FIELD EVALUATION OF SPINOSAD FOR CONTROL OF THE WILLOW SAWFLY (*NEMATUS OLIGOSPILUS)* IN HAWKE'S BAY

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ABSTRACT

Willow sawfly (*Nematus oligospilus* (Hymenoptera: Tenthredinidae)), a species recently discovered in New Zealand, has spread throughout the country. In Hawke's Bay, it is a threat to willow trees, many of which are an important part of river flood control systems. A trial was conducted in Napier to test the efficacy of the insecticide Spinosad against sawflies infesting golden willows (*Salix alba var. vitellina*). Insecticide was applied once at each of two sites, while a third site was used as an untreated control. Larval densities were measured on two trees from each site, immediately before the experiment began and for 28 days afterwards. At both treated sites, 100% mortality occurred within seven days of insecticide application. The results showed that Spinosad can provide effective control of willow sawfly.

Keywords: willow sawfly, *Nematus oligospilus*, golden willow, Spinosad, control.

INTRODUCTION

The willow sawfly, *Nematus oligospilus* Förster (Hymenoptera: Tenthredinidae), was first discovered in Auckland in 1997 (Charles & Froud 1997) and has since spread throughout the country. It is a serious problem in the Hawke's Bay, affecting the willows comprising part of the river flood control systems (G. Hansen, pers. comm.). In addition, willows are utilised for soil conservation, as amenity trees and as fodder for stock during droughts (Harding 2004). While several species of willow are affected by this pest, the golden willow, *Salix alba var. vitellina,* is the most affected in Hawke's Bay (D. Gorst, pers. comm.).

The Hawke's Bay climate is highly conducive to willow sawfly development and several generations are completed each year (Charles et al. 2001). Sawfly populations can increase rapidly and the larvae severely defoliate willow trees in short periods (D. Gorst, pers. com.). Repeated or continual defoliation throughout the warmer months results in seriously weakened trees which are susceptible to strong winds and are more likely to be uprooted (D. Gorst, pers. com.).

To date, the preferred solution to this problem has focused on production and utilisation of resistant willow species in flood control systems (Fung et al. 2001). However, this solution may be several years away from implementation. An interim solution for achieving control of sawfly populations, particularly in the worst affected areas, would be extremely beneficial to existing riverbank stabilisation systems.

Spinosad, a naturally-derived insecticide produced from fermentation of the bacterium *Saccharopolyspora spinosa* (Tomkins et al. 1999), was chosen for testing because of its activity on Hymenoptera and reduced risk profile for non-target species. Recent New Zealand research has shown good mortality in another insect pest species, brownheaded leafroller, for up to 28 days (Tomkins et al. 1999).

This paper reports a preliminary study of the efficacy of Spinosad on willow sawfly populations inhabiting golden willows on the banks of the Tutaekuri River, Napier.

MATERIALS AND METHODS

Three sites situated at least 50 m apart were randomly selected within a stand of golden willows on the banks of the Tutaekuri River. The sites were already exhibiting foliage damage from an inhabiting population of willow sawfly. Within each site, two trees were randomly selected and the trunks marked. On each tree, 50 branchlets, each with about 10 leaves, were tagged with labelled markers.

Prior to treatment, the total number of willow sawfly larvae and pupae per branchlet were recorded. The control site (Site C) was sprayed with water while the two treated sites (Sites A and B) were sprayed with a single application of Success Naturalyte Insect Control, containing 120 g/litre Spinosad in a suspension concentrate. The spray solution (4 ml of product in 10 litres of water) was applied onto the foliage using a backpack sprayer to point-of-run-off.

Following treatment, the number of larvae and pupae present on each branchlet was recorded on days 1, 3, 4, 7, 11, 14, 23 and 28. Behaviour of larvae, presence of adults or eggs and the weather conditions were noted. Digital photographs were used to document defoliation during the trial.

The results of the larval counts were visualised using line graphs and analysed using time series analysis. To determine the effect of Spinosad on willow sawfly survival, one-way ANOVAs were used to test for significant variation in pre- and post-treatment sawfly larval numbers.

RESULTS

Before treatment, willow sawfly larvae were abundant at all sites, but following treatment, larval abundance declined rapidly at both treated sites ($P<0.001$) (Fig. 1). The reduction in larvae numbers from day 0 to 3 was 94.3%. The few surviving larvae ceased feeding, were curled up and inactive. On day 3 at Site C, a significant reduction in larval abundance was detected compared to day 0 ($P<0.001$). Nevertheless, larvae numbers at Site C were significantly higher than those at Sites A ($P<0.001$) and B ($P<0.001$) on day 3.

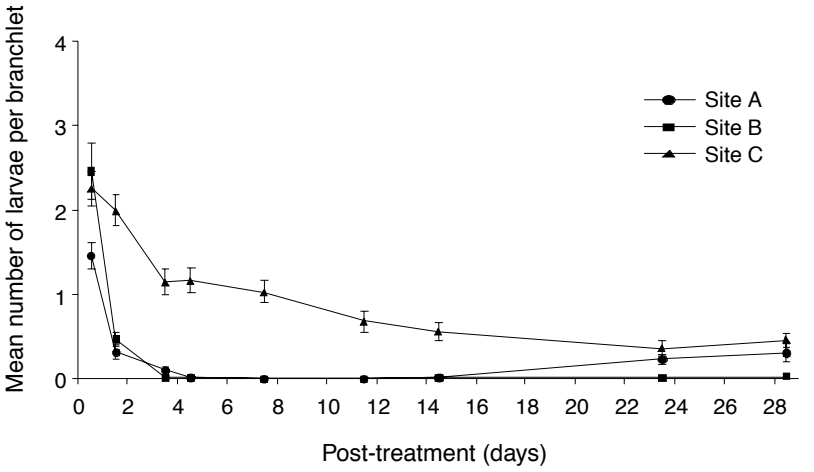

FIGURE 1: Mean numbers (± SE) of willow sawfly larvae per monitored tree branchlet (n = 100) over time. Sites A and B were treated with Spinosad, while Site C was the untreated control site.

From day 7-11, there were no live larvae on all treated trees. An increase in larvae numbers was observed at site A, 14 days post-treatment ($P<0.001$). Larval abundance at Site C declined over this time period.

Willow sawfly adult and pupal activity was monitored throughout the trial. All pupae present on monitored branchlets in all trees emerged by day 14 and no fresh pupae were observed. No new eggs were observed on the treated trees until day 14 when they were present on nearly all of the study branchlets. New larvae observed from day 14 to day 28 were less than 6 mm in length and many were not feeding.

By day 14, the control trees were observed to be more defoliated than the treated trees. Throughout the second half of the study, the defoliation increased, with defoliation of the control trees estimated as 65% and the treated trees as 7% by the end of the trial (data not shown).

In general, throughout the 28 day study period, the weather was fine with rain occurring only on days 2, 21 and 22. During rain showers, willow sawfly larvae were less active, tending to hang below the leaves and cease feeding.

DISCUSSION

Results of this study indicate that Spinosad produces rapid mortality on willow sawfly larval populations, with substantially reduced abundance after only 24 hours and cessation of all feeding activity.

Data obtained from larval counts were consistent with visual observations of the extent of defoliation and general tree health. Differences between treated and untreated trees were evident, with untreated trees being more defoliated.

Low levels of oviposition observed during the first 11-14 days of the trial suggest that Spinosad may also have had some repellent effect on oviposition. Adults were observed on and around the trees but no eggs were found on the treated leaves. Larvae found on treated trees were not observed to be feeding and did not grow past the 1st/early 2nd instar life stage. This indicates that treatment was still effective, by either killing the larvae when sufficient product was consumed or by retarding their growth via feeding inhibition.

Reduction in larval population densities on control trees could be explained by the extensive defoliation. By day 14, both control trees were substantially defoliated and presumably became less attractive to adults for oviposition as there was insufficient foliage to support the larvae through to pupal stage. In addition, continued disruption to the larvae during monitoring could have resulted in some larvae being knocked off branchlets.

By the end of the study, good control of population numbers on treated trees was achieved with only one of the treated sites showing signs of increased larval numbers. This can probably be attributed to the untreated trees surrounding the site, which supported large populations of willow sawflies with declining food and oviposition sites. Individuals from these untreated trees may have moved to the treated trees to reduce or avoid competition.

Climatic variables such as rainfall may influence the activity of willow sawfly. Observations on larvae during this study indicate that willow sawfly larvae may be affected by rainfall, but further study is required to determine any actual effects on larval populations.

In conclusion, Spinosad works very rapidly and effectively against willow sawfly larvae. High levels of control of this pest could be achieved through the warmer months of the year, which represent peak larval activity.

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