

Hylobius attack: other ways of protection

Dr Ian H. Willoughby FICFor and **Dr Roger Moore** of Forest Research describe some of the results of a collaborative pan-industry research programme looking into alternative ways of protecting trees from browsing by the large pine weevil

The large pine weevil, *Hylobius abietis*, is arguably the most serious pest of young trees on restock sites in the UK and Ireland. Adult insects emerge from the stumps of trees that were felled 9 - 18 months previously, and then feed voraciously on the stems of any young seedlings they find. Trees of all species are browsed, be they hardwood or conifer, and the insects don't distinguish between seedlings that have been planted or have arisen from natural regeneration. Typically, if nothing is done, around 50% of newly planted seedlings on affected restock sites will be dead within two years. On the sites with the highest populations of Hylobius, it is not unusual for all young trees to be completely wiped out. It's been estimated that the impacts from this insect cost the UK forest industry between £7,000,000 and £40,000,000 a year.

The scale of the problem won't be a surprise to anyone who's tried to establish trees on restock sites lately. For many years, foresters have protected trees by spraying them with synthetic pyrethroid insecticides such as permethrin, and in more recent times alpha-cypermethrin and cypermethrin. This can be very effective, but the problem is that these chemicals are highly toxic to aquatic life if they get into watercourses as a result of spray drift, run off, or poor mixing and filling practice, and therefore voluntary certification schemes such as that run by the Forest Stewardship Council now discourage their use.

Because of concerns over pesticides, and their impact if misused, in the UK it is recommended that an

integrated approach to the management of Hylobius is adopted (Willoughby et al., 2017). This involves predicting the likely insect population level for a particular site, for example through using a tool such as the Hylobius Management Support system (www.forestresearch.gov.uk/tools-and-resources/tree-health-and-protection-services/hylobius-management-support-system), and then using the combination of methods that will best protect trees whilst having the least risk



An adult large pine weevil mid-feast. This young tree is unlikely to survive.

of negative environmental impacts, with a preference for non-chemical approaches so long as they are not prohibitively expensive.

Non-chemical approaches that are sometimes practical to adopt in the UK and Ireland include the use of continuous cover forestry rather than clear felling, biological control of insect larva through inundating stumps with nematodes, physical protection, leaving sites fallow for 3-5 years after tree felling, using larger, well balanced planting stock, cultivation, and practising good weed control. However, there is no one size fits all approach and in many instances there are, unfortunately, currently still no viable non-chemical alternatives to the use of insecticides.

Our research - some possible solutions?

For this reason, a large programme of collaborative research involving a range of organisations across the private and public sectors took place during 2009 - 2015. Some of this research was described by Imam Sayyed in the October issue of Forestry and Timber News (Hardy et al., 2020; Sayyed et al., 2020). Forest Research have recently published a paper in the scientific journal Forestry giving the results of a further 16 of those experiments, which examined over 50 different potential solutions to the problem of protecting trees from Hylobius damage (Willoughby et al., 2020).

We found that, of the alternative synthetic insecticides tested, acetamiprid, which is less toxic to aquatic life than alpha-cypermethrin or cypermethrin and has not been linked to bee decline, provided very good levels of protection, even on the sites with the highest populations of Hylobius. It is perhaps unsurprising then that since the research was completed, acetamiprid has increasingly been phased in across the forest industry in the UK and Ireland in place of synthetic pyrethroid in-



Physical barrier sleeves like this MultiPro guard may sometimes be a viable option for protecting trees, but only where on-site populations of Hylobius are predicted to be low.



secticides. Chlorantraniliprole also showed great promise in our research, and this relatively low toxicity non-neonicotinoid insecticide merits further study.

Bioinsecticides contain naturally occurring micro-organisms, and hence normally have a relatively low toxicity. In contrast, natural product insecticides are chemicals that are derived from natural organisms such as plants, or as by-products of micro-organisms, rather than being produced synthetically. Some people consider natural product insecticides to be preferable to synthetically produced ones, although they are not necessarily inherently any less toxic. Whilst the natural product insecticide spinosad, and the entomopathogenic fungal bioinsecticide *Metarhizium anisopliae*, gave only limited protection in our work, we believe they may both have some future potential if methods of applying them can be improved.

Other chemical and non-chemical approaches that we tested, but unfortunately found to be largely ineffective, included the natural product insecticides azadirachtin (derived from neem trees), maltodextrin, and pyrethrins; the synthetic insecticides lambda-cyhalothrin and spirotetramat; repellents such as blood meal, sheep fat, and the essential plant oils eucalyptus, geraniol, limonene, garlic, or capsicum; flexible stem coatings using wax or polysaccharide films; and a range of physical barrier products. In the UK and Ireland we often suffer from much higher populations of *Hylobius* on our restock sites than in mainland Europe, which may go some way to explaining why non-chemical methods developed

in Scandinavia such as flexible stem coatings and physical barriers do not always work over here.

However, based on our research we do believe that physical barrier sleeves such as MultiPro® guards 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. Even then, we recommend that guards should be properly fitted and only be considered for sheltered, cultivated, and weeded sites, with soil textures that are not stony or very friable, and only in combination with well-balanced planting stock with few side branches, which may limit their use in practice to vegetatively propagated material.

FURTHER INFORMATION

Full details of the research, including links to a free copy of the scientific paper (Willoughby et al., 2020) are available:- www.forestresearch.gov.uk/research/are-there-viable-chemical-and-non-chemical-alternatives-use-conventional-insecticides-protection-young-trees-damage-large-pine-weevil-hylobius-abietis-l-uk-forestry/

For comprehensive guidance on the integrated pest management of *Hylobius*, please refer to the Forest Research guide (Willoughby et al., 2017) freely available:- www.forestresearch.gov.uk/research/integrated-forest-management-of-hylobius-abietis/

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