

TWO DESTRUCTIVE BARKBEETLES IN CALIFORNIA

When a forest is changed from a green canopy to one in which dead trees and ghost-like snags predominate, the cause is usually due to one or a combination of three destructive agencies—fire, insects, disease. In the California region two species of barkbeetles are recognized as the most important of the insects which kill living trees. These are the western pine beetle (Dendroctonus brevicomis Leconte) and the mountain pine beetle (Dendroctonus monticolae Hopkins).

More commonly these insects are known as pine beetles. In the adult stage of their life history they are tiny cylindrical black beetles, smaller than the ordinary house fly. It is the adults which initiate the attack upon the living tree by boring through the bark of the main trunk and mining the cambium layer between the bark and the wood with tunnels slightly larger in diameter than the body of the insect. This process effectively girdles the tree and causes it to die quickly.

EXTENT OF PINE LOSSES

These two barkbeetles confine their attack to pines only, and because of their depredations the most serious forest insect problems of the State are found in the pine areas of National Forests and Parks. The western pine beetle attacks ponderosa pine, the most valuable tree for commercial use, and Coulter pine in Southern California; the mountain pine beetle attacks primarily sugar pine and lodgepole pine of the Sierra Nevada region. There are other species of insects with similar habits which do some damage but are of relatively minor importance.

The coast redwood and the big tree have no serious insect enemies such as the pine beetle. This is one reason why the Sequoias grow to such great age and enormous size.

Pine beetles are old established residents in their present environment and their numbers fluctuate from year to year like other forms of wild life. For long periods in any given forest area, their population may exist in relatively small numbers killing no more than 10 to 20 trees annually in each square mile of forest area. Then rather suddenly natural factors may become favorable to their increase. Great barkbeetle armies are built up which spread their attack over wide forest areas killing trees by the thousands.

The loss of timber in California due to insects is about 500 million board feet annually when averaged over long periods. This volume of dead timber has been greatly exceeded during seasons of epidemic outbreaks, such as the period from 1930 to 1933. During the season of 1932 pine beetles killed approximately 1500 million board feet of potential lumber, or more than the combined total cut by the lumbermen and that killed by forest fires.

The trees killed by barkbeetles not only deprive the State of possible income from its timber resources, but National Parks and other recreational areas lose some of the finest exhibits of forest growth as well. Trees which have been centuries in growing to attain their great size are suddenly killed by the work of a tiny insect.

HOW BARKBEETLES KILL TREES

When a pine beetle flies to a tree and begins its attack, the first operation is to cut its way through the outer bark of the main trunk. Once through these corky bark layers, it encounters the living tissues of the cambium or sap layer, rich in moisture, resins, and the dissolved sugars, from which the wood rings are built up during the process of growth.

The first reaction of the tree is to pour into the entrance cut by the beetle resins or pitch, with which wounds of this sort are sealed to aid the healing process. These resins are highly obnoxious to the beetle and the flow must be overcome before the insect can continue its tunnel under the bark. The first beetles to attack a healthy vigorous tree are nearly always forced back to the surface and die because of the copious pitch flow. To overcome this resistance the beetles concentrate their numbers on certain trees. Thousands will attack the same tree in the course of a few days, all of them boring into the cambium simultaneously and causing the sap to flow at many entrance holes along the main bole. Around the entrance the beetle builds the surplus resins into a tube on the outer surface of the bark, thereby keeping the entrance to its tunnel open. These little resin masses are known as "pitch tubes".

If the attack is successful the flow of resin ceases within a week or so and the resistance of the tree is broken. The beetles are then free to extend their tunnels through the cambium. This they do in pairs, one male and one female working in each tunnel. Each species of beetle constructs its own characteristic type of tunnel, the mountain pine beetle making a vertical gallery extending up the trunk, the western pine beetle constructing a winding criss-cross pattern. Eggs are deposited along the sides of these tunnels and the larvae upon hatching feed in the dying cambium tissues which contain the nutritious sugars.

As soon as the attack is successfully completed the circulatory system of the main trunk is damaged beyond repair. The tree can no longer draw water to the leaves or transport the food materials essential to growth.

COLOR PHASES OF INFESTED TREES

The foliage is one part of the tree which first shows the effect of the injury. The needles of the infested pine tree turn from a normal green to a sickly greenish yellow. This is known as the "fading" color phase.

Then, as the chlorophyll in the leaves continues to oxidize, the foliage turns to a yellowish brown color known as the "sorrel" phase.

Finally, as leaves continue to weather, they take on a dull reddish brown color and the "red" stage is reached. This last color phase is in evidence in from six months to a year after the tree was attacked.

During the second year after death the needles fall, and the tree passes into the "blacktop" and "snag" stages which may last for many years or until it ultimately decays and falls.

Recognition of the first three color phases of infested trees is important in control operations, as it is only in the fading and sorrel phases that the broods of the beetles are to be found in or under the bark. By the time the red phase is reached, the insects have usually completed development and have emerged through the bark to fly to and attack other trees.

HOW BARKBEETLE OUTBREAKS MAY BE CONTROLLED IN PINE FORESTS

No practical method has yet been devised which will prevent bark-beetles from attacking certain trees which they select in the forest. Neither is there any way to save a tree after the attack has become established and brood development of the beetles has started. The only remedy is to destroy the insects while they are in the dead, infested trees before their broods can emerge and attack other trees that are living.

The object of control work is to reduce the barkbeetle population within a forest area without regard to saving the infested trees. This can be accomplished because the entire beetle population, particularly during the winter season, is concentrated in certain trees or groups of trees, while the remaining trees in the forest are not infested. It is necessary, first, to find these infested trees in the woods and, second, to destroy the insects under the bark by one or more of several available methods.

UTILIZATION

Infested trees can be logged, taken to the mill and the broods destroyed there. However, in National Parks and in areas not accessible to mills, it is not practicable to carry on control by utilization. It then becomes necessary to carry on a control campaign by using direct methods, whereby the broods are destroyed at the point where the tree is located in the woods.

DIRECT CONTROL METHODS

When direct control is undertaken on a forest area, the project has some similarity to a military campaign. Camps, manned by men experienced in work with woods tools, are established at strategic points in the infested territory. Scouts known as "spotters" are sent through the forest to locate infested trees, mark and map their position. They are followed by the control crews who fall the trees and destroy the insects.

The spotter is the technical man in a control project, and its success depends upon his efficiency. He must know the characters by which infested trees are recognized, and be skilled in methods of conducting forest surveys. Plans for the campaign are based upon maps and reports submitted by the spotter.

BURNING The usual method used in California forests for destroying the broods consists of falling the tree and burning the infested bark along the sides of the down log. It is necessary to peel only the top half of the log, as the fire will burn off the bark on the underside. This method is practical only during the winter and spring period when there is little hazard of the fire escaping.

PEELING Mountain pine beetle can be destroyed by peeling the entire log and exposing the larvae to the weather. This method is sometimes used when burning is impracticable.

SOLAR HEAT Still another method used in destroying the western pine beetle during the summer season is known as the "solar heat" control. This consists of removing the infested bark and spreading it in the sun. When the bark becomes heated up to 115° Fahr., or more, the insects in the bark are killed. In thin-barked trees, like lodgepole pine, solar heat is effective without peeling, if logs are turned so that all bark surfaces have been completely exposed to the sun.