



Forest Genetics Council Seed Pest Management Program

Project Report to January 2006:

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| Name of Applicant/Project Leader Gary G. Grant | For Official Use Only |
| Legal Name of Organization: Great Lakes Forestry Centre Canadian Forest Service Mailing Address: Great Lakes Forestry Centre 1219 Queen St. E. Sault Ste. Marie, ON P6A 2E5 Telephone: (705) 541-5519 Fax: (705) 541-5700 E-Mail: ggrant@nrca.gc.ca Financial Officer: Jerry Longo | SPM Project # |

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: \$4,725

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Objectives:

1. Chemical analysis, identification, synthesis of the female sex pheromone components of the fir coneworm, and preparation of experimental lures will be carried out by Jocelyn Millar (see companion fir coneworm proposal).
2. In collaboration with Jocelyn Millar and Ward Strong, field trials will be conducted in BC seed coniferous orchards to evaluate and refine experimental lure blends, dosages and releaser devices to provide an optimized lure for monitoring. Trials will also include testing of several sticky trap designs against the current standard Pherocon IC trap to ensure the most cost effective and efficient trap design is utilized.
3. Laboratory tests involving static and/or flight tunnel bioassays utilizing lab reared insects from the CFS colony in SS Marie will be attempted to provide additional information on the role of various components in the pheromone blend.
4. Using catches from traps baited with non-optimum lures (out best 2004 lures) deployed in various seed orchards, estimates of when flights occur and number of peak flights during the flight season of the fir coneworm will be obtained to provide new information on its life history.

Results:

- In collaboration with Jocelyn Millar and Ward Strong (and USDA Forest Service colleagues), chemical analysis of female fir coneworm gland extracts and field tests led to the identification of a new pheromone component, (3Z,6Z,9Z,12Z,15Z)-pentacosapentaene, for the fir coneworm. A

5:1 mixture of this component with the previously identified diene component (9Z,11E)-tetradecadienyl acetate was attractive in 2004 field tests in seed orchards located in both BC and Chico, CA. This work was published in 2005 (see below).

- In May 2005, we assisted Ward Strong in placing the initial set of trials of lure blends and dosages at the Vernon seed orchards to refine and optimize the monitoring lure for the fir coneworm. Details of the trials and their results will be found in the companion report by Jocelyn Millar, who designed those tests.
- Hanula et al 1984 (J. Econ Entomol. 77: 1449-1453) reported that Phercon IC wing type trap was the most effective trap design for catching southern coneworm (*Dioryctria*) species. To establish if this design was the best for monitoring the fir coneworm in BC seed orchards, four commercially available trap designs obtained from PheroTech were deployed in May 2005. These included three sticky traps (a delta trap, a diamond-shaped trap and a wing trap without spacers) and a bucket type, the white Unitrap. The results (Table 1) showed that the diamond and delta traps were superior to the wing trap while the bucket trap was completely ineffective.

Table 1. Mean (n = 5) catch of *Dioryctria abietivorella* in various trap designs baited with a new fir coneworm lure (ZE9,11-14:Ac + Z3Z6Z9Z12Z15-pentacosane)

| Trap type | mean \pm SE catch ¹ |
|--------------|----------------------------------|
| Diamond trap | 14.4 \pm 3.4 a |
| Delta trap | 7.2 \pm 1.3 a |
| Wing trap | 3.2 \pm 0.9 b |
| Bucket trap | 0 b |

¹Means with different letters are significantly different (P<0.05), Tukey test.

A second test in July-August 2005, included two additional sticky trap designs, the Pherocon IIa and IIb, which were intermediate in shape between the diamond and delta traps. The mean (n = 5) catches were as follows; diamond trap 22.0 \pm 4.4, delta 22.7 \pm 4.4; Phercon IIB 8.9 \pm 4.0; Phercon IIC 9.6 \pm 4.3, wing trap without spacer 10.2 \pm 4.0 wing trap with spacer 9.0 \pm 1.8. There was no difference (P > 0.05, F-test) among the catches with these traps. As catches were numerically superior in both trials with the diamond and delta type traps over the wing traps, it would appear that they are more efficient and useful for monitoring purposes, particularly as they are easier to use and less costly than the wing trap.

- No progress was made in the laboratory study to bioassay and evaluate the role of the fir coneworm pheromone components. Although a number of female extracts were produced for bioassay, all had very low titres of the pheromone components. This was unexpected and contrasted with previous experience. Also, male GC-EAD responses to synthetic samples of the pheromone components (ZE9,11-14:Ac, Z9-14:Ac and C25 pentaene) were very weak. It was not clear why these poor results occurred. The rearing unit at GLFC has undergone drastic changes and rearing procedures have changed substantially, and this may be a factor. This study is continuing and will use some alternative experimental techniques to improve both pheromone titre and male responses.
- The study to monitor various seed orchards across BC was conducted by Ward Strong with lures provided by Jocelyn Millar. Strong will report his findings independently but preliminary information suggests that there was a surprising lack of distinct flight periods in most seed orchards, contrary to expectations. This outcome would have important implications for some types of control methods such as mating disruption and indicates a need to better understand the bionomics of the fir coneworm.



Output and Deliverables:

- The identification of the key missing pheromone component of the fir coneworm was identified and published. A generic monitoring lure is available.

Millar JG, Grant GG, McElfresh S, Strong W, Rudolph C, Stein JD, and Moreira JA. 2005. (3Z,6Z,9Z,12Z,15Z)-pentacosapentaene, a key pheromone component of the fir coneworm moth, *Dioryctria abietivorella*. J. Chem. Ecol. 31: 1229-1234.

- The results of the 2005 field trials involving various lures blends and dosages will result in an optimized monitoring lure for the fir coneworm.
- The evidence to date supports the use of diamond or delta shaped sticky traps in preference to wing traps for monitoring fir coneworms in BC coniferous seed orchards.

Financial (2005-2006:

| | Quarter | | | | Total Year |
|---|-----------------|-------------------|-----------------|------------------|-------------------|
| | 1 st | 2 nd | 3 rd | 4 th | |
| a) Salaries and benefits | | | | | 0 |
| b) Equipment | | | | | 0 |
| c) Travel | | \$ 2093.69 | | | \$ 2093.69 |
| d) Materials & supplies | | \$ 2362.84 | | \$ 778.90 | \$ 3141.74 |
| e) Other expenses: courier & customs | | \$ 74.08 | | \$ 39.99 | \$ 114.07 |
| f) Administrative Costs | | | | | 0 |
| TOTALS | | \$4,530.61 | | \$ 818.89 | \$ 5349.50 |

| | |
|--|-------------|
| BC MoF Funds carried forward from 2004-05: | \$ 5,459.00 |
| BC MoF Funds received for 2005-06: | \$ 4,750.00 |
| | ===== |
| Total funds available in 2005-06 | \$10,209.00 |

Expenditures to date (Mar 27, 2005):

| | |
|------------------------------------|------------|
| Insect diet and rearing materials: | \$ 778.90 |
| Custom duties | \$ 39.99 |
| Pheromone traps for 2005 season: | \$2,362.84 |
| Custom duties | \$ 18.50 |
| Travel, BC seed orchards, May 2005 | \$2,093.69 |
| Service fees | \$ 55.58 |
| | ===== |
| Total expenditures 2004-05 | \$ 5349.50 |

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|--|-------------|
| Unexpended BC MoF Funds remaining (2005-06): | \$ 4,859.50 |
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Employment: None. The cost of personnel involved in rearing coneworms was provided by Great Lakes Forestry Centre, CFS.



Forest Genetics Council
of British Columbia

Signature Block:

Name (Project Leader): Gary G. Grant

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