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THE SOUTHERN PINE BEETLE
AND ITS CONTROL

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PLATE I. Group of dead pines surrounded by living healthy trees. These dead trees are abandoned.

(Original.)

THE SOUTHERN PINE BEETLE AND ITS CONTROL

INTRODUCTION.—It is a well known fact that pine trees of various species are dying in increasing numbers in Alabama. This dying occurs usually in groups of trees and has caused much alarm among owners of timber. In a general way it is recognized that insects are the cause of the trouble but the blame is usually placed upon the wrong species of insect. Quite naturally the larger insect species are more frequently noticed and charged with being the cause of the trouble. Closer and more careful observation, however, reveals the fact that the primary cause of the dying of the pines is the work of very small beetles which attack the living trees. The nature of the work of these beetles will be described in a general way in succeeding paragraphs. As a matter of fact the larger beetles do not injure vigorous healthy trees but are attracted to those in a weakened or dying condition.

In this circular we shall make no attempt to cover the work of all those insects which may cause the death of or develop in dying pines. Our object is to spread more widely information in regard to the species which is usually the first cause of trouble in this State, in order that immediate steps may be taken to bring this pest under control and thus prevent an outbreak of the species which is now increasing and seems likely to do immense damage to the pine forests of Alabama during the next few years.

We make no claim for originality in the matter of information given herein except in regard to the illustrations used. The subject of forest insects is sufficiently large to command a life time of study. The best authority in the United States on this subject is Dr. A. D. Hopkins, in charge of Forest Insect Investigations, U. S. Bureau of Entomology. Dr. Hopkins has recently issued Farmers' Bulletin No. 476 entitled, The Dying of Pine in the Southern States: Cause, Extent and Remedy. While this publication may be obtained free of charge by any applicant, it has seemed advisable to embody most of the information given therein, in this circular, in order that it may have more general distribution through

the State than could be obtained in any other way. We shall also include some information drawn from several other publications issued by Dr. Hopkins upon the bark beetles.

DESTRUCTIVE BARK BEETLES OCCURRING IN ALABAMA.

According to Dr. Hopkins, only one species of bark beetle having the ability to kill living pines is likely to be found in this section of the South. This is known commonly as the southern pine beetle. It seems quite possible that more careful field investigations in this State may show that still other really destructive species occur here. It is not necessary, however, to wait for such investigations. We know that at least one of these destructive species occurs and the general measures for control of all such species would doubtless be the same. These general measures of control should be put into operation immediately as the extent of the injury and the difficulty of securing control of these species is increasing rapidly with each succeeding season.

Past experience has demonstrated that these destructive bark beetles, when they occur in great abundance, are able to kill perfectly healthy timber over large areas before they are brought under control by their natural enemies or by other factors. Thus about twenty years ago the same species that is now most common in Alabama became very abundant in Virginia and West Virginia and destroyed timber worth many millions of dollars before the outbreak subsided. The area then affected was equal to about three-fourths of that of Alabama and Georgia combined. Conditions in the South at the present time indicate that a similar outbreak is beginning in the South Atlantic and Gulf States.

SECONDARY ENEMIES FOLLOWING THE DESTRUCTIVE BARK BEETLES.

As soon as the attack of one of the destructive beetles causes a weakened or dying condition of a tree, such a tree becomes at once the breeding place of many other species of bark beetles and bark and wood boring grubs which cannot attack healthy trees. These secondary enemies of a tree are

dependent on the more aggressive destructive bark beetles or on other factors that may cause a similar weakened or dying condition of the trees. Some of them render special service to the destructive beetles by attacking the twigs, the branches, and the unoccupied bark on the upper and lower portions of the trunk, and thus aid in bringing about the certain death of the trees. There are some insects which live in the galleries with the adult beetles in the relation of guests, others as scavengers, etc., so that it is always important to distinguish which are the real primary enemies, which are secondary, which are beneficial and which are neutral in their relation to an affected tree.

THE SOUTHERN PINE BEETLE.

(*Dendroctonus frontalis* Zimm.)

This is a small, cylindrical, brownish to black beetle varying in length from about 1-10 to 1-6 of an inch. It is shown natural size in Plate II, Fig. 1. It attacks healthy, injured and felled trees of all of the pines and spruces growing from Pennsylvania southward into Florida and westward into eastern Texas. The beetles excavate long winding egg galleries through the inner bark just barely marking but not burrowing into the surface of the wood. These conditions are shown in Plate II, Fig. 1, and Plate III, Fig. 2. The female lays her eggs at frequent intervals along the sides of the egg galleries and the white legless grubs burrow into the inner bark making their galleries away from the original burrow of the parent. The change from the grub to the beetle stage occurs in the outer bark and soon thereafter the mature beetles may emerge and fly in all directions seeking new healthy trees to attack. The period of flight in Alabama probably extends from the latter part of March until the time of frost in the fall. They may pass through the winter in various stages of development so that emergence in the spring is irregular from trees that were infested the preceding fall. This may occupy a period of three or four months. By the end of July at the latest all of the trees attacked during the preceding year will be entirely dead and abandoned by this species of beetle although they may still serve as breeding places for many of the secondary species as mentioned above.

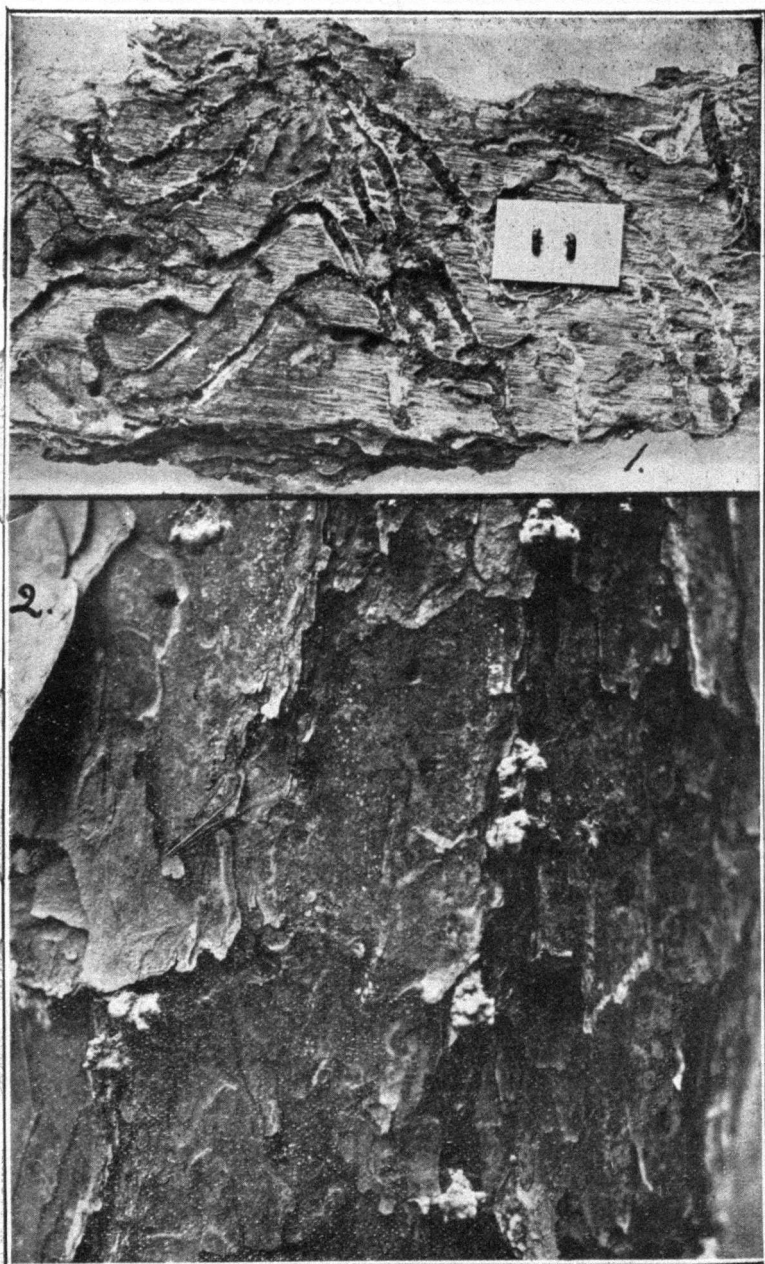


PLATE II. Fig. 1: Inner side of bark showing beetle burrows and beetles, $X \frac{1}{4}$. Fig. 2: Pitch tubes exuding from bark, $X \frac{3}{4}$. (Original.)

There may be from three to five generations each season of the southern pine beetle. These generations overlap so that it is difficult to distinguish them and to indicate any definite periods during which the pines are killed. There seems to be a rather continuous dying throughout the season with the climax occurring apparently during June, July and August in this State.

FIRST ATTACK.—These beetles evidently fly principally late in the evening and at night. They are attracted to lights and are frequently found in great numbers around electric lights particularly. From the fact that infested trees usually occur in well defined groups, it seems quite certain that the beetles emerge and fly in swarms. They are sometimes found congregated in large numbers under the loose flakes of bark on healthy trees just before they begin their simultaneous attack on the trees. It appears frequently that the beetles all leave the vicinity of the group of trees in which they have developed and the next indication of their work may be found in a group of trees at some little distance away. We cannot say just why this general movement occurs so frequently as seems to be the case.

As a usual thing the beetles attack first the middle and upper portions of medium sized trees often appearing to select the largest and best trees first. This work occurs so far from the ground that we must depend for recognition of it upon some of its secondary effects upon the tree.

EVIDENCES OF DESTRUCTIVE BEETLE WORK.—Danger centers are indicated in a general way by the occurrence of dead pines which have not been injured by fire or other destructive agency. This condition is shown in Plate I. The bark of trees which have been abandoned by broods of these beetles has the general appearance shown in Plate III, Fig. 1. The "shot holes" of this species are hardly as large as the head of a pin. Under this bark the wood shows the characteristic surface markings and the deep black staining indicated in Plate III, Fig. 2. Frequently also the bark shows "pitch tubes" exuding from the beetle burrows as shown in Plate II, Fig. 2.

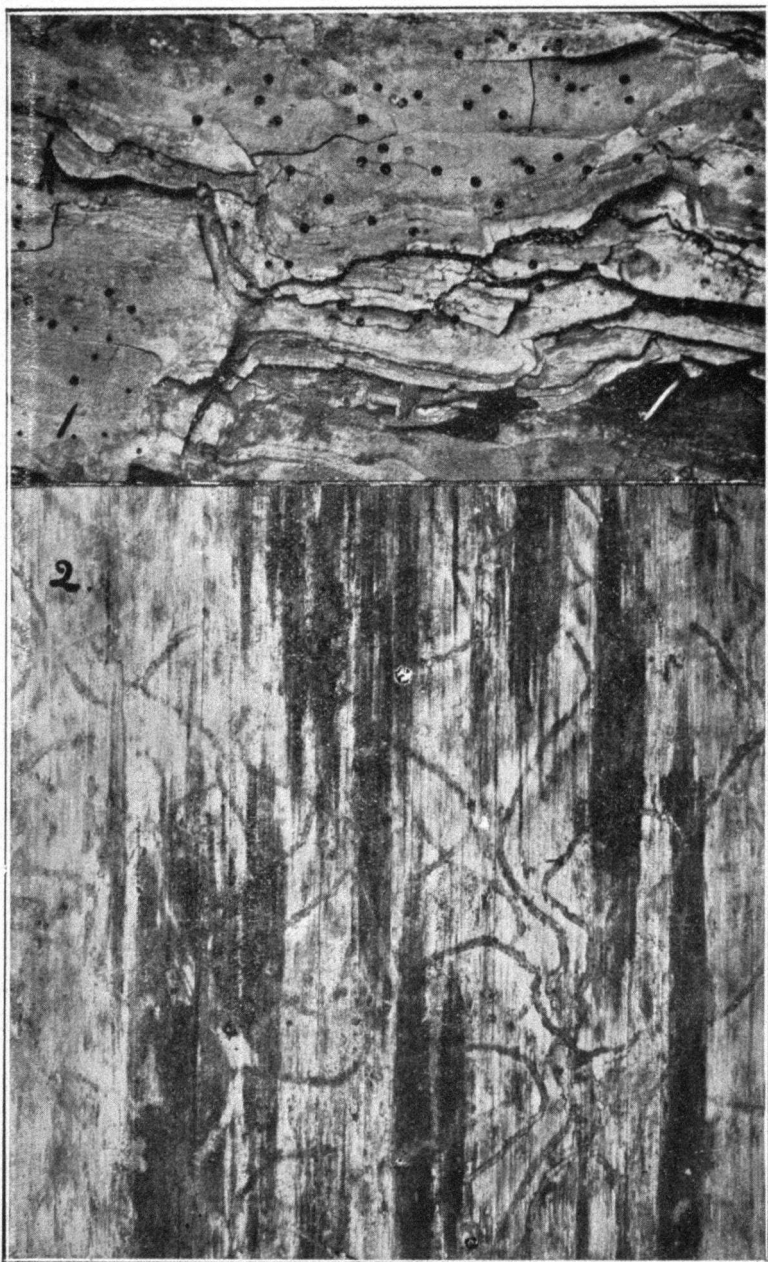


PLATE III. Fig. 1: Emergence holes of beetles from abandoned tree, X $\frac{1}{2}$.
Fig. 2: Surface view of wood showing traces of burrows and black staining, X $\frac{1}{2}$.
(Original)

The burrows of beetles and grubs extending through the delicate inner bark cross and recross each other until they finally completely girdle the tree in many places. The girdling cuts off the flow of sap from the roots to the top of the tree and brings about its death within a few weeks after the attack begins. The leaves or needles of infested trees quickly show the effect of this vital injury and on all trees except those attacked late in the fall, the needles begin to fade, turning yellow first at their bases and gradually becoming dry and brown throughout. The tops of such trees are known as "faded tops." By the time the foliage has become reddish brown, the beetles have usually abandoned the trees and are attacking others. These abandoned trees may contain some belated individuals of the destructive species but most of the insects found in them from this time on are not of primary economic importance. The trees to be especially sought for in order to reduce the numbers of this southern pine beetle are those which show evidences of recent attack and from which the beetle brood has not yet emerged.

SPREADING OF THE PEST.—These beetles spread upon the emergence of the adults at the end of each generation. This may occur several times, therefore, during the season. The beetles are quite strong flyers and it has been determined that they may spread to a distance of three or four miles from the locality in which they developed. Each patch of dying trees may be considered as a center of infestation which endangers healthy timber around it within an area of twenty-five to thirty square miles. The swarming broods may move in any direction and start another center of infestation among healthy trees. It is evident that the occurrence of even a few such centers a few miles apart really endangers all pines within a large area. The presence of these beetles constitutes a greater danger to pine than does the occurrence of the ordinary forest fires. The centers of infestation really call for even more determined treatment in order to protect living timber than would be needed in the case of fire. Measures of control will depend quite largely for their fullest success upon general cooperative action over the threatened territory.

CONDITIONS FAVORING INJURY.—Favorable conditions for the multiplication and spread of the beetle are found in areas of large, matured timber and where the trees are frequently struck by lightning, felled or injured by storms, etc., during the summer months.

It is a generally recognized fact that the cutting of pines during the summer months is almost certain to start trouble. During the winter of 1911-1912 heavy winds in various sections of Alabama have wholly or partly blown down pines in perfectly healthy groves. It would seem that these weakened trees unless removed before the end of March may be especially attractive to bark beetles during the coming summer and serve as centers of serious infestation.

The odor from the exposed wood, and perhaps from the wilting foliage of a few trees cut in the midst of a healthy growth of pine during the summer, serves to attract this species, apparently from a long distance, and to induce attack on the surrounding healthy trees. Therefore, an irregular or sporadic local cutting of timber for fuel or any limited purposes during the summer months furnishes most favorable conditions for the concentration of individuals from widely scattered colonies and broods and thus increase their power of attacking and killing the surrounding living trees. By this means their forces are greatly augmented and much of the surrounding timber is killed. If conditions favorable for the continued concentration of the beetles prevail from year to year, an invasion like that of 1891 and 1892 may be started which may far exceed any forest fire in the history of the country, both in the extent of area covered and in the number of trees of commercial value killed.

THE MORE IMPORTANT EVIDENCES OF THE PRESENCE AND WORK OF THE BEETLE.

(1) If in clumps or patches of pine, where there is no plain evidence of serious injury by fire, the foliage fades to pale green and changes to yellowish and pale brown, it indicates that the trees are dying from the attack of the southern pine beetle, and that the bark on such trees is infested with the developing broods of minute white grubs and transforming

beetles. Therefore such infested trees are a *menace to the living trees*.

(2) If the trees have reddish brown and partially fallen foliage or if all of the foliage has fallen, it indicates that the broods of beetles have emerged and that such trees are no longer a menace to the living ones.

(3) If the trees die during the period between the 1st of March and the 1st of October, they will be abandoned by the broods of beetles within a few weeks after the foliage begins to fade.

(4) If the trees begin to die during the period between the 1st of October and the 1st of December the broods of beetles will remain in the bark until the following March or April.

HOW TO LOCATE THE INFESTED TREES.

The location of trees that are infested by the southern pine beetle is the first and one of the most important things to do before definite plans are made for the active work of cutting the trees. Some of the essential things to remember are as follows:

(1) The southern pine beetle attacks the upper and middle portions of the trunks of healthy trees.

(2) A freshly attacked tree may show pitch tubes on the trunk, reddish boring-dust around the base, or there may be no external evidence of attack until the leaves begin to fade.

(3) By the time the tops are faded and the bark on the middle and upper trunk is dead the broods of the beetles are in an advanced stage of development; yet, at the same time, the bark on the lower third of the trunk may be living and show no evidence of attack, or may be attacked by other kinds of insects which are not responsible for the death of trees.

(4) As soon as the bark begins to die on any part of the trunk it is attacked by numerous other insects, including the adults of the "sawyer" borers which do not attack healthy trees.

(5) By the time the tops have changed from pale green to greenish brown the broods of the southern pine beetle are nearly all developed to the stage when they enter the outer bark to transform to the adults.

(6) By the time the tops have changed to a reddish hue the broods have developed and are either emerging or have emerged.

(7) During the warm months the broods will develop and emerge from a tree within about 30 to 40 days after it is attacked.

(8) Trees attacked in November will usually carry the broods over winter. The foliage of some trees will fade and reach the reddish stage before spring; other trees attacked in December or later may not fade until the warm days of February, March, or April.

Therefore, in estimating the character and extent of an infestation within any given area, or in locating infested trees and marking them for utilization or treatment, one has only to consider those with fading or greenish brown foliage, or the first stage of the yellowish red tops.

ESSENTIAL DETAILS IN METHODS OF CONTROL.

There are certain essential details in the recommended methods of combating the southern pine beetle which must be observed in order to avoid not only serious mistakes but possibly ultimate failure:

(a) The principal clumps or patches of *dying* trees which are actually infested by the broods of the destructive beetle, as indicated by the *fading and dying* foliage, or otherwise, should be located and marked during the months of November, December, January, and February. In order to do this work, proper experience or special instruction is required. Therefore, some one who has had instructions should have charge of the work in each important area in which control work is to be undertaken.

(b) The *broods of the beetle* in the bark of the *main trunks* of the medium to larger sized dying infested trees within an area of 8 or 10 square miles or more must be destroyed in order to stop their depredations.

(c) The broods may be destroyed by *one or more* of the following methods, the work to be done between the 1st of November and the 1st of March: (Plate IV.)



PLATE IV. Working up dead and dying timber in winter. Pile brush and infested bark over stumps and burn before April 1st. (Original)

(1) Removing and burning the infested bark from the trunks of the standing trees; or

(2) Removing and burning the infested bark from the trunks of the trees after they have been cut down; or

(3) Scorching the infested bark, or burning the wood with the bark after the trees are cut down; or

(4) Placing the infested portions of the trunks in water; or

(5) *Converting the trunks of the infested trees into cordwood and using the wood for fuel before the beetles leave the bark; or*

(6) *Converting the infested trees into lumber or other products and burning the slabs or bark.*

(d) It is not necessary to burn the tops or branches of treated trees or to cut and burn small infested saplings *if the larger infested trees are disposed of.*

(e) It is not necessary to remove or destroy the bark on the lower portion of the trunks or on the stumps if it is not infested with the destructive beetle, and it is not necessary to cut or treat dead trees from which the beetles have emerged.

(f) It is necessary and essential that the broods of the destructive beetle in the bark of any portion of the main trunks of the medium to larger sized dying infested trees of any given locality should be destroyed.

(g) If the wood of the infested trees can be utilized for fuel, lumber, or other purposes, its value should cover the cost of the work. If the work of felling and barking the trees is done at direct expense, the cost will average 10 to 30 cents per tree.

(h) The cost of protecting the living timber of any locality with average infestation should not exceed an average of from 1 to 5 cents per acre for the total area of pine-covered land, and if estimated on a basis of volume it should not cost over 2 cents per cord of the living timber protected.

(i) The best time to conduct control operations against the southern pine beetle is during the period between November 1 and March 1.

(j) If a pine tree standing among or near a grove or woods of living pine is either struck by lightning or felled and barked or split into cordwood during the summer and early

fall, it will, as a rule, attract the beetles within a radius of 3 or 4 miles and result in the starting of a new center of infestation and in the death of a large number of trees.

(k) The principal owners of pine in each community should cooperate in the disposal of the required infestation but should not undertake the work until *some one or more of the owners is sufficiently familiar with the essential details of the proper methods.*

REQUIREMENTS FOR SUCCESS.

The requirements for success in any effort to protect the living pine from the destructive attacks of the southern pine beetle are the destruction of the broods of the beetle in the bark of the main trunk of the dying infested trees before they leave the bark. This is accomplished by the adoption of one or more different methods of direct utilization of the infested trunk, or treatment at direct expense in cases where the wood can not be utilized.

The attainment of the best success from the practical application of any of these methods will depend on their adaptation to local conditions and requirements for disposing of the infested timber and strict adherence to certain details which are absolutely necessary to the destruction of the broods.

The period in which to locate and mark the trees that are actually infested and in which the marked trees should be utilized or treated to kill the broods is between the 1st of November and the 1st of the following March, but in some cases the period may be extended to the 1st of May.

The adoption of the method of destroying the broods which in each case is the most economical and effectual can be determined by the owners in each community if they are sufficiently informed on the essential facts.

Detailed advice, recommendations, or conclusions as to the most economical and effective method of procedure for any given area should be deferred until certain reliable information is at hand in regard to the local condition as to (a) the character and extent of the infestation, (b) the interest manifested by the people of the community in the value to them of the pine and the importance of protecting it as the source

of future revenue, (c) the assurance of the majority of the owners that concerted action will be taken according to a definite plan and purpose, and finally, if a demonstration is desired, that local facilities will be offered for its successful prosecution.

If the owners of pine will consider the protection of their timber from the standpoint of a common interest and will realize the necessity for concerted action in the control work, success will be assured.

Under certain conditions the U. S. Bureau of Entomology may undertake the supervision of demonstrations in the control of the southern pine beetle where it is abundant and threatening further damage and the owners in the locality will guarantee the necessary cooperation.

It will help much in future work if readers of this circular will report to the Entomologist, Alabama Experiment Station, Auburn, regarding the occurrence of this pest within the State as it may be known to them.