



Forest Genetics Council Seed Pest Management Program

Project Report, to December 31, 2004:

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Project Title:

Identification of an effective sex pheromone lure for the fir coneworm, *Dioryctria abietivorella*, and demonstration of its efficacy in seed orchards

Approved project funding: \$20,000 CAN

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Objectives:

- 1. To identify the sex pheromone of the fir coneworm.**
- 2. To develop the sex pheromone of the fir coneworm as a tool for sampling fir coneworm populations and monitoring coneworm phenology in seed orchards.**

Results:

The work at UC Riverside focused on two areas in 2004. First, it was discovered by NMR analysis that the commercially available Z9,E11-14:Ac, one of the components of the pheromone, even after exhaustive cleanup steps aimed at removing chemical and stereoisomeric impurities, actually consisted of two inseparable positional isomers. We had missed this before because these compounds eluted from the gas chromatograph and from several types of liquid chromatography columns as a single peak (i.e., all indications up until then were that the mixture was a single pure compound), and it was only by taking the NMR spectrum that the pair of compounds was finally revealed. Because the compounds were inseparable, we then developed a new, pilot scale synthesis of Z9,E11-14:Ac from scratch to provide material of high chemical and isomeric purity.

This material was used in the first field trial in 2004, alone and in combination with analogs that might be minor pheromone components. However, all the test lures were no more active than controls. Because we were now using materials of confirmed high purity, this suggested that the problem might lie with one or more missing components. Thus, infested cones were shipped to us from US Forest Service collaborator Carline Rudolph in northern California, and we reared out several hundred pupae. The pupae were sexed, and upon emergence, the pheromone glands were dissected from 212 virgin female moths, and a composite extract of the glands was analysed by GC-mass spectrometry and GC-electroantennogram detection. These analyses detected the known compounds Z9,E11-14:Ac and Z9-14:Ac, as well as weak but consistent responses to a third component. This compound was subsequently identified and a small-scale, "quick and dirty" synthesis was devised to provide material to confirm the structure, and to conduct preliminary bioassays to verify that the compound might indeed be the elusive, missing pheromone component. These preliminary bioassays, carried out in both British Columbia and northern California, confirmed that the new compound was a crucial component of the pheromone blend, and suggested that the blend ratio was also critical; only the lures with a relatively high proportion of the new compound caught significant numbers of moths.

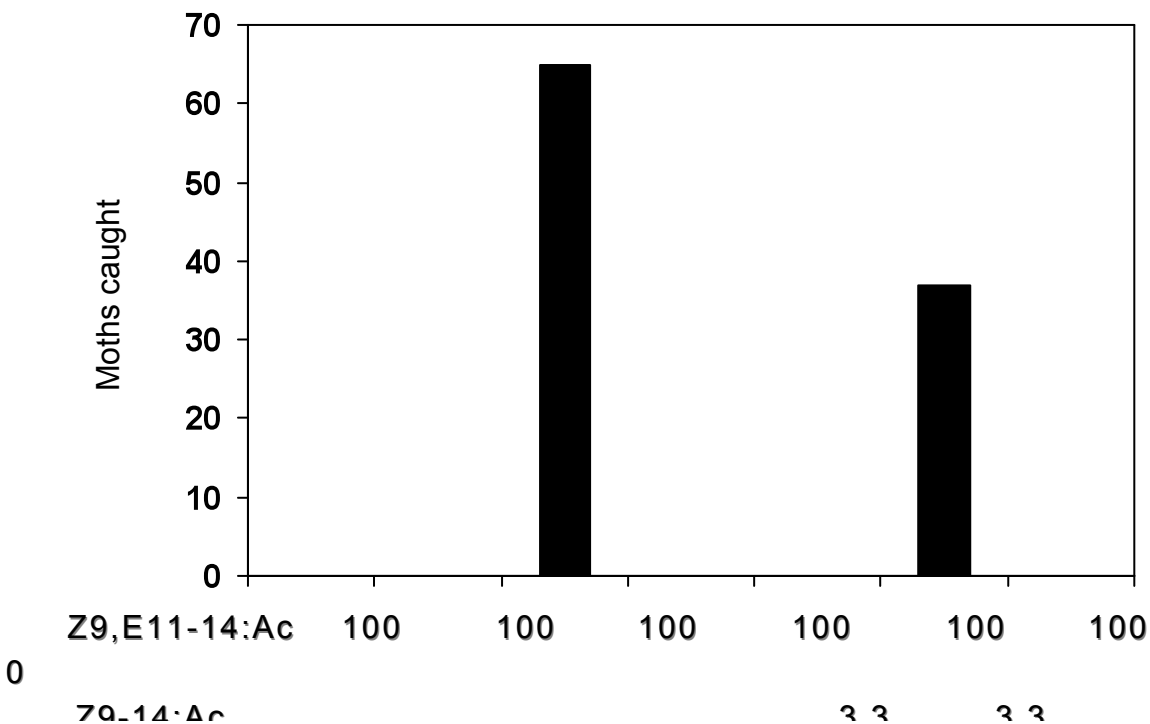


Figure 1. Trap catch data from 2- or 3-component lures tested in a seed orchard in northern California by project collaborator Carline Rudolph.



The trap catch data also suggested that the third compound, Z9-14:Ac, which does elicit significant responses from antennae of male moths in electroantennogram trials, may not be a pheromone component, and in fact, it may be significantly inhibitory. A subsequent, late-season trial confirmed these results.

Thus, with the major components of the pheromone now identified, our goals in 2005 are 1) to develop short and efficient syntheses of the active pheromone components that will produce the compounds in high purity and good yield, so that the technology can be readily commercialised; 2) to finish developing the pheromone for field use, including optimisation of blend ratios, dose, formulations, and release devices.

Output and Deliverables:

The two key components of the fir coneworm sex pheromone have been identified. With this crucial information in hand, we will be able to deliver optimised lures for trapping this species by the end of the 2005 field season, ready for use by forestry personnel.

Financial:

No changes to budget or expenditures.

Employment: Project required part time services of one senior staff research associate and one postdoctoral chemist.

Signature Block:

Name (Project Leader):	<u>Jocelyn G. Millar</u>
Signature:	_____

2002-2004 Financial

Note: Work was carried out over 2 years, with a no-cost extension

	Quarter				Total Year 1-2
	1 st	2 nd	3 rd	4 th	
a) Salaries and benefits					15,257
b) Equipment					
c) Travel					790
d) Materials & supplies					3,000
e) Other expenses (attach list)					
f) Administrative Costs					953
TOTALS					\$20,000



Forest Genetics Council
of British Columbia

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