Diseases and Insects in the Southwide Pine Seed Source Study Plantations During the First Five Years 1/

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Detailed data on the occurrence of diseases, insects, and other forms of damage have been taken at the end of the first, second, third, and fifth growing seasons on 33 of the 57 Southwide Pine Seed Source Study plantations established during the winter of 1952-53. Details of the study and its establishment are available (1, 2), as are two earlier reports of pest incidence (3, 4). The next examination of the plantations is scheduled for the end of the tenth growing season.

The locations of the 33 plantations and the seed sources, by States, are given in table 1. A plantation consisted of stock from several seed sources, with each source represented by 4 square plots of 121 seedlings each. The center 49 seedlings in each plot were individually inspected for pests at each examination. The seedlings were healthy 1-0 stock when planted. Survival after 5 years averaged 55 percent or better in 29 of the plantations; the Tennessee loblolly and one of the Arkansas shortleaf plantations averaged 43 percent. The longleaf planting in North Carolina averaged 40 percent, and the one in South Carolina 31 percent.

Of the many disease and insect pests that put in their appearance during the 5 -year period, none were unexpected and, luckily, most of them have caused only minor damage.

Brown spot, Scirrhia acicola (Dearn.) Siggers, was common on longleaf pine but, because of periodic application of fungicides for its control, data on its occurrence are not included in the pest appraisals. This disease and_Hypoderma lethale Dearn, have also been reported on loblolly pine in some plantings.

The pine webworm, Tetralopha robustella Zell., was recorded during the first 3 years on all species in all plantations except the North Carolina and South Carolina longleaf plantings. It caused little damage, and was largely absent by the fifth year.

1/ Field data on which this report is based were taken by pathologists and entomologists of the Southern and Southeastern Forest Experiment Stations, Forest Service, U. S. Department of Agriculture, in conjunction with the cooperators who installed and maintained the plantations.

Other pests found occasionally in minor quantities were the needle blight and needle rust diseases, pales weevil, red-headed sawfly, Pityophthorus bark beetle, aphids, pitch midges, and scale insects.

Two old standby plantation pests are not to be dismissed so lightly, however. They are the Nantucket tip moth, Rhyacionia frustrana Comst., on loblolly and shortleaf pines, and the southern fusiform rust, Cronartium fusiforme Hedgc. and Hunt, on loblolly and slash pines.

Very little tip moth attack was noticed in any of the plantations at the end of the first year. Since then, it has been possible to group plantations by 3 rather definite patterns of attack: 1) Those plantations in which up to about 50 percent of the seedlings were attacked the second and third years and very few or none the fifth year; the 2 Louisiana and 2 Alabama loblolly plantings and the Louisiana and Alabama shortleaf plantings fall into this class. 2) Those in which there was a rather gradual increase in number of seedlings attacked, reaching 100 percent or near the fifth year; this group includes the Tennessee, 1 Georgia, and 2 North Carolina loblolly plantings and the Mississippi, Georgia, South Carolina, 2 Arkansas, and 2 Tennessee shortleaf plantings. 3) Those in which the buildup was very rapid to 100 percent of the seedlings attacked the third year and again the fifth year; this pattern appeared on the South Carolina, 2 Mississippi and 2 of 3 Georgia loblolly plantings.

No explanation of the 3 patterns is offered. Merely because the plantations in Louisiana and Alabama were lightly attacked, however, it should not be conjectured that tip moth is a lesser problem in these States than elsewhere in the South. The data do not indicate that differences in attack are related to seed source.

Incidence of fusiform rust has varied greatly between planting sites for both slash and loblolly pines. In the Tennessee loblolly planting, there has been no rust. In the others, infection generally has increased gradually from the first through the fifth year. The percentages of infection mentioned here are cumulative and are based on the numbers of living seedlings pins those that have been killed by the rust.

The amount of infection in the slash, pine plantations at the end of the fifth year is given in table 2. The variation of incidence between plantations is obvious. It ranges from very high in the Louisiana to relatively low in the Alabama and Florida plantings. As a further indication of severity, it may be noted that 87 percent of the infected seedlings in the Louisiana planting are stem-cankered, with 13 percent already rust- killed; corresponding figures for the Mississippi planting are 70 percent and 15 percent; and for the South Carolina planting 43 percent and I percent. In the latter planting, most of the infection has occurred since the third year, so that fewer branch cankers have reached the stem. It is likely that stem-cankered 5-year-old seedlings

will die prematurely or through stem-brooming be useless to man, and that at least some additional stem infection will occur. Hence the rust will make the Louisiana planting virtually a total loss, and will severely damage the Mississippi and South Carolina plantings. Of possibly more interest from the tree improvement standpoint is the fact that there is a significant difference between seed source and rust incidence only in the South. Carolina planting, where the Florida source is significantly higher in infection than the other sources. The same source had the highest or one of the highest infection rates in the other 4 plantings, but the differences are not significant. Analysis of the third-year data gave identical results.

Tables 3 and 4 summarize the incidence of fusiform rust in the loblolly pine plantations at the end of the fifth year. Series 1 is the "Temperature Series" and Series 2 is the "Botanical Origin and Migration Series" (1). The tables omit the Tennessee plantation, where there was no rust, and the South Carolina and 2 of the 3 Georgia plantings, where there was less than 15 percent rust in any seed source. The range of infection between plantations is again wide, as it was with slash pine. The Coosa County, Alabama, planting and the Louisiana plantings, which are in the same place as the Louisiana slash pine planting, have the most rust. About 66 percent of the infected seedlings in the Louisiana plantings are stem-cankered, with 8 percent already rust-killed, while corresponding figures for the Coosa County, Alabama, planting are 93 and 8 percents. Consequent losses due to rust are certain to be heavy in such cases.

Though the relative amounts of stem cankering and of mortality due to rust do not appear to be affected by seed source, the total percentage of stock infected is definitely influenced, for the differences are significant in every plantation listed in table 3 and 4. Results at the end of the third year gave a similar picture. In general, the seed sources fall into similar susceptibility classes in the various plantations. Though later data may alter the picture, the present indications are that, as represented in this study, the Texas, Maryland, Arkansas, and Louisiana loblolly sources fall into a relatively low susceptibility group as compared with the North Carolina, South Carolina, Georgia, Alabama, and Mississippi sources. The one marked exception noted in this pattern is the inexplicably high infection of the Texas source and low infection of the Onslow County, North Carolina, source in the Talladega County, Alabama, planting.

Reaction to fusiform rust is but one of many ways in which racial differences may show up. Hence it seems reasonable to think that because of its restricted natural range slash pine would show little evidence of races while loblolly pine with its much wider range would show more evidence. From the standpoint of variation in the rust organism, these data indicate no racial complex, because the hosts (seed sources) reacted similarly when exposed from the Carolinas to Louisiana.

Thus, in summary, many diseases and insects have been noted during the first 5 years of the Southwide Pine Seed Source Study, but only 2 are of major importance. Tip-moth injury was and is severe in most of the shortleaf and loblolly plantations, irrespective of seed source, and most certainly is impeding height growth. Fusiform rust is variable in intensity among the slash and loblolly plantations, causing no damage in some and near total loss in others. Rust incidence consistently showed significant differences between seed sources in the loblolly pine plantings, but in only one case with slash pine. Evidence is negative for the existence of races of the rust fungus.

Literature Cited

1. Committee on Southern Forest Tree Improvement (Subcommittee on Geographic Source of Seed). 1952. Working Plan for Cooperative Study of Geographic Sources of Southern Pine Seed. 35 pp. [Processed.]

2. Committee on Southern Forest Tree Improvement (Subcommittee on Geographic Source of Seed). 1956. Supplement No. 1 to the Original Working Plan of September 12, 1952, for the Southwide Pine Seed Source Study. 110 pp. [Processed.]

3. Henry, B. W. , and Coyne, J. F. 1955. Occurance of pests in Southwide Pine Seed Source Study. Proc. Third South. Conf. Forest Tree Improvement, pp. 49-54. U. S. Forest Serv. South. Forest Expt. Sta. [Processed.]

4. Henry, B. W., and Hepting, G. H. 1957. Pest occurrences in 35 of the Southwide Pine Seed Source Study plantations during the first three years. U. S. Forest Serv. South. and Southeast. Forest Expt. Stations, 7 pp. [Processed.]

Table 1. Sources of seed and locations of plantations, by States

States	Loblolly		Slash		Longleaf		Shortleaf	
	Seed collection areas	Plantations studied	Seed collection areas	Plantations studied	Seed collection areas	Plantations studied	Seed collection areas	Plantations studied
	Number							
New Jersey	0	0	0	0	0	0	1	0
Pennsylvania	0	0	0	0	0	0	1	0
Maryland	1	0	0	0	0	0	0	0
North Carolina	2	2	0	0	2	1	0	0
South Carolina	1	1	1	1	2	1	1	1
Georgia	3	3	0	0	1	1	1	1
Florida	0	0	1	1	2	1	0	0
Alabama	3	2	1	1	1	0	1	1
Mississippi	1	2	1	1	0	1	2	1
Louisiana	1	2	1	1	2	0	1	1
Texas	1	0	0	0	1	0	1	0
Oklahoma	0	0	0	0	0	0	1	0
Arkansas	1	0	0	0	0	0	3	2
Tennessee	1	1	0	0	0	0	1	2
Missouri	0	0	0	0	0	0	1	0
Totals	15	13	5	5	11	5	15	9

Table 2. Slash pine; fusiform rust infection after 5 years in plantation

Seed source	Planted in:				
	Washington Parish, La.	Pearl River Co., Miss.	Monroe Co., Ala.	Baker Co., Fla.	Georgetown So., S. C.
	Percent				
Baker Co., Fla	81	34	11	6	68 1/
Colleton Co., S. C.	81	34	3	3	46
Monroe Co., Ala.	73	28	7	3	40
St. Tammany Parish, La.	66	25	9	4	34
Harrison Co., Miss.	-	24	-	-	-

1/ Significantly higher at 5-percent level.

Table 3. Loblolly pine series 1; fusiform rust after 5 years in plantation 1/

Seed source	Planted in:			
	Washington Parish, La.	Pearl River Co., Miss.	Talladega Co., Ala.	Craven Co., N. C.
	Percent			
Angelina Co., Texas	15	3	28	4
Somerset County, Md.	21	4	6	6
Clark County, Ark. 2/	35	7	1	4
Livingston Parish, La. 2/	41	12	3	6
Pamlico County, N. C.	56	19	13	13
Onslow County, N. C. 2/	67	9	5	22
Wilcox County, Ga.	71	21	21	15
Jefferson County, Ala.	71	26	21	19

1/ Differences among seed sources in each plantation are significant at the 5-percent level.

2/ Also in series 2.

Table 4. Loblolly pine series 2; fusiform rust after 5 years in plantation 1/

Seed source	Planted in:				
	Washington Parish, La.	Pearl River County, Miss.	Coosa Co., Ala.	Spalding Co., Ga.	Craven Co., N. C.
	Percent				
Clarke Co. Ark. 2/	44	6	29	-	3
Livingston Parish, La. 2/	41	8	35	11	3
Hardeman Co, Tenn.	66	17	59	15	2
Prentiss Co, Miss.	73	27	71	28	8
Onslow Co, N. C. 2/	67	24	82	31	20
Newberry Co, S. C.	86	36	66	35	12
Clarke Co, Ga.	74	38	80	25	14
Spalding Co, Ga.	82	29	75	31	15
Clay Co, Ala.	85	38	86	30	12

1/ Differences among seed sources in each plantation are significant at the 5-percent level.
2/ Also in series 1.