

EVALUATION OF NATURALLY OCCURRING ANTIFEEDANTS AND GROWTH DISRUPTANTS FROM MAPLE (ACER) SPECIES AS A POTENTIAL SOURCE OF RESISTANCE TO FOREST TENT CATERPILLAR

INTRODUCTION

The forest tent caterpillar (*Malacosoma disstria* Hbn.) is a serious pest of deciduous trees in Canada. Its larvae are serious economic pests because they are voracious feeders that can defoliate vast areas of trees. There has been considerable interest in natural products as new pest control agents, but little evaluation of indigenous North American trees as potential sources of active naturally occurring compounds. Evidence is accumulating, however, that an array of biochemicals present in these trees provides a degree of natural defence against forest insects. Many of these compounds are phenolic in nature and are found in foliage in various combina-

tions and concentrations. Phenolics are hydrophilic substances; their common origin is the aromatic precursor shikimic acid. The goal of this study is to identify active compounds in red maple and silver maple species that have antifeedant and growth disruptant and/or toxic effects on the forest tent caterpillar. Effects of these extracts will be assessed on a variety of forest insects, including the forest tent caterpillar. Efficacy of isolated compounds when applied to natural host foliage will be determined, and potential synergistic effects of phenolic compounds in different maple extracts will be examined. Compounds will be assessed as potential natural control agents.

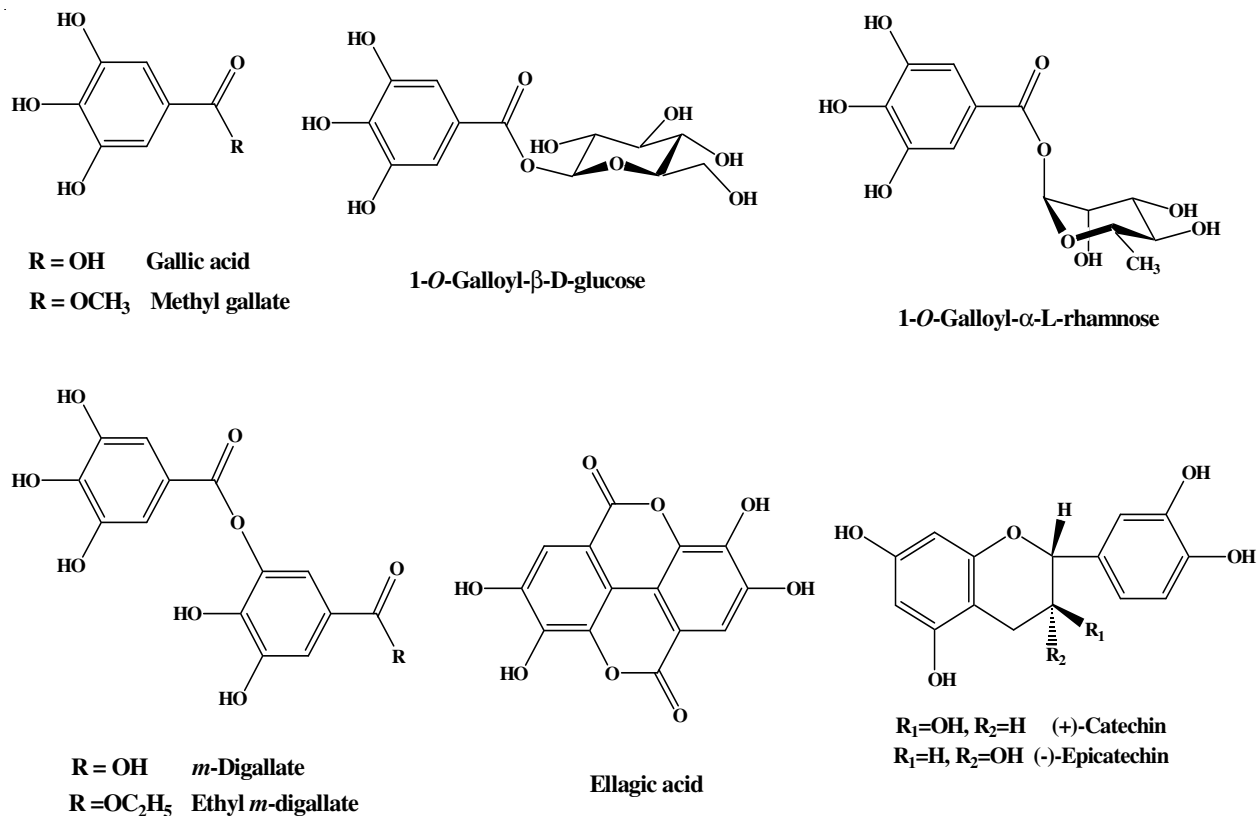


Fig.1. Phenolic compounds of red maple extracts.

LOCATION/SITE

Foliage samples collected near Sault Ste. Marie and Thessalon, Ontario, have been evaluated in laboratories at the Great Lakes Forestry Centre.

RESULTS

Forest tent caterpillar larvae fed with sugar maple foliage gained significantly less weight and had a reduced number of pupae, than a similar number of larvae fed with trembling aspen foliage. All larvae that were fed red maple foliage died within 2 weeks. A nutritional bioassay with fourth-instar larvae revealed that sugar maple foliage has a growth-inhibitory component, whereas that of red maple revealed an antifeedant component.

A number of phenolic compounds have been isolated and found to possess properties that alter insect behaviour. Various red maple extracts, placed on aspen leaf discs, deterred forest tent caterpillar larvae from feeding and led to decreased growth and survival rates.

CONCLUSIONS

There is clear evidence that phenolic extracts from red maple are resistance factors, which deter the development of forest tent caterpillar larvae. Novel control strategies using phenolic extracts from North American forests can act as potential sources of new control agents of forest insect pests.

MANAGEMENT INTERPRETATIONS

These studies will increase the understanding of how phenolic compounds affect the feeding preference, performance, and fitness of forest insects. Data could lead to the development of new pest control agents with a primarily behavioural mode of action (e.g., feeding and oviposition deterrents). This knowledge may also be useful in predicting the vulnerability and susceptibility of forest stands and help identify the range of host-plant resistance to insect pests.

SOURCES OF RELEVANT INFORMATION

Abou-Zaid, M.M.; Grant, G.G.; Helson, B.V.; Beninger, C.W.; de Groot, P. 2000. Phenolics from deciduous leaves and coniferous needles as sources of novel control agents for Lepidopteran forest pests. Chapter 36, pp. 398-417 In: F. Shahidi and C. Ho, ed. *Phytochemicals and Phytopharmaceuticals*; AOCS Press, Champaign, Illinois, USA.

Abou-Zaid, M.M.; Nozzolillo, C.; Helson, B.; Lombardo, D.A. 2000. Phenolic composition of leaves of six maple species in the great Lakes Forest Region of Canada. *Polyphenol Communications* 1: 95-96.

Abou-Zaid, M.; Nozzolillo, C. 1999. 1-0-galloyl-²-L-rhamnose from *Acer rubrum*. *Phytochemistry* 52: 1629-1631.

Nicol, R.W.; Arnason, J.T.; Helson, B.; Abou-Zaid, M.M. 1997. Effect of host and nonhost trees on the growth and development of the forest tent caterpillar, *Malacosoma disstria* Hbn. (Lepidoptera: Lasiocampidae). *The Canadian Entomologist* 129: 995-1003.

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