A COMPARISON OF WHITE PINE WEEVIL RESISTANCE IN CAGED AND OUTPLANTED SEEDLINGS FROM TWO SOURCES[1,2]

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INTRODUCTION

Wright and Gabriel (1959) in a study of observed differences in weevil resistance among geographic ecotypes in Eastern White Pine Pinus strobus L., concluded that there may be inherent differences in susceptibility to damage by the White Pine Weevil, Pissodes strobi (Peck) associated with differences in geographic origin.

A study made by Connola and Wixson (1963) in New York from 1954 through 1958 on white pine weevil attack in 266 one-tenth acre sample plots of eastern white pine throughout the State showed that there was more weevil damage in natural stands in the southern half of the State than in the northern half.

Tests on caged trees

In a continuing study in the spring of 1964, cage tests were begun with 2 to 6-feet tall non-weeviled, wild, eastern white pine seedlings taken from two sources in the State. One source was from a heavily weeviled area in southern New York near Oneonta, and the other from a lightly weeviled area in northern New York near Warrensburg. The sources were approximately 150 miles apart. The trees at both sites were growing in open fields. They were root-pruned in the fall of 1963, dug in early spring of 1964, potted in 5-gallon pails in their native soil, and taken to the Saratoga State Tree Nursery. There they were placed in 4 outdoor cages each measuring 24' x 24' x 18'. Thirty-two trees were placed in each cage, 16 from each of the two sources. The trees were spaced 4 feet apart in rows 4 feet apart. Trees from the two sources were alternated in each row so that trees from the northern source occupied positions 1, 3, 5, etc. and those from the southern source occupied positions 2, 4, 6, etc.

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A month after the trees had been potted and placed in the cages, 160 weevils collected in an area geographically midway between the two sources were liberated in each cage. Weevil counts made on the trees in the 4 cages over a 6-week period following liberation of the weevils indicated that the weevils strongly favored the southern source trees. Forty-nine percent of the trees became weeviled, and of the weeviled trees 81 percent, or 4 out of 5, were from the southern source, (Connola, 1966). Whether or not this difference could be ascribed to the differing conditions under which the trees were grown or to genetic differences could not be determined in this experiment. Also, since the trees were newly potted and not fully established, any conclusions drawn would be tentative, pending results of similar studies with more established plants.

Tests of outplanted trees

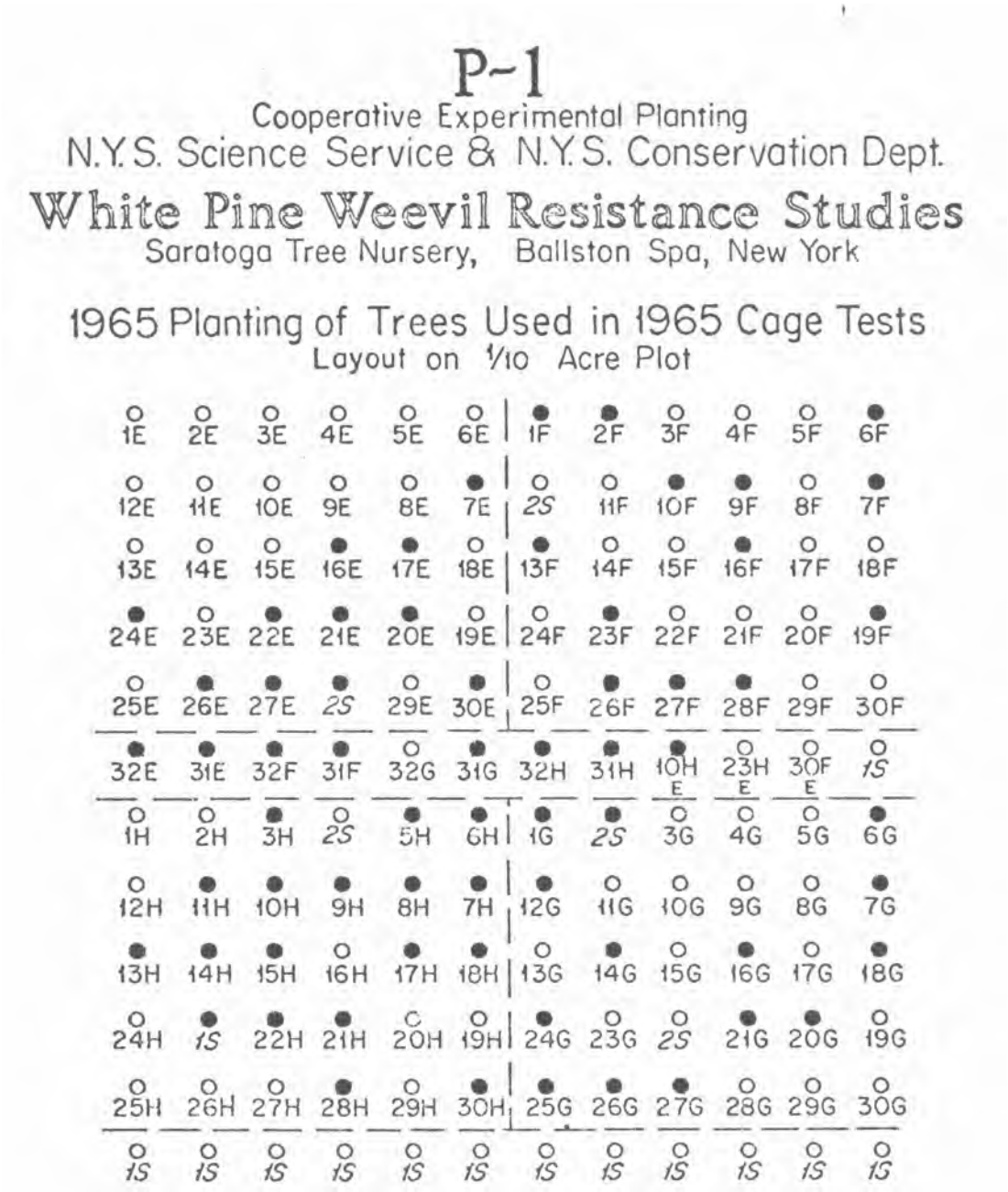
In the fall of 1965 trees from the same two sources were outplanted in a 1/10 acre planting at the Saratoga Nursery. The design of this planting is shown in Fig. 1. It contains 66 trees from the northern source (Warrensburg) identified by the odd numbers and 66 trees from the southern source (Oneonta) identified by the even numbers. The trees were planted 6 feet apart in rows 6 feet apart alternating the sources in the rows as in the cage tests. The planting was divided into sub-plots E, F, G, and H, similar to cage letter assignments used in the 1964 cage tests. The trees were allowed to grow and become.established so that site influences would be reflected in their growth as much as possible.

Results and Discussion

Natural weeviling did not begin in the outplanting until 1968. Annual recording of the weeviling was begun that year and has continued for 5 years through the spring of 1972. The results of the tests to date are presented in Tables 1 and 2.

During the 5-year period, there were 41 weevilings in the northern source trees, and 59 in the southern source trees (Table 1).- The 41 weevilings in the northern source trees were made on 30 trees and the 59 weevilings in the southern source trees were made on 34 trees (Table 2). Although the numbers of trees weeviled in each source were close (30 and 34), the southern source trees were weeviled more repeatedly. Thus, the average number of weevilings per weeviled tree was 1.37 in the northern source and 1.74 in the southern source.

Additional evidence suggesting greater susceptibility to weevil attack in the southern source trees is shown in Table 3 in which factors associated with weeviling were measured in 1970 in both sources. More southern source trees were weeviled than northern source trees. The percent of leaders stunted in growth by weevil feeding, the percent of trees fed upon by the weevils, the average number of weevil-caused pitch droplets on tree leaders from feeding activities, the average length of main stem killed by weevils on weeviled trees, the average number of years of main stem growth killed by weevils, and the average leader length, the leader diameter and bark thickness in weeviled trees all were greater in the southern source trees. The bark thicknesses were measured on main stem growth made in 1963 and 1969. The measurements were made just prior to the commencement of weevil activities in the spring of 1970. Average tree height of weeviled trees was 4 inches greater in the



NOTE: Trees are planted in a six foot by six foot spacing.
Inclined numbers are replacement trees.

Fig. 1.--Black circles represent weeviled trees. Odd-numbered trees (1, 3, etc.) are from northern source. Even-numbered trees (2, 4, etc.) are from southern source. The letters E, F, G, and H indicate subplots corresponding to the arrangement used in the 1964 cage experiments. IS indicates northern source trees planted to separate the test plots from adjacent Scotch pine next to the last row. IS and 2S trees in the experiment are replacement trees for trees which died after transplanting; the 2S trees being from the southern source.

White Pine Weevil Resistance Studies

Saratoga State Tree Nursery, Ballston Spa, N.Y.

P-1 (1/10 A. Eastern White Pine Plot)

Table 1

5-Year Study of Annual and Total Weeviling in the Plot

Year	No. of Weevilings in the 132 Trees in Test		Percent Annual Weeviling in plot
	Northern Source (66 trees)	Southern Source (66 trees)	
1968	7	10	12.9
1969	7	14	15.9
1970	10	14	18.2
1971	8	11	14.4
1972	9	10	14.4
Total	41	59	

Table 2

5-Year Study of Weeviled Trees in the Plot (1968-1972)

Northern Source (66 trees)				Southern Source (66 trees)			
No. of weeviled trees	% of total source trees	Weevilings		No. of weeviled trees	% of total source trees	Weevilings	
		Total	Av. per tree			Total	Av. per tree
30	45.5	41	1.37	34	51.5	59	1.74

Table 3

1970 White Pine Weevil Resistance Studies

Saratoga State Tree Nursery

Plot P-1

Factor	Plot P-1 (132 Trees)	
	Northern Source Trees (66)	Southern Source Trees (66)
Number of weevils counted (8 counts) 4/29/70 to 6/11/70	92	131
Number of weeviled trees	10	14
Percent of tree source weeviled	15.2	21.2
Percent of leaders stunted by weevils	9.1	12.1
Percent of trees fed upon	51.5	68.2
Average number of weevil-caused pitch droplets per tree	16.4	19.9
Average length of stem killed per weeviled tree (inches)	15.1	17.0
Average years of stem killed per weeviled tree (years)	1.4	1.5
Average length of weeviled leaders (inches)	14.4	16.4
Average length of non-weeviled leaders (inches)	11.2	10.3
Average diameter of weeviled leaders (inches)	.294	.298
Average diameter of non-weeviled leaders (inches)	.217	.216
Average tree height of weeviled trees (inches)	93.0	89.1
Average tree height of non-weeviled trees (inches)	82.7	81.5
Average 1969 bark thickness of weeviled trees (mm)	1.12	1.21
Average 1969 bark thickness of non-weeviled trees (mm)	1.05	1.04
Average 1963 bark thickness of weeviled trees (mm)	1.65	1.75
Average 1963 bark thickness of non-weeviled trees (mm)	1.68	1.73

northern source. This was probably due to less previous weeviling in that source in the form of repeated weeviling and extent of weevil damage on the main stem. The same series of measurements made on non-weeviled trees not only showed smaller differences between dimensions in the two tree sources, but the dimensions themselves were generally smaller than in the weeviled trees.

In Table 4, the percentages of weeviled trees in the outplanting during the period 1968 through 1972 are compared with those in the 1964 cage tests in which the same tree sources and experimental design were used.

White Pine Weevil Resistance Studies

Saratoga State Tree Nursery, Ballston Spa, N.Y.

Table 4

Comparison of Percent Weeviled Trees in the Cage Tests and the Outplantings

Experiment	% of Trees Weeviled	% of weeviled trees from different sources	
		Southern Source	Northern Source
Cage Tests (128 trees)	49	81	19
Outplanting (132 trees)	48	53	47

In each of the experiments, about half of the trees were weeviled, that is, 49 percent in the cage tests and 48 percent in the outplanting. As shown, 81 percent of the weeviled trees in the cage tests were from the southern source and 19 percent from the northern source making a ratio 4 to 1. This compares to a 1 to 1 ratio of weeviled trees or 53 percent southern source trees and 47 percent northern source trees in the outplanting. This would suggest that the environment plays an important part in tree growth which in turn influences weevil activity. When trees from the two sources were dug, potted and tested in the 1964 cage tests, they brought with them the effects of the environment of their native habitat on their growth. It was inferred that the weevils introduced into the cages reacted to those growth factors and attacked the southern source trees in preference to the northern source trees. However, when the two tree sources were planted side by side in the outplanting, the growth differences due to original site exposure apparently diminished with time, and growth in both sources was conditioned by site factors associated with the outplanting. Although there has been no appreciable difference, to date, in the percent of weeviled trees from the two sources, differences appearing in the future, for example in the susceptibility to repeated

attack or to greater damage, may presumably be ascribed to genetic differences.

It is planned to continue the studies at least until the trees have reached a minimum height of 16 feet (first log size), at which time a statistical analysis of the data will be made. Present minimum height of the stand is about 10 feet.

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