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Spraying for Douglas-Fir Needle Midges in Christmas Tree Plantations

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Three related species of flies, *Contarinia pseudotsugae, Contarinia constricta,* and *Contarinia cuniculator* have caused serious damage to some Northwest Douglas-fir Christmas tree plantations. Collectively, these species are commonly called Douglas-fir needle midges. Periodically, large portions of important production regions have been severely infested. The results are deformed, discolored needles and (in some cases) premature needle drop. Damage can make the trees unsightly and unfit for market.

With growth and development of Christmas tree plantations, these midges have attracted increased attention as pests of economic significance. Whether midge populations and their damage have increased over the last few seasons is not known, but Northwest Christmas tree growers should be on the alert in case control is required.

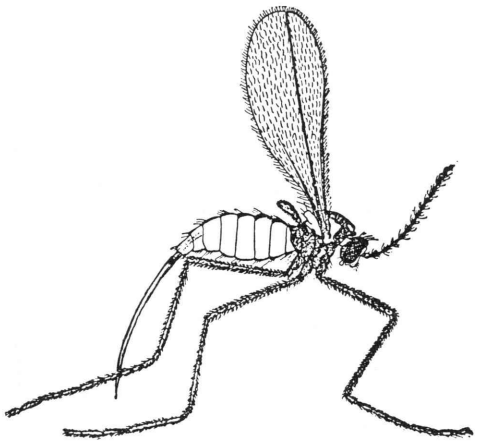

Figure 1.—Adult female Douglas-fir needle midge is distinguished by her long ovipositor.

Figure 2.—Midge-infested needles show a marked distortion—either a slight crooking or a swollen area where midge larvae are feeding within.

Description of midge

Adults: The adult midges are delicate, orange, two-winged flies about ⅛ inch long. Adult females are distinguished from males by being stouter and having a long ovipositor (figure 1). Adult life span is short; males live 1 to 2 days after emergence. Females live 2 to 4 days.

Eggs: The female flies lay eggs on the surface of new needles, where they hatch in a few days.

Larvae: The newly emerging larvae quickly chew into the needle, where they feed thoughout the summer. Larvae of each species cause slightly different needle damage, but all three species mine the needles. Often several larvae can be found in a single needle, usually within gall-like structures (figure 2). The needles become discolored, ranging from yellowish to purple. When mature, the larvae are about ⅛ inch long and are yellowish, white, or orange (figure 3). Larvae drop from the needles in the fall and overwinter in the soil.

Pupation occurs in the spring; adults emerge from the ground beneath the host trees about the time Douglas-fir buds are bursting. However, timing for application of an insecticide should be determined by monitoring adult emergence, which does not necessarily coincide with bud burst.

The most reliable means of monitoring adult emergence is the use of an emergence trap. The period during which adults emerge from the soil is approximately 10 days. This period may vary, depending on prevailing weather, especially temperature. Life span of the adults is very short, from 1 to 4 days. Though males emerge first, time your insecticide treatment to coincide with the first consistent emergence of adult female midges.

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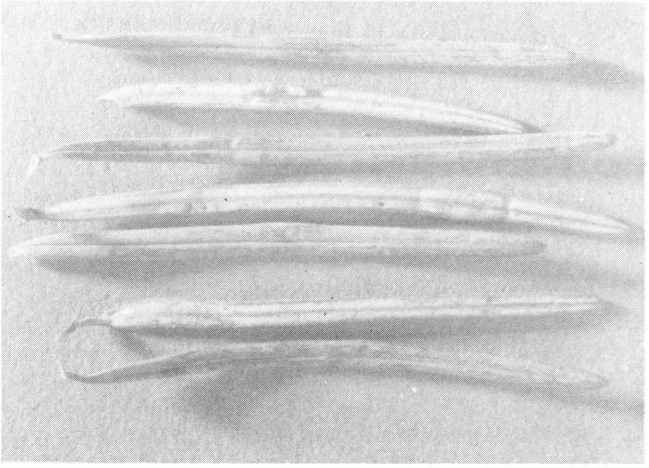

Figure 3.—Flattened midge larvae feed within the needle. Emergence holes are seen in the fall when mature larvae drop to the ground.

Constructing an emergence trap

You can construct a trap using any opaque, weather-resistant material, such as sheet metal, plywood, or heavy cardboard (wax-coated shipping boxes are ideal). Construct or use a box with at least a 15-inch-square opening on one side. Several inches from the bottom on one side of the box, cut a circular hole slightly smaller than the lid of a wide-mouth glass jar. A pint or quart size canning jar works well. Secure the collection jar to the side of the box. When this trap is placed on the ground close to a tree, the emerging midges are attracted to the light and enter the jar. Condensation makes it necessary to place a bit of paper toweling in the jar. The adult midges appearing in the jar can be counted and sexed.

Place traps on the north sides of trees in an area where damage has been observed. In large plantations where differences in elevation or sun exposure exist, trap additional locations to detect variations in midge emergence that minor climate differences cause.

Begin trapping of midges before the first bud break of Douglas-fir to determine peak emergence. Check traps daily to detect if midges are emerging, especially when females first appear.

Controls

Chemical control: Thiodan and Orthene, two insecticides registered for use on Douglas-fir, are effective in controlling needle midge. Use Thiodan 50 WP or 3 EC at the rate of 2 pounds active ingredient per acre. Thiodan also will control aphids and susceptible stages of adelgids at this time of application. Or, use Orthene 75 S at the rate of 0.5 pounds active ingredient per acre. Both insecticides can be applied with ground equipment using sufficient water to thoroughly wet trees. From an aircraft, use the active ingredient in 5 to 10 gallons of water per acre.

Survey the plantation carefully. Midge infestations often begin at the perimeters of a planting. Perimeter applications may be adequate to stop infestations from spreading. If good control is achieved (this can be determined in August or September), additional applications a second or third year may not be necessary. You can decide whether to spray the following year by determining the number of midges caught the next spring using traps.

Cultural control: Tests have shown that early budding Douglas-fir trees become significantly more infested than late budding trees. The latter case may result in considerable mortality to eggs and young larvae. Nevertheless, if midge populations are high, there may be enough late emergents to infest the new needles. This suggests that selection may be possible of suitable planting stock for use in areas subject to recurrent midge attack. With bud break delayed as much as 2 weeks from normal for a given area, the peak of midge emergence would have passed, and damage will be reduced.

Weather: Unfavorable spring weather may result in injury to adults. Midges are fragile and weak fliers. Hail, rain, and strong winds easily damage their legs, wings, and antennae.

Biological control: In one study aea, about 75% of the overwintering midge larvae were parasitized by a small wasp in the genus *Platygaster*. The larvae of the parasite develops slowly within the larvae of the midge and overwinters inside the midge larvae. The following spring, before the midge larvae pupate, the parasites develop rapidly and make cocoons from the skin of the midge larvae. The adult parasites emerge several weeks after emergence of the adult midges.

However, *Contarinia pseudotsugae,* the most common midge on the Douglas-fir, apparently resists parasites to some extent by sealing parasite eggs in the body with a layer that prevents hatching. Even so, parasites may destroy a large proportion of the midge larvae. The delayed emergence of the parasites in the spring is another reason for trapping, so that chemical spray application can be closely timed to coincide with peak emergence of adult female midges. Do not spray so late as to miss the initial emergence of adult female midges. Poor control of the needle midge as well as parasite mortality would result.