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Sequoia Pitch Moth

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Introduction

Sequoia pitch moth, *Synanthedon sequoiae* Hy. Edwards, is one of two clearwing moths (order *Lepidoptera*; family *Sesiidae*) that infest conifers in western North America. Sequoia pitch moth larvae feed on the phloem of many species of pines, and may occasionally attack Douglas-fir and spruce. Large-scale outbreaks in forest settings are not known to occur, but sequoia pitch moth can be a serious problem in seed orchards. Non-native and off-site pines are at high risk of attack. Sequoia pitch moth can be a damaging pest of ornamental plantings and tree improvement plantations where trees originate from many different seed sources. Sequoia pitch moth occurs from central British Columbia to California and east to Idaho and Montana (Figure 1).

The first report of this species was provided by Henry Edwards in 1881. It was originally placed in the genus *Bembecia*, then *Aegeria* and later *Vespa*, all now defunct.



Figure 1 – Distribution of sequoia pitch moth (*Synanthedon sequoiae*)

According to an early report by Edwards, the species was “devastating the pine forests in Mendocino County, California, and is particularly destructive to the big-tree (*Sequoia sempervirens*)...” Despite this early report, sequoia pitch moth is not known to feed on sequoia species.

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Another clearwing moth, the Douglas-fir pitch moth (*S. novaroensis*), infests Douglas-fir, Sitka spruce, Engelmann spruce, western white pine, ponderosa pine and lodgepole pine. It is similar to sequoia pitch moth in its appearance, distribution and habits. However, the abdomen of the Douglas-fir pitch moth has a mostly orange (rather than yellow) ventral surface and orange bands (rather than yellow bands) across the dorsal surface.

The only other clearwing moth in North America known to feed on hosts in the family Pinaceae is the pitch mass borer (*S. pini*). This insect is similar in appearance to the Douglas-fir pitch moth. It is not known to occur in the west, but ranges from southeastern Canada, south along the Atlantic Coast, the Appalachians and the Midwest, largely following the range of its principal host, eastern white pine (*Pinus strobus*).

Description

Clearwing moths strongly mimic bees and wasps in general appearance and behavior. The adult sequoia pitch moth superficially resembles a yellowjacket wasp in color and size (Figure 2). It has narrow wings devoid of scales similar to the membranous wings of wasps. Adults are capable of rapid flight facilitated by the interlocking of fore and hind wings. The head and thorax are black with yellow markings and the abdomen is black with yellow bands. Width of the bands is variable, with some adults predominantly yellow, others predominantly black.

Adults are about $\frac{3}{4}$ " long with a wingspan of $\frac{3}{4}$ " to $1\frac{3}{4}$ ". Both sexes are similar in appearance although



Figure 2 – Adult male sequoia pitch moth

females are generally larger and stouter than males. Males also have somewhat more of a tuft at the abdominal apex.

Eggs are rarely seen. They are oblong and slightly flattened, about $\frac{1}{16}$ " long and $\frac{1}{36}$ " in diameter. The egg surface is reddish brown with a fine reticulate pattern (Figure 3). Larvae are creamy white, grayish or pink with red-brown heads (Figure 4). Larvae develop through four instars that increase in size with each molt; the final instar reaches an inch or more in length. Pupae are about $\frac{3}{4}$ " long, brown with prominent spines (Figure 5) extending across the top of each abdominal segment.

Life History

The sequoia pitch moth has a 2-year life cycle with overlapping generations.



Figure 3 – Sequoia pitch moth egg.



Figure 4 – Late instar sequoia pitch moth larva.



Figure 5 – Sequoia pitch moth pupa emerging from pitch mass. Note spines on the tops of the abdominal segments

Adults emerge from late May to early September, with peak emergence in June and July. Adults do not feed and only live a few days, during which they mate and lay eggs. Males are able to locate mates by detecting pheromones (sex attractants) emitted by females.

Females lay their eggs soon after mating. Eggs are deposited singly in bark crevices or at branch nodes of host trees. Females are strongly attracted to recent wounds or any exudation of pitch from a host tree; they preferentially oviposit at those locations. Mechanical wounds caused by pruning or cone stimulation

girdling in seed orchards are common oviposition sites. In fact, pitch masses associated with larval feeding are attractive to females, and oviposition may occur at these locations repeatedly over a period of years.

Eggs hatch in about two weeks. Newly-hatched larvae bore into the cambial area of the host tree, where they create a shallow cavity and feed on phloem until winter temperatures become too cold for further activity. They resume feeding when temperatures warm. Usually two years are required to complete the life cycle, so two winters are passed in the larval gallery. Larvae feed in a winding pattern, causing copious amounts of pitch to flow at the site of entry. These pitch masses can become very large; up to several inches in diameter, often overlapping (Figure 6). The larvae are tolerant of pitch, and are not drowned or “pitched out” as may happen with other phloem-boring insects.



Figure 6 – Overlapping pitch masses from sequoia pitch moth attacks.

Larvae pupate between late April and early August, constructing a silk-lined chamber at the end of a tunnel in the pitch mass close to the surface. The pupal stage lasts about 30 days. Just before the adult emerges, the pupa begins to move toward the surface of the pitch mass, aided by rows of spines on the dorsal surface of its abdominal segments. Eventually the pupa forces itself halfway out of the pitch mass, and the adult emerges.

Hosts

Principal hosts of sequoia pitch moth are lodgepole and ponderosa pine. Other known hosts are Monterey pine, Bishop pine, Jeffrey pine, piñon pine, sugar pine, various ornamental pines, and occasionally Douglas-fir and spruce. Host species or cultivars that are non-native or off-site, or trees with recent bole wounds or pruning wounds are most susceptible to attack.

Impacts

In forest settings, sequoia pitch moth is a minor, mostly aesthetic pest that produces individual cream-pinkish pitch masses several inches in diameter along tree boles and branches. Mature trees can withstand attacks with little to no impact on their growth and survival. Small trees are more at risk of damage. Stems less than four inches in diameter can be girdled by larval mining. Heavily mined boles and branches are susceptible to breakage.

Sequoia pitch moth can cause substantial damage to saplings or seed orchard trees. Girdling to stimulate cone production in seed orchards creates wounds that are attractive to ovipositing females. Subsequent

feeding by larvae and the associated accumulations of pitch attract further oviposition and prevent or delay healing. Trees with stimulation wounds that have not healed are at elevated risk of breaking during high winds.

In managed settings, heavy attacks over repeated years may result in trees that have many overlapping pitch masses and abundant pitch flows on the bole and branches, causing the trees to become highly flammable. In recreational or urban landscape settings, abundant pitch flows can become a serious nuisance (Figure 7).



Figure 7 – Pine with profuse pitching in a parking lot in Hood River, Oregon.

Evidence of Infestation

Sequoia pitch moth attacks are characterized by the development of large pitch masses around larval entry sites. Current year pitch masses are soft to the touch, gradually hardening as they get older. The brown shell of an empty pupal case often can be seen sticking out of a pitch mass from which an adult has emerged (Figure 8).

Pitch tubes from bark beetle attacks may be confused with pitch masses from sequoia pitch moth. Most bark beetle pitch tubes are much smaller, generally less than one-half inch in diameter. Infestations of pyralid moths in the genus *Dioryctria* are sometimes confused with sequoia pitch moth. However, *Dioryctria* infestations generally have abundant granular frass and relatively little pitch.

Natural Controls

Braconid wasps in the genus *Apanteles* are known to parasitize the larvae of some clearwing moths. However, the importance of parasites, predators and diseases in controlling sequoia pitch moth populations has not been documented.

Management

The best way to prevent damage from sequoia pitch moth is to avoid wounding trees. If pruning is needed, it should be done when branches are small in diameter to promote rapid occlusion of wounds and reduce the time these wounds are attractive to sequoia pitch moth. The best time of year for pruning is generally between October and January. Pruning should be done before the sequoia pitch moth flight period begins in May, and during



Figure 8 – Empty pupal case from a sequoia pitch moth that has emerged.

a season when wounds will exude little or no pitch. As wounds heal and volatiles in the oleoresin dissipate, oviposition sites become less attractive to sequoia pitch moths and attacks tend to taper off. Avoid planting non-native pines or planting pine species or cultivars that are not suited to the site or microclimate.

Individual larvae can be excavated from pitch masses and destroyed to reduce population numbers. Softer pitch masses will contain a single larva or pupa, depending on timing, and should be removed prior to emergence. Over time trees may become less attractive to sequoia pitch moth attack.



Figure 9 – Fabric tree wrap to prevent sequoia pitch moth attacks.

Sticky traps baited with pheromone lures attractive to males are effective for identifying when moths are flying and aid in the proper timing of pruning operations. “Trapping out” males may have limited effectiveness in reducing the number of mated females in an area. Traps and lures are widely available from many manufacturers at a low price and can be located online.

Individual trees can be protected from attack by wrapping boles with a fabric, which acts as a physical barrier to oviposition (Figure 9).

No pesticides are currently registered for sequoia pitch moth control.

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