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CAN SYSTEMIC INSECTICIDES OR VERBENONE CONTROL SOUTHERN PINE BEETLE ON LONG ISLAND?

Division of Lands and Forests – Forest Health

Southern Pine Beetle Response May, 2016

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Systemic insecticides

Background

The application of systemic insecticides is a promising treatment for the protection of high-value, uninfested trees at risk to southern pine beetle (SPB) attack (Fettig. et al. 2013), many of which may be in recreational or residential settings. However, this treatment is not feasible on a landscape-level scale, or with trees that are already infested. Mechanical control (cut-and-leave, cut-and-remove), which is rooted in SPB biology, behavior and host/beetle dynamics, has largely replaced chemical controls like systemic insecticides in commercial forest settings.

For high-value individual trees, systemic insecticides are showing promise as a safer, more portable and long-lasting alternative to bole sprays. These water-soluble insecticides can be injected directly into the trunk and transported by the phloem and xylem, killing or repelling insects that attempt to colonize or feed on the tree. Stem injections in trees eliminate drift and reduce non-target effects and applicator exposure (Fettig et al. 2013).

The systemic insecticides emamectin benzoate and fipronil (both nervous system disruptors) have shown the most promise in their capacity to reduce bark beetle colonization success and mortality in conifers. In 2004, Grosman and Upton (2006) showed that these chemicals were highly effective in protecting loblolly pine from *Ips* bark beetles. After this success, they extended their injection trials to the more aggressive *Dendroctonus* bark beetles (SPB is a *Dendroctonus* species). In Alabama and Mississippi, results from 2006-2007 conclusively showed that emamectin benzoate prevented successful attack by SPB. It inhibited gallery construction, brood development, and emergence of SPB from treated loblolly pines. Fipronil also reduced mortality of treated trees, but reduced brood size to a lesser extent than emamectin benzoate (Grosman et al. 2009).

Can systemic insecticides be used to control SPB on Long Island?

The application of systemic insecticides to control SPB on Long Island is not feasible. Trunk injections take a minimum of 15 minutes (Fettig et al. 2013), which is an impractical amount of time when dealing with millions of uninfested trees that need protecting. And although emamectin benzoate and fipronil have successfully protected conifers from bark beetle attack, they do not protect trees from the blue-stain fungi that bark beetles introduce. To protect trees from the blue-stain fungi, fungicide treatments need to be incorporated with insecticide treatments, further increasing the cost of the treatment.

Fettig and others (2013) showed that emamectin benzoate was effective at protecting lodgepole pine from mountain pine beetle-induced mortality, but only if injections of emamectin benzoate occurred the year before protection was needed. SPB flies from May-December in New York, and rates and directions of spread have been difficult to define. Therefore, it is challenging to determine which trees need to be protected one year in advance. If emamectin benzoate and propiconazole (fungicide) are injected together, trees may be protected the same year of injections; if injections are applied

before beetle flight (Fettig et al. 2013). However, the direction and rate of infestation spread still would need to be determined to predict which specific trees will be attacked.

Although injections may be applied any time during the year that a tree is translocating, sufficient time is needed after the injection to allow the active ingredient to be dispersed and become effective. Under optimal conditions (good tree health, moderate temperatures, moist soil), this takes about four weeks (Grosman et al. 2009). Since SPB flies from May-December – when the trees are the most actively translocating, there would not be sufficient time to treat a large number of trees before the infestation expanded.

The use of systemic insecticides on Long Island may end up playing an important role in protecting high-value, uninfested trees in recreational or residential settings, such as arboretum collections or backyard trees. However, their use is not practical on a landscape-level scale, or when trying to manage thousands of already-infested trees. Therefore, systemic insecticides will not be used by DEC to protect trees from SPB on Long Island.

Verbenone

Background

Semiochemicals are organic compounds emitted by one organism to convey a message to another organism; usually of the same species. Pheromones are a common type of semiochemical that is emitted by one member of a species to send a message to another member of the same species. Since the 1960's, a number of semiochemicals have been identified and synthesized for management of SPB. Given challenges and concerns associated with traditional methods of SPB control (synthetic insecticides), semiochemical treatments could be used when less toxic alternatives to insecticides are required. The use of semiochemicals has been more flexible across a broader range of management unit sizes than traditional tactics (Strom and Clarke, 2011).

Verbenone is a SPB pheromone used by the beetles to tell each other a tree is fully attacked. Host-seeking SPB will "smell" the verbenone message and avoid attacking a tree. Verbenone has shown potential for disrupting SPB spots, as it can reduce the likelihood that beetles will land on and attack a tree, but there are underlying problems with its application. Despite intensive research since the 1970's, verbenone trials for the management of bark beetles have continued to produce mixed results. Difficulties in developing verbenone-based management tools are due to the complex nature of SPB attack behavior, which varies greatly over time and is somewhat dependent on the numbers and sexes of the beetles and the amount and timing of the pitch response by the host tree. Because these factors complicate the use of verbenone, it is difficult to interpret successes or failures in achieving management objectives and no published studies can confirm the ability of verbenone to protect individual pines against SPB attack (Strom and Clarke, 2011). Due to these problems, there are no widely accepted

use strategies with verbenone or other disruptant semiochemicals for the control of SPB (Sullivan 2016).

Will verbenone be used to control SPB on Long Island?

Because there are no widely accepted strategies using verbenone for SPB control and there are unexplained conflicting results from SPB-verbenone research, DEC will not use verbenone to control SPB. In addition, the verbenone products available for pest management are not SPB-specific, meaning that they are not currently efficient at effecting SPB behavior. However, if strategies for using verbenone to control SPB are developed, research becomes more definitive, and SPB-specific verbenone products become available for pest management, the use of verbenone will be reconsidered by DEC for management of SPB.

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