FOREST SERVICE RESEARCH NOTE NE-242
1977

Northeastern Forest Experiment Station

FOREST SERVICE, U.S. DEPT. OF AGRICULTURE, 6816 MARKET STREET, UPPER DARBY, PA. 19082

DECAY IN YELLOW-POPLAR, MAPLE, BLACK GUM, AND ASH IN THE CENTRAL HARDWOOD REGION

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Abstract.—In a study of decay in yellow-poplar (*Liriodendron tulipifera* L.), red maple (*Acer rubrum* L.), sugar maple (*Acer saccharum* Marsh.), black gum (*Nyssa sylvatica* Marsh.), and ash (*Fraxinus* spp.) in the central hardwood region, decay was found in 57 of 148 study trees. Extent of decay, causal fungi, and method of entry are discussed. The relationship between tree age and diameter and decay is also examined.

Several years ago, we investigated the extent of decay in oak stands of the central hardwood region. One hundred fifty sample plots, 1/5-acre in size, were established in well-stocked, undisturbed (except for fire), even-aged oak or oak-hickory stands in Kentucky, Ohio, Indiana, Illinois, and Missouri. Trees 3.6 inches dbh (diameter breast high) and larger were felled and dissected, and decay data were collected. Papers on the extent of decay in oak and hickory, the fungi associated with decay, and the relation of decay to external indicators, tree age, and diameter in these species have been published (*1, 2, 3, 4, 5*).

When hardwood tree species other than oak and hickory were encountered on our plots, these species were also felled and examined for decay. This paper deals with decay in these other hardwood species, namely yellow-poplar (*Liriodendron tulipifera* L.), red maple (*Acer rubrum* L.), sugar maple (*Acer saccharum* Marsh.), black gum (*Nyssa sylvatica* Marsh.), and ash (*Fraxinus* spp.).

Infections and Decay Volumes

Fifty-seven of the 148 study trees had decay (table 1). Sugar maple had the least incidence and amount of decay. Almost half of the red maple trees were infected. Although root and butt infections (41) only slightly exceeded trunk infections (36), 76 percent of the decay volume was in the butts.

The Fungi that Caused Decay

Cultures were prepared from decay samples to determine the fungus species that caused decay. Only about one-fifth of the fungi respon-

Table 1.—*Number of infections and percent of decay volume, by tree bole location, for several hardwood species in the central hardwood region*

Host species	Trees	Trees infected	Infections			Decay volume		
			In butt[1]	In trunk	Total	In butt[1]	In trunk	Total
	No.	*No.*	*No.*	*No.*	*No.*	*Pct.*	*Pct.*	*Cu. ft.*
Yellow-poplar	47	19	12	10	22	82.2	17.8	33.7
Red maple	35	17	15	14	29	78.8	21.2	34.4
Sugar maple	32	7	4	4	8	12.0	88.0	2.5
Black gum	25	10	7	7	14	89.9	10.1	33.8
Ash	9	4	3	1	4	16.3	83.7	10.4
All species	148	57	41	36	77	76.0	24.0	114.8

[1] Decay originating at stump height or below was considered as butt rot.

sible for infections could be identified. Thus we were unable to draw conclusions about the relative importance of the various fungus species. The species of *Coprinus* isolated from a white rot in sugar maple is an undescribed new species near *C. exstinctorius* Fr. *(6)*. Identified fungi associated with decay were as follows, by host species:

Ash:
- None identified.

Black gum:
- **Spongipellis delectans* (Pk.) Murr.

Red maple:
- *Hericium erinaceus* (Bull. ex Fr.) Pers.
- *Pholiota adiposa* (Fr.) Kumm.
- **Pleurotus cystidiosus* O. K. Miller
- *Spongipellis delectans* (Pk.) Murr.
- **Spongipellis fissilis* (Berk. & Curt.) Murr.
- **Inonotus andersonii* (Ell. & Ev.) Černý
- *Hypoxylon deustum* (Hoff. ex Fr.) Grev.

Sugar maple:
- **Coprinus* sp.
- **Inonotus andersonii* (Ell. & Ev.) Černý

Yellow-poplar:
- **Pholiota adiposa* (Fr.) Kumm.
- **Spongipellis fissilis* (Berk. & Curt.) Murr.

How Fungi Gained Entry

As trees were felled and dissected, we attempted to trace established heart-rot infections to the various entry points. Infection courts were characterized by type and frequency of occurrence (table 2).

Fire scars were the most important entry court for decay fungi, accounting for approximately one-third of all infections and 63 percent of the total decay volume. As protection from wild fires in forested areas becomes more efficient, butt rots should be reduced. Mechanical wounds—for example, felling and skidding injuries during partial cutting—were second in importance as entry courts, followed by top damage, unsound branch stubs, and parent stumps. Four of the six infections through unsound branch stubs and all six of the infections through parent stumps were in red maple.

Decay vs. Tree Age and Diameter

The amount of decay in trees of different ages is shown in table 3. In trees up to 70 years old, decay losses were relatively minor in the five hardwood species. Beyond this age, decay volume increased rapidly in red maple and ash. In black gum, decay losses rose rapidly after trees reached 90 years of age. In yellow-poplar and sugar maple, decay losses were minimal for all age classes.

Tree diameter is, of course, a function of age. Hence the percentage of decay volume should increase with diameter as well as age. Generally, this held true (table 4). Indications are that larger yellow-poplar and sugar maple trees are relatively free of decay. It should be pointed out, however, that parts of this analysis are based on a small number of samples.

*These species have not previously been reported on these hosts.

Table 2.—*Infection incidence and percent of decay volume by type of infection court and species*

Host species	Fire scars		Mechanical injuries		Damaged tops		Unsound branch stubs		Parent stumps		Miscellaneous		Unknown		Totals	
	Infect.	Decay	Infect.	Decay	Infect.	Decay	Infect.	Decay	Infect.	Decay	Infect.	Decay	Infect.	Decay	Infect.	Decay
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
Yellow-poplar	10	23.4	4	3.5	4	0.8	—	—	—	—	3	0.9	1	0.7	22	29.3
Red maple	5	11.5	4	1.7	1	.4	4	2.7	6	11.2	7	1.6	2	.9	29	30.0
Sugar maple	2	.2	2	.2	2	.6	1	1.2	—	—	—	—	1	(*)	8	2.2
Black gum	6	26.2	—	—	—	—	1	.3	—	—	4	1.9	3	1.0	14	29.4
Ash	3	1.5	—	—	1	7.6	—	—	—	—	—	—	—	—	4	9.1
All species	26	62.8	10	5.4	8	9.4	6	4.2	6	11.2	14	4.4	7	2.6	77	100.0

*Less than 0.1 pct.

Table 3.—*Relationship between age and percent of decay volume in several hardwood species in the central hardwood region*

Age class (years)	Yellow-poplar		Red maple		Sugar maple		Black gum		Ash	
	Trees	Decay volume	Trees	Decay volume	Trees	Decay volume	Trees	Decay volume	Trees	Decay volume
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
31 to 50	15	2.3	17	0.6	6	1.4	5	0.0	—	—
51 to 70	12	1.9	6	1.6	22	.8	7	.0	6	1.2
71 to 90	18	2.3	8	18.3	4	(*)	4	2.2	2	14.7
90+	2	.0	4	15.2	—	—	9	13.7	1	8.3
Total	47	2.0	35	10.7	32	0.6	25	11.2	9	10.8

*Less than 0.1 pct.

Table 4.—*Relationship between diameter and percent of decay volume in several hardwood species in the central hardwood region*

Dbh class (inches)	Yellow-poplar		Red maple		Sugar maple		Black gum		Ash	
	Trees	Decay volume	Trees	Decay volume	Trees	Decay volume	Trees	Decay volume	Trees	Decay volume
	No.	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*	*No.*	*Pct.*
3.6 to 7.5	5	0.2	22	2.8	18	0.6	14	(*)	5	1.6
7.6 to 11.5	15	.9	7	6.9	5	.6	1	.0	2	1.6
11.6+	27	2.2	6	14.0	9	.5	10	12.6	2	15.2
Total	47	2.0	35	10.7	32	0.6	25	11.2	9	10.8

*Less than 0.1 pct.

Conclusions

Although no direct control of heart rots is known, losses can be minimized by fire control and silvicultural practices.

It was pointed out earlier that fire scars serve as entry courts for a large number of heart rot fungi. With more effective fire protection, occurrence of decay in the butt log should decrease.

In red maple, more than half of the infections took place through parent stumps. By removing unwanted sprouts before heartwood is formed, butt rot can be reduced in tree species that originate from stump sprouts. In thinning operations, sprouts low on the parent stump are less likely to decay and should be favored over others at higher levels.

Since decay loss increases with tree age, rotation age should be adjusted depending on species so that trees are cut before decay losses become significant. For example, the rotation age of red maple should not exceed 70 years, while the rotation age of yellow-poplar and sugar maple could be considerably longer.

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MANUSCRIPT RECEIVED FOR PUBLICATION 25 JANUARY 1977