



BIOCOMES

New biological control products
for sustainable farming and forestry

CONTACT

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EPN for pine weevil control in reforestation

Introduction

The large pine weevil (*Hylobius abietis*) is a serious pest of reforestation across northern Europe. Weevils develop in the stumps of recently felled coniferous trees and emerging adults feed on the bark of newly planted trees. Weevil damage can kill these young trees. Entomopathogenic nematodes (EPN) applied to stumps can reduce numbers of emerging adults and this strategy has a place in integrated pest management of pine weevil.

Our objective in BIOCOMES is to optimize strain selection and application parameters for EPN against large pine weevil in reforestation under contrasting conditions of climate and soil conditions, in Ireland and Poland.

Approach

Pine weevil larvae feed under the bark of the tree stumps, under the soil, making them hard to reach even for the active host-finding EPN infective juveniles (IJs). Previous research indicated that the more active “cruise foraging” species such as *Heterorhabditis downesi* were more effective against pine weevil than so-called “ambush foraging” species such as *Steinernema carpocapsae*, but that the latter performed surprisingly well given its reputation for sitting and waiting for mobile hosts. Other recommendations include targeting the weevils at the late instar larval stage. Pupae are relatively unsusceptible but are vulnerable when metamorphosing to callow adult. Nematodes are applied in aqueous suspension at a rate of 3.5×10^6 IJs per stump. As for EPN in general, limiting factors are soil temperature and moisture. In Ireland, late instar larvae are present in June, when temperatures are suitable for EPN activity. Drought is rarely an issue. In Poland, late instar larvae are present by September, and drought can occur at time of EPN application. Moreover, Polish stumps are large and the weevils are widely dispersed along root branches, meaning that EPN must be applied across a larger area. Trials of EPN against pine weevil are assessed in two ways – destructive sampling of stumps to locate parasitized weevils, or by erecting emergence traps over stumps to enumerate adults. In small scale trials for comparison of different species and application methods, stumps are treated individually in randomized block trials. In operational trials nearly all stumps on a site are treated with the exception of a small number which are left untreated as controls. Internal controls are used due the large variability in weevil numbers both between and across sites.



Application of nematodes to tree stumps for suppression of the large pine weevil, *Hylobius abietis*.



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Results

Both *S. carpocapsae* and *H. downesi* were equally effective in suppressing weevil numbers below the damaging threshold in Ireland. The method of application (top of stump versus sides/soil) had a slight impact on performance, in a species-specific manner, with the standard method of application working best for *S. carpocapsae*. Nematodes were equally effective in deep peats (which are widely used for conifer plantations) as in mineral soils. Treating sites with heavy weevil infestation with nematodes is being considered by Coillte, Ireland's state forestry company, as part of its weevil management strategy. In countries such as Poland, where weevils are typically found at depths of more than 0.5 m beneath the soil surface and drought conditions are possible at time of application, using EPN against weevils is less viable. Replacement of chemical insecticides by biocontrol and silvicultural management is important for Sustainable Forest Management (SFM) certification, a Europe-wide policy for forestry, and EPN can be included where conditions are favourable.

Next steps

EPN have shown efficacy against the large pine weevil where soil and weather conditions are optimal, and have a place in an integrated management programme against this pest. Local decision support systems for the pest can be refined to decide on which sites are most suited to nematodes. Further development of application strategies may extend the range of sites where use of EPN would be recommended.



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