# Protecting Restock Crops from *Hylobius abietis* Damage in UK Forestry:

# Outcomes from the Maelor Weevil Trials

Synthetic Pyrethroid Insecticides:

- Alpha-cypermethrin
- Cypermethrin

Tilhill

BSWGROUP member of binderholz

Forest Research

Scottish Woodlands

Maelor Forest Nurseries

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# Are there viable chemical and non-chemical alternatives to the use of conventional insecticides for the protection of young trees from damage by the large pine weevil *Hylobius abietis* L. in UK forestry?

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In UK forestry, the synthetic pyrethroid insecticides alpha-cypermethrin and cypermethrin have been used for many years to provide protection for young trees planted on restock sites from damage by the large pine weevil, *Hylobius abietis* L. However, concerns over the toxicity of these insecticides to aquatic life if misused have led to a search for alternative forms of protection. This paper describes a detailed programme of efficacy experiments undertaken between 2009 and 2015 to find replacements for these products. Over 50 combinations of chemical and non-chemical approaches were tested on 16 different sites. Of the alternative synthetic insecticides tested, applications of 0.037 g a.i. stem$^{-1}$ acetamiprid provided high levels of protection from *Hylobius* browsing damage on young Sitka spruce (*Picea sitchensis* (Bong.) Carrière) trees, without causing any phytotoxic symptoms, and gave comparable levels of protection to those achievable using alpha-cypermethrin or cypermethrin. Acetamiprid is less toxic to aquatic life than alpha-cypermethrin or cypermethrin and has not been linked to bee decline. Applications of 0.0129 g a.i. stem$^{-1}$ chlorantraniliprole also showed promise, and this relatively low toxicity non-neonicotinoid insecticide merits further study. Although imidacloprid and thiacloprid also provided good levels of protection, their use in forests is not now permitted due to concerns over their potential impacts on bees and drinking water, respectively. Whilst the natural product insecticide spinosad, and the entomopathogenic fungal control agent *Metarhizium anisopliae* (Metschn.) Sorokin, gave only limited protection in our work, they may have some future potential if methods of deployment can be improved. Other chemical and non-chemical approaches tested, but found to be largely ineffective in UK conditions, included the natural product insecticides azadirachtin, maltodextrin and pyrethrins, the synthetic insecticides lambda-cyhalothrin and spirotetramat and a wide range of repellents, flexible stem coatings and physical barrier products. However, we conclude that physical barrier sleeves such as MultiPro® and BioSleeve® may have a limited role as a partial substitute for the use of insecticides in the UK in some circumstances, but only if on-site populations of *Hylobius* are predicted to be low.

## Introduction

The large pine weevil (*Hylobius abietis* L., hereafter referred to as "*Hylobius*") is a major pest of young trees planted to restock recently clearfelled forest sites in the UK and the rest of Europe (Långström and Day, 2007; Willoughby *et al.*, 2017). In the UK, preventing *Hylobius* damage has been estimated to cost the forest industry at least £4 million per year (Leather *et al.*, 1999) (nearly £7 million in 2019, adjusted for inflation), but if indirect impacts such as delays to revenue received are included, total losses are estimated to be ~£40 million per year (Moore, E. Wilson, I.H. Willoughby, T. Connolly, I. Sayyed, K. Leslie, *et al.*, in preparation).

An even-aged high forest silvicultural system encourages high populations of *Hylobius* to develop in coniferous forests, as large volumes of fresh woody material left on site after cutting, especially the stump and root systems of harvested trees, attract the insect to breed in large numbers (Eidmann, 1985). Adults mate and lay their eggs in cut stumps, roots and other debris,

Example Trial Site.

**- 2009 - 2015**

**- 16 experimental sites** located in Scotland, Wales and Northern England.

Over **50 combinations** of chemical and non-chemical approaches.

Examples of Physical Barriers.

# Key Findings

# Acetamiprid:

- Synthetic insecticide.

- High levels of protection.

- No phytotoxic effects to trees.

- 500 times less toxic to aquatic life than Cypermethrin.

# Chlorantraniliprole:

- Synthetic pesticide.

- High levels of protection.

- No phytotoxic effects to trees.

- 100 times less toxic to aquatic life than Cypermethrin.

- Further investigations into its efficacy are recommended.

# Bioinsecticides:

- Entomopathogenic biological control agent ***Metarhizium anisopiae.***
- Poor levels of protection, at intermediate to high population levels.
- Future potential if deployment methods can be improved.

## Spinosad:

- Natural Product Insecticide.
- Variable protection provided.
- Good spray coverage is key.

## Neem Extracts:

- Didn’t give acceptable levels of protection.

# Repellents:

- **Sheep Fat**
- **Blood meal**
- **Essential plant oils** (eucalyptus, geraniol, limonene, garlic and capsicum).

- Didn’t provide acceptable levels of protection.

- Many were phytotoxic to young trees.

# Physical Barriers:

- At high populations, as seen in the UK, largely ineffective.
- Swedish studies have found them effective at smaller populations.
- Potential for future use, when used as part of an integrated approach.



Examples of Physical Barriers.

**Since 2015:**

- Trials have continued with 50+ combinations of chemical and non-chemical approaches.

- 2022: Two Tilhill trial sites in Northern England, trialling 10 treatments.

# Thank you