

# Terpene analysis Chemical clues to conifer kinship

*The composition of terpenes, a class of substances found in all conifer species, appears to be genetically determined. In fact, they can be used as chemical "fingerprints" to separate morphologically similar trees and identify the parentage of pine hybrids.*

Jasmine oil, rose petal extract, a whiff of patchouli... to a highly trained "nose" or odor specialist in the French perfume industry, these are clearly discernible notes in the glorious odor symphony evoked by a great French perfume. Should one of the great French "noses" take a stroll in a Canadian conifer forest, he would be struck by the rich variety of pine and cedar fragrances in the air. These fragrances come from terpenes, a group of compounds which accumulate as volatile oils in conifers, a family of trees that include pines, spruces and firs.

However, besides conferring this pleasant piney scent on forest meadows, terpenes also play important biological roles; for example, they are linked with the tree's ability to defend itself against attack by such pests as the pine bark beetle and the spruce budworm. For man, they represent the base material from which such familiar products as turpentine and camphor oil are produced and, if a study at NRC's Prairie Regional Laboratory in Saskatoon, Saskatchewan, lives up to expectations, they will ultimately serve as valuable genetic markers in the hybridization programs of tree breeders.

For several years now, terpenes have been a subject of great interest to NRC's Dr. Ernst von Rudloff. Says Dr. von Rudloff: "Evergreen forests are one of Canada's most valuable renewable resources, and here, in the Forest Product group, we are using our knowledge of terpene chemistry to tackle some of the practical problems encountered in the forest industry."

One of these practical problems involves the breeding of better trees for reforestation. The Canadian forest industry is long past the stage where it can just harvest trees indiscriminately from virgin forest expanses, confident that the supply of trees in Canada is without limit. Forest exploitation is now more akin to tree farming, with a careful cycle of tree planting, growth and harvesting designed to produce optimum qualitative and quantitative yields.

In tree nurseries, breeders try to combine many of the desirable traits of existing tree species in new hybrids for



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Looking at the branches of these three varieties of Douglas fir, not even an experienced tree breeder can tell them apart. NRC scientists are able to distinguish them, however, by analyzing the terpenes found in their foliage oil. The centre species is a cross (or hybrid) between a coastal-type fir on the left and an interior-type fir on the right. The terpene profile of the hybrid is a mix of those exhibited by the two parents.

Même un arboriculteur expérimenté ne saurait, à première vue, distinguer ces trois variétés de sapins de Douglas. Les chercheurs du CNRC sont cependant en mesure de les identifier en analysant les terpènes contenus dans l'huile de leur feuillage. L'espèce que l'on voit au centre est le résultat d'un croisement (hybride) entre un sapin de Douglas du type poussant sur le littoral, à gauche, et du type poussant dans l'intérieur, à droite. Le profil terpénique de l'hybride est un mélange des profils des deux arbres dont il est issu.