Sitka-Spruce Weevil

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The Sitka-spruce weevil (*Pissodes sitchensis* Hopk.) is the most serious insect enemy of young Sitka spruce throughout the range of the host tree in Oregon, Washington, and British Columbia (fig. 1). Intensive search has failed to find it in Alaska, where Sitka spruce also grows abundantly.

This small weevil kills or seriously injures the terminal shoots when trees are from about 8 to 30 years old and up to 50 feet tall. When the terminal is killed, height growth is held back until a lateral branch can replace it. Forked tops and crooked trunks often result from weeviling, and repeated weeviling may result in other tree species overtopping the spruce and becoming dominant in the stand.

Weeviling has become so severe in some areas along the coast of Washington and Oregon that planting of this highly valued and fast-growing tree either has

Figure 1.—Distribution of the Sitka-spruce weevil in North America.

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been stopped or is seriously questioned. In some years, 40 to 50 percent of the susceptible-age trees in a stand may be weeviled. Trees that are attacked year after year often become shrublike in form and are worthless for timber and of little value for pulp or other products.

Host Trees

The weevil attacks only Sitka spruce and does most damage on sites a few miles inland from the coastal fog belt. Weeviling is most severe where spruce comprises a high percentage of the stand, but damage may also be considerable where other tree species predominate.

Evidence of Infestation

The first indications of attack occur in the spring when tiny bark punctures are made by adult weevils near the top of the previous year's leader. Drops of shiny pitch that accumulate in these wounds can be detected by close observation. About midsummer the new shoot, which has grown from the top of the attacked leader, begins to wither and droop in a characteristic manner (fig. 2).

Subsequently the green needles on the shoot turn yellow, then red or brown, and are visible for some distance. Since both the terminal of the preceding year and the leader growth of the current

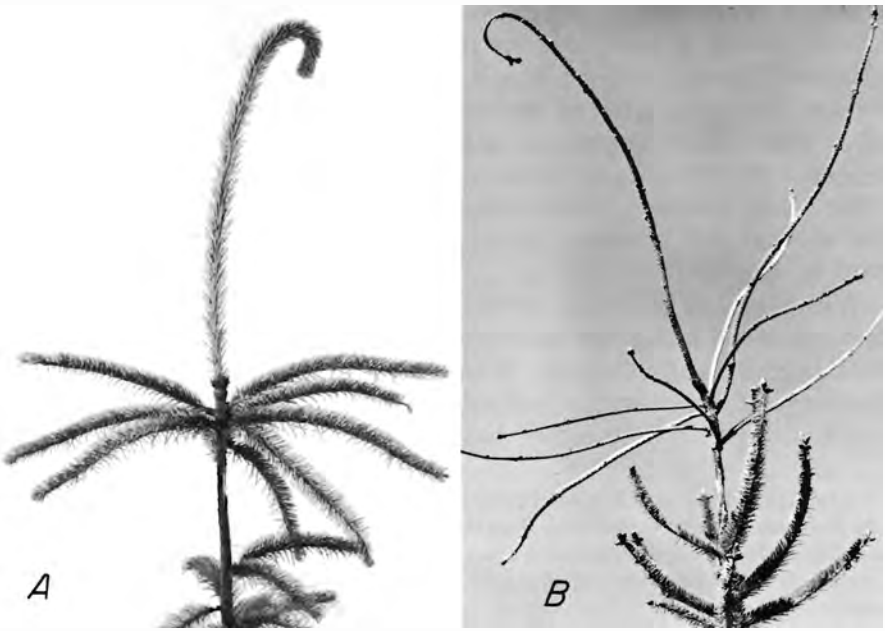

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Figure 2.—Evidence of weeviling: *A*, Current leader beginning to droop following girdling of previous year's growth; *B*, appearance of a killed leader about 8 months after attack.

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Figure 3.—Degrees of damage by weeviling: *A*, Tree that has recovered well; note remains of old, killed leader. *B*, Tree with severe deformity. This 45-foot tree had been weeviled six times during its 26-year lifetime.

season are killed, as much as 6 feet or more of height growth is lost from 1 year's attack.

The best time for evaluating damage is usually August or September, when the killed leaders are still on the trees. Through the fall and winter, evidence of weeviling decreases as storms remove the dead needles, the bark, and finally much of the length of the leader. The remaining stub, however, persists for many years. A history of past weeviling on a tree can be obtained by climbing it and counting the number of stubs, which usually protrude at an angle from the bole (fig. 3).

Description of Life Stages

Adult Sitka-spruce weevils are typical of the weevil family and can be recognized by their long, curved beaks, their overall body shape, and their roughened wing covers. They vary in length from about three-sixteenths to one-fourth inch and are generally reddish brown with patches of lighter brown or gray scales (fig. 4, *A*). The eggs are pearly white, slightly oblong, equally rounded at both ends, and about half as large as the head of a pin. The yellowish-white larvae have light brown heads and are elongate, cylindrical, wrinkled, and legless (fig. 4, *B*).

Between the larval and the adult stages is the pupal or transition stage. Pupae are the same general size and form as the adult, but are shiny white. The developing head, beak, and wings are prominent (fig. 4, *C*).

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Figure 4.—The Sitka-spruce weevil: *A*, Adult; *B*, larva; *C*, pupa. Each 13 times natural size.

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Figure 5.—Weevil pupal cells in a Sitka-spruce leader (X1½). Note emergence holes, which show that adults have completed development and left the leader.

Habits

Adult weevils fly or crawl in April or May to the terminals of young spruce trees, where they make feeding punctures in the bark with their beaks. After a short time, usually by May or June, they mate and make more punctures just below the top of the terminal. The females then lay one or two eggs in each puncture.

Larvae hatching from the eggs feed down the terminal just under the bark until they become mature, usually about midsummer. They then construct oval-shaped pupal cells in the wood (fig. 5). As many as 30 to 40 larvae and pupae may be found in a single spruce leader. The pupal cells are well covered with shredded wood fiber and are visible for many years on the killed leader stubs, which usually remain attached to the trees.

The newly formed adult weevils begin emerging from the pupal cells about August, and emergence continues into fall. After emergence the weevils feed at random on the bark, subsequently dropping into the debris of the forest floor to overwinter.

Although only one generation is produced each year, there is considerable overlapping of development, both within a particular brood and between broods from different parents. Most stages can be found at any time from spring to fall, and the insect has been found overwintering in every stage except the egg.

Natural Enemies

The Sitka-spruce weevil is subject to a number of natural controls, including insect parasites and predators, adverse climatic or weather conditions, and resistance of the host trees. The most important insect enemy is a small, shiny-black, predaceous fly (*Lonchaea polita* Say), the larvae of which congregate in great numbers in the weevil mines and pupal chambers. Other species of flies and several small wasps also prey on the weevil, particularly when it is in the larval or pupal stages. An unknown disease, possibly a virus, has occasionally wiped out entire broods of larvae.

Studies in eastern North America of the white-pine weevil (*Pissodes strobi* (Peck)), a near relative, have shown that successful egg laying depends on favorable temperatures. This is believed to be also true for the Sitka-spruce weevil.

After Sitka spruce trees reach about 30 years of age and 40 to 50 feet in height, weevil attack is not serious. Whether the trees have developed resistance to the weevils or are no longer palatable to them is not known.

Control Through Forest Management

The most serious damage from weeviling is found on open-grown spruce. Under these conditions several lateral branches usually attempt to replace the weeviled leader, but none may fully succeed. As a result, the weeviled tree takes on a sprawling, many-branched form. In close-grown spruce, on the other hand, where all the trees are competing for overhead light, the killed leader is usually replaced by a single lateral that turns up and soon becomes dominant. In this case, the main stem of the tree shows little deformity, and a minimum of height growth is lost. Accord-

ingly, it has been recommended to forest managers that spruce be grown in closely spaced, well-stocked stands.

In Oregon and Washington, weeviling causes significant damage throughout the range of Sitka spruce. Heaviest damage, however, has occurred in large even-aged plantations located 10 to 25 miles from the ocean near the eastern edge of the spruce range. To minimize damage, forest managers should not create large blocks of young, even-aged Sitka spruce, which offer ideal conditions for buildup and maintenance of weevil populations. It is also recommended that other tree species, such as Douglas-fir, be planted instead of spruce on inland sites that will grow them.

Because some individual Sitka spruces appear to be resistant to weevils, it may be possible through selection to develop weevil-free strains. Other species and hybrids of spruce also are being tested for weevil resistance.

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