

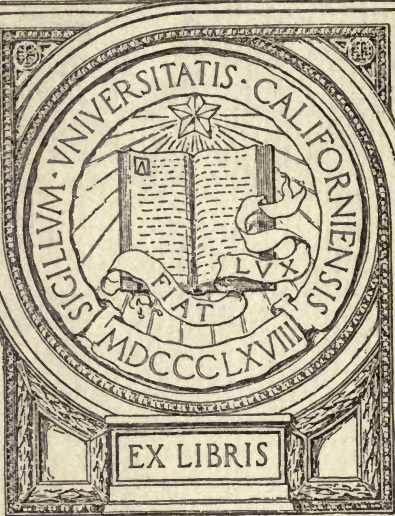
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REPORT ON THE WHITE PINE WEEVIL
by
M.W. Blackman
Maine Forestry Dept. Univ. of Me., & Maine
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WHITE PINE WEEVIL

BY

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THE WHITE PINE WEEVIL, WITH METHODS OF CONTROL AND RECOMMENDATIONS FOR A MODIFIED SYSTEM OF PLANTING WHITE PINE AND NORWAY SPRUCE.

BY M. W. BLACKMAN, Ph. D.

At one time the greater part of the southern half of Maine was covered with forests in which the white pine was the predominating tree. From this fact the state became popularly known as the "Pine Tree State." Even now the uncultivated portions of this region support many pine trees and they reproduce naturally surprisingly well, so that many of the rocky hillsides, farm woodlots and pastured woodlands contain a large percentage of new growth pine. But how different are these crooked, scrubby or bushy pines from the tall trees with their clean straight boles, characteristic of the original virgin forests of this region.

It is undoubtedly true that a considerable part of the land of southern Maine is better fitted for the rearing of forest trees than any other use. Foresters usually agree that the white pine grows more rapidly, can be harvested sooner, and yields a larger return in a shorter time than any other planted forest tree suitable to this region. However, in spite of these undisputed facts, it is very questionable whether under present conditions, it is wise to advise the making of pure plantations of this valuable timber tree. This is because of two very serious enemies which threaten the destruction of its life or its commercial value. One of these, the Pine Blister Rust, is a fungus disease accidentally introduced from Europe, while the other is an insect native to this country—the White Pine Weevil. At the present time more frequent mention of the former of these two pests is heard by those interested in the preservation of our forests, than of the pine weevil. This is due largely to a well organized propaganda based upon a real menace to the white pine and its kindred species, and should in no degree be discouraged or hampered. It is doubtless also due to the fact that a new, formerly unknown danger always appeals more strongly

than an equally great or even greater one, to which one has become accustomed, by long association. It is indeed very doubtful if the blister rust is as important an enemy to the production of white pine timber as is the pine weevil.

The adult of the white pine weevil is a small brown beetle, about a quarter of an inch long, with two gray or band-like markings across each hard, shell-like wing cover. It differs from the more ordinary beetles in the possession of a long snout-like extension of the head equal to about one-fourth of the body length. The insect usually passes the winter in the adult condition and leaves its hibernation quarters early in the spring and immediately flies to young pine trees. Here the female seeks the terminal shoot or leader of a tree and places her eggs under the bark of that part of the leader produced the preceding year. This she accomplishes by excavating a number of shallow pits in the bark with her biting jaws which are at the end of the snout, and by then reversing her body and placing her eggs in these cavities from the end of her abdomen. Whenever the leader is injured in this manner droplets of pitch are exuded which soon harden, and thus indicate the leaders in which eggs have been oviposited. The depositing of eggs begins with the first few warm days of spring—usually during April—and continue actively for several weeks or a month. The exact season of egg-laying cannot be stated, as this varies with the locality, and in the same locality varies with the advancement of the season. Some egg-laying may occur as late as the latter part of June, but it is usually mostly completed by the middle of May.

The eggs usually hatch within a period of eight or ten days, each producing a small white larva or grub, which feeds voraciously under the bark of the terminal shoot, eating the cambium, the essential growth producing portion of the tree. Usually the eggs are deposited in the upper part of the last year's growth and the grubs work downward, destroying the entire inner bark and completely killing the tissue as they proceed. As they become larger, the larvae eat deeper and deeper into the surface of the sapwood and finally, in their last larval stage when they have reached about their full growth, they burrow into the wood, usually in the lower part of a terminal shoot. There they construct small oval chambers about one-third of an inch long, which are covered with partially chewed up bits of wood, known

as "chip-cocoons." Within these cocoons which may lie either near the surface of the sapwood or in the pith, each larva changes into the state known as the pupa, which requires no food and is capable only of feeble movements of the abdomen. The insect remains in this stage for a period which varies with conditions of temperature and moisture. This transformation in the region of Orono was at its apex during the season of 1919 in the latter part of July, although a few of the insects were still larvae in the middle of August. The first adults of the new generation were obtained July 30, but these were but recently transformed from the pupae and from a considerable number of infested leaders which were under observation, no adult emerged before August fifth. The adults continue emerging from the old hosts throughout the month of August and to decreased degree during early September, while a few derived from eggs laid late, pass the winter in the old leaders either as larvae or as young immature adults. By far the greater number, however, emerge before September and on the approach of cool weather, seek some sheltered place in which to pass the winter.

The leader which has been attacked at first shows no signs of injury aside from the exudations of pitch already mentioned. The new growth begins normally, but soon after the larvae begin feeding, the new growth above the injury begins to wilt, and soon turns brown and dies. As the larvae continue feeding, the terminal continues to die farther and farther down and usually the entire leader down to the first whorl of laterals is killed. Occasionally, when the number of larvae is greater than usual, they may continue their work of destruction below the upper whorl of laterals. In this manner, two years' growth and rarely three years' growth is killed.

The killing of the leader in this manner throws the vitality of the tree into the next group of laterals below the injury. These turn upward; each develops a more or less strong growing tip, and they all contend for leadership. If these new leaders are not again attacked the result is the production of a forked or branched top, known among woodsmen as a "stag-horn pipe." This either much decreases or entirely destroys the timber value of the tree, and at the same time detracts from its beauty. However, very often the new leaders may be attacked year after year, resulting in the production of a stunted, bushy growth

which has neither commercial nor esthetic value. Instances where this has been carried so far that from 25 to 100 leaders are striving for supremacy, may be seen by the thousands throughout southern Maine. Indeed, in this region, only a very small per cent of the young pines escape injury by the weevil.

While the pine weevil shows a decided preference for white pine (*Pinus strobus* L.) over all other species of trees, it will occasionally attack other species of pine such as the jack pine (*Pinus banksiana* Lamb) and true pitch pine (*Pinus rigida* Mill) and several species of spruces including the red spruce (*Picea rubens* Sarg.) and the Norway spruce (*Picea excelsa* Link.) Plantations of Norway spruce, especially, are often subject to great damage—second only to white pine in this respect. Young trees from 4 to 20 feet in height, are most subject to attack, although less commonly pines well over thirty feet high may be injured by the weevil. It also shows a decided preference for trees growing in plantations or in open stands. Thus it is that the most noticeable damage usually occurs in pure plantations of white pine or Norway spruce or in the younger volunteer growth in pastures, along the borders of woodlands or along roadsides. Where white pine occurs under cover in woodlots it is nearly exempt from attack and injury.

Methods of Control. The white pine weevil is best controlled by removing the infested leaders and so treating them as to destroy the contained grubs and young beetles before they have an opportunity to emerge and escape. This is most easily accomplished by burning, and should be done before July 1st. By this procedure all of the new brood is destroyed, but unfortunately all of its parasitic enemies are also killed. A better method, but one involving more trouble, is that recommended by Dr. A. D. Hopkins, of the U. S. Bureau of Entomology. He recommends that the collected leaders be confined in tight barrels closed at each end with ordinary wire screen. This allows the smaller parasites to escape. By the time cold weather begins, all of the weevil will have emerged from the leaders earlier collected, and will have died, so that the screens can then be removed and the barrels and their contents left until the succeeding June to allow the emergence of the larger parasites which develop later. The leaders collected later in the season—those wilting after the middle of July—should either be burned at

once, or should be kept screened until the midsummer following as some of the weevil will not be ready to emerge until the following spring.

Plantations, whether known to be infested or not, and natural woodlands in the vicinity of plantations, should be inspected at least twice during the summer (late in June and again about the middle of July) and all wilted leaders collected and either burned at once or confined in screened containers as recommended above. It should be borne in mind that weevils develop just as readily in natural growth of pine where these occur in the open, as they do in planted trees. The adults are equipped with wings and are capable of flying for a considerable distance, so that no matter how clear of dying leaders a plantation be kept, it will certainly become reinfested if the weevil breeding in the woodlands of the vicinity are not also destroyed. Above all things, it should be borne in mind that the mere removal of the infested leader does no good for the insects will breed just as readily in one broken off as in one still attached to the tree. It must either be destroyed by burning, or screened so that the emerging beetles cannot escape to infest new trees.

In plantations where an infestation is thoroughly established, or in a region in which the weevils are numerous, the collection and treatment of infested terminals should be supplemented by other measures to prevent, in so far as is possible, the beetle from depositing its eggs. One means to this end consists in the collections and destruction of the weevil while they are on the terminals preparing to oviposit. With but little practice the insects can be readily seen upon the leaders just below the terminal group of buds. If the tree is slightly jarred the weevils will release their hold of the stem and drop to the ground. Advantage may be taken of this habit in collecting them. If an insect net or a light vessel containing a small quantity of kerosene or crude petroleum is held at one side of the leader, and the other side is tapped with a stick, the insect will nearly invariably fall in the receptacle. If an insect net is used, this should be emptied from time to time in a vessel of kerosene or petroleum, a thorough bath which is always fatal. This collection and destruction of adults should be repeated at intervals of a week or ten days during the height of the egg laying period. In southern Maine this would usually be from the be-

ginning of warm days late in April, till early in June when most of the adults have disappeared. Three or four thorough collections made in this manner will very much reduce the number of infested leaders, but those dying later should be removed and treated as recommended above. If these recommendations are followed thoroughly and conscientiously for several years, it will result in a very material lessening in the number of the weevil and if they are supplemented by widespread and thorough destruction of the infested parts of natural growth, the weevil will soon be entirely under control. But the work must be *thorough*, and to be lasting must be widespread.

Indeed, scientifically there seems to be no reason why the pine weevil should not be controlled throughout the state—or indeed throughout its range—and their numbers so reduced that a pine or spruce infested by them should become a rarity. There is no real reason why the “stag-horn” pine and the “bushy” pines along the roadsides and in the woodlots and plantations should not give place to symmetrical trees growing in the way nature intended them to grow; no reason why the present unsightly, stunted trees should not be replaced by objects of real beauty and from being of no value, become the producers of the most valuable timber it is possible to grow in the state. The writer thoroughly believes that the control of the pine weevil is a practical proposition. All that is necessary is a concerted, co-operative effort by all land owners, directed and aided by a corps of experts employed by the State. The cost for a few years would be considerable, but it would not be excessive when the increased value of the woodlands is taken into consideration. The State would be a more attractive place to live in, and the coming generations would not only receive a heritage of greater beauty, but could also reap a crop of immensely greater value.

Even if state-wide efforts at controlling the pine weevil are not undertaken, much can be accomplished by co-operative community efforts. Several public spirited men in a community interested in the preservation and improvement of the woodlands of their region, can readily interest a number of their neighbors in a matter of this sort, and by a thorough, conscientious endeavor can do much to protect their pines and spruces and thus insure a more beautiful and profitable future for their locality. However, it should be borne in mind that several

years' effort will be necessary to establish control and the results will be more or less temporary unless neighboring communities are co-operating.

*Suggested Systems of Planting White Pine and Norway Spruce
To Obviate Weevil Injury.*

The question is often asked why it is that while the virgin pines were most of them so perfect, the new growth is so markedly subject to weevil injury. It is believed the correct answer is that these perfect and symmetrical trees came up under cover of larger trees either of the same or of other species, and were thus protected from injury. By the time their crowns reached through to the open above the surrounding trees, the pines were of such a size as to be exempt from attack, or if attacked, were injured but slightly. There is good reason for believing that any open woodland in this part of the country, if left untouched for several centuries, would at the end of that period have become as perfect a forest as was here when the white man first came, and that the predominating tree would be the white pine, provided a few good seed trees of white pine were present at the start. The history of such a forest would be somewhat as follows: A very large percentage of the first new growth of pines would be attacked by the weevil, and never reach a height of much more than thirty feet. A few would probably escape without injury or with only minor injuries. Later lots of pines coming up under cover of the older "bushy" growth would escape with a much smaller percentage of injury, and the survivors would eventually over-top the injured growth. Having reached a height where they were comparatively exempt from injury, some of them would continue to grow, and eventually they would become sufficiently numerous to suppress and kill the imperfect stunted trees by shading.

Such a process as that outlined above, however, would certainly require several centuries for its completion. The writer thoroughly believes that comparatively good results can be accomplished in a much shorter time by using proper methods of planting, intelligently devised to combat the pine weevil. Observations made several years ago at the Great Bear Springs Plantation near Fulton, N. Y., first suggested that such a system

might be possible. Most of the pine is there planted in blocks of pure white pine, Scotch pine, or Western yellow pine. However, in a small part of the plantation a dozen or so rows occur between two larger blocks of Scotch pine, and in still another place white pine and Scotch pine were planted in alternate rows. When examined, the injury by the weevil was serious in all of the blocks of pure white pine, while the other species showed no evidence of its attack. In the small block of white pine, surrounded by Scotch pine, only a few leaders were killed, while in that plot where the two species had been planted in alternate rows, no evidence of attack by the weevil was found. The two sorts of pine had been planted at the same time, but the Scotch pine, on account of its more rapid early growth, had outstripped the white pine and, at the time observations were made, was several feet higher. The protection of the white pine from beetle attack was probably due either to the higher, denser growth of the other species, or possibly the odor of the Scotch pine predominated and acted as a deterrent to the weevil. It is probable that both factors aided. The higher leaders of the Scotch pine protected the white pine by inducing the weevils to alight upon them, it being common observation that up to a height of 20 feet, the higher leaders in a plantation are more often chosen for ovipositing. The weevil, however, having alighted on a Scotch pine, found it undesirable for ovipositing and soon sought further.

It is the belief of the writer that a system of planting white pine can be devised which will give a large measure of protection to the young trees during the period when they are most susceptible to weevil injury. However, it will require a number of experiments carried out over a long period before the best system could be decided upon. Several experimental plots are suggested below. In all cases the rows should be laid out at right angle to the prevailing winds during the active period of the weevil.

Experimental Plot No. 1. A plot of a minimum of several acres planted 6'x6' as follows: The center of the plot to be planted with alternate rows of Scotch pine and white pine, surrounded by a border of at least six rows of Scotch pine, and this in turn surrounded by another band of at least six rows of pure

white pine. This outer border of white pine would serve the double purpose of a check plot to determine the normal percentage of infestation in pure stands, and would also serve as trap trees to induce ovipositing.

The history of this plot would probably be somewhat as follows: On account of its more rapid early growth, the Scotch pine would in a few years outstrip the white pine, and by the time the latter had reached a height when it would be attractive to ovipositing weevils, the Scotch pine would act as a cover or protection, so that at worst a much decreased percentage of white pine would be injured. But when Scotch pine reaches a height of 20 or 30 feet its further growth in height continues much more slowly and at this time the white pine would soon overtake and eventually outstrip the other species. But by the time this occurs, it would have reached a height where it would be less liable to weevil injury, and a large percentage would escape unharmed. The Scotch pine having served its purpose as box boards or other cheap lumber. The gaps thus made should be immediately planted with new white pine which, growing up under cover, would be nearly immune to weevil injury.

In the meantime the border of white pine surrounding the plot, from the time the young trees reached a height of 5 or 6 feet, would suffer a large percentage of infestation. As soon as the leaders begin to wilt they should be removed from the young tree and treated as previously recommended. Many of these trees would soon become bushy growth, but they should be allowed to remain to serve as traps, and as soon as attacked, the infested parts should be removed. The inner border of Scotch pine would serve as a partial barrier and could either be cut when the trees of the same species in the center of the plot are removed, or could remain till the interplanting of white pine had become thoroughly established.

Experimental Plot No. 2. Similar in general to Plot No. 1 but with Norway spruce or other species of spruce replacing the white pine in the center of the plot. The outer border may be either white pine or Norway spruce.

Experimental Plot No. 3. Similar to Plot No. 1, but with the central area planted with alternate strips of from 2 to 10

rows each of white pine and Scotch pine, or of Norway spruce and Scotch pine. It is believed that not so high a percentage of protection would be thus secured but there would be less difficulty in removing the Scotch pine, and if desired this could remain until more mature. Its removal would also be accomplished with less mechanical injury to the more valuable white pine.

Experimental Plot No. 4. Similar in general construction to Plots 1 and 2, but with some rapid growing broad-leaf tree replacing the Scotch pine. It is believed at least equal immunity for the pine or spruce would be secured, but care would probably have to be exercised to prevent some of the pines from being shaded out. An occasional judicial thinning might be necessary, but this should not be carried far enough as to make large openings in the cover until the size of the pines (more than thirty feet high) make them comparatively immune from injury.

There is every reason to believe that any of the experimental plots suggested above would be successful to a considerable degree. Perhaps a small percentage of the protected pines would suffer injury, but this percentage would never be great, and in no way compare with the injury in pure plantations or that occurring in the protecting border of trap trees. However, in all cases there should be a systematic effort at reducing the number of weevils by conscientiously collecting and treating the infested leaders throughout the plot, and better and more certain results will be secured if the natural growth in the vicinity is treated in like manner. This would require only a few hours', or at the outside only a few days' labor per year especially if the man is equipped with long handled pruning hook.

