Spruce Budworm
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Spruce Budworm

Biology and Control

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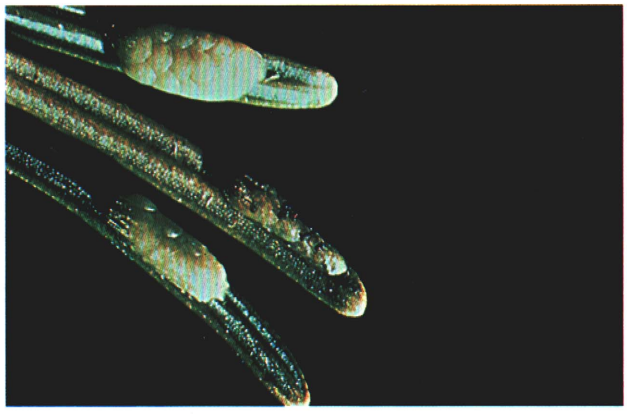


Spruce budworm egg clusters on balsam fir needles. Each cluster numbers from 5 to 50 eggs. Black dots are eggs that have been killed by a parasitic wasp.

Biology and Life History

The spruce budworm, *Choristoneura fumiferana*, is the most important insect of our North American fir-spruce forests. This native defoliator feeds primarily on balsam fir and white spruce in Michigan forests, but has also been observed in low numbers on ornamental blue spruce. Over the past several years, the spruce budworm has been active throughout approximately one million acres of fir-spruce forest in the Upper Peninsula and some isolated portions of the northern Lower Peninsula.

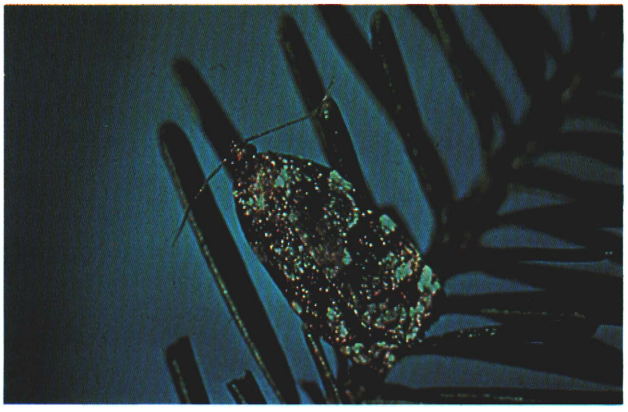
The spruce budworm has one generation each year. Eggs are laid in clusters numbering 5 to 50 eggs on balsam fir and white spruce needles during late July and August. Each female moth can lay upwards of 200 total eggs before she expires from exhaustion. After 8 to 14 days, tiny larvae hatch but do not feed. Instead, the microscopic larvae are blown by the wind among the trees in the stand. After several hours to several days of repeated dispersals, larvae find hiding places among bark scales, staminate flower bracts and lichen mats where they spin a winter shelter in which to hibernate. The larvae remain in hibernation until May, when they emerge from their shelters, disperse within the stand, then begin feeding.

Still less than one-eighth inch in length, the caterpillars begin feeding by hollowing single needles or by mining staminate flowers. As buds burst and shoots expand, the caterpillars grow and begin feeding on the succulent shoots. They continue feeding on new shoots and spin a small web that serves as a feeding shelter.

Full-grown caterpillars reach about 1¼ inches in length. Pupation takes place in the feeding shelter

Mature spruce budworm larva. Full-grown caterpillars reach about 1¼ inches in length.

Spruce budworm pupa. Pupation takes place in the feeding shelter in late June and early July.



Spruce budworm moth.

in late June and early July. After about 10 to 14 days, the adult moth emerges to mate and lay eggs for the next generation.

Insect Damage and Impact

When caterpillar populations are dense (exceeding one per growing tip), the webbing of several needles into the feeding shelter imparts a reddish-brown hue to the forest (most visible in mid-July). Although alarming at first, such an appearance of damage is no cause for concern during the first year of noticeable defoliation. Budworm outbreaks occur in a cyclical pattern when the existence of large areas of mature balsam fir coincide with the right weather conditions. Top-killing usually occurs after about three years of severe infestation and tree mortality begins after five years. Prolonged outbreaks usually last from 7 to 10 years. One study conducted in the Lake States revealed that 67 percent of the basal area of balsam fir was killed while 42 percent of the white spruce was killed.

Mature and overmature balsam fir stands are most severely damaged, but immature stands can also be defoliated. Spruce mixed with balsam fir is more likely to be damaged by budworm than is pure spruce.

Chemical Control

Most of the chemical control of spruce budworm in the northeastern United States and eastern Canada is based on the philosophy of foliage protection. Spraying is not done to control the insect population, but is carried out to protect the trees from damage just to the extent of keeping most of them alive. This approach is currently being used in New Brunswick and Maine where the spruce-fir type is a major component of the ecomony in these areas. Spraying of this kind has a negative side effect of prolonging an outbreak. Populations may collapse periodically, but outbreaks eventually return because the stands are still susceptible.

Many of the characteristics of the spruce-fir type in the Lake States are different. The spruce-fir type occurs in scattered blocks rather than large, continuous areas. In many areas of the Lake States, the cost of a continuous spray program to protect the current crop of spruce-fir may exceed the benefits to be derived in the future.

If it is decided that chemical control is feasible, then aerial application of a registered biological or chemical insecticide is the most efficient method. Some materials currently registered for control of spruce budworm are Thuricide, Dipel, Sevin 4-oil

Spruce budworm feeding damage on balsam fir foliage. Caterpillars begin feeding on new shoots but will also move to old needles if new shoots have been exhausted.

Reddish-brown hue seen in mid-July during a spruce budworm infestation. Needles clipped and webbed into feeding sites turn color creating an alarming appearance of damage.

and Dylox. Check with a county agricultural agent, state agricultural experiment station or local forester to make sure your choice of insecticide is registered for spruce budworm control.

Silvicultural Control

Some conditions are known to affect budworm populations. Stand density affects larval survival. A mature balsam fir stand with well-developed lateral crown exposure is the optimum for survival of both small and large larvae.

Stand composition affects damage. Stands with nonhost conifers or hardwoods in the overstory sustain less mortality. Severe damage can occur to regeneration and young stands with a scattered overstory of host trees.

Weather affects budworm dispersal. Stands downwind may be invaded by moths and small dispersing larvae. Spruce budworm populations increase with successive years of dry summer weather. Some recommendations that can be made on the basis of this information are:

(1) Harvest cut should be a block or modified-block clearcut. All trees, including nonmerchantable trees, should be cut to avoid leaving a scattered residual overstory of host trees. If scattered trees are left standing at the time of harvest, they should be removed in a subsequent TSI operation.

(2) Existing young balsam stands (to 15 feet tall) with a scattered overstory of host trees should have that overstory removed to reduce damage to the trees below.

(3) After harvest, converting to a less susceptible stand by burning and planting white spruce, black spruce or jack pine should be considered for the better sites.

(4) Balsam fir and mixed balsam fir and white spruce stands should be managed on a 40-year rotation. Stands that are essentially pure white spruce can be managed on a 70-year rotation.

(5) During an outbreak, priorities for salvage should be established. The following factors should be considered when setting priorities. They are not necessarily listed in order of importance, but stand condition should be given primary consideration.

Balsam fir trees killed by spruce budworm feeding. Top-killing usually occurs after about 3 years of severe infestation and tree mortality begins after 5 years.

During a spruce budworm outbreak salvage logging is an excellent means of protecting investment dollars and reducing spruce budworm outbreak potential.

(a) Stand condition. Stands with top-kill or mortality already present should be given first priority.

(b) Stand age. Oldest stands should be cut first.

(c) Stand composition. Stands with highest component of balsam fir will be most heavily damaged. Stands with nonhost species in overstory will be more resistant.

(d) Stand volume. Take stands with the highest potential volume first.

(e) Site. Stands on poor sites may be damaged earlier and to a greater extent than those on better sites.

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