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Canadian Forest Service, Great Lakes Forestry Centre

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# BIOLOGICAL CONTROL AGENTS AND THEIR POTENTIAL USE IN THE MANAGEMENT OF SAWFLIES

## INTRODUCTION:

The balsam fir sawfly, *Neodiprion abietis*, and the yellowheaded spruce sawfly, *Pikonema alaskensis*, are the major pests of young plantations in western and central Newfoundland, respectively. Severe defoliation by these insects reduces tree growth, and may cause tree mortality, resulting in significant economic losses. Because of the increasing inability to use chemicals to control these pests, environmentally sound alternatives are urgently needed. At present, no effective alternative control means are available against either species.

A young balsam fir damaged by the balsam fir sawfly.

A naturally occurring, species-specific nuclear polyhedrosis virus (NPV) has been discovered from natural populations of the balsam fir sawfly. This virus may have potential for use in suppressing sawfly populations in the field. *Bacillus thuringiensis*-based biopesticides are already being used in forestry operations in Canada to control lepidopterous defoliators, but no effective Bt products are currently available to control sawflies. Natural products from plant extracts such as neem, have shown promising results against other forest defoliators. Natural enemies including parasites are important mortality factors of sawflies in the field, and possess potential as biocontrol agents for these pests.

The objectives of this study are: to determine the viral pathogenicity of NPV against the balsam fir sawfly; to study the toxicity of neem and/or Bt against the balsam fir sawfly and the yellowheaded spruce sawfly; to determine the impact of natural enemies on field populations of both sawfly species; and, to carry out field tests to evaluate promising biocontrol agents discovered in the laboratory.

## LOCATION/SITES:

Research is being conducted in Newfoundland.

## RESULTS:

In the laboratory, results of tests on *N. abietis* larvae fed NPV-treated foliage indicated that larval mortality was dependent on viral concentration — higher concentrations caused higher mortality. The virus was found to be a faster-acting pathogen than other insect viruses ($LT_{50}$ = about 7.5 days), such as spruce budworm NPV. Sublethal doses that did not kill sawfly

Dr. Li performing virus work in the laboratory.

larvae, reduced feeding activities of survivors, and reduced pupa size, which will reduce next generation populations because reproductive potential of this sawfly is positively related to pupal weight.

The toxicity of Neemix 4.5 EC, a commercial neem preparation, to different larval stages of *N. abietis* was studied in the laboratory. Results indicated that younger larvae were more susceptible to neem than older instars. These results have been verified in field trials. The acute toxicity of Neemix 4.5 to *N. abietis* larvae was comparable to that of the organophosphate insecticide Dylox 420 EC. Toxicity of VectoBac 12AS, a biological *Bacillus thuringiensis* var. *israelensis* formulation, to 2nd, 3rd, and 4th instar larvae was very low, suggesting that this product is not a strong candidate for sawfly control.

## MANAGEMENT IMPLICATIONS:

Efforts are being made to register *N. abietis* NPV as a biological control agent against the balsam fir sawfly in Canada. Techniques of mass production of this virus have been developed. Mass production of this sawfly virus is underway.

When possible, operational sprays with neem-based products for control of *N. abietis* should target younger larvae. This strategy would maximize control efficacy and minimize foliage damage by older larvae. Targeting young larvae would also minimize direct adverse effects of neem, if any, on parasitoids of *N. abietis*, because most parasitoids do not become active until late in the season. Because neem is less harmful to the environment than synthetic chemicals, Neemix 4.5 is a promising and strong candidate for control of *N. abietis*.

## SOURCES OF RELEVANT INFORMATION:

Li, S.Y. 2000. Larval susceptibility of balsam fir sawfly (Hymenoptera: Diprionidae) to neem. Proceedings of Entomological Society of Ontario, 131: in press.

Li, S.Y.; Kettela, E. 1999. Comparative studies of the toxicity of biological, botanical and chemical insecticides to balsam fir sawfly, *Neodiprion abietis*. Annual Report of Spray Efficacy Research Group. pp 56-65.

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