# IMPROVING PREDICTIONS OF PEST MORTALITY PRIOR TO PEST ERADICATION OPERATIONS: PART III

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Client Report No. 39473

# Improving predictions of pest mortality prior to pest eradication operations: Part III

## The influence of the host plant on the susceptibility of the painted apple moth to a viral pathogen.

**M. K. Kay**

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Client: **FBRC**
Contract No:

# EXECUTIVE SUMMARY

## Objective

The objective of this work was to determine the efficacy of Virtuss, when applied to a selection of host plants of known nutritional value to the painted apple moth.

## Key Results

Seven days after treatment significant mortality was only recorded for larvae feeding on treated foliage of *P. lophanta*, a poor host for painted apple moth. The result supported the contention that larval mortality on poor host plants is exacerbated by pathogens.

## Application of Results

The trial had some shortcomings in methodology and results may have little relevance in field conditions.

## Further Work

It is planned to refine the methodology when more viral material becomes available.

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Information for Ensis abstracting:

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|---|---|
| Contract number | |
| Client Report No. | 39473 |
| Products investigated | |
| Wood species worked on | Pinus radiata |
| Other materials used | Nectria fuckeliana |
| Location | Berwick Forest, Otago |

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# INTRODUCTION

There are a number of options available for the eradication of the Painted apple moth, *Teia anartoides* (Lepidoptera: Lymantriidae) in New Zealand. From December 2003, a programme was initiated to investigate the availability and potential of microbial insect pathogens for control of painted apple moth (Markwick *et al.* 2005). The overall goal of the project was to determine if any microbial pathogens had potential as biological control agents. Among the many pathogens the team assessed, one showing promise was the commercially available biopesticide 'Virtuss', a nucleopolyhedral virus (NPV) produced from the white marked tussock moth, *Orgyia leucostigma*.

Standard efficacy tests for viral biopesticides utilise bioassays where the target insect is fed artificial diet to which aliquots of known viral titre have been applied (Hunter-Fujita *et al*. 1998). Given the strong influence of the host plant on the efficacy of the bacterial biopesticide Foray 48B (Part I of this study), the mainstay for the current painted apple moth eradication programme, it seemed judicious to evaluate the same phenomenon for any potential viral pathogen. The study described here investigates the efficacy of Virtuss, when applied to a selection of host plants of known nutritional value to the painted apple moth.

# MATERIALS AND METHODS

Virtuss was supplied as a freeze dried powder by Ngaire Markwick (HortResearch) from an ERMA approved import of Travis Glare (AgResearch). It was rated at $4.77 \times 10^{9}$ PIB/g. The freeze dried preparation was suspended in a solution of distilled water and 2.5% by volume of the adjuvant-sticker Mobait® and adjusted to an equivalent aerial application rate of $2.5 \times 10^{11}$ PIBs in 9.4 l/ha (Martignoni 1999).

Five foliage samples from each of three trees of eight plant species (*Acacia decurrens, A. dealbatum, A. mearnsii, Paraserianthes lophanta, Sophora microphylla, Nothofagus solandri, Corynocarpus laevigatus, Pinus radiata*) were dipped in the stirred suspension and air dried. Controls were treated similarly with water and adjuvant only.

One third instar painted apple moth larva was placed on each separately 'caged' foliage sample and allowed to feed for seven days. The trial was undertaken in the PC2 Ensis, Rotorua, quarantine facility (essentially a sophisticated fume hood) and run at 20ºC with a 14hour photoperiod. The spatial restrictions limited the cage quality to individual 130 x 100mm 'Ziplok' plastic bags for each replicate. The individual bags of control and treated replicates were shuffled within two (Control & Treated) larger 600 x 900 bags to achieve randomness. Larval mortality was recorded on the seventh day.

# RESULTS

Seven days after treatment significant mortality was only recorded for larvae feeding on treated foliage of *P. lophanta* (Table 1).

| Host species | Rep. | % larval mortality | |
|---|---|---|---|
| | | controls | treated |
| *Acacia mearnsii* | 1 | 0 | 0 |
| | 2 | 0 | 0 |
| | 3 | 20 | 0 |
| *A. dealbatum* | 1 | 0 | 0 |
| | 2 | 0 | 20 |
| | 3 | 0 | 0 |
| *A. decurrens* | 1 | 0 | 0 |
| | 2 | 0 | 0 |
| | 3 | 0 | 0 |
| *Paraserianthes lophanta* | 1 | 0 | 80 |
| | 2 | 20 | 40 |
| | 3 | 0 | 20 |
| *Nothofagus solandri* | 1 | 20 | 0 |
| | 2 | 20 | 0 |
| | 3 | 0 | 20 |
| *Sophora microphylla* | 1 | 40 | 0 |
| | 2 | 0 | 0 |
| | 3 | 0 | 0 |
| *Corynocarpus laevigatus* | 1 | 0 | 40 |
| | 2 | 20 | 20 |
| | 3 | 20 | 0 |
| *Pinus radiata* | 1 | 0 | 20 |
| | 2 | 20 | 0 |
| | 3 | 0 | 0 |

# DISCUSSION

*Paraserianthes lophanta* is a poor host for painted apple moth. The result supported the contention that larval mortality on poor host plants is exacerbated by pathogens. However, the foliage of *P. lophanta* was also the first to deteriorate under the conditions of the trial. This undoubtedly stressed the larvae, which may well have had synergistic effects for any viral infection. While this is of benefit in achieving a result, it may not be reliably replicable in the laboratory and may have little relevance in the field.

The trial revealed other shortcomings in methodology. The use of first instar larvae would be expected to result in greater mortality because of their age or a greater viral loading for a given larval biomass. However, strong air currents within the filtered containment cabinet precluded their use. A higher dose rate may be required for third instar larvae to achieve a more reliable and rapid assay. The Mobait® adjuvant was also

used at the recommended 2.5% by volume, however, BC Forest Service recommend a 25% mix (Hunter-Fujita *et al*. 1998).

It is planned to refine the methodology when more viral material becomes available.

# REFERENCES

Hunter-Fujita, F.R., Entwistle, P.F., Evans, H.F. and Crook, N.E. 1998. Insect viruses and pest management. Wiley, England.

Markwick, N., Ward, V., Kay, N. and Glare, T. 2005. Microbial control of painted apple moth: the virulence and safety of *Oran*NPV. Unpubl. report

Martignoni, M.E. 1999. History of TM BioControl-1: the first registered virus-based product for control of a forest insect. American Entomologist 45: 30-37.