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## SELECTIVE DEFOLIATION BY THE YELLOW-HEADED SPRUCE SAWFLY<sup>1/</sup>

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The yellow-headed spruce sawfly (Pikonema alaskensis Roh.) is a native defoliating insect which attacks several species of spruce in Canada and the United States. Larvae have been reported to feed on white spruce (Picea glauca Moench), black spruce (P. mariana Mill.), blue spruce (P. pungens Englem.), red spruce (P. rubens Sarg.) and Englemann spruce (P. englemannii Parry) among indigenous species, and the commonly planted Norway spruce (P. abies L.) of Europe (Wilson, 1962; Raizenne, 1957; and Nash, 1939).

Attacks by this insect are most frequently observed in plantations or on other open-grown trees. Fully stocked closed stands are typically free from serious damage (Wilson, 1962 and Peterson, 1950). In northeastern Minnesota the larvae appear from middle to late June and feed for a 30 to 40 day period beginning on young succulent leaves and later moving to older leaves. Often only scattered branches of a tree are affected; however, complete defoliation of a tree may occur in a single season. Larval feeding over several years can result in mortality.

Attacks by the yellow-headed spruce sawfly were noted in the vicinity of Grand Rapids and Cloquet, Minnesota in roadside and young commercial planting of white spruce in 1966-1968. Larval feeding was also observed in two test plantations at the Cloquet Forest Research Center during this period and the incidence of attack on a variety of materials recorded. Results of these observations are summarized below.

The first plantation was a test of 23 white spruce seed sources and one local

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black spruce seed source. Seed origins covered the range of white spruce fairly well, with collections made from Alaska to New Hampshire. The design is randomized complete blocks with five replications, four-tree row plots and 8 ft. by 8 ft. spacing. The plants were in their eleventh growing season from seed in July of 1968.

Trees of this plantation had been subjected to natural attack by sawfly for at least three years: 1966, 1967 and 1968. In October of 1966 evidence of feeding by larvae of the yellow-headed spruce sawfly was noted on 75% (337 of 447) of the surviving trees. While a high percentage of the trees were attacked, actual defoliation was light. The amount of foliage removed was estimated to exceed 50% on only 16% of the trees. In late July, 1968 a second survey indicated defoliation on 78% (346 of 445) of the surviving trees. Defoliation was far more severe with half or more of the needles removed on 50% of the surviving trees.

There was no consistent evidence of variation among white spruce sources in the frequency of attack. In 1968 trees from seed collected near Flin Flon, Manitoba were the least damaged with only 25% of the individuals showing evidence of attack. All other sources had from 75% to 100% of their trees defoliated to some degree. The high incidence of escape by the Flin Flon sources in 1968 is striking. In 1966, however, this source suffered defoliation roughly equal to the other 22 white spruce seed sources.

The incidence of sawfly feeding in this plantation was apparently related to species. In October of 1966 and in July of 1968 no evidence of yellow-headed spruce sawfly feeding was noted on any of the 19 surviving black spruce plants in the plantation.

Species related patterns of feeding were also found in the second plantation. This planting contains white spruce, black spruce and open-pollinated progeny of their natural hybrid, Rosendahl spruce. The hybrid, described by Little and Pauley (1958), is intermediate to black and white spruce in many characteristics. The twelve replications of the planting each contain a five-tree row plot of white spruce, a similar plot of black spruce and a twenty-five tree plot of the Rosendahl spruce progeny. Spacing is 6 ft. by 6 ft. In July of 1968 the white and black spruce plants were in their ninth growing season, and the progeny of Rosendahl spruce were in their eighth growing season from seed.

These trees had been subjected to natural attack by the sawfly for at least two years: 1967 and 1968. In July of 1968 less than 2% (1 of 60) of the black spruce trees had been attacked by sawfly. Damage to the single black spruce attacked was limited to about 10% defoliation. In contrast, 64% of the white spruce trees had been attacked and the percentage of their foliage destroyed ranging from 5% to 85%. The open-pollinated progeny of Rosendahl spruce were intermediate. Approximately 24% of the progeny group showed evidence of larval feeding with defoliation ranging from 5% to 100%.

Observations in these two plantations indicate a higher incidence of feeding by the yellow-headed spruce sawfly on white spruce in northeastern Minnesota, when both white spruce and black spruce are present. The intermediate level of feeding on the open-pollinated progeny of Rosendahl spruce also suggest a relationship between host species and incidence of feeding.

Long-term studies will be required to confirm these observations. If confirmed, the relationship may be significant in the selection of species for planting. In addition, the performance of the white spruce-black spruce hybrid's progeny suggests the possibility of breeding for types combining low susceptibility to this pest and the favorable characteristics of white spruce.

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