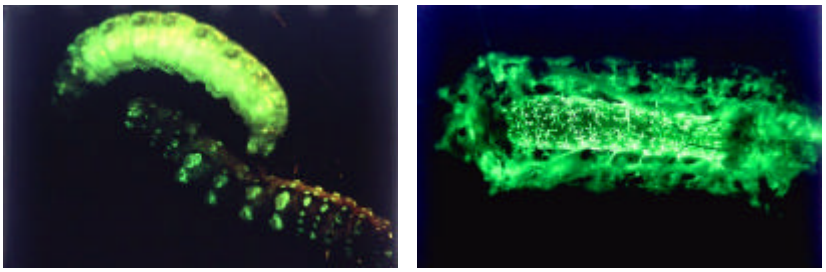
GFP in Forest Research

Developing an effective method of managing pests with no harmful effects on other organisms

One of the greatest problems faced by foresters and researchers in the forestry industry is the effective and environmentally friendly control of insect pests. Random spraying with chemical pesticides affects both the ecosystem and the beneficial insects. A method that targets a specific species is by far the best method.

Spruce budworm project

In the Biotechnology project at the Great Lakes Forestry Centre in Sault Ste. Marie, Ontario, Canada, alternative methods are being developed to control the spruce budworm, *Choristoneura fumiferana*. This insect is a destructive defoliator of the spruce-fir forests in North America.



Larva of the spruce budworm (*Choristoneura fumiferana*), infected with its own CfMNPV-GFP virus.

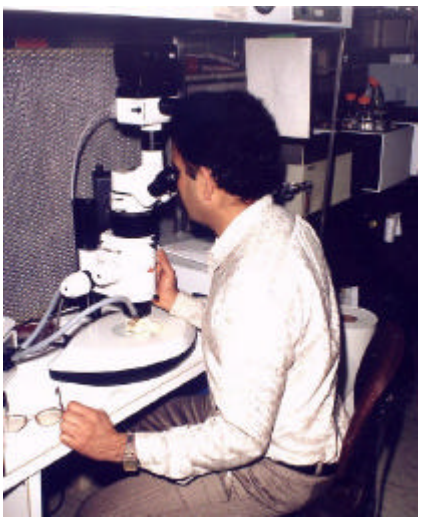
All organisms on Earth are affected by their own viruses that have co-evolved over time, and the budworm is no exception. A particular virus of the budworm is the baculovirus CfMNPV (*C. fumiferana multicapsid nucleopolyhedrovirus*). This double-stranded DNA virus affects only the budworm and a few related species. CfMNPV has been shown to be harmless to humans and animals. However, CfMNPV is not very virulent and it is relatively slow acting. While it is environmentally benign, it is not very effective at controlling these pests.

Combatting the pest with its own virus

The research team at the Great Lakes Forestry Centre is using Genetic Engineering techniques to improve the effectiveness of CfMNPV. The idea is to choose one of the budworm's own genes that has a regulatory function in the development of the insect, and insert this gene into the virus. Upon infection, this gene will be expressed through the virus and will cause a disruption in the insect's development.

Visualization with GFP

However, to effectively develop this technique, one needs more information on the virus and how the infection proceeds. In order to do this, GFP (a green fluorescent protein from the jellyfish *A. victoria*) has been engineered into CfMNPV. When the GFP in living tissue is exposed to light of 490 nanometres,



it fluoresces brightly in a yellow-green colour that can be seen clearly under a microscope.

Leica stereofluorescence system

Using a Leica stereomicroscope equipped with a special GFP fluorescence illuminator and the GFP-CfMNPV-GFP recombinant virus, the infection process in budworm larvae is being investigated to establish which tissues are affected first and most severely by the virus. This allows the researchers to produce a more active virus. The same stereomicroscope can be used for studying the host range and environmental fate of the CfMNPV-GFP virus in the forest ecosystems of North America.

This type of technology will provide an effective and targeted method of managing pests in the ecosystem with no harmful effects on other organisms, thereby preserving the ecosystem.

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