

A natural resistance gene against spruce budworm found

Scientists from Université Laval, the University of British Columbia and the University of Oxford have discovered a natural resistance gene (R-gene) against spruce budworm in the white spruce (*Picea glauca*), a member of the Christmas tree Family. The breakthrough, reported in *The Plant Journal*, paves the way to identifying and selecting naturally resistant trees to replant forests devastated by the destructive pest.



A plantation of *Picea glauca*

A research team composed of professors Éric Bauce, Joerg Bohlmann and John Mackay with their students and postdocs discovered the gene in spruces that had remained relatively undamaged by a local budworm outbreak. The spruce budworm (*Choristoneura fumiferana* - Family: Tortricidae) is a moth whose caterpillar feeds primarily on balsam fir and white spruce needles. It is the most devastating insect to coniferous stands in Eastern North America.

The scientists compared the expression levels of nearly 24,000 genes in the two groups of trees (resistant and non-resistant), explains Professor Mackay. We discovered a gene, *betaglucosidase-1*, whose expression in the needles of resistant spruce trees is up to 1,000 times higher than in non-resistant trees." Postdoctoral scientist Melissa Mageroy then produced the protein encoded by the gene. Tests showed that the protein plays an essential part in chemical reactions resulting in the production of two compounds that are toxic to the budworm, piceol and pungenol, identified in 2011 by a research team supervised by Dr. Éric Bauce. "We could say the gene we discovered produces natural insecticides in the tree foliage," sums up Dr. Mackay.



Cones of White spruce



The 5th instar larva of *C. fumiferana*

The resistance gene is present in all white spruces, but is expressed to varying degrees. "Theoretically, we could create white spruce stands that are less vulnerable to the budworm by reforesting areas with plantings from trees with a high expression of the resistance gene," says postdoctoral fellow and study coauthor Geneviève Parent. Université Laval and University of British Columbia researchers have partnered with Quebec's Ministère des Forêts, de la Faune et des Parcs and the British Columbia Ministry of Forests, Lands and Natural Resource Operations to evaluate applications of their discoveries.

The last major outbreak that took place between 1970 and 1990 caused an estimated loss of half a billion cubic meters of wood in the province of Quebec alone, roughly the equivalent of 15 years of harvesting. Since 2003, the total affected forest area has been increasing steadily. Related caterpillars are affecting other types of conifer trees across Canada.

Source

<http://www.sciencedaily.com/releases/2014/11/141121102920.htm>

Mageroy, M.H., Parent, G., Germanos, G., Giguère, I., Delvas, N., Maaroufi, H., Baucé, E., Bohlmann, J. and Mackay, J.J. 2014. **Expression of the β -glucosidase gene Pg β glu-1 underpins natural resistance of white spruce against spruce budworm.** *The Plant Journal*, November 2014 DOI: 10.1111/tpj.12699