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IN NORWAY SPRUCE**

by
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Comparison of Norway spruce (*Picea abies* (L) Karst.) and white spruce (*Picea glauca* (Moench) Voss.) plantations in eastern Canada suggest that Norway spruce possesses a higher yield capacity. For this reason Norway spruce could be an important species in future planting programs, and careful selection of strains suitable to eastern Canadian climatic regions is of considerable importance. However, a serious drawback to the use of Norway spruce on a large scale is its susceptibility to damage by the white pine weevil (*Pissodes strobi* (Peck)).

The study here described was undertaken to investigate the relation between genotypic** form and the resistance of Norway spruce to weevil damage. Norway spruce exhibits a wide variation in genotypic form, particularly with respect to branching habit. European tree breeding work has shown that the branching habit is closely associated with volume per single tree. The present study suggests that branching habit of Norway spruce may be associated with weevil damage as well as with stem form and width of crown.

The study was made at the Petawawa Forest Experiment Station (46°N 77°W) in a plantation of Norway spruce established in 1924 with 2-2 stock. Only 24 trees of the 1,500 originally planted were available for study, since early heavy thinnings had removed all frost-damaged trees, and some weevil-damaged trees. Because of the open stand the trees are branched to the ground, making branch and crown types easily recognizable and comparable. Under these favourable conditions it is felt that even such a small number of trees may indicate the relative susceptibility to weevil killing of the leaders of these particular genotypic forms of Norway spruce.

Each of the 24 trees was classified as to diameter at breast-height, height, height-diameter ratios, crown diameter, and branching habit.

Branching habit was classified as follows:—

Comb Type

Branches of first order undivided. Branches of second and higher order, hanging vertical, giving a comb appearance.

Brush Type

Branches of first order often divided. Living branches of second and higher order, confined to the outer part of the crown, giving the branch the appearance of a brush or broom.

Plain Type

Branches of second and higher order more or less horizontal giving the branch a flat appearance.

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**The appearance of any plant is brought about by interaction of two causal factors, one extrinsic, the environment, and the other, intrinsic, the genotype. It is often possible to estimate one feature of the genotype, such as genotypic form or branching habit, in one suitable environment, while other genotypic characters must be determined under different appropriate sets of environmental conditions.

The extent and location of weevil damage was plotted in relation to the branch whorls for each tree. The killing of the leaders by weevils had no influence on crown diameter or breast-height diameter. While this affected tree height, the apparent relationships of weevil damage to genotypic form were verified when corrections were made for lost height increment due to weevil-killed leaders.

RESULTS

It was found that trees with broad crowns were more often weeviled than those with narrow crowns (Figure 1), and trees with low height-diameter ratios more often weeviled than those with high height-diameter ratios.

Three of the trees were double-stemmed, and because of this, were extremely slender. They were highly resistant to weeviling. Of the six stems involved, three were weeviled within the last year, and the other three were untouched.

A relation was also found between height-diameter ratio and height above ground of the first damaged leader. Stout trees were all damaged earlier than slender trees.

The comb spruce had larger crown diameters and showed heavier weevil damage than the brush types (Figure 2). The plain spruce type was not found in this material.

For the material investigated it would appear that slender genotypes with narrow brush-type crowns are associated with light weevil damage, while stout genotypes with broad comb-type crowns tend to have heavy weevil damage.

DISCUSSION

Selective European tree breeding in Norway spruce has mainly concentrated on the comb-spruce type since this type grows larger than the brush type and is therefore considered more valuable.

The relatively broad-crowned comb-spruce types could be very useful in an extensive Canadian forest management because they would be able to utilize the space given to them when spot planted, planted along skidways or planted with wide spacing. However, material selected for comb-spruce types would be dangerous in areas where the weevil is present or where the weevil menace cannot be controlled. This is very evident in older Norway spruce plantations where the slender co-dominants monopolize the site when early stout dominants are weeviled and weakened.

Selection of Norway spruce for use in Canada should for this reason be concentrated on slender types.

The trees studied have been propagated to investigate the variation of weevil susceptibility and if possible to breed weevil resistant types.

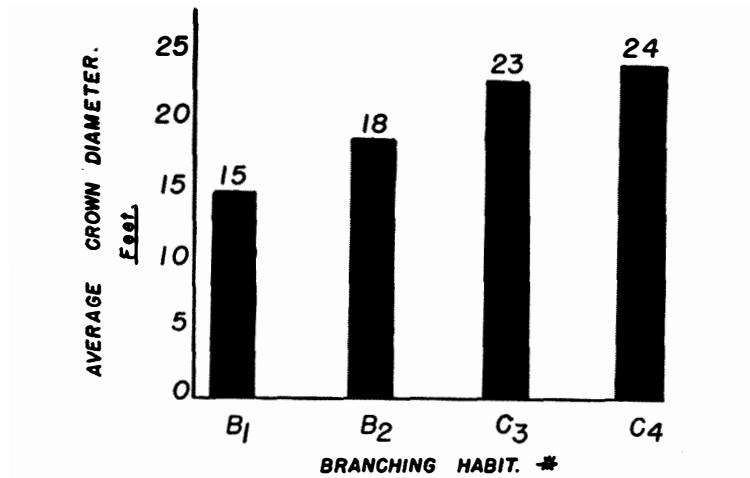


Figure 1. Crown Diameter in Relation to Branching Habit.

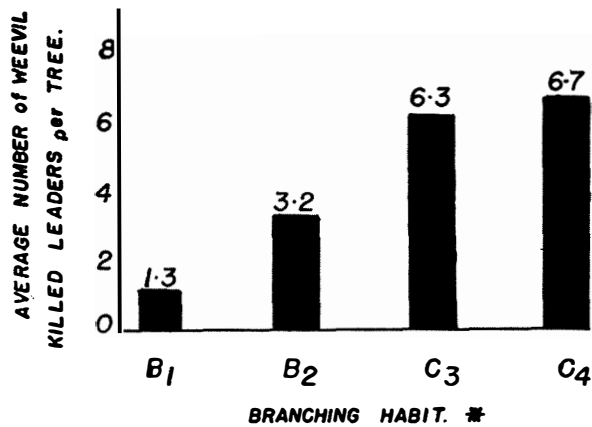


Figure 2. Weevil Damage in Relation to Branching Habit.

* B₁ — Typical Brush Spruce Type.

B₂ — Intermediate Brush Spruce Type

C₃ — Intermediate Comb Spruce Type.

C₄ — Typical Comb Spruce Type.