

DOUGLAS-FIR. NEEDLE MIDGE ... Determining a Spray Schedule Through Use of a Midge Trap

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 resulting in deformed, discolored needles, and in some cases premature needle drop (Figure 1). With growth and development of Christmas tree plantations, these midges have attracted increased attention as pests of economic significance.

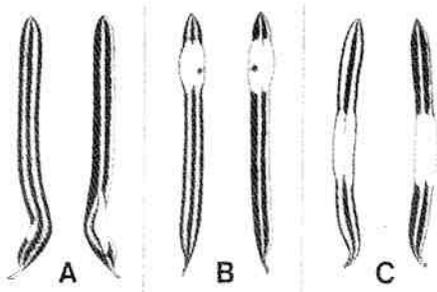


Figure 1. Needle galls on Douglas-fir caused by: A, *Contarinia cuniculator*; B, *Contarinia constricta*; and, C, *Contarinia pseudotsugae*.

Damage can make the trees unsightly and unfit for market. 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 this spring in case control is required.

Description of Midge

Adults: The adult midges are delicate, orange, two-winged flies about one-eighth inch long. Adult females are stout and have a long ovipositor.) Adult life span is short; males live 1-2 days after emergence. Females live 2-4 days.

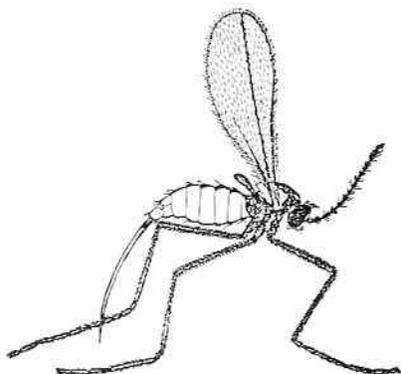
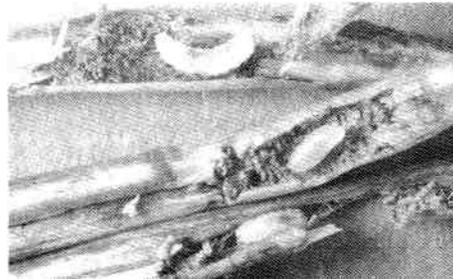


Figure 2. Adult female Douglas-fir needle midge is distinguished by her long ovipositor.

Eggs The female flies lay **eggs** on the surface of new needles where they itch in a few days.

Larvae: The newly emerging **larvae** quickly enter the needle and feed throughout the summer. Larvae of each species cause slightly different needle damage (see Figure 1). All three forms, however, mine the needle, often several larvae being present in one needle, and form gall-like structures. The needles become discolored, ranging from yellowish to purple. When mature, the larvae are about one-eighth inch long and yellowish, white or orange in color. Larvae leave the needles in the fall and over-winter in the soil.

Figure 3. Feeding damage and exposed larvae in Douglas-fir needles. This stage of life cycle can be found in late summer or early fall.



Larvae emerge the following spring as adults from the ground beneath the host trees about the time Douglas-fir buds are bursting.

Timing for application of an insecticide, however, should be determined not by observing bud development, but by monitoring emergence. Because of the long interval of Douglas-fir bud break in Christmas tree plantations, lasting three weeks or more, needle length should not be used as a criteria.

The most reliable means of determining emergence is the use of an emergence trap. The emergence period during which adults emerge from the larvae that over-wintered in the soil is of relatively short duration, approximately 10 days. Life span of the adults ranges from 1-4 days. Insecticide treatment should be timed to coincide with the period of adult female midge emergence.

Construction of an Emergence Trap

A trap can be constructed using any 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 Mason 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 paper toweling in the jar. The trapped midges come to rest on the paper, and this facilitates counting. Set the trap on the north side of a tree in an area where damage has been observed. In large plantations where differences in elevation or sun exposure exist, additional trap locations may be indicated to monitor variations in midge emergence due to microclimate differences.

Trapping of midges should begin prior to first bud breaking of Douglas-fir to determine any sharp increase in emergence. Daily checks of the trap will reveal if an increase of midges occurs and particularly the onset of female emergence.

Controls

Chemical Control

Thiodan and Orthene, two insecticides registered on Douglas-fir, are effective against needle midge. Use Thiodan 50 WP or 2 EC at the rate of two pounds active ingredient per acre. Thiodan will also control aphids and susceptible stages of adelgids at the time of application. Or, use Orthene 75 SP 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; by aircraft, use 5-10 gallons of water per acre. Insecticide treatment should be timed to coincide with the period of adult female midge emergence.

Survey the plantation carefully. Frequently midge infestations begin at the perimeters of the planting. Perimeter applications may be adequate to stop infestation spread to the remainder of the stand. If good control is achieved (and this can be determined in August or September), additional applications the second and third year may not be necessary. A decision on whether to spray the following year can be determined by the number of midges caught.

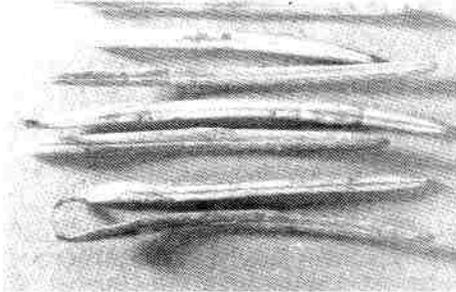


Figure 4. Damaged needles in late summer and fall. Look for swollen gall-like areas and yellowish to purple discoloration.

Cultural Control

Tests have shown that advanced Douglas-fir buds become significantly more heavily infested than retarded buds..the tree which leafed out two weeks earlier was heavily attacked while the other was hardly affected. Phenological asynchronism of insect and host 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 later 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 after normal for that area, the peak of midge emergence would be out of synch and damage thus reduced. (Condrashoff, 1962).

Physical Controlling Factors

Unfavorable spring weather may result in mechanical injury to adults. Their legs, wings, and antennae are easily damaged by collision with hail, rain and objects moved by strong winds.

Biological Control

"...about 75 percent of the overwintering midge larvae were parasitized by *Platygaster* sp."(Condrashoff, 1962). The parasite larva develops slowly and overwinters inside the midge larvae. The following spring, before the midge larva pupates, the parasite develops rapidly and makes a cocoon from the midge larva's skin. The adult parasite emerges several weeks after emergence of the adult midge. However, *Contarinia pseudotsugae*, the most common midge on the Douglas-fir, apparently resists parasitism to some extent by encapsulating parasite eggs in the body with a sclerotized layer that prevents hatching. Even so, parasitism may destroy a large proportion of the midge larvae (Condrashoff, 1962). The delayed emergence of the parasite in the spring (parasite emerges several weeks after the adult midge emerges) is another reason for trapping so chemical spray application can be closely timed to coincide with peak emergence of adult female midges. Sprays should not be applied so late as to miss the adult female midge and wipe out the later emerging parasites.

References:

- Condrashoff, S.F. 1962. Bionomics of three closely related species of *Contarinia* Rond. (*Diptera: Cecidomyiidae* from Douglas-fir needles. *The Canadian Entomologist* 94(4):376-394.
- Nagel, N.P. 1968. Douglas-fir needle midge control. *Northwest Lookout*, Nov. 1968.

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