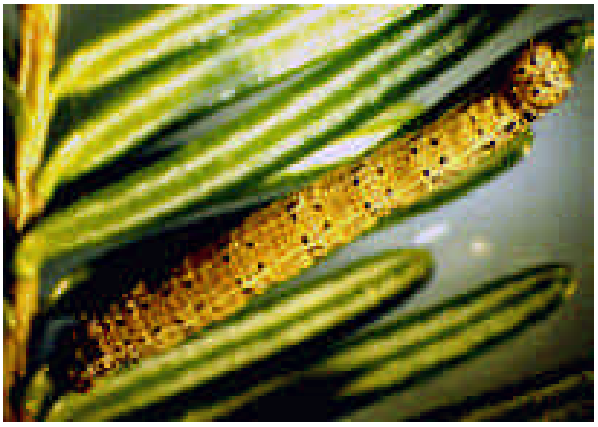
Frontline EXPRESS
Canadian Forest Service, Great Lakes Forestry Centre

Bulletin No. 16

MICROBIAL PATHOGENS OF FOREST PEST INSECTS

INTRODUCTION:

Insects suffer from a myriad of microbial diseases caused by viruses, bacteria, protozoa, and fungi. The objectives of our research are: to determine the impact of naturally occurring microbial pathogens on pest insect populations, and the potential of specific viruses, fungi, and protozoa for use in biological control through studies on host ecology and pathogen epidemiology and the examination of the life cycles, cytologies, and genetics of specific pathogens. Methods for the mass production of pathogens are also being investigated. Forest pest insects currently being researched are the eastern hemlock looper (EHL – *Lambdina fiscellaria fiscellaria*), the eastern spruce budworm (SBW – *Choristoneura fumiferana*), the pine false webworm (PFW – *Acantholyda erythrocephala*), the introduced pine sawfly (IPS – *Diprion similis*), and the balsam fir sawfly (BFS – *Neodiprion abietis*). Central to these investigations is work on nuclear polyhedrosis viruses (NPVs), which are a group of viruses found almost exclusively in insects. Additionally, studies have been carried out on *Coelomomyces*, a fungal pathogen of mosquitoes and copepods.



A swollen abdomen and yellowish colour are symptomatic of heavy *Leidyana* infections in hemhemlock looper larvae.

LOCATIONS/SITES:

Research is being carried out in both field and laboratory settings. Field trials of balsam fir sawfly NPV have been undertaken in Newfoundland and Nova Scotia; pine false webworm and introduced pine sawfly field work is being done in Ontario but eastern hemlock looper and spruce budworm field work has been carried out mostly in New Brunswick. Work on Coelomomyces has been restricted to the laboratory.

RESULTS:

Balsam fir sawfly NPV proved effective in the aerial application trials carried out in Atlantic Canada in July, 2000. Work on NPVs of the three subspecies of *L. fiscellaria* has shown that the NPVs from the EHL and western hemlock looper (WHL - L. fiscellaria lugubrosa) are similar to each other but are unrelated to the NPV specific to the western oak looper (WOL – *L. fiscellaria somniaria*). The NPVs of spruce budworm (SBW) and a closely related insect, the obliquebanded leafroller (OBL – *C. rosaceana*), are also closely related. However, OBL NPV is not very infective to SBW larvae but SBW NPV can infect both SBW and OBL larvae.

A new species of gregarine (insect gut-dwelling protozoa), *Leidyana canadensis*, was described from and found to be highly prevalent in declining populations of EHL larvae in New Brunswick. This gregarine is acquired by larval EHL when they consume balsam fir foliage contaminated with oocysts (a resistant stage in the life of the gregarine). Light and electron microscopic studies have shown that the trophozoite stage of the gregarine can occur in high numbers in the larval gut and prevent the passage of food thereby lowering the overall fitness of the insect.

The red foliage of the balsam fir trees on the right is typical of the damage caused by the balsam fir sawfly.

In its life cycle, Coelomomyces must alternate between its mosquito and copepod hosts. The yellow fever mosquito

(*Aedes aegypti*) breeds in small containers where certain copepods also live. Work has shown that a certain species of Coelomomyces is able to infect the ovaries of adult female yellow fever mosquitoes. Instead of laying eggs, these infected females lay resting spores of the fungus, which then release the stage that infects the copepod host. This process is an adaptation of the fungus so that it may move, with the aid of the mosquito, from one breeding container to another.

PEST MANAGEMENT IMPLICATIONS:

BFS NPV proved effective in field trials. Registration of the virus for operational use against balsam fir sawfly is being pursued. Field trials of BFS NPV and EHL NPV are planned for summer 2001.

Leidyana canadensis has little potential as a biological control agent due to its apparently low virulence and the requirement that it be produced in its living host.

Coelomomyces may have potential as a classical biological control agent where it would be released to regulate populations of mosquitoes.

SOURCES OF RELEVANT INFORMATION:

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