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Douglas-fir Beetle

IN BRITISH COLUMBIA

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INTRODUCTION

The Douglas-fir beetle (Dendroctonus pseudotsugae Hopk.) is an important native pest throughout most of the range of its principal host, Douglas-fir (Pseudotsuga menziesii (Mirb.) Franco). Western Larch (Larix occidentalis Nutt.) is occasionally attacked. Damage caused by the insect has been most extensive in the interior of British Columbia. Losses from 1956 to 1970 were estimated at about 538,000 and 238,000 cu m (19 million and 8½ million cu ft) in the Interior and on the Coast, respectively.

DESCRIPTION

The egg is elliptical, pearly-white, and 0.5 mm (1/32 in) long. The larva is a white, legless grub with a pale brown head, about 6 mm (¼ in) long when mature. The pupa is white to light tan, about 6 mm long, with adult features (Legs, wings, etc.) visible. The adult is a brown to blackish brown beetle about 5 mm (3/16 in) long.

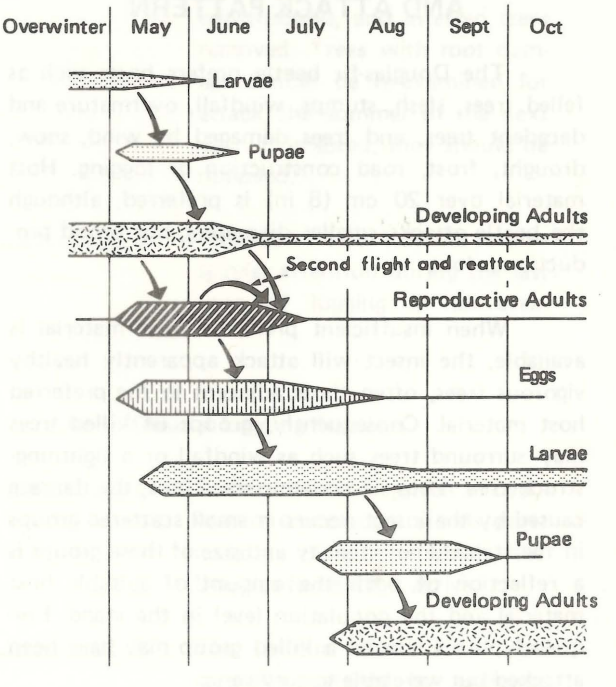
LIFE HISTORY

The duration of the life cycle is approximately 1 year and two broods may be produced each year.

The insects overwinter primarily as young adults and mature or nearly mature larvae. The adults typically fly and attack in the spring, shortly after daytime temperatures exceed 18°C (65°F). The major flight period usually occurs in May and June. A second flight or "summer flight" may be made by adults developing from the overwintering larvae and re-emerging adults of the early or "spring flight".

The female chews through the outer bark into the inner bark, constructs the egg gallery and deposits eggs in small niches in groups which alternate along the sides of the gallery. A male follows the female into the gallery; although he does no excavating, he helps initially in pushing boring dust out the entrance and later in packing the boring dust in the part of the gallery closest to the entrance.

The eggs hatch in about 2 weeks and the young larvae bore away from the egg gallery. The larvae feed in the inner bark for 2 or 3 months (unless winter intervenes), enter the pupal stage, and a few weeks later become young adults. When ready to emerge, the young adults bore a circular hole to the bark surface. Although young adults may be present as early as late July, none emerge until the following spring.



Generalized seasonal history of Douglas-fir beetle.

DAMAGE

Gallery System

The gallery system is in the inner bark next to the wood. The egg galleries made by the parent adults are parallel to the grain of the wood, usually with a slight hook or curve at the beginning. They are usually 20 to 25 cm (8 to 10 in) long, but may be 75 cm (30 in) long, and 5 to 6 mm (3/16 to ¼ in) wide. The larval galleries occur in fan-shaped groups which alternate from side to side of the egg gallery. Most of the egg gallery and all of the larval gallery are packed with boring dust. The larval mines frequently disappear from the inner surface of the bark since the larvae, when nearing maturity, often bore into the inner bark.

Effect on Tree

The work of adults and larvae eventually girdles the tree and, along with an associated fungus, results in the tree's death. Foliage discoloration, from green to pale yellow-green to red, occurs a few months to a year after attack, depending on the weather; the warmer and drier the season, the more rapid is the discoloration. The red foliage remains on the tree for an average of 2 years. Occasionally the needles may drop without discoloration.

HOST SUSCEPTIBILITY AND ATTACK PATTERN

The Douglas-fir beetle prefers hosts such as felled trees, slash, stumps, windfall, overmature and decadent trees, and trees damaged by wind, snow, drought, frost, road construction or logging. Host material over 20 cm (8 in) is preferred, although the beetle attacks smaller diameters, but brood production is low.

When insufficient preferred host material is available, the insect will attack apparently healthy vigorous trees, often those adjacent to the preferred host material. Consequently, groups of killed trees may surround trees such as windfall or a lightning-struck tree. Thus, in endemic situations, the damage caused by the insect occurs in small scattered groups in the stand. The intensity and size of these groups is a reflection of both the amount of suitable host material and the population level in the stand. Frequently, trees around a killed group may have been attacked but were able to survive.

In urban areas, trees weakened by the sudden change in environmental conditions, due to subdivision or other construction, may become suitable hosts for the insect.

DETECTION

The first obvious evidence of attack in a stand is the presence of trees with discolored foliage. However, this discoloration may not occur until a year following attack when the beetles are ready to leave (in some cases, may have already left) to attack new host material. Observation of this discoloration may be made from the air or from vantage points. Confirmation that the damage is due to Douglas-fir beetles may be obtained by removing bark and observing the typical gallery systems.

Detection of infested trees in the early stages of attack is difficult. The earliest evidence of attack is the reddish-brown boring dust on the bark at the entrance holes of the gallery. There are no pitch tubes such as those associated with certain other Dendroctonus species. Early detection thus requires examination of individual holes, which is best done in late June or July while the boring dust is still easily seen.

ROLE OF LOGGING IN DOUGLAS-FIR BEETLE POPULATION DYNAMICS

With the above background, we can now examine how logging can contribute to the increase of, and how it can be used to minimize, populations of the Douglas-fir beetle, and thus control the damage caused. Since felled trees are preferred host material, the time sequence in which falling, removal and utilization of logs and the treatment of slash occurs is of utmost importance. Any situation in which infested logs are left until after the beetles emerge contributes to the population. On the other hand, removal and utilization of these logs before the beetles emerge reduces the subsequent population. Ary program that ensures that felled trees are available for attack during the major flight period, will be beneficial, provided removal and utilization occur before beetle emergence. The disposal of slash must follow the same pattern. Reduction of stump height will reduce available breeding space for the beetle.

Removal and utilization of infested trees in the stand before the beetles emerge will also reduce the population. Removal of red-topped trees after the beetles have left does not contribute to population reduction. Programs involving removal of in-infested trees will require early detection, which means ground examination of the boles. When the beetle is active in a stand, freshly-felled trees (to be utilized prior to the following spring) in the area during May and June will absorb a large proportion of the beetle population.

Thus, in relation to control of damage caused by the Douglas-fir beetle, there are two primary objectives: a) leave in the woods a minimum of host material suitable for the insect and b) ensure that all host material is removed and utilized, or destroyed, prior to beetle emergence.

In the above discussion, the time of attack is a major criterion of when treatment must take place. The major attack period occurs during May and June, decreasing during July and August. Broods initiated during May, June and July will produce young adults ready to fly the following spring, while beetles will not emerge until 1 year later from host material attacked after August 1. Thus, treatment of host material infested during May, June and July must occur before the following April; that infested after August 1 requires treatment before 1 year from the following April.

PREVENTING AND CONTROLLING DOUGLAS-FIR BEETLE DAMAGE

The following recommendations are grouped primarily into two catagories: I) Preventive Measures and II) Remedial Measures. Although the concepts are the same, the timing of operations changes somewhat when dealing with trees already infested. A third category describes methods of brood distruction.

I. Preventive Measures:

These procedures are divided into two groups: a) Log and Slash Disposal and b) General Logging Practices.

a) Log and Slash Disposal

_____ 1. All logs should be removed and utilized before beetles emerge. Those felled during May, June and July should be removed before April of the following year and those felled after 1 August before April, 1 year later.

_____ 2. All culls and slash over 20 cm (8 in) in diameter should be kept to a minimum and, if infested, treated to prevent emergence of the brood within the time specified above for removal of logs.

_____ 3. Tops should be kept small (under 20 cm in diameter).

_____ 4. Stumps should be cut as low as possible and, if infested, treated to destroy the bark beetles in them.

_____ 5. Roads and rights-of-way should be cut in the fall immediately before their use. If logs, slash, etc., resulting from road construction, can be utilized or treated as in steps 1 to 4 above, cutting roads and rights-of-way in early spring would remove some of the beetle population. Stands adjacent to new roads should be carefully examined in late summer of the year of road construction, and infested trees removed. Trees with root damage should be re-examined for attack the summer of the next year. If infested, they should be removed.

_____ 6. Procedures 1 to 4 should receive special attention during the last year of logging in an area.

b) General Logging Practices

_____ 1. Priority should be given to overmature or decadent stands, particularly those in which the Douglas-fir beetle is active.

_____ 2. The residual stand should be carefully watched for evidence

of infestation, and infested trees removed promptly.

_____ 3. Trees felled during May and June will absorb much of the beetle population. If this felling procedure is followed, it must be accompanied by strict sanitation as in a) 1 to 4.

_____ 4. Care must be taken that as little mechanical damage as possible occurs to the residual stand. This includes root damage such as that caused by road cuts.

II. Remedial Measures:

If, in spite of all precautions, infestations develop in standing timber, remedial action may be necessary for control.

_____ 1. The procedures recommended under "I. Preventive Measures" should be continued and, if possible, intensified.

_____ 2. Currently infested trees should be removed before the following April. Identification of these trees requires examination of individual boles for the presence of the reddish-brown boring dust. Removal of red-topped trees from which the beetles have emerged does not contribute to reduction of the beetle population. In some years, discoloration of foliage may occur in the year of attack before beetles emerge.

_____ 3. A trap tree program should be initiated. This consists of felling groups of green trees, about 10 per group, shortly before beetle flight in the spring. The groups should be placed where they can be easily removed. The trouble area should be gridded with groups of trap trees at about .4 to .8 km (¼ to ½ mile) intervals. Beetles will be attracted to these trap trees and may attack some adjacent green trees as well; all of the resulting infested material should be removed or treated by April of the following year.

III. Methods of Brood Destruction:

The following methods may be used for brood destruction in slash and other material not removed from the woods.

_____ 1. Piling and Burning: The fire should be intense and all bark should be thoroughly burned. Broadcast burning does not produce a fire hot enough to overcome the insulating qualities of Douglas-fir bark.

_____ 2. Peeling: Peeling the bark exposes the broods to weather and predators. Since many beetles can overwinter in the forest duff, peeling should be done in July or August, before the young adults develop. The procedure increases the fire hazard, but when used in conjunction with burning, requires a less intense burn.

References:

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Walters, J. 1956. Biology and control of Douglas-fir beetle in the interior of British Columbia. Can. Dept. Agric. Publ. 975.

Further information may be obtained from:

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