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The Biology and Control of the Douglas-fir Needle Midge in Christmas Trees

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The Douglas-fir needle midge (DFNM) can be a very destructive pest of Douglas-fir grown for Christmas trees. Severe infestations of this pest can cause intolerable needle loss to trees in Christmas tree plantations. Trees may take several years to recover from the defoliation.

DFNM is actually a complex of three closely related species, *Contarinia pseudotsugae*, *C. constricta*, and *C. cuniculator*. All three species have similar traits, and we'll treat them as one for the purposes of management in Christmas trees.

Description and life cycle

Adults of the DFNM are small, fragile orange flies about ⅛ inch long. The females are distinguished by the presence of a long ovipositor (figure 1), which they use to insert their eggs into expanding buds of Douglas-fir. The males are slightly smaller and lack the ovipositor. Individual adults live only a couple of days, long enough to mate and deposit their eggs.

Most people don't notice the eggs of the DFNM, but they can be observed easily with a hand lens. Look for them in newly expanding buds when adults are observed in the field. The orange eggs are deposited in groups (figure 2) on young needles or between bud scales in swollen buds.
Midge eggs hatch in a couple of days, and the larvae immediately bore into young needles inside the buds. Larvae feed in the needles throughout the summer, and their presence becomes obvious during August.

Needles infested with DFNM become discolored, yellow at first at the site of the feeding midge, and then purple to brown during the fall (figure 3).

The needles are frequently bent and distorted by the larval feeding. A single needle may harbor up to ten midge larvae. The larvae are full grown in the fall, when they're about ⅛ inch long; they may be white or orange (figure 4). The larvae drop from the needles and spend the winter in the soil beneath infested trees.

The larvae pupate during March; adults begin to emerge in early

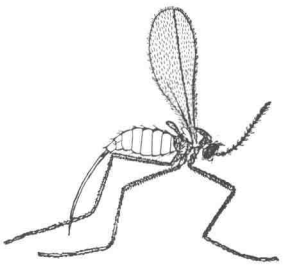

Figure 1.—Adult female needle midge. Note the long ovipositor.

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Figure 2.—Cluster of orange needle midge eggs placed in a breaking bud.

Figure 3.—Infested needles of Douglas-fir, showing color of damage and characteristic bending of needle caused by the feeding of the midge larva.

to mid-April, and emergence is typically complete by early May (figure 5). The males may emerge slightly ahead of the females. Clouds of mating and egg-laying midges can be seen during warm April days (60°F or warmer), when emergence and egg laying activity peaks.

The adult females lay eggs on bursting buds (figure 6) and new needles. The eggs hatch and the cycle (figure 7) begins again; there's one generation per year.

We don't know what causes midge outbreaks. There appears to be a cycle in midge populations every several years. Some natural biological control does occur. Two species of tiny parasitic wasps, *Gastancistrus* and *Platygaster*, may help regulate midge populations.

These wasps attack the larvae of the midges and overwinter inside the larvae. They emerge shortly after the adult midges during the spring, and they may show up in emergence traps.

Figure 4.—Maggotlike midge larvae dissected from galls in needles.

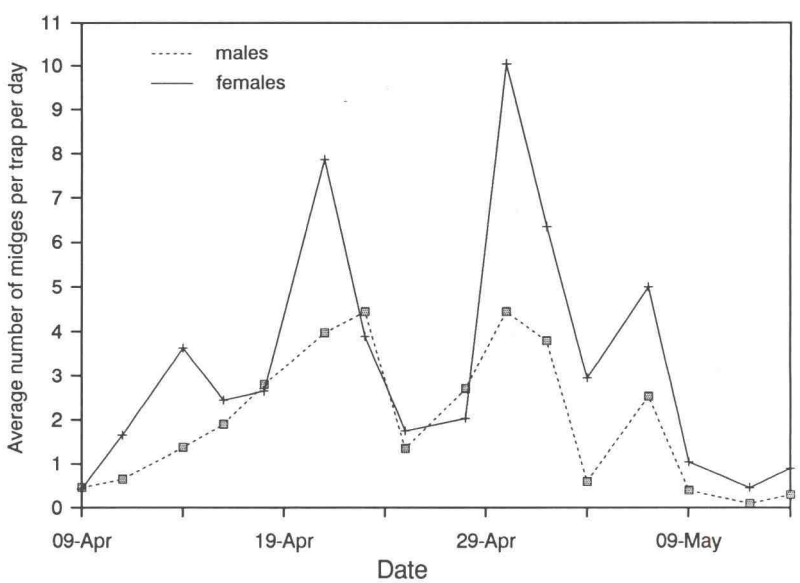

Figure 5 (right).—Pattern of emergence trap catch of needle midges in the southern Willamette Valley during the 1990 season. The decline in numbers in late April was caused by wet and cool weather.

Figure 6.—Female needle midge depositing eggs into an expanding bud of a Christmas tree.

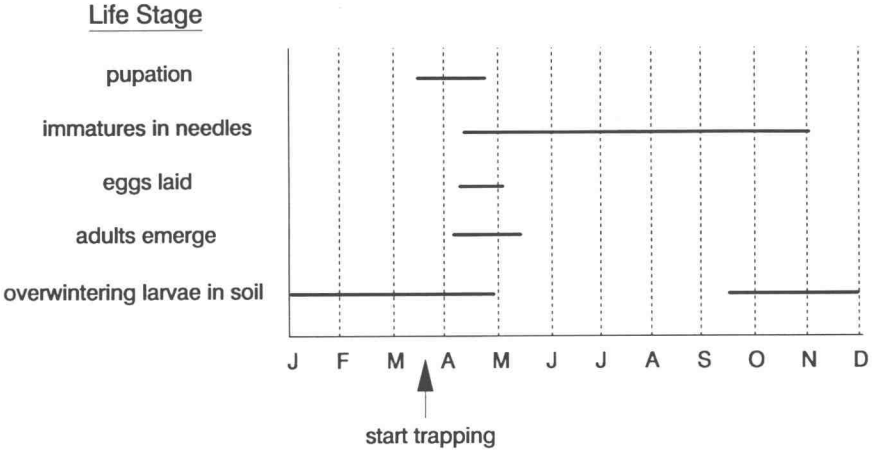

Figure 7.—Life cycle of the Douglas-fir needle midge in western Oregon; exact times of events in the life cycle will vary with weather and location.

Figure 8.—A simple but effective emergence trap for monitoring needle midge emergence.

Cultural control

There's some evidence that midges prefer trees with early budbreak. If your area has a history of needle midge outbreaks, consider planting varieties of Douglas-fir with later-breaking buds.

Using these varieties (northern seed sources) will not only shorten the time midges can infest the trees but will also make the timing of chemical control easier and more effective. Balance this against other cultural concerns—late-flushing trees may produce less growth during periods of drought.

Chemical control

Controlling the needle midge requires accurate timing of treatments. Emergence traps are the best way to monitor adult midge emergence. You can easily construct a trap from a cardboard box and a jar (figure 8). Wax-coated produce boxes are ideal; however, you can use any weather-resistant, opaque material, including sheet metal or plywood.

Use a box about 12 to 15 inches on a side, turn it upside down, and cut a hole slightly smaller than the lid of a canning jar. Cut the hole near the top of the upside-down box. Screw the jar into the hole and secure it in place. Midges emerging beneath the box will fly to the light coming in through the jar, and they'll collect in the jar.

Place your traps underneath the north side of an infested tree during the middle of March. Place at least three traps per field. Check the traps every other day starting the last week of March.

The midges begin emerging during early April in western Oregon, but this can vary by as much as 10 days with weather and exposure. Heavy rain and cool weather will reduce trap catches. In addition, adult emergence occurs later further north.

Within a week of your first trap catch, depending on the weather, apply Thiodan (endosulfan): 50WP in Oregon, 50WP or 3EC in Washington, and 3EC in Idaho. There's no threshold for midge trap catch; make your decision to spray for midge on the basis of the damage from the previous year.

A single application of Thiodan at the start of DFNM emergence will usually control the midge during the current year. You might consider a second application, 2 weeks after the first, when the infestation has been severe on trees that you'll harvest or when the first application is closely followed by very heavy rain.

Note: Overuse of Thiodan could lead to mite problems.

The timing of applications of Thiodan is critical. Adult midges must encounter treated foliage before

they lay eggs. You must use emergence traps to ensure appropriate timing.

Late application of any chemical will result in little or no control and could worsen midge problems by killing later-emerging parasites.

Note: Orthene 75S is also labeled for midge control on Christmas trees. Orthene isn't as effective as Thiodan, and it's likely to cause later spruce spider mite outbreaks or to poison new growth.

Orthene doesn't control adelgids, which may also be present this time of year—in fact, it may cause adelgid outbreaks.

Because of constantly changing labels, laws, and regulations, Oregon State University assumes no liability for the consequences of the use of any chemicals suggested here. *Always read and follow the specific product label directions carefully when you use any pesticide.*

Use pesticides safely!

- **Wear** protective clothing and safety devices as recommended on the label. **Bathe or shower** after each use.
- **Read** the pesticide label—even if you've used the pesticide before. **Follow closely** the instructions on the label (and any other directions you have).
- **Be cautious** when you apply pesticides. **Know** your legal responsibility as a pesticide applicator. You may be liable for injury or damage resulting from pesticide use.

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