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Western Tent Caterpillar

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The western tent caterpillar, *Malacosoma californicum* (Packard) (Lepidoptera: Lasiocampidae), is a defoliator of broadleaf trees and shrubs throughout much of the western United States, southern Canada and parts of northern Mexico (Fig. 1). This insect is the widest ranging and most variable of the North American species of *Malacosoma.* Six subspecies and several unclassified forms are recognized. Three subspecies: *M. californicum californicum* (Dyar), *M. californicum ambisimile* (Dyar), and *M. californicum recenseo* (Dyar) have localized ranges in California. *M. californicum pluviale* is found in the Pacific Northwest and across Canada from southern British Columbia east to western Quebec. Isolated populations of this subspecies have also been found in Minnesota, New Hampshire and New York. *M. californicum lutescens* is found in the Great Plains from eastern Montana south to Oklahoma and Texas and in the Prairie Provinces of Canada. *M. californicum fragile* is found in the southwestern U.S. A "central" population, simply known as *M. californicum*, is known from eastern Oregon and Washington, southern Idaho, Wyoming and the southwestern U.S. Western tent caterpillar is also known from three states in northern Mexico: Chihuahua, Coahuila and Durango (Fig. 2).

Figure 1 – Western tent caterpillar "tent" and larvae on wild currant.

In the U.S., *M. californicum* and all of its subspecies and forms are collectively known by the common name western tent caterpillar. In Canada, two subspecies have their own common names. *M. californicum pluviale* is known as the northern tent caterpillar (livrée du nord) and *M. californicum lutsecens* is known as the prairie tent caterpillar (livrée des prairies).

Host Plants

A wide range of trees and shrubs are reported as hosts of western tent caterpillar and its subspecies and host preference varies with location.

Tree hosts in the Pacific Northwest include red alder (*Alnus rubra*), cottonwoods (*Populus* spp.), willows (*Salix* spp.), crabapple (*Malus diversifolia*), and various fruit trees. Ash (*Fraxinus spp.*), birch (*Betula* spp.), hazel (*Corylus* spp.), hawthorne (*Crateagus* spp.), and Pacific madrone (*Arbutus menziesii*) are also reported hosts. In California, oaks (*Quercus* spp.), along with willows and fruit trees are hosts. Chokecherry (*Prunus virginiana*) is a host across much of the range of western tent caterpillar. In the central and southern Rocky Mountains and northern Mexico, quaking aspen (*Populus tremuloides*) is a favorite host and subject to periodic outbreaks. During outbreaks, which can last for three to five years, thousands of acres of aspen forests may suffer complete defoliation.

Woody shrub hosts of western tent caterpillar include: bitterbrush, (*Purshia tridentata*), mountain mahogany, (*Cercocarpus ledifolius*), Ceanothus (*Ceanothus* spp.), ninebark (*Physocarpus spp.*), three-leaf or skunkbush sumac (*Rhus trilobata*), wild currant (*Ribes* spp.) and wild rose (*Rosa* spp.).

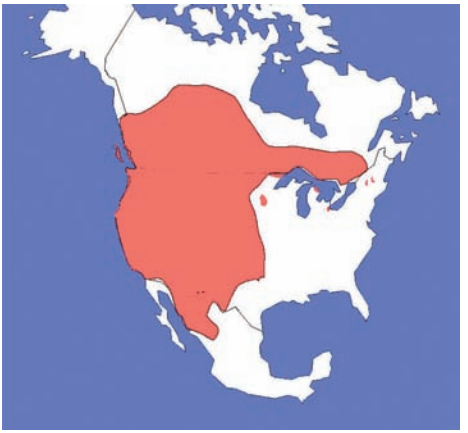

Figure 2 – Approximate distribution of western tent caterpillar and its subspecies in North America

Figure 3 – Heavy defoliation of a quaking aspen stand by western tent caterpillar.

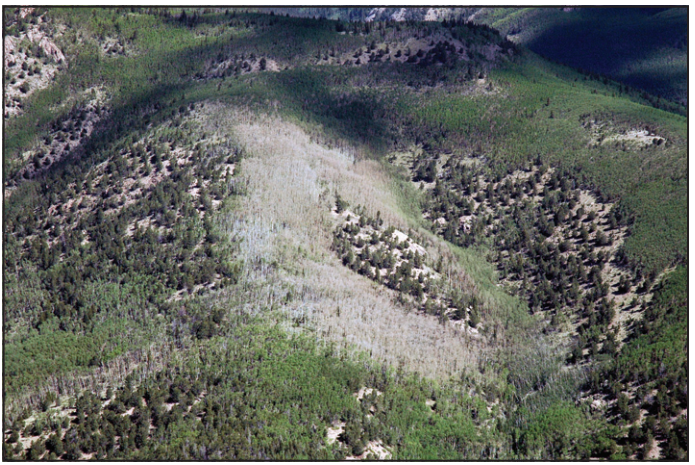

Figure 4 – Aerial view of heavy defoliation of quaking aspen by western tent caterpillar.

Evidence of Infestation

The first evidence of infestation is the presence of white silken tents in the branches of host plants (Fig. 1). These are generally visible shortly after budburst. The tents increase in size as the larvae grow. Later, defoliation of individual branches becomes apparent and, during outbreaks, entire trees and stands can be completely defoliated by late spring (Fig.3). Moderate to heavy defoliation of quaking aspen forests is easily seen from low flying aircraft (Fig. 4). When the larvae finish feeding, they construct white silken cocoons on the branches of host plants, which are conspicuous on defoliated trees (Fig. 5). Cocoons may also be found on branches on non-host plants and in the litter.

Description of Life Stages

The adults are heavy bodied moths with a wingspan of 1 -1 ½ inch (2.54 – 3.81 cm) for males and 1 ½ - 2 inches (3.8 – 5.08 cm) for females. The color of the moths of both sexes ranges from dark red-brown to yellow, tan or gray. The forewings have a pair of lines that can be either darker or lighter than the wing color (Fig. 6A).

Figure 5 – Tents and cocoons of western tent caterpillar in heavily defoliated quaking aspen.

Eggs are laid in oval-shaped masses of 150 to 250 eggs that partially encircle twigs, branches and sometimes the main stems of small diameter trees and shrubs. The egg masses are covered with a frothy material known as spumaline, which ranges in color from dark brown to pale gray or even gray white (Fig 6B).

When first hatched, the larvae are about 1/8 inch (0.31 cm) long, dark brown to black in color with whitish hairs. Mature larvae are 1 ¾ to 2 inches (4.45 – 5.08 cm) long and highly variable in color and markings. Most larvae have a pale blue head capsule and body, speckled with black markings. They have a mid-dorsal stripe formed

Figure 6 - Life stages of the western tent caterpillar.

A - Two adults showing variation in wing color.

B – Female adult and egg mass (Photo by J.E. Dewey, USDA Forest Service R-1 [retired]).

C – Larval colony on tent. Note variation in color and patterns on the larvae.

D – Mature larvae.

E – Cocoons on branches of quaking aspen in various stages of development.

F – Pupal case following emergence of adult.

by a blue-white to pale blue dash on each body segment. The mid dorsal stripe is edged with two bands that may be black, or yellow - orange banded with black. The body is covered with orange or orange - brown hairs with white tips (Fig 6 C-D).

The pupa is ¾ to 1 inch (1.9 – 2.54 cm) long and reddish brown to black in color. Pupae are enclosed in white silken cocoons, dusted with a white or yellow powder and are attached to branches (Fig 6 E-F).

Life History and Habits

Western tent caterpillar has one generation a year and the winter is spent as a first instar larva within the egg.

Larvae emerge in spring just as the buds of host plants begin to burst. Early instar larvae feed as a colony and construct a silken tent in the branches. Larvae from 2 or more egg masses may join to form a single tent. When not feeding, the larvae remain in the tent, which they use for

Figure 7 – Top kill in quaking aspen following several successive years of defoliation by western tent caterpillar.

shelter, a molting site and as protection from unfavorable weather. As the larvae grow they increase the size of the tent. Late instar larvae become solitary feeders and no longer use the tent for shelter. The larvae mature in 30-42 days, depending on weather conditions (dry, warm weather is most favorable for development) and feeding is usually completed by late spring-early summer. The larvae then construct silken cocoons on branches or in the remaining leaves of host trees and pupate. During outbreaks, the cocoons are often clustered in groups of three or four. The duration of the pupal stage is from 12 to 18 days.

Adult emergence usually takes place in late July to early August. Both males and females are strong fliers and, during outbreaks, swarms of moths are common.

Eggs are laid in masses on the twigs and branches of host trees. Each female lays a single egg mass. Live branches under ¾ inch in diameter are the preferred egg laying sites. One study in British Columbia indicates that females prefer to lay eggs on the south (sunny) side of host trees, or on open grown trees. Larvae hatch 3-4 weeks later but remain inside the egg until the following spring.

Economic Importance

Successive years of defoliation of aspen, red alder and other host trees can cause reduced diameter growth, branch dieback and top kill, reduced production on fruit trees and, in some cases, tree mortality (Fig. 7). Choke cherry fruit is an important food source for some indigenous cultures. It is also used as a food source for many wildlife species.

Heavy infestations on bitterbrush in eastern Oregon and northern California have killed large areas of this plant, an important browse species for deer and livestock, resulting it its replacement with less desirable species. Defoliated trees and tents are unsightly and large hordes of larvae are a nuisance in residential and recreation areas.

Natural Enemies

Western tent caterpillar is known to have a number of natural enemies that help keep populations under control. These include parasites, predators and disease organisms. Some 36 species of parasites and predators have been documented as attacking this insect. Some of the more important parasitoids are wasps. *Tetrastichus malacosome* Girault (Hymenoptera: Eulophidae) attacks the eggs and *Habrobracon (=Bracon) xanthonotus* (Ashmead) (Hymenoptera: Braconidae) is a common parasite of the larvae. The larval stage of this parasitoid feeds externally on the larvae of western tent caterpillar.

Figure 8 – Western tent caterpillar killed by a nuclear-polyhedrosis virus.

A nuclear polyhedrosis virus (NPV) infects the larvae and has been known to cause the collapse of outbreaks. Larvae killed by NPV typically hang from branches or nests, head down or in an inverted "v" shape, and have a wilted appearance (Fig. 8).

Pest Management

Because western tent caterpillar is more of a nuisance than a damaging pest, infestations normally are allowed to run their course with no intervention. However, outbreaks in fruit trees, forests designated for timber or fiber production, heavily used recreation sites or homesites in urban-wildland interface areas, may require direct control.

If populations are at low levels, individual colonies can be removed from trees by pruning branches containing tents with a pole-pruner and disposed of by immersion in soapy water or sealing them in plastic bags. This is best done during early morning or evening when most of the larvae are in the tent. Egg masses can be stripped or pruned from branches on small trees during winter.

In some areas, a common method of tent caterpillar control has been to set fire to the tents while still in the trees. This practice is NOT recommended because it can cause more damage to the trees than the defoliation by the caterpillars

Several chemical insecticides and the biological insecticide, *Bacillus thuringiensis*, are effective direct control agents. Contact local extension agents or forest entomology experts for information on currently registered and effective insecticides.

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Illustrations (All photos by W.M. Ciesla unless otherwise noted)

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