isolated and identified. Basal fire scars, open branch stub scars, large unsound branch stubs, and mechanical injuries were important entry courts for decay fungi.

Hickory (*Carya* spp.) is widely distributed in the Eastern and Central United States. There is a net volume of 24 billion board feet of hickory in sawtimber-size trees—6 percent of the volume of all hardwoods in these states (*2*). Hickory is a valuable wood for many uses, such as furniture, implement handles, sporting goods, charcoal, and fuel. Increasing utilization of hickory has created a need for information about decay losses in the numerous species of the genus *Carya*.

Study Areas and Methods

From 1962 to 1968 we investigated decay in the principal species of deciduous trees in the oak-hickory forest type. One hundred fifty sample areas were selected in even-aged stands from 20 to more than 100 years old in Ohio, Kentucky, Indiana, Illinois, and Missouri. Data for this study were taken from hickory trees found on these sample areas. No attempt was made to separate the different species of hickory.

Each sample area consisted of concentric circular plots of 1/20-, 1/10-, and 1/5 acre. All living trees 3.6 inches d.b.h. (diameter at breast height) and larger were cut on the 1/20-acre plots; trees 5.6 inches d.b.h. and larger were cut on the 1/10-acre plots; and trees 11.6 inches d.b.h. and larger were cut on the 1/5-acre plots. Data collected from trees on the 1/20- and 1/10-acre plots were so weighted that all computations were based on 1/5 acre.

After felling, the trees were cut into 4-foot bolts up to a 4-inch top diameter inside bark and examined for decay. Where decay appeared, its extent and dimensions were determined by splitting the bolts longitudinally. Where external indicators of defects had been noted before the trees were cut into bolts, the indicators were examined, and any decay associated with them was recorded.

The gross volumes of the merchantable trunks and of decay were calculated for each age and size class. No reduction in gross volume was made for trim or breakage.

Cultures were prepared from samples of decayed wood to determine the fungi associated with decay. Sample blocks of decayed wood were split to expose a fresh face of infected wood. Six cores of infected wood, approximately 4 mm in diameter, were removed from each block with a sterilized increment hammer and placed in test tubes containing 2.5 percent Fleischman's diamalt with 2-percent agar. (Mention of a particular product should not be taken as endorsement by the Forest Service or the U.S. Department of Agriculture.) When the decay fungus was not isolated on the first attempt, re-isolations were attempted.

Decay vs. Tree Age and Diameter

The hickory industry frequently uses small, young trees. Age-decay and diameter-decay relationships indicate that heart-rot fungi cause little economic loss in hickory trees less than 100 years old or 11.6 inches in d.b.h. (tables 1 and 2). In fact, no decay was found in any of the 201 trees under 50 years old. Only 16.67 percent of the 600 trees in the study had measurable amounts of decay, and the overall loss was only 1.58 percent of the gross volume.

Table 1.—*Relationship between age and decay in living hickory trees*

Age class (years)	Trees	Gross Volume	Trees with decay	Decay volume as percent of gross
	No.	*Cu. ft.*	*Pct.*	*Pct.*
20 to 50	201	328.51	0.00	0.00
50 to 100	332	2,126.09	20.18	.96
100+	67	1,370.47	49.25	2.92

Table 2.—*Relationship between diameter and decay in living hickory trees*

Diameter class (inches)	Trees	Gross volume	Trees with decay	Decay volume as percent of gross
	No.	*Cu. ft.*	*Pct.*	*Pct.*
3.6-11.5	558	2,433.54	14.69	0.94
11.6-17.5	39	1,155.34	38.46	2.56
17.6-21.5	3	236.19	100.00	3.47

The Decay Fungi

Decay columns often become inactive after the entry point has healed (*3*). Almost 75 percent of the columns in the decayed hickories we examined were inactive, and we were unable to isolate any decay fungi from

Table 3.—*Fungi causing decay in living hickory trees, and portion of the trunk affected*

Fungus (species)	Number of infections			Decay volume (cu. ft.)		
	In butt[1]	In trunk	Total	In butt[1]	In trunk	Total
Poria spiculosa Campbell & Davidson	3	3	6	0.21	11.56	11.77
Poria andersonii (Ell. & Ev.) Neuman	5	8	13	3.43	.43	3.86
Pholiota aurivella (Batsch ex Fr.) Kumm.	1	—	1	2.64	—	2.64
Poria cocos (Schw.) Wolf	3	—	3	2.36	—	2.36
Corticium vellereum Ell. & Cragin	3	—	3	1.56	—	1.56
Polyporus adustus Willd. ex Fr.	2	—	2	1.10	—	1.10
Corticium galactinum (Fr.) Burt.	—	1	1	—	.05	.05
Unknown[2]	59	27	86	28.31	8.85	37.16
Total	76	39	115	39.61	20.89	60.50

[1]Decay originating at stump height or below.
[2]Decay columns from which we were unable to isolate any heart-rot fungi.

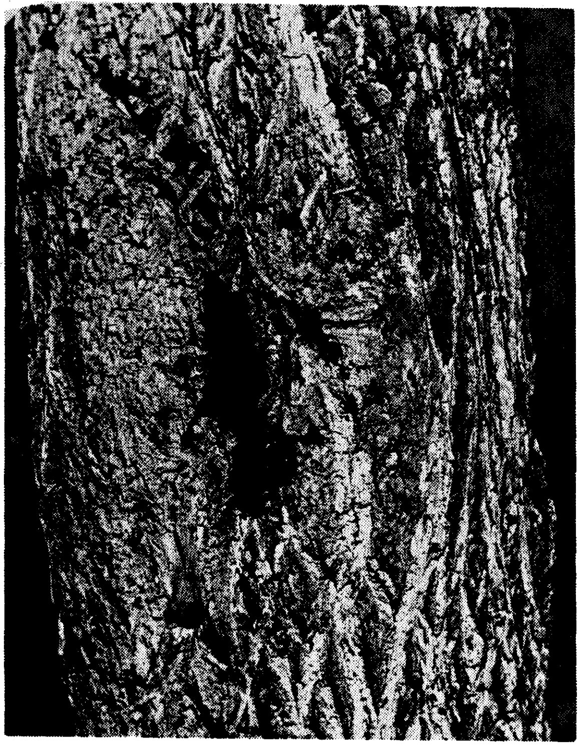

Figure 1.—Rot canker associated with *Poria spiculosa* on shagbark hickory.

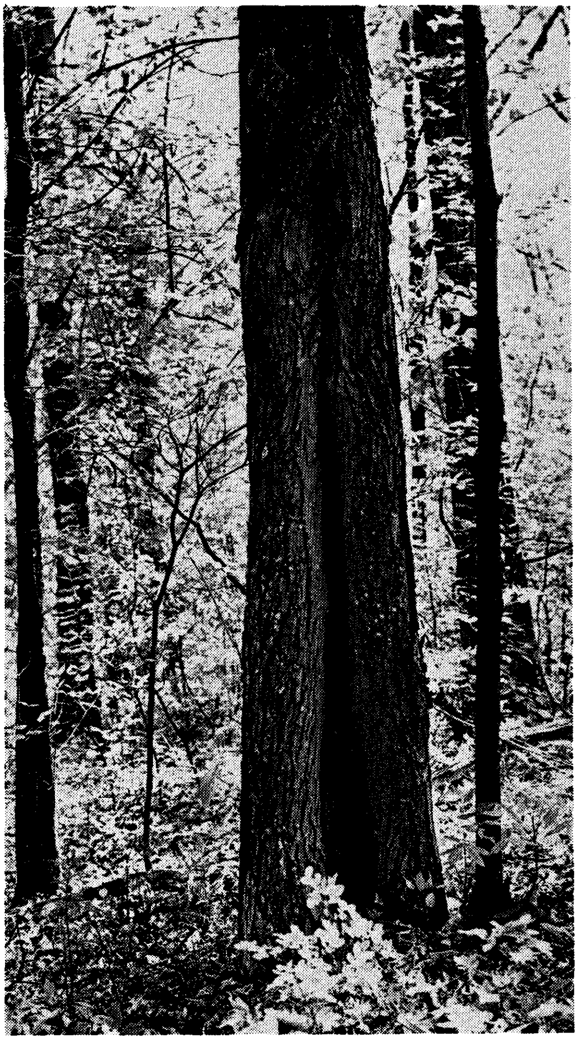

Figure 2.—An open fire scar on hickory.

them. Bacteria and non-decay fungi were recovered from some of the columns. These organisms have been shown to play an important part in the decay process (*4*).

Seven species of heart-rot fungi associated with decay in hickory were isolated and identified (table 3). *Poria spiculosa* Campbell & Davidson caused more than half of the decay volume in which the causative species was identified. This rot, which is accompanied by characteristic cankers (fig. 1), is probably the most widespread and damaging disease of hickory (*1*). Decay volume associated with the other fungus species identified was too small to support any conclusions as to their relative importance.

Decay originating at stump height or below is classified as butt rot; decay originating above stump height, as trunk rot. Two-thirds of the infections resulted in butt rot and accounted for two-thirds of the volume lost to decay.

How Fungi Gained Entry

Most heart-rot fungi enter the central core of living trees through wounds or dead tissue. Fire scars that expose a large area of wood provide an easy means of entry for these fungi (fig. 2). In hickory, more than 57 percent of the decay volume was associated with fire scars (table 4). Other wounds of significance

Table 4.—*Relationship of entry courts to incidence of infection and volume of decay*

Entry court	Infections	Volume of decay	
	No.	*Cu. ft.*	*Pct.*
Fire scars	55	34.52	57.06
Open branch stub scars	9	12.00	19.83
Unsound branch stubs[1]	2	3.60	5.95
Mechanical injuries	6	3.21	5.31
Parent stumps	4	1.67	2.76
Unsound branch stubs[2]	2	1.13	1.87
Branch bumps[2]	2	.31	.51
Sound branch stubs[1]	3	.20	.33
Insect wounds	4	.17	.28
Sound branch stubs[2]	1	.14	.23
Woodpecker injuries	2	.07	.12
Unknown	25	3.48	5.75
Total	115	60.50	100.00

[1]4 inches and more in diameter.
[2]Less than 4 inches in diameter.

in hickory included open branch-stub scars, large unsound branch stubs, and various mechanical injuries. About 33 percent of the total decay volume was associated with these other entry courts.

Conclusion

The hard, strong, durable wood of hickory makes it relatively resistant to decay fungi. Most decay fungi cause little, if any, decay in fairly small, young trees. Therefore, it seems that decay will not limit utilization of the hickory resource.

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