MANAGEMENT OF THE BALSAM GALL MIDGE IN CHRISTMAS TREE PLANTATIONS

by
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INTRODUCTION

The balsam gall midge (*Paradiplosis tumifex*) is one of the most serious pests of balsam fir in Christmas tree plantations. It is currently at or near outbreak stage in many northeastern locations. If growers see subglobular swellings or galls on the new needles during the growing season or needle loss that is most apparent toward the tops of the trees following the growing season, and they find some attached needles with the galls on them, they have probably been attacked by the balsam gall midge.

HISTORY

The balsam gall midge is a native North American insect that first received attention in 1886 during an outbreak in New York. The insect occurs throughout the range of balsam and Fraser fir, but in New England it has developed on native balsam fir, so this host receives the heaviest damage. Planted Fraser fir here avoids many attacks by breaking bud later than balsam fir. The same is true for Canaan fir, while Fralsam fir is intermediate in susceptibility.

Like most tree insects, the balsam gall midge is cyclical in nature, reaching damaging population levels only after a period of years at extremely low population levels. Previous outbreaks of gall midge in Vermont peaked in 1976, 1982, 1990 and 1998, 6 to 8 years apart.

DAMAGE

Attacks by the balsam gall midge cause subglobular swellings or galls to form on the current year's needles, particularly toward the base of the needles (Figure1). Infested needles turn brown and begin to drop from the twigs in October, making heavily infested trees unsuitable for Christmas trees or wreath material. Unsuspecting growers may not notice the damage until after the trees or branches have already been harvested.

The midge is considered to be at outbreak levels when more than 10 percent of the current twigs have galled needles. When populations are beginning to increase within a plantation, it is common for the damage to be confined to scattered, individual trees that are noticeably damaged. This is probably due to high susceptibility on the part of these trees and is likely related to a chemical attractant within the needles. Shaded needles are less susceptible to attack. For this reason, open-grown trees are often the most severely damaged, as are the upper portions of the trees. In Wisconsin, studies by Ronald Giese in 1959 revealed that heavily damaged sites had higher soil pH readings (5.0) than sites with light or no damage (pH 3.4-4.5). This relationship might be worth investigating in New England.

Figure1. Balsam gall midge damage to balsam fir needles.

DESCRIPTION

Adult midges are small, fragile, orange-bodied flies just over 1/8th of an inch (3.5mm) in length. They emerge from the soil beneath the infested trees in the spring about the time the majority of fir buds in the area are breaking. Female adults lay eggs on the needles of newly opened buds (Figure 2). Eggs hatch in two to three days and then needle tissue begins to grow around each larva, eventually enveloping it in a gall.

Egg laying takes place soon after bud break. In northern Vermont this usually takes place during the second and third week of May, and galls are apparent by mid-June. When full grown and about 1/8th of an inch (3.5mm) in length, the small yellow to orange larvae squeeze out of the galls through exit slits, in September to November, and drop to the soil. These larvae overwinter in the soil and pupate in the spring.

Figure 2. Balsam gall midge adult laying eggs.

NATURAL CONTROLS

There are a number of species of tiny parasitic wasps that attack and kill gall midge larvae. The most common ones observed in Vermont during previous outbreaks are minute shiny, black insects in the genus *Platygaster*. These adult wasps are less than half the length of the gall midge, but could frequently be observed on the buds being attacked by the midge, particularly during the second year of noticeable damage.

The Fir-Fern Rust, a needle disease of balsam fir that is transmitted from nearby sensitive ferns, also may act as a natural control of the midge. Galled needles that become infected with the rust disease drop prematurely from the trees, resulting in death of the midges. The most important natural control of the gall midge, however, is a non-gall making midge (*Dasineura balsamicola*) that enters newly forming galls and indirectly kills the larva of the gall maker by preventing it from developing to maturity, presumably by causing it to cease feeding. This non-gall making midge adult looks very much like the gall maker to the naked eye, but can be identified by different antennae and wing veination features when magnified.

This second midge tends to become the predominant one during the third year of noticeable damage in each infested plantation, resulting in a reduction and eventual collapse of the gall maker population. A grower could easily mistake this **beneficial** midge for the gall maker and resort to unnecessary chemical spraying to control it. When the beneficial midge becomes the predominant one within galls, damage can be expected to decrease the next year.

PEST MANAGEMENT

In Vermont, chlorpyrifos (Lorsban) has been the most commonly recommended insecticide for control of balsam gall midge. This is best timed for the larvae, just after egg hatch but before they become enveloped in the gall. Proper timing of insecticide application to kill larvae is critical to success. In past New England spray trials, this has been when the average length of new growth in the upper third of the tree crowns is between one and one-half and two inches in length. Since shoot elongation can vary tremendously from one tree to another, this information should be obtained by measuring several terminal shoots per tree (but not the leader) for a number of trees scattered throughout the plantation. Be sure to include trees with damage the previous year in your measurements. Spraying a little later than recommended may still result in adequate control, but spraying too early is less likely to be successful. For severe infestations, it is sometimes necessary to make a second application about one week after the first treatment. Some growers who have sprayed two or more times per year with chlorpyrifos have experienced persistently heavy damage year after year, with no signs of the gall midge populations collapsing. There is some evidence that these repeated applications of chlorpyrifos have kept populations artificially high by killing the good midge (*D. balsamicola*) that is the primary biological control agent, while not providing adequate control of *P. tumifex.*

More recently, OnyxPro (bifenthrin) has provided very effective control when targeting the adults just after budbreak. This has been shown to be efficacious at relatively low rates of material (4-6 oz. of OnyxPro) per acre. One advantage of this timing is that it should control balsam twig aphids as well.

Within plantations, there is a tendency for damage to first appear and eventually be heaviest in low-elevation pockets and corners or edges bordered by woods. This may be related to wind protection for the fragile adults during egg laying, since they appear to have difficulty remaining on buds under windy conditions. Such locations are good places to begin looking when scouting for gall midges or their damage.

When gall midge is just beginning to become a problem, noticeable damage is often limited to scattered individual trees. If these trees can be identified and marked with flagging, monitoring and control activities can be concentrated on them, reducing the amount of time and insecticide needed to deal with the problem. Damaged trees are easily identified during winter when most of the galled needles have fallen off. These trees should then be monitored in the spring for the presence of gall midge adults.

Start looking for the orange-bodied adults laying eggs in the buds soon after bud break has begun. Pick a warm, windless day, if possible. Several visits to the plantation may be necessary between bud break and when the needles start flaring to determine the presence or absence of gall midge adults. The presence of numerous adults on and around buds of individual trees, particularly when at the building end of an outbreak, indicates the need for control. When monitoring for adults in years following peak damage, remember that the beneficial non-gall making midge may be the predominant one. If in doubt, seek the help of an entomologist to

identify which midge or midges are present.

Balsam gall midge adults are attracted to the color yellow, so sticky yellow boards can be hung in the tops of previously damaged trees to help monitor adult emergence. The boards can be coated with insect-trapping adhesive such as Tanglefoot, or a heavy weight oil product such as STP Oil Treatment or 30 weight oil to trap the midges. For those wishing to avoid the mess of handling Tanglefoot or other sticky substances, pre-stickied yellow plastic cards or strips can be purchased from companies specializing in pest management monitoring supplies. This may be useful for the grower who is unable to make frequent visits to the plantation just after bud break and wants to check to see if any adult emergence took place during his or her absence. A few strategically placed traps should be sufficient. If few or no midges are observed or trapped between bud break and when the needles begin to flare, then little damage should occur. If targeting larvae for control, sticky cards can also be used to confirm spray timing by counting trapped adults on a daily basis. Once the number of adults caught has tapered off and then none are caught for 2-3 consecutive days (providing it is not due to a temporary cold period), this should be the time to treat.

Balsam gall midge outbreaks can seriously reduce the profitability of fir Christmas tree plantations, but these typically occur only once or twice during the rotation. By careful annual monitoring and early intervention with insecticides after damage is just becoming noticeable, growers should be able to protect their trees with a minimum amount of time and chemical.

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