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## EFFECT OF WHITE SPRUCE RELEASE ON SUBSEQUENT DEFOLIATION BY THE YELLOWHEADED SPRUCE SAWFLY, *PIKONEMA ALASKENSIS* (HYMENOPTERA: TENTHREDINIDAE)<sup>1</sup>

B. W. Morse and H. M. Kulman<sup>2</sup>

### ABSTRACT

Hand release of 22 5-year-old white spruce, *Picea glauca* (Moench) Voss, dramatically increased the amount of defoliation by the yellowheaded spruce sawfly, *Pikonema alaskensis*. The percent defoliation of the released trees was six times the defoliation in the control trees. A light overstory for young white spruce is suggested as a silvicultural method of reducing defoliation by this sawfly.

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In north central Minnesota, the yellowheaded spruce sawfly (YHSS), *Pikonema alaskensis* (Rohwer), is the most important defoliator of young white spruce, *Picea glauca* (Moench) Voss, plantations. This univoltine sawfly feeds on the current year's foliage from early June to July, when the larvae drop to the ground to overwinter.

Population outbreaks usually occur on south facing slopes before crown closure (Morse and Kulman 1984). In addition, severe defoliation has been observed after mechanical and chemical removal of hardwood overstory. It was the purpose of this study to document the effect of release on subsequent YHSS-caused defoliation of white spruce.

### METHODS

The study took place in a 1.5-ha, 5-year-old white spruce plantation located in the Chippewa National Forest, Minnesota. Approximately 70% of the trees were overtopped predominately by aspen, *Populus spp.* There were 3000 to 5000 aspen stems/ha.

Fifty spruce trees were selected of the same size and with the same amount of overtopping. One half of the trees were randomly selected for treatment in September 1982, and the other half were used as untreated controls. The treatment consisted of cutting all light-competing vegetation within 1.5 m from the spruce. Percent defoliation of the current year's foliage, and terminal shoot length were then recorded.

The following August, after the larvae had completed feeding, percent defoliation and terminal shoot length were again measured for both groups. An angular transformation of percent defoliation was performed to stabilize the variance. Student *t*-tests were used to compare the difference between the groups and years.

### RESULTS AND DISCUSSION

There was little defoliation, less than 0.5%, recorded in 1982 for both groups (Fig. 1). Seven marked trees were not relocated the second year and were dropped from the analysis. In the control group, the average defoliation significantly increased in 1983, indicating a general population buildup ( $P = 0.018$ ). A dramatic increase of defoliation occurred after the trees were released in the treatment group ( $P < 0.001$ ). In 1983, there

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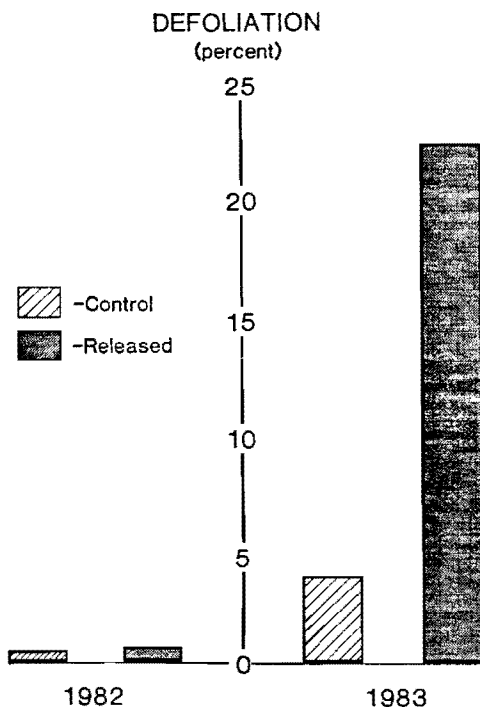


Fig. 1. Response of yellowheaded spruce sawfly-caused defoliation of plantation white spruce to the release, or removal, of a hardwood overstory in the Fall of 1982.

was a six-fold increase of defoliation in the treatment over the control ( $P < 0.001$ ). Increases of defoliation occurred in 21 out of 22 of the released spruce. Half of the control trees showed an increase of defoliation, while the rest remained the same.

White spruce in sunny locations such as roadsides, lakefronts, and pastures, tend to be heavily defoliated by the YHSS (Morse 1982). Observations of adult behavior indicate that it is a sun-loving insect (Bartelt et al. 1982). These observations help explain why defoliation increased following the release of shaded white spruce.

Terminal shoot growth did not differ between the two groups in 1983 ( $P > 0.5$ ), yet with only one growing season, no inferences can be made about the effect of this release on growth. It could not be determined whether sawfly-caused defoliation resulted in greater growth loss than that due to overstory suppression. White spruce is considered a shade-tolerant species (Barker 1949), withstanding 30–40% overtopping during the first 10 years after planting (Roe 1955). A recent study showed that south-facing slopes had the highest risk of YHSS-caused defoliation (Morse 1984). From a management point of view, high-risk, south-facing slopes could be left with a light overstory during the period before crown closure to prevent heavy defoliation by the YHSS.

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