



QUICK GUIDE SERIES

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Douglas-fir Tussock Moth

About Douglas-fir Tussock Moth

Douglas-fir tussock moth (*Orgyia pseudotsugata*) is a defoliator of Engelmann spruce, Douglas-fir and true firs. In urban areas, it also often defoliates Colorado blue spruce; however, this tree is seldom damaged in naturally occurring forests. The preferred host in Colorado is Douglas-fir, although white fir also may be defoliated.

The moth is a native species found throughout mixed-conifer forests in the western United States and southern British Columbia. Widespread outbreaks have occurred in the Pacific Northwest, northern Rocky Mountains, California and the Southwest. In Colorado, isolated outbreaks tend to be cyclic in nature and may occur in intervals of seven to 10 years. During outbreaks, trees can be stripped of all of their foliage in a single season. Outbreaks typically develop rapidly and subside abruptly, usually after one to three years. Early stages of infestation may lead to partial tree defoliation, which typically doesn't cause tree mortality. Subsequent attacks of Douglas-fir tussock moth over multiple seasons may weaken a tree and predispose it to bark beetle attacks, however, which can lead to tree death.

In Colorado since the mid-1990s, Douglas-fir tussock moth outbreaks have occurred in numerous locations, but most frequently along the southern portion of the Front Range, west of Colorado Springs and Boulder and in the Rampart Range.

Life History

Douglas-fir tussock moths produce one generation per year. Peak adult activity is in July and August, but may continue until November. Male moths, which can be seen flying, are most active around midday. Females do not have functional

wings, and remain on the pupal case from which they emerged, emitting a pheromone that attracts males; mating occurs shortly after emergence. Adult male moths are gray-brown to dark brown with feathery antennae and a wingspan of about 1 to 1¼ inches. They have gray-brown forewings with cinnamon-brown-colored hind wings. The wingless female moths have small thread-like antennae and a large



Figure 2. An adult male Douglas-fir tussock moth. Photo: William M. Ciesla



Figure 1. A Douglas-fir tussock moth outbreak in Perry Park, west of Larkspur.
Photo: Dan West, CSFS

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Quick Facts

- Douglas-fir tussock moth defoliates Douglas-fir, spruce and true fir tree species, including white fir.
- Outbreaks tend to be isolated and occur every seven to 10 years around the state.
- Natural controls of the moth in its larval stage include wind dispersal, parasitic wasps and a phenomenon known as “wilt disease” caused by nuclear polyhedrosis virus (NPV).
- Douglas-fir tussock moth larval hairs can cause skin irritation in humans, and a rash known as “tussockosis.”
- Talk with a CSFS forester to discuss management options, including the benefits and risks of each.

abdomen, which may be filled with eggs. They are about $\frac{3}{4}$ - inch long, gray-brown in color and covered in hairs.

After mating, females lay an egg mass that can contain up to 350 eggs. Eggs are white and frequently deposited in masses on or near the pupal case of the female moth. Usually the egg masses are attached to pupal cases on foliage and branches, but as an outbreak increases, they can be found on main trunks of trees, the forest floor, homes, vehicles or other structures. Egg masses can be $\frac{1}{2}$ -inch to 1-inch long and equally as wide.

Eggs remain dormant over winter and hatch from late May to early June, which coincides with bud break and new shoot growth on host trees. Young larvae remain on the egg mass, which is primarily comprised of eggs embedded in larval body hairs, for several days and are subject to dispersal by winds as they reside on the mass or as they crawl toward the tops of trees.

One to seven days after hatching, the larvae begin to feed on the current year’s needles. When half-grown, larvae can complete their development by feeding on older foliage. Early stage larvae are less than $\frac{1}{4}$ -inch long and have fine body hairs, while mature larvae are about 1-1 $\frac{1}{4}$ inches long and have dark tufts of hair behind the head and at the rear of the abdomen. Four cream-colored tufts of hair, or tussocks, with an orange-red-colored band on top are located behind the head and at the rear of the larvae, giving these moths their common name. The rest of the body is covered with short tufts of hair radiating from red centers.

Pupation usually takes place on branches of host trees in late summer to early fall, inside a cocoon made of silken webbing and larval hairs. Some larvae may migrate and pupate on the sides of buildings, windows and door frames. Pupation lasts for 10 to 18 days, at which time adult moths emerge.



Figure 3. Egg masses, held together by a frothy substance made up of larval hairs. *Photo: William M. Ciesla*



Figure 4. A larva feeding on foliage showing the four cream-colored tufts with the orange-red-colored tops. *Photo: Dan West*



Figure 5. An adult moth will emerge from a pupal case in 10-18 days. *Photo: William M. Ciesla*



Figure 6. A pupal case and an adult male moth. *Photo: William M. Ciesla*

Signs and Symptoms of Infestation

Tree defoliation is the most conspicuous symptom of Douglas-fir tussock moth infestation. Defoliation typically begins at the top of infested trees and progresses downward. Upon closer inspection, damaged trees should reveal the presence of Douglas-fir tussock moth life stages (larvae, pupae, etc.).

Douglas-fir tussock moth damage can be confused with damage caused by western spruce budworm (*Choristoneura freemani* Razowski) and, in some cases, both insects may be present. The main difference in damage caused by the two insects is that while Douglas-fir tussock moth can feed on both new shoots and older foliage, western spruce budworm larvae restrict their feeding to expanding buds and current year's foliage. Also, Douglas-fir tussock moth doesn't produce silken webbing on trees, a common characteristic of western spruce budworm.

Natural Controls

Many larvae are killed shortly after egg hatch, when they are subject to dispersal by wind. Also, several species of parasitic wasps and flies deposit eggs on the larvae and subsequently kill the insect before it matures into an adult moth. But the primary natural control, which attacks Douglas-fir tussock moth during large outbreaks, is a virus (nuclear polyhedrosis virus, or NPV) causing a phenomenon known as "wilt disease." This disease can cause moth outbreaks to collapse suddenly. Infected larvae can be observed hanging head-down from branches, appearing to have wilted. The virus spreads through the population after infected larvae fall to the ground and rupture, or lie smeared over the foliage and expose other larvae to NPV. Virus particles may persist in the environment for many years thereafter.

Management/Prevention

One of the best ways to mitigate the effects of Douglas-fir tussock moth outbreaks is to manage for overall forest health and resiliency. Improving tree stand condition, achieved by creating tree age and species diversity, will maintain and support tree health and reduce the potential impact of future outbreaks.

When considering any treatment for Douglas-fir tussock moth, choose an option that best meets individual management objectives. Treatments often can be effective, but also time-consuming and costly, and may not be practical or effective for all situations. It is essential to research the best possible management option for a specific area before taking action.

Long-term management of mixed-conifer forests at risk to periodic outbreaks of Douglas-fir tussock moth involves reducing an over-abundance of host trees (Douglas-fir and true firs) and favoring non-host species where possible; for example, if ponderosa pine and quaking aspen are naturally present.

Use of traps baited with the Douglas-fir tussock moth female sex pheromone can be purchased through retail vendors and deployed in areas suspected of infestation, or areas which have had a history of outbreak populations, to predict looming outbreaks. Trap catches of 25 or more male moths provide an



Figure 7. Douglas-fir tussock moth larvae feed on both new and older needles. Photo: Dan West, CSFS



Figure 8. There are slight color variations in the four tussocks on top of the Douglas-fir tussock moth larvae. Photo: Dan West, CSFS



Figure 9. A Douglas-fir tussock moth outbreak in Aspen Park. Photo: William M. Ciesla

early warning that an outbreak may be imminent. Follow-up surveys for the presence of egg masses in winter and early spring, or young larvae shortly after bud-break, provide a further indicator of impending outbreaks.

Individual, high-value landscape trees also can be treated with one of several insecticides, provided the entire tree is treated – especially the upper crown. The best time to apply insecticides is early spring, when new needles emerge, as this will prevent feeding on the new needles. Chemical insecticides (listed with common trade names) known to be effective against Douglas-fir tussock moth include pyrethroids such as permethrin (Astro), cyfluthrin (Tempo), bifenthrin (Talstar, Onyx) and lambda-

cyhalothrin (Scimitar). Other chemical insecticides that may provide effective control include Carbaryl (Sevin, Sevimol), tebufenozide (Confirm, Mimic) and spinosad (Conserve).

In forested areas, aerial application of insecticides by either helicopter or fixed-wing aircraft is an effective, efficient treatment for Douglas-fir tussock moth, but should only be considered at the local level. Aerial treatment options include use of the bacterial insecticide *Bacillus thuringiensis* (Dipel, Foray), the insect growth regulators diflubenzuron (Dimilin) or tebufenozide (Confirm, Mimic) or Carbaryl (Sevin, Sevimol). Aerial applications of insecticides over forested areas pose a risk of danger to non-target organisms, including aquatic insects, fish and/or organisms that may be rare or endangered. These factors should be taken into consideration when considering aerial spray operations for this native insect.

Impacts of Douglas-fir Tussock Moth on Colorado's Forests

One year of complete defoliation by the moth can cause tree death, either directly from larval feeding or indirectly by predisposing trees to attacks by bark beetles, such as Douglas-fir beetle (*Dendroctonus pseudotsugae*). Two to three years of partial defoliation also can lead to tree death. Partial defoliation in a single season can cause diminished tree growth, top kill and reduced cone crops.

Douglas-fir tussock moth outbreaks in Colorado forests often are preceded by defoliation of Colorado blue spruce in suburban areas along the Front Range. Large numbers of larvae in subdivisions or other populated areas are a

nuisance, and can pose a public health risk to humans. Douglas-fir tussock moth larval hairs can cause skin irritation and an itchy rash, a condition known as “tussockosis.” Some individuals are more sensitive to exposure to the larval hairs than others. This is especially problematic when larvae sometimes migrate to homes and other buildings to seek pupation sites, especially around door and window frames.



Figure 10. Pupal cases on a home in Boulder. Photo: William M. Ciesla

The Importance of Forest Management

It is important to remember that the Douglas-fir tussock moth is a native insect in Colorado's forest ecosystems and part of an ever-changing forest. However, the potential negative impacts of natural disturbances, such as this moth and other insects and diseases, can be reduced through proactive forest management.

Colorado's forests provide clean air and water, wildlife habitat, world-class recreational opportunities, wood products and unparalleled scenery. These benefits contribute to quality of life and are vital to state and local economies. Without careful management of forest resources, these assets and community safety are at risk. It is critical to proactively manage forests and for landowners and communities to remain informed about threats to their forests, to ensure healthy, resilient forests for present and future generations.



Figure 11. A Douglas-fir tussock moth outbreak in Perry Park. Photo: Dan West, CSFS

For More Information

To learn more about Douglas-fir tussock moth and its management, or to discuss general forest management, contact a local Colorado State Forest Service district office or visit www.csfs.colostate.edu.

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Figure 12. Defoliation in Perry Park. Photo: Dan West, CSFS



Figure 13. Douglas-fir tussock moth mortality on the Rampart Range. Photo: William M. Ciesla

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