RECOGNITION AND MANAGEMENT OF CHRISTMAS TREE PESTS

EB 0735
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All insects on Christmas trees are not injurious—in fact, many are beneficial since they feed on other insects. Many insects merely rest on the trees without causing damage.

Even insects that do feed on Christmas trees may not be numerous enough to warrant an overall insecticide application. You must make a value judgment: Is the pest doing enough feeding damage to downgrade the tree's quality to where you can justify treatment? Or are you simply applying a chemical prophylactically in a routine fashion? Consider the total effect the pesticide application will have. Insect predators and parasites are commonly present and help keep pest numbers low. They too may be killed, leading to still more severe insect damage.

Pests common to Christmas tree plantations are described in this publication. Control strategies are also discussed. Pesticide recommendations are provided at the end and should be used only if chemical control is warranted.

APHIDS AND THEIR ALLIES

Adelgids

Many adelgid pests are treated as aphids because of the context of their common names. There is a close relationship between adelgids and aphids, but there are differences that are critical when it comes to making control decisions. Most of the common aphicides are not effective against adelgids, so it is important to determine proper identity to insure a wise pesticide choice.

Cooley spruce gall adelgid. *Adelges cookeyi*, otherwise known as the cooley spruce gall aphid, is the most important pest of Christmas trees in Washington. It is a sucking pest of both Douglas fir and native spruces. On Douglas fir, these insects appear as cottony tufts on the needles and may cause yellowing, distortion, and premature needle drop. This pest causes swelling or galling of tips on terminal shoots of spruce. Ultimately, these tips die. (See figures 1 and 2.)
Trees of Christmas tree size are rarely killed by the feeding of this pest, but the residual needle damage causes unsightliness if they become numerous and thus could lead to lowered tree quality and reduction in sales.

Chemical control is the only practical method of control when natural enemies fail to suppress it. Spring sprays just prior to or at bud break are generally recommended. When this pest first hatches out, the young appear as tiny dark specks on the new unfolded growth. You can “roughly” project the potential number of cottony tufts you will have later from the number of “specks” you observe on your trees at this time. If large numbers of dark specks are detected on sufficient numbers of new buds of Douglas fir, it would be wise to begin spray operations. If the pest is allowed to develop to the cottony stage it will be too late, since the insecticide will not remove the unsightly tufts nor will it do an adequate job of control.

Balsam woolly adelgid. *Adelges piceae*, formerly known as the Balsam woolly aphid, is the most important pest of true firs grown for Christmas trees. It is particularly damaging to Frazier fir. These adelgids also produce a cottony or white wool covering as they mature. They feed on the stem, branches, and twigs, and produce grayish encrustations on the stem and “gouty” swellings at the branch tips and nodes. (See figure 3.) In addition to general deformation, they can kill Christmas trees. Balsam woolly adelgid over-winters on the stem of the host tree and becomes active at bud swell. At this time females lay eggs under the woolly masses. There appear to be peaks in adult populations during mid-April, mid-July, mid-September, and mid-November. It is necessary to spray for this insect if it is determined to be present. Timing is essential. Population peaks mentioned above may imply a necessity for repeated sprays at these times. However, a thorough bud break application should be adequate unless infestations are extremely severe. Knowledge of these recurrent summer and fall peaks will help time a later spray should the spring applications not be made for some reason.

Pine adelgids. There are several species of adelgids that occur on pines. The only important one of these is a pine bark aphid or adelgid, *Pineus cimbride*, which appear as a white woolly encrustation on the trunk and limbs of pines. (See figure 4.) This adelgid has caused very serious damage to Scots pine Christmas trees by severely distorting new growth.

If populations become damaging, spraying is essential. Applications must be made at bud break.

True aphids

Aphid pests of Christmas trees are generally naked when mature. That is, most of those commonly encountered do not produce the woolly covering of the adelgid Christmas tree pests. There are, however, several species that do produce the
woolly tufts, and this makes them difficult to distinguished from adelgids. Thus, professional assistance is often necessary when it comes to “woolly” aphid identification—particularly with those found on pines.

**Woolly leaf pine aphid.** *Schizolachus pineti* and its allies are woolly aphids that are occasionally encountered by Christmas tree growers on their pine trees. They are long-legged, dark-green aphids. The stationary feeding forms are covered with a cottony wax. (See figure 5.) These aphids are very common and sometimes numerous but do not usually cause any economic damage.

**Balsam twig aphid.** *Mindarus abietinus* is widely distributed throughout the coastal regions and has been reported on many true fir species and some spruce. It feed on the new growth causing a twisting of the new growth such that the undersides of the needles become visible when viewed from above, thus making Christmas trees unsightly and valueless unless shearing is employed which adequately eliminates the unsightly effects. (See figure 6.) This twisting is usually the only symptom since the aphids are not often apparent. Lammas or secondary growth in late summer or early fall sometimes appears as twig aphid damage, but the time of year that it occurs sugests that it is not. In western Washington the aphid becomes abundant in April and May or when new growth occurs and then disappears. The aphid is small, greenish yellow, and somewhat powdery in appearance. If controlling them is necessary, they should be sprayed in the spring when first noticed. Sometimes a second application in early summer is necessary.

**Giant conifer aphids.** *Cinara* spp. contain a large number of potential pest species. They are long-legged, dark-colored aphids that are sometimes lightly covered with a powdery wax. (See figure 7.) Most species feed gregariously in large groups on twigs and branches of their hosts. Some feed on the trunk and roots. They are only occasionally a pest in Christmas tree plantations where they cause yellowing of the needles and reduce growth when they become numerous. They also excrete a sweet material, typical of most aphids, called honeydew.
This material not only gives rise to unsightly sooty mold, but it is also very attractive to thatching ants which can become very numerous in the trees. However, there is no evidence that the ants are harmful to the trees. Spray for these aphids only when they become numerous. *Cinara* spp. are frequently held in check by biological control agents. In rare instances, spraying may be necessary.

**Spruce aphid.** *Elatobium abietinum* is a destructive insect on many kinds of spruce. (See figure 8.) Paintings of various kinds of spruce are damaged almost every spring. Aphid feeding on spruce trees results in yellowish blotches on the needles. Needles later become entirely yellow or brownish and drop. Although it feeds almost exclusively on spruce, the spruce aphid has been found on pine and Douglas fir. The small green aphids increase in numbers on the needles in February and March, but little damage is apparent at this time, and close observation is required to see them. Damage to the needles becomes apparent in April, May, or June.

When damage becomes severe enough to demand attention, aphid numbers are much lower than they were during the early season, and most of the damage has been done. As the damage occurs in the cooler part of the year, so then should control be implemented in those rare instances where spruce is grown for Christmas trees.

**Spittlebug**

The spittlebugs only occasionally become serious enough to warrant control. According to the records, one species of spittlebug, *Aphrophora parallela*, the pine spittlebug, is the only one for which control measures are necessary. (See figure 9.) Its occurrence has been exclusively on Scots pine. Eggs are laid during July-September under the bark of twigs. The eggs hatch in May. As the nymphs mature, they tend to cluster on the main stem near the top of the tree. Several nymphs may be found under a single frothy mass (spittle). (See figure 10.) Pine spittlebug feeding can seriously affect growth in the leader and terminal twigs. June applications have shown good control of this pest.
Fig. 8. Adult spruce aphid on spruce needle (left) and spruce aphid damage. Note defoliation on inner twigs.

Fig. 9. Adult spittlebug, "Aphrophora" sp.

Fig. 10. Spittlebug nymph within spittle froth.
MOTHS

Silver-spotted tiger moth

*Halisidota argentata* is an occasional pest of ornamental conifers. (See figure 11.) Its main host is Douglas fir, but it will sometimes feed on spruce, pine, and other conifers. This insect is often confused with tent caterpillars because both make tents; however, they do not feed on the same kinds of trees.

Mature caterpillars, the damaging stage of this moth, are about 1½ inches in length and covered with a combination of dense black, reddish brown, and yellowish hairs. (See figure 12.) The small, newly hatched, rusty brown, or blackish caterpillars feed on the needles in large numbers. (See figure 13.) They feed well into fall until cold weather begins. The winter is spent as young caterpillars hibernating in the dense webs they spin. Early in the spring they resume their feeding. On warm days, you may even find them feeding as early as January. When they are about two-thirds grown, they become less gregarious and begin to disperse and feed throughout the tree singly or in small groups of two or three. Feeding during this period is not usually very harmful to the trees or noticeable since the damage is widely scattered.

There are no chemicals currently registered for control of this insect. Chemical control, however, is rarely warranted since infestations are not usually widespread throughout a plantation.

Simple removal of the infested limb, tent, and caterpillars is frequently all that is necessary. If removal of the limbs threatens the tree's symmetry, then removal of the caterpillars alone is an option. This is tedious and practical only if the number of trees infested is few.

European pine shoot moth

*Rhyacionia buoliana* is an established pest in Christmas tree pine plantings in western Washington. (See figure 14.) The shoot moth stunts and deforms pines so that symmetry is lost. As a result, they no longer are suitable for Christmas trees. Distorted or dying shoots are often evident. Damage to buds can be detected throughout the winter. Damage to new shoots is noticeable in late spring or early summer. New infestations are first noticed as tents comprised of pitch and silk on buds. Old injury may appear as bushy growth on leaders and ends of lateral branches, forking of the leader, tree stunting, or the presence of dead,
curled shoots. The larvae are the damaging stage. They are small, hairless, and brown with black heads. When fully grown, they are about 3/4 inch long. After hatching, the larvae bore into needle sheaths and feed for a time before boring into the buds. This insect overwinters as young larva found either within buds or under resin-silk masses on the buds. In spring the larvae leave the buds in which they overwinter and attack uninfested buds or expanding shoots. (See figure 15.) In May and June the larvae change into pupae which wiggle part way out of the infested shoot before emerging as adults 2 or 3 weeks later.

Adult moths usually begin emerging in late May and continue until mid-July, with peak emergence in June. They are orange-brown with silvery markings and have a wing spread of 3/4 inch. They lay single eggs or small clusters of yellowish disc-shaped eggs on needles near the ends of branches.

Good control of the pest depends upon proper timing. The proper beginning spray date can be predicted through monitoring. This has been done only for the Puyallup area where dates have varied from May 25 to June 13. In all likelihood, dates vary geographically as well. Satisfactory predic-

Fig. 13. Silver-spotted tiger moth tent on immature larvae (close-up).

Fig. 14. European pine shoot moth adult (top) and European pine shoot moth lar-

Fig. 15. Shoot moth damage to buds.
this determination. Make a graph and plot percent pupation for each weekly observation; then extend the line to 80% pupation. That calculated date is the predicted date to begin pesticide application. For more precision, increase the frequency of sampling after mid-May.

2. Use sex-lure traps. The sex lure (pheromone) trapping method is effective for determining first flight. Place baited traps in or near pines that you intend to protect. Examine them every few days from mid-May on to determine the time to make the first application. When the first moth is caught it is time to spray, so be prepared to spray on short notice. Commercial growers interested in using these traps may contact the author for information on where to get them.

3. Keep temperature records. This method involves some calculation but has the advantage of enabling prediction from a site at any distance from the plantation, provided there is a means for obtaining daily maximum and minimum temperatures from a site near the plantation (or a site with climatic conditions similar to those at the plantation). The projected time of first European pine shoot moth emergence is $711 \pm 10 \text{ day-degrees (Fahrenheit)}$ after April 1. Day-degrees are calculated by averaging the daily maximum and minimum temperatures and subtracting 40°. Negative figures are recorded as zero. (See table 1.) Another moth problem that occasionally occurs in pine plantations is a coneworm-related moth called *Dioryctria* spp. Exactly which species it is has not been determined. It is a secondary invader of wounds. It has been found most frequently in Scots pine grown as Christmas trees. They invade wounds caused by hail stones and pruning of lower limbs for “handles.” In most cases, this problem can be avoided by management practices. “Handling” done in the spring leaves the tree vulnerable to attack. If “handling” is done in late summer or fall, you can avoid this pest.

### BEETLES

#### White pine weevil

*Pissodes strobi*, also known as the Sitka spruce weevil, feeds on the terminals of pines and spruces. This weevil is found throughout many of the western states. Adult white pine weevils are oval-shaped beetles. They are brown with light flecks that form a band across the wing covers. They are about $\frac{1}{4}$ inch long and have a prominent curved beak. Adults become active during late spring and early summer. During this time they feed on the tender bark of spruce or pine terminals, creating small cavities within which they deposit pearly white eggs. The eggs hatch in about 10 days and the small larvae bore through the bark into the wood and down the stem. (See figure 16.) The larvae are curled, white, and legless. When the larvae are mature in the fall, they form fiber-lined cells in the wood or pith. The cells are pupal chambers. Pupation takes about 2 weeks. There seems to be one generation per year, but some white pine weevils overwinter as larvae or pupae in the terminal and change to adults the following spring, while others overwinter as adults in litter on the ground. Smaller trees 2 to 8 inches in diameter and 5 to 25 feet high are generally the most susceptible to weevil damage. Larval feeding kills or

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NOTE: Accumulation of these daily day-degrees will increase with the progression of the season and allow one to project when 711 will be reached.

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Fig. 16. White pine weevil larvae.
seriously injures the terminals causing either a
crook in the trunk or a forked trunk. Feeding does
not kill the entire tree, but it does destroy the tree’s
natural shape.

To control this pest, recommended materials
should be sprayed on terminal shoots in early May
and again in early June to protect new growth
from egg deposit and development.

**Douglas fir twig weevil**

*Cylindrocopturus furnissi* attacks and kills the
small branches of Douglas fir on rare occasions.
Much of the damage is done by the small, colorless,
legless, curled larva which bore down through the
surface of the wood. (See figure 17.) The adult, a
small bronze-colored beetle, and sometimes mottled
with pink spots, also feeds on the tender twigs prior
to egg laying in early August. Open grown trees,
such as Christmas trees, are particularly suscepti­
ble. (See figure 18.) Natural stands suffer less
damage. Damage is more intense during drought
years or on dry planting sites. Damage causes re­
tardation and deformation. Small trees are some­
times killed outright. Maintaining vigorous grow­
ing conditions will help prevent maximum damage
effects.

**FLIES (Needle Midge)s**

Most fly pests of conifers are not directly im­
portant to Christmas tree growers since they are
cone seed pests. There are a few flies, however, in
the genus *Contarinia* that do attack foliage and
can cause considerable problems during severe in­
festations. These are the Douglas fir needle midges.
The adult midge is a long-legged, delicate, orange
fly. It is about 1/8 inch long. Mature larvae are leg­
less maggots, about the same length as the adult
varying from white to orange. Adult flies emerge
from oval, leathery brown cocoons which can be
found in the soil. Adult emergence occurs about
the time Douglas fir buds are bursting. The fe­
male flies lay eggs on new needles where they
hatch in a few days, and the newly emerged larvae
quickly enter the needles and feed throughout the
summer. Up to 40 eggs have been found on a single
needle. Larvae become full grown by fall. They
generally leave the needles from October to De­
cember, although some larvae have been found in
needles considerably later than December. They
overwinter as larvae (maggots) in the soil and
enter a brief resting pupal stage in the spring.
There is one generation per year.
The maggots infest only a portion of the needle.
The infested part becomes swollen on the lower
surface. It also becomes discolored on both surfaces
with yellow, pink, or purple. These symptoms may
be seen in the middle and at either end of the
needle. (See figures 19, 20.) Severe damage to the
needles is evident by mid-summer, during which
time the needle has become dry, hard, and darker.
By late fall it is brown and brittle. The maggots

![Fig. 17. Douglas fir twig weevil larva.](image1)

![Fig. 18. Douglas fir twig weevil damage. Note light col­
ored tips—these are reddish in appearance and
represent weevil damage.](image2)
frequently cut off sap circulation to where the needle drops during winter. When the needle is only slightly damaged, it may remain on the tree for an additional season or two. An infestation continuing for 2 to 3 years in a row may result in severe needle drop with noticeable thinning on younger trees—the overall result being that trees become unsightly and unfit for market. Timely sprays at bud break or just prior are essential to control this pest.

MITES

There are two kinds of mites of importance as pests of conifers. The spider mites are the kind most commonly encountered. These are eight-legged (as adults) variously colored mites, about 1/32 inch long. For the most part, they rarely reach pest levels in western Washington except under prolonged hot and dry conditions. They are more commonly encountered as a pest in the dry conditions of eastern Washington. The most commonly occurring species of spider mite is the spruce spider mite, Oligonychus ununguis, which feeds on a wide variety of conifers which include spruce, fir, pine, and Douglas fir. (See figure 21.) To date, it has become a severe pest only on Frazier fir. They cause damage by sucking juices from the foliage. The result is fading or yellowing of the leaves and premature needle drop. Under severe attacks, the mite’s presence is easily detected by the presence of visible webbing.

Another factor that is associated with buildup of spider mite populations in some species is dust. It is thought that dust has an interference effect on predatory mite development and no appreciable effect on the pest mites. When conditions are dusty, avoid driving service vehicles at excessive speed through the plantation. This is a practice long adhered to by tree fruit orchardists.

The second kind of mite occurs as a pest chiefly on pines. These are the Trisetacus spp. of the eriophyid mite family. They are unusual mites inasmuch as they are torpedo shaped and four legged. Their presence is detected only by the damage, since they cannot be seen with the naked eye. (See figure 22.) They feed within the needle sheaths of pine on new growth. The needles gradually yellow, begin to twist, and prematurely drop. The terminal twigs occasionally die as a result of this feeding.

Control of spider mites is rarely warranted in
most Christmas tree plantations unless the aforementioned conditions of dryness prevail for a good part of the season. Should the decision to control be made, choose a recommended miticide for the job. The use of an insecticide, even though registered for mites, often does not do an adequate job. Reducing damage attributed to eriophyid mites has not been very successful.

**YELLOWJACKETS**

Yellowjackets are beneficial insects. Adults feed their young many insects that damage our trees and crops. However, during outbreak years (populations reach maximum pest levels during years when precipitation is low during the previous fall, winter, and spring) the frequency of encounters between foraging yellowjackets and farm laborers begins to become serious in terms of safety. Thus, their benefits become obscured with the threat of being stung. Statistics report that 17% of all farm accidents during summer and fall are caused from yellowjackets. Many, of course, are from stings but many more are from lacerations incurred by shearing knives while fighting off yellowjackets.

A typical yellowjacket is about ½ inch long and appears short and blocky. All yellowjackets are yellow and black or white and black. Yellowjackets have annual colonies, and the only members of the colony to overwinter are fertilized queens. These queens spend winter in protected locations, such as under bark, in stumps, or in hollow logs. They emerge during the first warm days of spring (rarely as early as March, usually in May), select a nest site, and build a small paper nest in which they lay their eggs. When the eggs hatch, the queen feeds the young larvae for about 18 to 20 days. The larvae then pupate and later emerge as small, infertile females called workers. Once the first five to seven workers appear, they being rearing and feeding the brood. The queen is rarely seen again outside the nest. The colony then rapidly expands and, depending on species, may total up to 4,000 workers with a nest of 10,000 to 12,000 cells when maximum size is attained in August-September. About this time, reproductive cells are built and new males and queens are produced. These emerge and mate. The males eventually die, and the mated queens seek sheltered locations in which to overwinter. The next year the cycle starts over.

There are two groups of yellowjackets: (1) those nesting below the soil in mouse burrows or similar sites, (fig. 23) including within the wall voids of houses, and (2) aerial nesters that build their nests in trees, in sheds, or under eaves of houses (fig. 24). Nests are built of wood fiber resembling paper and are enclosed except for a small opening at the bottom.

When it becomes necessary, the control of yellowjackets can be undertaken in a number of ways. In all cases, aim control measures at the nest. Area-wide sprays are generally useless, environmentally disruptive, and expensive.
Treatment of stings

When stung, immediately apply a poultice of meat tenderizer (an enzyme). This will break down the components of the sting fluid, if the sting is superficial, thus reducing pain and damage. It is recommended that a jar of this be kept in the glove compartment of the service vehicle to facilitate quick field treatment of the sting. If preferred, a commercial preparation, such as a Sting Kill® swab can be used. Antihistamine ointments and tablets (to be taken orally) seem to be effective in reducing the reaction to the sting.

People who are highly sensitive to stings should consider a desensitization procedure in an allergy clinic, and consult their physician about emergency medical kits, such as Ana Kit®, which con-
tains in addition to antihistamines, aqueous epi-
nephrine (administered by injection) and fre-
quently a bronchodilator material (inhaler).

SPIDERS

Spiders, like yellowjackets, are also beneficial. However, their presence in trees can be a bane to the grower in a rather subtle way. In warm autumns and early winters resident spider populations build and often linger till the time of sale. This is particularly common with orb weavers and jumping spiders. (See figure 25.) This distresses and sometimes sours the buyer from future pur-
chases of your trees. Although there is no legal method of treating for spiders on Christmas trees, such problems can be avoided if you can tactfully enlighten the buyer on this natural condition and on how to eliminate much of the problem before the tree is set up in the living room. You can do this either by explaining the method to the buyer, or preparing a brief leaflet that explains the same. It should state that the tree can be left overnight in a semi-warm garage (many will leave the tree), or that spiders can be removed by shaking the tree.

STRESS-RELATED PESTS

There are a number of insects and insect-like creatures that are commonly misidentified as the cause of a tree's demise. These are not primary pests but, rather, they are associated secondarily with a tree after a primary cause of decline is already underway. The primary cause could be another insect, drought, disease, mechanical or chemical injury, or some undetectable cause. Once in a state of stress, the tree is rendered susceptible to secondary attack organisms, such as bark beetles, flat-headed wood borers, or long-horned beetles. (See figures 26, 27.) Healthy trees ordinarily have a defense mechanism that repels attacks by these insects called "pitch power" or internal water pres-
ture (turgor). These insects and other secondary attack organisms are actually beneficial since they

Fig. 25. Orb weaver spider feeding on grasshopper.

Fig. 26. Bark beetle (left), flat-headed, wood-boring beetle (center), and long-horn, wood-boring beetle (below).
are part of a complex recycling of nutrients scheme under the direction of Mother Nature. Professional foresters refer to them as “Mother Nature’s undertakers.”

There are no chemical cures for these arboral ailments. The only cure is cultural prophylaxis or prevention. Maintain tree vigor by avoiding injuries, excessive drying where possible, and other primary causes of decline, and you will probably never, or rarely, experience this natural secondary step of tree decline. Another situation to avoid is prolonged exposure of your trees to excesses of dying or felled trees (slash). These contribute to the buildup of secondary pests, locally, and create a hazardous situation for even healthy trees.

**Chart 1. General numerical relationship of predator and prey through time.**

(A generalization where there is no alternate food source for the beneficial organism.)

![Chart 1](chart1.png)

**NATURAL CONTROLS**

Under stable conditions, natural controls such as disease, predators, and parasites keep insect and mite populations in check most of the time with only occasional outbreaks of pests occurring when things periodically get out of balance. The usual process of control operates like the picture presented in chart 1. Natural enemies tend to lag behind the pest or prey species and only gradually overtake and depress the pest species and then go through a decline themselves.

In many agricultural crops, success of biological controls cannot be wholly depended upon because the controls do not demonstrate their benefits until after considerable damage to crops has already occurred. Also, many agricultural crops are annual and do not provide a permanent residence for beneficials. Thus, it takes time for them to move in, and the lag between predator and prey is even greater. In some cases, the lag can be avoided by programs that increase benefits from natural controls, but often as not such programs are not utilized by farmers because of the difficulty or complexity of the program or the unavailability of a workable program.

Christmas tree growers are more fortunate because their crop offers a more stable environment than that of the typical farmer and it is more conducive to natural control buildup and persistence. More importantly, because of this condition, their crop is rarely threatened by the killing aspects of insect or mite pests. However, unsightliness is a condition that is sometimes not alleviated by beneficial insect populations, and therefore occasional spraying becomes necessary. Christmas tree growers can maximize or increase beneficial insect activities and in many cases avoid this kind of spray operation. Avoiding sprays can be done in a number of ways:

- The foremost consideration is to avoid unnecessary sprays that kill both pest and beneficial insects. Often area-wide sprays cause resurgence of an incompletely depressed pest species to numbers of even greater magnitude than before and affect the area such that beneficial insect
replacement and their effects will not occur before losses occur. Resurgence necessitates expensive repeat sprays. Frequently, pests occur on plantations in hot spots and can often be managed effectively by localized sprays, thus preserving segments of beneficial insect populations on the plantation. (See chart 2.)

- Frequently, beneficial insect population effects are not realized to their maximum potential because of unnecessary management of the understory. Many inoffensive wild flowers and weeds provide both cover and alternate food sources for beneficials, particularly parasites, which feed only as larvae on the pests while many need pollen or nectar as an adult food source. If such plants do not serve as disease or pest reservoirs, do not compete with trees, or do not interfere with plantation operations such as pest weed control, then do not unnecessarily eliminate them. This management practice deserves careful consideration and understanding of the ecosystem; therefore, if you are uncertain as to impact, one way or another, check with your county Extension agent.

- The use of lady beetles as an approach to aphid control has long been utilized by the organic gardener. The process includes purchasing the beetles in bulk quantities and releasing them at the site. The idea is a good one; however, there are aspects of the beetles' biology that thwart the total effectiveness of such a practice. These beetles overwinter as adults in large masses in the forests or hillsides. They are collected at this time and kept in cold storage until they are sold. The beetles are often released in large numbers on a single site (backyard) and expected to remain. The aphid population is frequently not large enough at the time of release to support such a population of lady beetles, so they do what any hungry animal would do under such circumstances—leave the area in search of sufficient food. Furthermore, it is the belief of many entomologists that most species of lady beetle must undergo a dispersal flight after overwintering before they settle down, mate, and lay eggs. This is a phase which is missing in the beetle at the time of purchase, so when they are released, they take flight and leave the area. Thus, the beneficial effects are only realized by unknowing, nonpaying neighbors. Blueberry growers have used this technique for many years, and since many are doing so on an area-wide basis, they are apparently accidentally achieving success by trading beetles through random multi-directional dispersal flight. This has not been tested in our area, so the practice would be neither discouraged nor encouraged if Christmas tree growers chose to experiment with the technique in hopes of augmenting the effectiveness of natural resident lady beetle populations.

BEE POISONING

Honey bees and wild bees are an integral part of our lives. They pollinate and therefore are responsible for substantial yield production in many of our agricultural crops. Many of these crops would produce little or nothing at all without the activity of bees. The need to assume responsibility in using bee-hazard pesticides is generally obvious to those growing plants that are readily visited by bees; however, awareness of bee safety may be low in those growing crops not visited by bees (for example, Christmas trees). The understory or surrounding area may be saturated with wild flowers which bees are visiting. Fireweed and thimbleberry are among their favorites, and fireweed in particular may be quite prevalent in a plantation. Although bees may not be important to Christmas tree production, they are important to you in the long run. So, use careful discretion in selecting a pesticide for application in a plantation where flowering plants are present. For best results, refer to table 2. Sevin is especially hazardous to bees. If Sevin is the only material that you can use to do the job, apply it at the recommended rate, and to the mixture add molasses at a rate of one gallon
per acre. This greatly decreases the toxicity hazard of Sevin to bees because molasses repels bees.

Table 2. Toxicity of pesticides used in Christmas tree plantations to pollinating bees.

<table>
<thead>
<tr>
<th>Do NOT apply to blooming crops or weeds:</th>
<th>Sevin, Orthene, Cygon, Imidan, or Diazinon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Apply ONLY during late evening, night, or early morning when weeds are in bloom:</td>
<td>Thiodan, Metazystox-R, or Dursban</td>
</tr>
<tr>
<td>Apply at ANY TIME with reasonable safety to bees:</td>
<td>Kelthane, Pentac, or Vendex</td>
</tr>
</tbody>
</table>

REFERENCES

There are other publications that deal specifically or collectively with many of the pests dealt with in this publication. More extensive biological information is contained in them. Some also discuss control of pests not normally encountered by Christmas tree growers. They are listed below and are available at county Extension offices unless otherwise indicated.

1. *Beneficial Predators and Parasites Found on Washington Crops.* EB 640, WSU.
2. *Biology and Control of Douglas fir Needle Midge in Christmas Tree Plantations.* EM 4257, WSU.
3. *Cooley Spruce Gall Aphid.* EM 4119, WSU.
4. *European Pine Shoot Moth.* EM 4386, WSU.
5. *Insect and Mite Control in Ornamentals.* EM 3310, WSU.
7. *Silver-Spotted Tiger Moth.* EM 4271, WSU.
8. *Spruce Aphid.* EM 4322, WSU.

CHRISTMAS TREE PEST CONTROL GUIDE

(Use materials in recommendations in enough water to obtain good coverage)

<table>
<thead>
<tr>
<th>Pest</th>
<th><strong>Material</strong></th>
<th>***Actual insecticide per acre</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>ADELGIDS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooley spruce gall aphid</td>
<td>Thiodan</td>
<td>0.5 lb</td>
<td>Spray at or just prior to bud break or in the fall.</td>
</tr>
<tr>
<td></td>
<td>Sevin</td>
<td>1.0 lb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or Sevimol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balsam woolly aphid</td>
<td>Thiodan</td>
<td>0.5 lb</td>
<td>Spray in early spring (bud break). Thorough coverage is necessary. Difficult to control with anything other than high pressure spray equipment.</td>
</tr>
<tr>
<td></td>
<td>Sevin</td>
<td>1.0 lb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or Sevimol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine bark aphid</td>
<td>Thiodan</td>
<td>0.5 lb</td>
<td>Spray at bud break, particularly bark of limbs and twigs.</td>
</tr>
<tr>
<td></td>
<td>Sevin</td>
<td>1.0 lb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or Sevimol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TRUE APHIDS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conifer aphids</td>
<td>Diazinon</td>
<td>0.5 lb</td>
<td>Spray only when necessary. See text for specific species and economic importance.</td>
</tr>
<tr>
<td>&quot;Cinera&quot; spp.</td>
<td>Orthene</td>
<td>0.25 lb</td>
<td></td>
</tr>
<tr>
<td>Spruce aphid</td>
<td>Metazystox-R</td>
<td>0.25 lb</td>
<td></td>
</tr>
<tr>
<td>Balsam twig aphid, and</td>
<td>Thiodan</td>
<td>0.5 lb</td>
<td></td>
</tr>
<tr>
<td>Woolly pine leaf aphid</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPITTLBUG</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pine spittlebug</td>
<td>Diazinon</td>
<td>0.5 lb</td>
<td>Spray only when necessary. June application effective.</td>
</tr>
<tr>
<td></td>
<td>Metazystox-R</td>
<td>0.25 lb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Sevin</td>
<td>1.0 lb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>or Sevimol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pest</td>
<td>*Material</td>
<td>***Actual insecticide per acre</td>
<td>Remarks</td>
</tr>
<tr>
<td>--------------------------</td>
<td>-----------</td>
<td>-------------------------------</td>
<td>-------------------------------------------------------------------------</td>
</tr>
<tr>
<td>MOTHS</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>European pine shoot moth</td>
<td>Cygon</td>
<td>0.5 lb</td>
<td>Apply one of these materials at 2-week intervals starting approximately June 1, and ending in mid-July. See text for more detail on exact timing.</td>
</tr>
<tr>
<td></td>
<td>*Guthion</td>
<td>1.0 lb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(certified applicators only)</td>
<td>0.5 lb</td>
<td></td>
</tr>
<tr>
<td>Silver-spotted tiger moth</td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>There are no legally registered materials available for controlling this pest.</td>
</tr>
<tr>
<td>BEETLES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Douglas fir twig weevil</td>
<td>**Dursban, 4E</td>
<td></td>
<td>This material is registered in Washington only for use on Douglas fir seedlings. Use 5 1/3 oz Dursban, 4E per gal of water. Use one gal. of mix per 100 seedlings.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>See remarks.</td>
<td></td>
</tr>
<tr>
<td>White pine weevil</td>
<td>Metasystox-R</td>
<td>0.25 lb</td>
<td>Spray terminal shoots in early May and again in early June. Remove and destroy already infested shoots.</td>
</tr>
<tr>
<td>FLIES</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Douglas fir needle midge</td>
<td>**Orthene, 75S</td>
<td></td>
<td>Orthene is registered only in Washington on Douglas fir. Apply 2/3 lg of Orthene 75S per acre in not less than 2 gal water per acre by aircraft or in 100 gal water by ground equipment. Application should be made no more than 2 weeks prior to bud break.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>See remarks.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>**(Thiodan is also registered for this use; however, using it requires the use of fly-emergence cages to determine proper timing.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MITES</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eriophyid mites</td>
<td>Sevimol</td>
<td>1.0 lb</td>
<td>Frequently ineffective for unknown reasons.</td>
</tr>
<tr>
<td>Spider mites</td>
<td>Kelthane</td>
<td>0.35 lb</td>
<td>Repeat applications may be necessary. Mites may be resistant to Kelthane in some areas.</td>
</tr>
<tr>
<td></td>
<td>Vendex</td>
<td>0.5 lb</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Pentac</td>
<td>(spruce only)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Materials listed are registered on Christmas tree species including Douglas fir, true firs, pine, and spruce unless otherwise noted.

**Materials indicated as “Washington only registrations” are supplemental labels and as such must be procured from the dealer and be in possession of the user at the time of application.

***Use in sufficient amount of water to obtain good coverage.

□ Pests Not on Product Label. Some suggested uses of pesticides in this publication are for pests not listed on product labels. These are indicated by the symbol □. Such uses comply with the federal law (FIFRA) which says a use is consistent with label directions provided the crop or site is on the label and directions concerning rates and interval before harvest are followed. These suggested uses may not be used in advertising or other promotional literature.