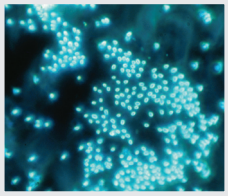
Natural Resources Canada | Ressources naturelles Canada

In Brief






from the Canadian Forest Service – Laurentian Forestry Centre

Number 20 – 2010

Poplar rust in Quebec: Watch out!

Rust is a disease that infects the leaves of poplar trees. While not a serious problem in natural forests, poplar rust can cause extensive damage in tree nurseries.

Researchers with the Canadian Forest Service and the ministère des Ressources naturelles et de la Faune du Québec conducted a study on two poplar leaf rust species in plantations and nurseries throughout Quebec: an indigenous species (*Melampsora medusae* f. sp. *deltoidae*) and a species native to Europe (*Melampsora larici-populina*) which was recently discovered in Quebec.

Photo: N. Feau

In this study, poplar leaves were collected from a natural poplar stand and in 10 plantations and nurseries. The goal was to determine the geographic distribution of the two types of rust. The European rust, found in Quebec for the first time in 2002, appears to have spread rapidly in nurseries and plantations in most regions of Quebec, except the Abitibi-Témiscamingue region.

Some families derived from poplar clones are resistant to the indigenous rust, but they may show a greater susceptibility to the European variety. Because this exotic rust is able to complete its life cycle, it can persist and spread year after year. What effect this will have on the growth and survival of susceptible poplars remains to be seen.

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Techniques for identifying pathogens in peat

Each year, Quebec produces roughly one million cubic metres of peat. A study on the working conditions of the 700 or so workers in this industry revealed a high level of exposure to dust containing a variety of bacteria and moulds. Peat acts like a reservoir of non-tuberculous mycobacteria. Although not all of these bacteria are pathogenic, some species are known to cause several pulmonary infection and hypersensitivity problems.

Precise measurement of worker exposure to mycobacteria is complicated by the fact that air samples are contaminated with moulds.

A molecular biology approach based on DNA amplification by polymerase has made it possible to improve the assessment of worker exposure to non-tuberculous mycobacteria. The method was originally developed by Canadian Forest Service researchers for the rapid detection of forest pests. It is now being used to detect human pathogens in peat.

This approach allows the detection of up to 10,000 more types of pathogens than conventional sampling methods. In addition, new mycobacteria have been detected, some of which are known to cause health problems.

CFS expertise in the field of molecular diagnostics has therefore helped to enhance the detection of pathogens and gain insight into the relationship between the level of exposure to mycobacteria and the presence of specific antibodies in workers.

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White spruce breeding - Trade-off between wood volume and mechanical properties?

Based on a study conducted by researchers with the Canadian Forest Service, FPInnovations and the ministère des Ressources naturelles et de la Faune du Québec, genetic selection of white spruce for wood volume only tends to produce trees that, when young, have poorer mechanical properties. Wood obtained these 30-year-old genetic trials was found to have reduced density, numerous knots, and a high proportion of juvenile wood.

In the scientific literature, these factors are recognized as having a negative impact on mechanical properties. Wood with these characteristics has a low modulus of elasticity and a low modulus of rupture, making it generally unsuitable as a construction material for light structures. However, as the trees age they will have a greater proportion of mature wood, thus enhancing their mechanical properties.

Although volume gain has always been a primary objective of breeding research, researchers believe that wood quality could also be improved by selecting trees with proportionally fewer branches. With fewer and smaller knots, the wood would have better mechanical properties. Therefore, the inclusion of wood properties in selection criteria should make it possible to produce higher value wood.

This research was conducted following commercial thinning operations carried out in two 36-year-old white spruce plantations.

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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

In Brief
from the Canadian Forest Service – Laurentian Forestry Centre

Poplars - Preserving the genetic integrity of our native species

In a recent study, researchers with the Canadian Forest Service and the ministère des Ressources naturelles et de la Faune du Québec developed some genetic markers that can be used to differentiate five poplar species that are widely distributed in eastern North America. These include two native species, specifically eastern cottonwood (*Populus deltoides*) and balsam poplar (*P. balsamifera*), and three exotic species introduced into Canada several decades ago, that is, black poplar (*P. nigra*), black cottonwood (*P. trichocarpa*) and Japanese poplar (*P. maximowizcii*).

Photo: S. Masse

The new diagnostic markers can be used to assess pollen-mediated gene flow from plantations of hybrid poplars with exotic components to native poplar trees through a natural process called introgression. The markers can be used to monitor this natural hybridization, which could have long-term consequences for the genetic diversity of native poplar species.

A number of morphologically typical individuals of each of the five species of interest were studied. Using leaf material, seven genes known for their important physiological role were sequenced to find a genetic fingerprint specific to each species. Further analyses are under way to increase the number of markers and cover other species. The ultimate goal is to enhance the analysis of gene dispersal in natural poplar populations in different regions across Canada.

A test using 12 markers applied to 257 poplar clones demonstrated the effectiveness of the method in differentiating both pure species and first generation hybrids. These diagnostic markers can also be used to validate and certify genetic material prior to the selection of cuttings or prior to its use in breeding programs.

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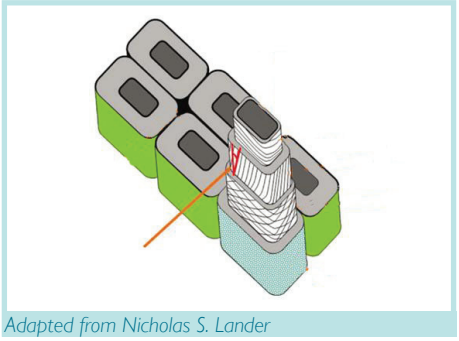
Microfibril angle: a key factor in the mechanical properties of black spruce

The internal physical characteristics of black spruce wood determine its main mechanical properties. The angle of the microfibrils in the cell walls of fibre tracheids is negatively correlated with the modulus of elasticity of the wood. The large microfibril angle in juvenile wood reduces the stiffness of young trees, allowing them to bend more easily in the wind. Tree ring width is not correlated with wood stiffness or elasticity. These relationships between the internal structure of wood and its mechanical properties do not vary among trees.

These findings come from a study conducted by researchers with the Canadian Forest Service, Université Laval and FPInnovations on 36 black spruce trees from a natural forest located in the Chibougamau region. All the samples used in the study were collected at a height of 2.4 m above the ground. The researchers found a marked improvement in wood mechanical properties beginning at a cambial age of 25 years, which confirms why juvenile wood is considered to be of lower quality. This characteristic of juvenile wood is recognized in young plantations.



Adapted from Nicholas S. Lander

The mechanical properties of wood take on considerable importance in the case of lumber needed for the construction of buildings. These properties vary with the position of the fibres in the tree. Microfibril angles show a gradual decline moving outwards, from 30 degrees near the pith to 10 degrees near the bark. One of the goals of silviculture is therefore to produce trees with a greater proportion of mature wood.

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Direct influence of atmospheric circulation on forest fires

Researchers at the Canadian Forest Service, the University of Winnipeg and the Université du Québec à Montréal conducted a study involving the dendrochronological analysis of more than 2,000 trees in the boreal forests of Quebec, Ontario and Manitoba, permitting the reconstruction of summer drought periods in eastern Canada. The information obtained from annual tree rings enabled the researchers to travel back in time 300 years. A climatology model was then used to relate the drought periods to patterns of atmospheric circulation.

Periods of drought and forest fires are more frequent when humid air masses are blocked by high-pressure systems. These systems result in sunny, warm days that create dry fuel conditions that can extend over several hundreds of kilometres. When the systems begin to break down, the ensuing thunderstorms lead to numerous lightning strikes that can ignite forest fires. This phenomenon is responsible for a major proportion of large forest fires.

The researchers found that the frequency of drought periods has declined in eastern Canada since 1850. The increasing incursion of humid air masses over eastern Canada may have contributed to an increase in storm activity (increased troughing) and therefore created moister weather conditions that are less conducive to fires. However, the researchers noted that present climate change trends could modify this situation and result in more forest fires. Blocking high-pressure systems are expected to increase in frequency, intensity and duration, thus leading to more droughts.

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