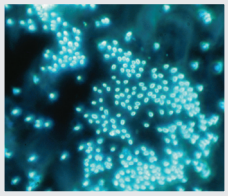
Natural Resources Canada
Ressources naturelles Canada

In Brief

from the Canadian Forest Service – Laurentian Forestry Centre

Number 4 – 2004






Insecticide resistance at what price?

In the insect world, insecticide-resistant individuals are generally smaller and develop more slowly than non-resistant individuals. Some experts believe that this resistance comes at the expense of reproductive capacity, particularly among insects in which reproductive capacity is linked to pheromone production by females.

With the aim of exploring this connection, researchers with the Canadian Forest Service and Agriculture and Agri-Food Canada's Horticulture Research and Development Centre compared two obliquebanded leafroller populations (*Choristoneura rosaceana*), an insecticide-resistant population and a non-resistant one. What they found is that resistant females produced less pheromones and they emitted pheromones less frequently and for shorter durations. The researchers were unable to detect a difference in the mating capacity of resistant males, despite their smaller size. However, these characteristics place resistant males and females at a disadvantage when they have to compete with non-resistant individuals in their environment.

According to the researchers, the transfer of resistance within a normal population has a tendency to decline because the resistant individuals are less successful at reproducing. However, resistance may develop in a population that is subjected to regular insecticide treatments.

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Low genetic diversity in Canada yew

Canada yew is a low-growing shrub that forms small colonies. The needles of this species contain paclitaxel (Taxol®), a compound that has proven effective in the fight against certain types of cancer. This property has sparked a great deal of interest in harvesting the species. Out of concern over the implications of this popularity, Canadian Forest Service researchers undertook a study of the genetic diversity and structure of six Canada yew populations at several locations in Quebec.

They found that Canada yew is genetically less diverse than other yew species and conifer species. This species' genetic pattern nonetheless appeared to be distinct from that of other conifer and tree species that colonize the boreal-temperate zone. In fact, yew populations show a greater degree of differentiation than that observed for most other coniferous species.

With the goal of conserving the genetic resources of this species, the researchers recommend the use of harvesting methods that will ensure the long-term sustainability of Canada yew populations, at the landscape level. For example, it would be wise to preserve specimens that have reached sexual maturity, to allow existing yew colonies to take advantage of the seed dispersal opportunities provided by birds and certain mammals.

Photo: G. Sirois

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Post-fire evolution of the boreal forest

A team of Canadian Forest Service researchers decided to investigate this topic by studying the evolution of the boreal forest in a vast area covering 6000 km^2 north of Baie-Comeau. They reconstructed the region's fire history from data on 380 sample plots managed by the MRNFPQ. The plots enabled them to study such aspects as species diversity and stand structure, as well as to detect traces of recent disturbances. Their objective was to analyse the changes that occur in stand composition and structure in the absence of fire, along with the factors that determine these changes.

The research team observed that post-fire forest evolution involves two stages: the first is characterized by the presence of shade intolerant species (white birch and trembling aspen) and the second, by black spruce. In the case of both stages, the longer it has been since the last forest fire, the greater the predominance of balsam fir in the landscape, and the more irregular the stand structure.

Disturbances such as spruce budworm outbreaks or windfalls create highly favourable conditions for a variety of species and they also allow advance regeneration to grow more rapidly. In the absence of fire, these disturbances and the resultant canopy gaps play a role in relation to the establishment and growth of stands dominated by black spruce and balsam fir.

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This publication is part of a series that presents popularized summaries of scientific articles written in whole or in part by Laurentian Forestry Centre researchers.

Canada

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from the Canadian Forest Service – Laurentian Forestry Centre

Stepping stones to the development of resistant elms

Canadian Forest Service researchers are striving to elucidate the phenomena that characterize various plant diseases in the hope of gaining insight into the defense mechanisms involved in Dutch elm disease and eventually finding better ways of controlling it. One of the diseases studied—Fusarium wilt of carnation—has been especially enlightening, because the pathological signs differ markedly between resistant plants and vulnerable plants. Based on this finding, the researchers were able to demonstrate that compartmentalization of infected tissue is the defense mechanism used by carnations to fight off Fusarium wilt infection.

They recently showed that this resistance is primarily attributable to changes in the cell walls and the production of new cell layers containing suberin. This substance makes the host's cell walls impermeable, helping to shut out the causal pathogen. This mechanism was not present in vulnerable plants.

These observations are consistent with findings showing that some of the defense mechanisms in Dutch elm disease involve modifications of cell walls. These changes appear to occur too late or to lack the requisite characteristics to wall off the attacking pathogen. The researchers concluded that, in order to select elms that are resistant to this disease, it will be necessary to identify elms that are able to quickly and effectively compartmentalize infected tissues through the above-described defense mechanisms.

Photo: R. Pomerleau

Stimulating growth in balsam fir, even at age 60

Shelterwood cutting is a method used to regenerate stands prior to the final cut by promoting the establishment of regeneration under the canopy.

Photo: R. Zarnovican

In the case of balsam fir–yellow birch stands in Quebec, little is known about the impact of these partial cuts on basal area growth and on the subsequent development of residual trees. Canadian Forest Service researchers conducted a trial in a second-growth balsam fir stand in the Lower St. Lawrence Model Forest in order to evaluate the potential impacts of such cuts. Five years after the preparatory cutting (first treatment in the shelterwood method), they evaluated the effect of cutting intensity on the basal area growth of the trees that were conserved and on the increase in DBH.

The results show that the preparatory cuttings stimulated the growth of the residual trees and increased their mean diameter. Since this growth effect was more apparent in the largest trees, it follows that fir stands that are 60 years old can still respond favourably to this type of treatment. In addition, the preparatory cuttings had a significant effect on five-year basal area growth, particularly in cases where cutting intensity was greater than 30%. In this study, strong correlations were found between some green crown characteristics and basal area growth, as well as between the size of trees and their relative position within the stand.

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Productivity of trembling aspen and stand origin

Little is known about the relationships that exist between the productivity of forest stands and their origin. One question that might be asked, for example, is the following: Are fire-origin stands more productive than those resulting from harvesting? With the aim of shedding light on this issue, some researchers with the Canadian Forest Service and the Université du Québec en Abitibi-Témiscamingue measured the height growth (the best indicator of site productivity) of trembling aspen stands on sites that had originated from fire, natural canopy gaps or clearcutting, taking into account two different soil types. In examining soil type, the researchers sought to identify the relationships that exist between certain soil properties and height growth in trembling aspen stands.

Although the researchers expected to find large differences in growth among young stands, this did not turn out to be the case. Height differences were identified at later stages of stand development, with a difference of less than 3 m being recorded for 50-year-old stands. In addition, height growth was much greater on sites with clay soils versus tills, but only for stems taller than 15 m. The researchers were also able to determine that, while the disturbance type associated with stand origin affects some soil properties, it does not have a significant impact on height growth and hence on productivity.

One of the conclusions reported in this study is that, in the case of trembling aspen, clearcutting or partial cutting can permit the establishment of stands that will have a growth rate comparable to that of fire-origin stands.

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 • ISSN 1925-5756