Forest Insect & Disease Leaflet 31

Forest Service
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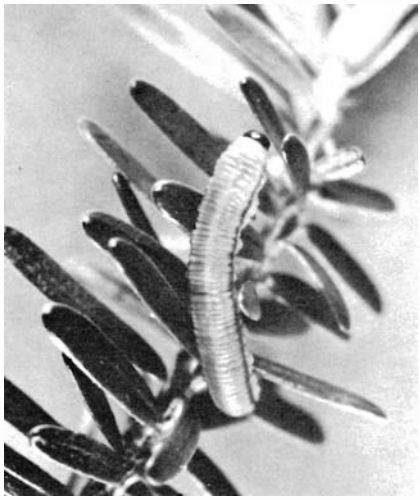

F-523609

Hemlock Sawfly

John S. Hard, Torolf R. Torgersen, and Donald C. Schmiege [1]

The hemlock sawfly (*Neodiprion tsugae* Middleton) is an important defoliator of western hemlock in southeastern Alaska and the coastal area of British Columbia, Washington, and Oregon. It also occurs in the interior of British Columbia and in Montana and Idaho (fig. 1).

Most outbreaks of the sawfly collapse with little or no tree mortality unless the insect is feeding in association with other defoliators, particularly the black-headed budworm (*Acleris gloverana* Walsingham). Some trees, however, are top killed and radial growth is temporarily reduced. Since the sawfly prefers old foliage and the budworm prefers new, their feeding together may result in complete defoliation.

Host Trees

Western hemlock (fig. 2) is the primary host of the sawfly, but conifers of several other species may be defoliated if they are in

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Figure 1.—Distribution of the hemlock sawfly in western North America.

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Figure 2.—Severe defoliation of mature western hemlock caused by hemlock sawfly.

the vicinity of infested western hemlock. These species include Sitka spruce, mountain hemlock, and Pacific silver fir.

Evidence of Infestation

Young sawfly larvae usually feed in colonies (fig. 3). Two or more larvae often feed on the same needle, starting from the tip and feeding back to the base. Frequently the center rib is left by the early-instar larvae. Immature larvae feed only on old foliage, but maturing larvae will also attack new foliage if all of the older foliage is depleted.

As the sawfly larvae mature, they often feed singly, but some feed in colonies until they pupate. High populations of the sawfly may remove all of the older foliage. This makes the tree crowns appear thin and gray. If defoliation occurs for 2 or more

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Figure 3.—Feeding colony of young hemlock sawfly larvae. Note character of needles which have been fed upon.

successive years, trees are weakened and may die or succumb later to diseases or other insects. During outbreaks, many cocoons can be seen on twigs, foliage, underbrush, and the forest floor.

Description

The egg is pale yellow and surrounded by host needle tissue. Just before hatching it swells, darkens, and may bulge from the needle. The newly emerged larva is nearly black, but later its body turns dark green. When the larva is nearly full grown, longitudinal stripes appear (see cover). The dominant color of mature larvae varies from green to yellow green, but the color of a few larvae may be shades of orange. Larvae of all ages have black head capsules. Mature larvae are 15 to 20 mm long.

The sawfly cocoon is cylindrical with bluntly rounded ends (fig. 4), light brown to dark golden brown, tough, and papery. Cocoons are from 6 to 10 mm long, and female cocoons are larger than male cocoons.

Adult sawflies are "thick-waisted" and 5 to 8 mm long. Females are larger than males, yellow or brownish, and have serrated antennae (fig. 5, top). Males are black and have plumed antennae (fig. 5, bottom).

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Figure 4.—Hemlock sawfly cocoon showing typical emergence hole cut by emerging adult.

Life History and Habits

The hemlock sawfly completes one generation per year, but some individuals remain in extended diapause as prepupae, taking 2 or more years to become adults. The sawfly overwinters in the egg stage, and eggs hatch in June.

Young larvae feed in colonies on old foliage. As larvae mature, they disperse. Many individuals feed singly, but some loose colonies remain until pupation. Male sawfly larvae have four feeding instars and most females have five. Mature larvae often move about in the tree crowns and may also migrate up or down tree tunks before pupating. Although no more than one generation occurs annually, larvae of various sizes can be found from late June through August.

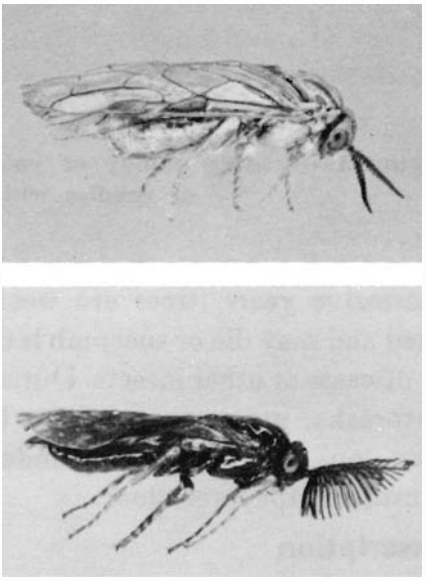

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Figure 5.—Adults: Top, female; bottom, male.

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Figure 6.—Eggs in hemlock needles.

After feeding is completed, the larvae enter a nonfeeding or prepupal stage in which the body becomes shortened. The prepupae then spin cocoons wherever they rest after feeding—on needles and twigs of the host tree, in the duff, or on understory shrubs. Bare twigs in the lower crowns of hemlock trees are common pupation sites. Adult sawflies emerge from the cocoons from August through October, males normally emerging earlier than females.

The eggs are deposited in slits cut by the female along the edge of hemlock needles (fig. 6). Usually the female deposits only one egg in a needle, but occasionally she deposits two or more. Robust females produce an average of 60 to 70 eggs, but individual fecundity varies from less than 10 to over 100 eggs, depending on degree of host defoliation and resultant vigor of individual females. Current year's foliage is preferred for egg laying.

Natural Control

Adverse weather, a fungus disease, and parasites control the sawfly in southeast Alaska. Cold summer and fall weather affect the sawfly directly by delaying larval maturity, reducing fecundity, and inhibiting oviposition.

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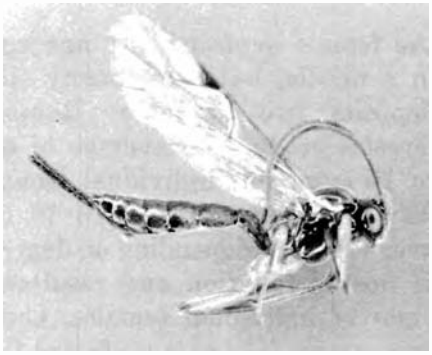
Figure 7.—Sawfly larva killed by the fungus *Entomophthora sphaerosperma*.



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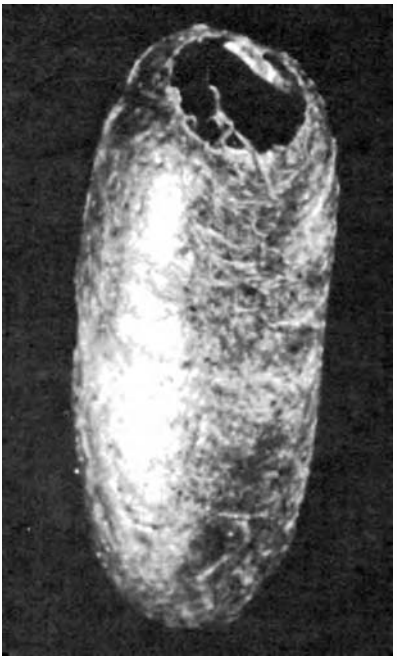

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Figure 8.— *Above*, adult female of the parasite *Delomerista japonica diprionis; right*, sawfly cocoon with characteristic parasite emergence hole.

Precipitation during the summer months affects the sawfly indirectly through its effect on disease and parasites. Frequent rainfall promotes spread of the fungus, *Entomophthora sphaerosperma* Fres. (fig. 7), in larval populations; and dry weather results in increased parasitization of cocooned sawflies by *Delomerista japonica diprionis* Cush. (fig. 8, left and right), *Oresbius tsugae tsugae* (Cush.), and *Itoplectis quadricingulatus* (Prov.). Between 1952 and 1974, most declining sawfly population trends in southeast Alaska occurred after two consecutive wetter than normal summers. Starvation and poor nutrition caused by depletion of host foliage contribute to population collapses by reducing sawfly fecundity.

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