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EARLY EVIDENCE OF WEEVIL RESISTANCE IN SOME CLONES AND HYBRIDS OF WHITE PINE

Abstract.—White pine species and hybrids are being tested for inherent resistance to the white-pine weevil. First-year results offer hopes of finding or developing resistance in this group. *Pinus monticola* had a low level of weeviling, while the hybrid between *P. strobus* X *P. wallichiana* was heavily weeviled. There is evidence that individual *P. strobus* with acceptable levels of weeviling can be located in natural populations.

Several approaches can be used to locate or develop plants that are resistant to pests. One can select resistant individual trees or provenances, use immune or resistant exotic species that have other properties similar to the native species, or develop hybrids between a well-adapted native species that has desirable growth properties but lacks resistance and a closely related species that may or may not have desirable growth properties but does have resistance to the particular pest. The success of any one of these methods depends on the combining ability of the resistant material, or the ability of the tree improver to mass-produce ramets from genetically resistant material by vegetative means.

This is a report on interim results from a study of white-pine weevil (*Pissodes strobi* Peck.) resistance in clones of *Pinus strobus* L., *P. monticola* Dougl., and some hybrids between *P. strobus* and *P. wallichiana* A. B. Jackson.[1] Although none of the hybrids showed resistance to weeviling, a number of clones of *P. monticola* had little or no damage, and one clone of *P. strobus* showed less than half the damage sustained by the rest. The wide variation in resistance found among clones during a year of large weevil populations makes documentation of these first-year results worthwhile as a base for future comparisons and as a guide for further research on weevil resistance.

[1] This species is also known as *P. griffithii* McClelland and *P. excelsa* Wall.

Methods

In the spring of 1967, scions of rust-resistant intraspecific hybrids of *P. monticola* were obtained from the Intermountain Forest and Range Experiment Station at Moscow, Idaho.[2] Additional material of this species was collected from a plantation in eastern New York State (origin of seed unknown). Scions of *P. strobus* were obtained from individual trees in a stand near Midhurst, Ontario.[3] The stand was relatively free of weeviling, though surrounding stands were weeviled considerably.

Scions of the hybrid *P. strobus* x *P. wallichiana* were selected from the best phenotypes in a 16-year-old experimental planting established by the Northeastern Forest Experiment Station at Washington Crossing, New Jersey.

All scions were side-grafted on main-stem terminal shoots of 6- to 8-foot plantation-grown *P. strobus* on the Massabesic Experimental Forest in southern Maine. The scions from each species group were grafted in separate plantations on the Experimental Forest, and scion material from a heavily weeviled native eastern white pine growing in the vicinity was grafted at the same time to serve as a check clone. No deliberate attempt was made to randomize the sources within the plantations, although the final stock selection resulted in a degree of randomization. This general region, being one of the most heavily weeviled in the northeastern United States, is one of the best locations available for studying weevil damage. Weevil populations are normally high, but they were extremely high in 1968 and again in 1969.

All trees were pruned to encourage scion growth and to prevent lateral branches from assuming a dominant position — a position favored by weevils for feeding and egg-laying. All trees were sprayed with an insecticide (Lindane) in the spring of 1967 and 1968. Observations of weevil damage were made in August 1969, when the grafts were large enough for weevil attack.

Results

Pinus monticola. — Of the *P. monticola* grafts, 60 survived and had reached a size suitable for attack by weevils in the spring of 1969. Successful attacks were made on only 22 percent of the scions from Idaho sources and on 18.2 percent of the scions from New York. The scions

[2] Scion material supplied by Dr. Richard T. Bingham.
[3] Scion material supplied by Dr. C. Heimburger, Ontario Department of Lands and Forests, Research Branch, Maple, Ontario.

from Idaho had an average length of 27.5 inches and those from New York 21.4 inches.

Because of the small number of surviving grafts from any one clone, the percent of weeviling varied considerably by clone. Ten of 18 clones received no weevil damage, 3 others were less than 20 percent weeviled, and only 5 were 50 percent or more weeviled.

The 34 *P. strobus* scions used as checks in this plantation averaged 22.8 inches and sustained almost 60 percent weevil damage.

Pinus strobus. — As in the *P. monticola* portion of this study, weeviling varied by clone. Only one (clone 1202) showed potential value for a resistance program.

Canadian clones	*Total (No.)*	*Weeviled (percent)*	*Unweeviled (percent)*	*Average length (inches)*
1200	32	66	34	38
1201	25	68	32	31
1202	19	32	68	29

The check scions of local *P. strobus,* averaging 24 inches in length and represented by 31 grafts, were weeviled more than any of the select clones (71 percent), although the difference between the two heavily weeviled clones and the check material was not significant.

Pinus strobus x *Pinus wallichiana.* — The weeviling in this material was remarkably uniform and severe. There was no difference in weeviling between the hybrids and the check material in this portion of the study.

Washington Crossing clones	*Total (No.)*	*Weeviled (percent)*	*Unweeviled (percent)*	*Average length (inches)*
2-11	13	69	31	21
2-24	18	67	33	17
6-14	21	67	33	13
6-19	24	71	29	21
8-12	14	71	29	16
P. strobus checks	26	77	23	28

Discussion of Results

Pinus monticola. — Although this species is reported to be slow-growing in the early years, it has not been grown in sufficient numbers in the Northeast to verify this. The scions used are from rust-resistant individuals, which could be an important bonus in the program. Because of the high percentage of weevil-free scions in this study, the species deserves, and will receive, further intensive investigation. *Pinus monticola* seedlings are being grown in our nursery and will be cage-tested in transplant beds during the 1970 and 1971 seasons. The hybrids

between fast-growing *P. strobus* and *P. monticola* will be studied along with open-pollinated seedlings of both parents.

Pinus strobus. — Though only a few clones were investigated, there is evidence here and elsewhere that individual trees with a higher than normal degree of resistance will be located. More trees from this Canadian stand and individual selections from the entire natural range will be included in future work. Because of the large number of individual trees involved, a rapid method of prescreening candidates will have to be developed. We are investigating several possible techniques for this purpose.

Pinus strobus x *Pinus wallichiana.* — This combination of species is probably not too promising, although we want to study the same clones on root stocks of *P. wallichiana* when it becomes available. We will also obtain pollen of *P. wallichiana* to develop larger numbers of the *P. strobus* hybrid. This population will be tested for possible resistance to weevil attack.

These preliminary results suggest that more effort should be concentrated on *P. monticola* and possibly on hybrids between *P. strobus* x *P. monticola. P. wallichiana* does not appear to contain any more resistance than the local *P. strobus.* More attention should be given to selection of individual trees of *P. strobus,* and more effort should be devoted to techniques for vegetatively propagating large quantities of resistant material.

Because between 23 and 40 percent of the weevil-susceptible check scions of local *P. strobus* in these plantations remained unweeviled, there is reason to believe that some of the study material may also have escaped attack in this first season. Either low populations in these areas, resulting from two successive applications of Lindane, or a nonrandom distribution of weevils may account for the lack of attack on some susceptible clones. All trees will be observed in 1970 and again in 1971. If weeviling in the check scions does not approach 90 percent in all areas in 1970, the native populations of weevils will be supplemented by additional weevils before the 1971 season.

Finally, additional work will include Balkan pine (*P. peuce*), Korean pine (*P. koraiensis*), and other soft pines as individual species and in hybrid combination with both *P. strobus* and *P. monticola.*

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