



Christmas Tree Notes

Balsam Twig Aphid on Fraser Fir

CTN-#-019

The balsam twig aphid (BTA) (*Mindarus abietinus*) is a small, pale green aphid that feeds on fir trees in the spring. Their feeding on Fraser fir Christmas trees in western North Carolina often results in permanently curled needles which reduce the tree grade, quality, and value. Trees badly damaged may have to remain in the field an additional year or more so that good undamaged growth will cover up the damaged needles. Further damage is often created by the appearance of sooty mold, a black fungus that lives on the honeydew excreted by aphids and other pests. The black on the tree trunk and stems can stay on the tree until winter, further affecting the tree's appearance.

Since the BTA is native to western North Carolina, it is widespread and well adapted to the area. Therefore the year of sale and year before sale, all Christmas tree growers must evaluate their trees to determine if they need to control this pest.

Balsam twig aphid lifecycle. The BTA has an unusual lifecycle, different from any of the other pests of Fraser fir. There are three distinct adult forms that are produced one after another. Each has a role in the lifecycle and each must be produced in succession for the lifecycle to be complete. The first form, the stem mother, increases aphid numbers. The second form is winged and allows the aphid to spread to other areas. The final form produces the overwintering egg.

The egg. The aphid both "oversummers" and overwinters as a small, black, tear-dropped shaped egg with white waxy rods covering it. Eggs can be found anywhere on the tree, but are most common on the shoots produced that year. These eggs begin to hatch in the spring from early March to late April. Unlike some insects that all emerge at the same time, it takes several weeks for all the BTA eggs to hatch. This is a survival mechanism for the aphid. If the spring is warm, the earliest hatching eggs will survive and quickly mature to the stem mother who will begin to reproduce. However, if freezes occur after the eggs start to hatch and the young aphids die, there are still more eggs that will hatch later, ensuring the survival of the species.

The stem mother. The small green aphids that hatch from the eggs feed on the previous year's needles. Each aphid molts three times, becoming a little larger with each successive molt. This form of the adult aphid is female. These stem mothers produce live aphids without male fertilization or eggs being laid. Their young are clones, genetically identical to the mother. Each stem mother can produce as many as 70 live young. This allows a quick buildup of the twig aphids. Usually this occurs just prior to or just as the buds start to open. The adult stem mother and her offspring are easy to find, often feeding on the buds as they start to break.

The winged form. The young aphids that the stem mother produces also go through three molts. At maturity some of them will be like the stem mother, reproducing greatly. However, at some point the stem mother's offspring will be different, having wings at maturity. These are also all female and also lay live young.

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Though this stage has wings, they are not as useful to the aphid as the wings of a fly or bee. They are only strong enough to lift the aphid away from the tree for the wind to blow it to another location. If it turns out to be another fir tree, the aphid will continue to feed. If not, it will die. These winged aphids are found in May and June in western North Carolina.

Completing the life cycle. The young that the winged form produces also go through three molts to become an adult. These aphids are either male or female. This is the only time males are produced. Following mating, the females lay the overwintering eggs. These eggs, fertilized by the males, are important in maintaining genetic diversity in the aphid population. Each female lays only one or two eggs. These are first found at the end of May and June in western North Carolina. All twig aphids die by early July.

Twig aphid dynamics. While the BTA is completing its lifecycle, the tree is breaking bud. How badly the tree is damaged depends on how many aphids are feeding on it when the shoots are expanding. The overwintering egg population is the starting point. If there are lots of eggs, it is almost guaranteed that there will be enough aphids to cause a problem. However, even a few eggs can develop into a large population by bud break if the weather is right. The warmer it is, the faster each individual will molt and reach maturity. Cold weather slows down the process. It will also slow bud break. Freezing temperatures kill many individuals. Rain washes aphids from the trees and allows a fungal parasite to grow, killing many aphids. Rain can also hasten bud break.

The effect of predators. Added to this dynamic process are natural predators. The balsam twig aphids are food for many predators, the primary ones being several species of hover fly larvae, lady beetles and their larvae. Other predators also feed on twig aphids including lacewings, aphid midges, nabids, and big-eyed bugs. Predators can sometimes give control by eating all the twig aphids on a tree. However, their numbers usually lag behind the twig aphid build-up. Their influx is also slowed by cold, wet weather. Unfortunately, it's usually the case that damage has occurred by the time the predators do their job.

The effect of the tree. The tree itself can also help determine how much damage will occur. Trees break bud over several weeks. Usually, it is the trees that break bud first that end up having the most twig aphid damage. However, that isn't always the case. In some years where cold, wet weather slows the twig aphid development, it

is the late breaking trees that get the most damage. Also, if there is plenty of rainfall in the spring and the trees are adequately fertilized, much of the needle curl seen in mid-May will straighten out by the time the needles are mature in early July.

Cones are a factor. A third factor that affects twig aphid damage is cone production in trees. Fraser fir doesn't often readily produce cones until the trees are larger than what is cut for Christmas trees. However, if the weather was very dry the year before and the trees were under drought stress, trees even as small as 4-to-5 feet will produce cones. The cone buds break and grow before the shoots do. This provides a place for twig aphids to hide and feed, allowing their numbers to increase. They are also protected from pesticide application under the cone bracts. It is not known if their feeding in the cone of mature trees reduces seed set or damages the seed.

Assessing the need for treatment. So how does a grower know if there are enough aphids to cause a problem? One option is to not worry about it and treat based on the year in the rotation. Trees need to go to market with at least two years of undamaged needles. Therefore, the BTA needs to be controlled the year of sale and year before sale. Many growers treat for BTA control these years in the rotation regardless of the weather and pest numbers.

For the most part, twig aphid control in younger trees is unwarranted. Heavy twig aphid damage will reduce tree growth. But, the trees will produce plenty of buds for the following year, much the same way as they do when frost damage occurs. The trees seldom lose growth in the course of the rotation unless suffering from drought stress.

The other option is to scout. Scouting for BTA can reduce pesticide use. On the average one-year out of two there won't be enough twig aphids to cause damage in western North Carolina. Trees can be scouted in the spring to determine if treatment is necessary.

Twig aphid scouting is not easy, nor is it for everyone. Twig aphid numbers usually increase rapidly the week prior to bud break. At least three scouting trips are necessary from mid April to early May. And even then, the decision to treat may need to be made even as the trees are breaking bud. This greatly reduces the options for control. Once the trees break bud, the aphid is protected from most pesticides by the young growth. Dimethoate is the only material that has been proven to work well that late in the spring. Most growers would need to use a high-pressure sprayer to ensure the kind of

coverage necessary for control. This is very labor intensive. However, for the small grower especially, scouting can greatly reduce pesticide use. Scouting can also determine if prior treatments for rosette bud mites or balsam woolly adelgid have also controlled the twig aphid.

Balsam woolly adelgid control. Many growers treat for the balsam woolly adelgid in the spring. Applications of Lindane, Asana, or Thiodan can be made as early as February and still give twig aphid control. The earlier in the year these materials are applied, the less likely they are to last until twig aphid egg hatch. Therefore it is important to scout to determine if aphids have in fact been killed, and not just assume that they have. It is not recommended to use these materials solely for twig aphid control as they often create problems with the spruce spider mite.

Rosette bud mite control. Rosette bud mites are controlled by applying Dimethoate in June. This is the time when the twig aphid is producing eggs for the following growing season. The Dimethoate controls the aphids before they have a chance to lay their eggs. Often growers do not need to treat for twig aphids the year after a rosette bud mite application. Again, its important to scout to determine if that is the case.

Balsam twig aphid scouting. Scouting for twig aphids starts with knowing if there are problems with any of the other pests of Fraser fir. If the trees need to be treated for the balsam woolly adelgid, spruce spider mite, or hemlock rust mite, there is no need to scout for twig aphids. When controlling these pests, the twig aphid can also be controlled.

If none of these pests are a problem, make the first assessment for twig aphids after April 15. This is the average date for all the BTA eggs to be hatched. Examine 10 to 15 trees spread out over a block of up to 2 acres in size. A block of trees can include fields that were all planted at the same time and managed the same way.

Place a white piece of paper on something firm like a clipboard into the lower third of the canopy, and beat the branches over it several times, shaking loose any aphids that might be present. A sheet of paper laminated in plastic on both sides will last through the spring.

Use a handlens to look for aphids, as those newly hatched or newly laid will be very small. Count the total number of aphids found on each sampled tree. Also make note of any predators, particularly hover fly larvae, lady beetles and their larvae.

Keep track of both the number of trees that had aphids and the total number of aphids. The economic threshold is the number of aphids where damage will start to

occur. That threshold is small for the BTA. If more than three aphids are found on more than two trees, treatment is probably necessary. Remember that over the next month as the trees break bud, the few aphids found are quickly reproducing. Their numbers can shoot up from just one or two aphids shaken out of a tree to more than a hundred.

Pesticide application. If the decision is made to treat, the material must be applied before the trees start to break bud. Once the buds break, the aphids move into the tiny shoots feeding on the new needles. They are protected from any pesticide application by the immature needles. A large number of cones in the trees can also compromise control, as aphids will hide under the cone bracts. Removing cones from the field before pesticides are applied will increase control. Don't just drop the cones on the ground next to the tree, as the aphids will crawl out of them back into the tree.

Di-Syston 15 G. There are several materials labeled for twig aphid control on Fraser fir. The material that most growers use is Di-Syston 15 G. This granular material is easily and quickly applied during the narrow treatment window for twig aphids. It is not effective unless the aphids have hatched from the egg. Therefore the window for application is narrow – from the time that the aphids have all hatched out until the trees have broken bud. April 15 is the typical date after which it is safe to apply Di-Syston. However, if the spring is warm and hatch is early, it may be possible to apply Di-Syston as early as the first week of April. Keep in touch with your county extension agent to learn when aphids have all hatched.

Other materials for twig aphid control. All materials except for Di-Syston must be mixed with water and sprayed on the trees. Adequate coverage for twig aphid control can be obtained from a backpack sprayer, backpack mistblower, high-pressure hydraulic sprayer with a handheld gun, or a tractor-driven air-blast mistblower. All materials can be applied from mid-April until budbreak. Those materials that last several weeks on the tree such as Lorsban can be applied even earlier.

Scouting after treatment. There are several factors that can compromise chemical control. Di-Syston, especially, doesn't work well if environmental conditions are not suitable. Treatments made with air-blast mistblowers can also fail if too many rows are being treated for the size of sprayer used. It is important to determine if twig aphids were controlled. Scout for twig aphids 3 to 14 days after treatment using the same method as described above. If many aphids are found, it may be necessary to retreat.

Retreatment. If the window for treatment is missed and the buds have already broken, or if the trees were treated unsuccessfully, retreatment is possible. Dimethoate works well up to two weeks after bud break. After that, even if the Dimethoate controls the aphids, needle growth has reached the point where the curl will be

permanent. Retreating can also kill natural predators that are feeding on the aphids or spruce spider mites. Therefore, though retreatment is possible, it may not be the best thing to do. Consult with your county extension agent to help assess if retreatment will be cost effective.

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