

Treatment Options for Douglas-Fir Tussock Moth



About Douglas-fir Tussock Moth

Douglas-fir tussock moth (*Orgyia pseudotsugata*) is a defoliator of Douglas-fir, true fir (*Abies* spp.) and spruce (Engelmann and Colorado blue) trees. Native to Colorado's forests, the insect also may impact Colorado blue spruce in urban settings.

Infestations may lead to partial or even complete tree defoliation, although typically do not cause tree mortality. Subsequent attacks of Douglas-fir tussock moth over multiple seasons can weaken trees and predispose them to bark beetle attacks, however, which can lead to tree death.

Douglas-fir tussock moth produces one new generation each year. Peak adult moth activity occurs in July and August, but may continue until November. Male moths may be seen flying in late summer and early fall; however, female moths are flightless and remain on the pupal case from which they emerged through their lifespan, emitting a pheromone that attracts males shortly after emergence. Egg masses are produced in the early fall and hatch in late May to early June. After hatching, young larvae begin to feed on the current year's needles and are dispersed by winds as they feed in the tops of trees. As the larvae grow, they complete their development by feeding on older foliage.



Figure 1. Egg masses. Photo: William M. Ciesla



Figure 2. A larva feeding on foliage. Photo: Dan West



Figure 3. A pupal case. Photo: William M. Ciesla



Figure 4. A pupal case and an adult male moth. Photo: William M. Ciesla

Tussock moth larvae have five tufts of hair, or “tussocks,” and are covered in fine hairs which can cause skin irritation accompanied by an itchy rash on humans— a condition known as “tussockosis.”

For more detailed information on the life history of Douglas-fir tussock moth, please refer to the Colorado State Forest Service *Douglas-fir Tussock Moth Quick Guide*, online at <http://csfs.colostate.edu/csfspublications>.

Signs and Symptoms

Defoliation typically begins at the tops of trees and progresses downward. Damaged trees likely have the presence of observable Douglas-fir tussock moth larvae, pupae within pupal cases, empty pupal cases or egg masses.

More information is available on the CSFS website at www.csfs.colostate.edu. The Colorado State Forest Service (CSFS) is a service and outreach agency of the Warner College of Natural Resources at Colorado State University. This report was produced by the CSFS. CSFS programs are available to all without discrimination. No endorsement of products or services is intended, nor is criticism implied of products not mentioned.

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Biological and Chemical Control Options

The following treatment options should be timed shortly after larvae have emerged from egg masses, but prior to significant tree defoliation, to be successful. In Colorado, the treatment window may range from late May through June, depending on elevation and seasonal weather patterns in any given year. Monitoring for early larval stages should be conducted to help identify these requirements.

Some products can only be applied by a licensed pesticide applicator. Always read product labels and use appropriate personal protective equipment when applying biological or chemical controls.

Treating Individual Trees on Forested Properties

Individual, high-value trees can be effectively treated with one of the following biological or chemical products, provided the entire tree is treated – especially the upper crown, where damage is typically concentrated. Timing is critical and most effective in the spring, when new needles emerge and the larvae will be feeding on the new growth, increasing the likelihood of coming into contact with or ingesting the product. Below is a list of common pesticide active ingredients for use in ground-based applications, along with common trade names and brief descriptions of how each product works.

Products for Ground-Based Application

Permethrin (e.g., Astro, Onyx)

- Attacks the neurological system of insects, paralyzing them on contact or through ingestion.
- Breaks down relatively quickly in the environment when exposed to UV light; must be applied annually for effective treatment.
- Highly toxic to bees, fish and aquatic invertebrates during the application process. Impacts a broad range of insects in addition to Douglas-fir tussock moth or other *Lepidoptera* species (butterflies and moths).
- At least 24 hours without precipitation is necessary after application to allow the product to adhere to foliage and not run into surface water/drainage systems.

Carbaryl (e.g., Sevin, Sevinmol)

- Neurotoxin that kills insects through ingestion or on contact.
- Persists in the environment longer than permethrin, being less affected by UV light.
- Extremely toxic to aquatic organisms and bees; water sources and blooming plants must be protected when applying this pesticide.
- Impacts a broad range of insects besides Douglas-fir tussock moth or other *Lepidoptera* species.
- May leave a white residue on applied surfaces.
- At least 24 hours without precipitation is necessary after application to allow the product to adhere to foliage and not run into surface water/drainage systems.

Bacillus thuringiensis var. *kurstaki* (e.g., Dipel, Foray)

- Bacterium that kills caterpillars shortly after ingestion by rupturing internal organs.
- Most effective when timed with early caterpillar stages.
- Persists in the environment only for a few days to a week, so applying while larvae are small and feeding is important to ensure effectiveness; a second application may be necessary, depending pest population levels.
- Specific to *Lepidoptera* species, therefore non-target species impacted by this insecticide will be limited to *Lepidoptera*.

Tebufenozide (e.g., Confirm, Mimic)

- Insect growth regulator that specifically targets the caterpillars of butterflies and moths and induces premature molting once ingested, causing death shortly thereafter. Will cause death to non-target butterfly and moth species.
- Persists in the environment longer than biological insecticides (i.e., Btk), which may increase efficacy.
- Application timing should target small caterpillars, early in the season.
- At least six precipitation-free hours necessary after application to allow the product to adhere to foliage.
- Toxic to aquatic invertebrates, and has a potential via runoff or drift to enter surface water supplies for months after application.

Large-Scale Forest Treatments

Larger forested areas can be effectively treated with one of the following biological or chemical products, applied by either helicopter or fixed-wing aircraft. Aerial application of insecticides over forested areas poses a higher risk of danger to non-target organisms, including aquatic insects, fish and/or organisms that may be rare or endangered, than ground-based applications. Timing is critical and most effective in the spring when new needles emerge and the larvae will be feeding on the new growth, increasing the likelihood of contact or ingesting the product. Below is a list of common pesticide active ingredients for use in aerial applications, along with common trade names and brief descriptions of how each product works.

Products for Aerial Application

<i>Bacillus thuringiensis</i> var. <i>kurstaki</i> (e.g., Dipel, Foray)
<i>Bacillus thuringiensis</i> var. <i>kurstaki</i> (Btk) is a variety of bacterium that kills caterpillars shortly after ingestion by rupturing internal organs. This product must be ingested by the caterpillar and is most effective when timed with early caterpillar stages. See previous section for more information.
Tebufenozide (e.g., Confirm, Mimic)
Tebufenozide is an insect growth regulator that specifically targets caterpillar pests and is also labeled for aerial application. See previous section for more information.
Carbaryl (e.g., Sevin, Sevinmol)
Carbaryl is also labeled for aerial application, though is seldom used in this fashion due to the extreme toxicity to aquatic organisms and bees. See previous section for more information.

Interpreting Pesticide Labels

Pesticide labels and associated Material Safety Data Sheets (MSDS) contain important information that should be fully read prior to any application. If a pesticide is labeled for aerial application only, this will be clearly stated below the insecticide name. The label also will include directions for use and handling, mixing volumes, application and suitable pests/crops. The Environmental Hazards section of the label will notify the user of specific environmental hazards, such as risks to aquatic organisms and bees, as well as specific locations that should be avoided when applying the pesticide.

Flowable Concentrate	
Product Name	
Biological Insecticide	
For Commercial Forestry and Wide-Area Pest Treatment	Aerial Application Only
List No. 60181-04	
FOR ORGANIC PRODUCTION	
Active Ingredient: Bacillus thuringiensis subsp. kurstaki, Strain ABTS-351, fermentation solids, spores and insecticidal toxins	12.65%
Other Ingredients	87.35%
Potency: 10,600 Cabbage Looper Units (CLU) per mg of product (equivalent to 48 billion CLU per gallon).	
The percent active ingredient does not indicate product performance and potency measure.	
AGRICULTURAL USE REQUIREMENTS Use this product only in accordance with its labeling and with the Worker Protection Standard, 40 CFR part 170. Refer to supplemental labeling under "Agricultural Use Requirements" in the Directions For Use section for information about this standard. Refer to the Directions For Use (below) for further directions.	
STORAGE AND DISPOSAL Do not contaminate water, food or feed by storage or disposal. Pesticide Storage: Store at temperatures above 40°F (5°C) If separation occurs during storage, and less than entire contents of container are to be used, remix by inverting and shaking the container several times until contents are homogeneous. For the 5 gallon U-Turn container, grasp handle and rock container forward and backward vigorously.	
Environmental Hazards This product is extremely toxic to aquatic organisms, including fish and aquatic invertebrates. To protect the environment, do not allow pesticide to enter or run off into storm drains, drainage ditches, gutters or surface waters. Applying this product in calm weather when rain is not predicted for the next 24 hours will help to ensure that wind or rain does not blow or wash pesticide off the treatment area. Rinsing application equipment over the treated area will help avoid run off to water bodies or drainage systems. This pesticide is highly toxic to bees exposed to direct treatment on blooming crops or weeds. Do not apply this product or allow it to drift to blooming crops or weeds while bees are actively visiting the treatment area.	