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A FOE TO THE LUMBERMAN.

Scientific investigators are continually coming to the aid of practical workers with explanations of the evils which hedge about their work and endanger its results. These explanations we seek for publication, because often a knowledge of the evil suggests a remedy, and where this happy result does not follow, there is still the satisfaction of being acquainted with the occult agency which crosses the worker's pathway toward success in his avocation. A very interesting case of timber destruction by a fungus, which penetrates the growing tree and honeycombs its heart without leaving any exterior marks by which the lumberman can tell the worthlessness of the timber beneath the bark, was brought to the attention of the California Academy of Sciences, by Dr. H. W. Harkness. As the case is of such wide practical interest to lumbermen and tree growers generally, we have made engravings to show the way in which the fungus attacks the fiber of the tree. These engravings will be fully explained in the course of the paper which Dr. Harkness read at the Academy of Sciences, and which we print herewith:

During the past few years the study of the fungoid diseases affecting vegetation has proved to be one of much importance, not alone owing to the scientific interest attached to the subject, but also to the farmer as well, whose best efforts are often thwarted by the presence of a pestilence he is powerless to control. The *Peronospora*, affecting the potato, *Puccinia* and *Erysiphe* amongst wheat, are capable of destroying the fairest fields in a single night, while the *Sphaeria morbosa*, upon our fruit trees, and the *Merulius* and *Polyporus*, amongst those of our forests, are but types of a large order of parasites which are silently at work converting many of our forest trees into their original elements. In many instances it is probable that the tree has completed its growth before it is attacked, yet the external signs are so obscure as to mislead the observer, valuable trees being lost before the appearance of disease is even suspected.

A notable example in point is to be found in the Douglas spruce of our mountains; this is well known as one of our most beautiful trees, while for many purposes the timber is of great value. The lumberman suffers, however, a great loss from a form of dry rot which attacks the living trees, the presence of which disease he is often unable to detect until after much labor has been expended in preparing the lumber for market. The disease of this tree is owing to the presence of a new species of *Dredalia*, for which I propose the name, *D. vorax*, which first finds lodgment beneath some dead limb. Following the course of the limb as it enters the heart-wood of the tree, the mycelium begins immediately to branch upward and downward along the line of the longitudinal cells. Ramifying among these it saps the cell contents and destroys the vitality of the structure. On making a section of the tree the line of devastation may be easily traced by the minute channels filled with the decaying wood. The tree once fallen, the work of the fungus does not cease, but, on the contrary, is greatly accelerated, owing to the greater amount of moisture it imbibes when in recumbent position; and hence it is that our fallen spruces so soon disappear.

But let us pass to another, the fir trees of our Sierras, for a still further proof of the work of destruction wrought upon our living trees by fungi. In the case of the fir, the fungus (with little doubt *Polyporus rescolatus*—Cooke) attaches itself to the bark of the tree; its mycelium soon penetrates to the cambium beneath; there it spreads over a considerable space, and begins to force its way directly through the sapwood toward the heart. The tree does not,

however, readily yield to the influence of its foe, but commences to develop new tissue, in order to arrest the extension, or partially encyst the fungus. Layer after layer of new tissue is formed, until great bulbous expansions are produced upon the trunk; the parasite all the while is eating its way like a cancer, slowly but surely, into the heart, until finally, after years of contest, the tree falls a prey to its deadly enemy. So general is this disease amongst the firs that, as Mr. John Muir asserts, few, if any, die from any other cause. This fungus, like the one before mentioned, continues its work in the fallen trees.

In the fungus I am now to speak of there is a

diseased, and yet no external signs appear by which the lumberman may determine the diseased tree from that which is sound. The method, too, by which the fungus invades the tree is most singularly perplexing. If we examine a transverse section of an affected tree, we shall find numerous small openings, as shown in the larger engraving (Fig. 1), and which create the impression of being the work of some animal. Frequently 50 or 60 such openings may be seen in such a section. These openings vary from one-half to one inch in diameter. A longitudinal section of such a tree reveals the fact that these openings are not continuous throughout the body of the tree, but are simply

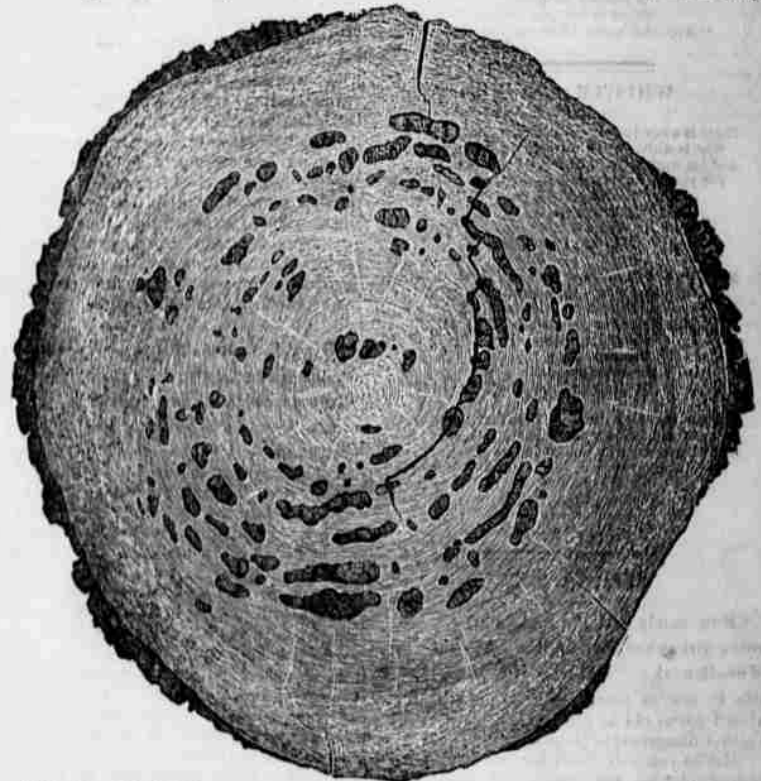


FIG. 1. CROSS-SECTION OF CEDAR, HONEY-COMBED BY THE FUNGUS.

marked exception, however, to this rule. I allude to the fungus which is at work upon our *Libocedrus decurrens*, a tree of great value for timber, the consumption of which is constantly



A SECTION CUT "WITH THE GRAIN."

increasing as its good qualities are becoming better known. In some localities, as can be shown, one-half or more of the trees are

elliptical cavities of from three to four inches in length. These openings are shown in the smaller engraving (Fig. 2).

These cavities are filled with the dead wood, pervaded with threads of mycelium. The wood so affected becomes contracted in the cavity, is very friable and easily powdered between the fingers; the medullary rays and fibro-vascular bundles, together with the cell structures in general, maintaining their proper relations to each other. A singular fact must in this connection be noted, which is this, that along the line of this decayed wood, or in other words, the borders of these cavities, there seems to be no partially decaying or decayed wood. Between any two such cavities there is a considerable portion of perfectly sound wood, the mycelium in some unaccountable manner, finding its way through the living wood, leaving behind not the slightest microscopic trace of its progress. The cavities always appear in the dry heart-wood, and, though I have diligently sought for them, I have never yet seen one in the sap-wood.

Under treatment with suitable reagents, the affected wood shows abundant branching threads of mycelium traversing the entire mass. Along with these are found a considerable number of zoospores. Thus far I have been wholly unable to detect the presence of any germ-spores. There is abundant evidence, in my judgment, however, that these spores must be sought for among the roots of the tree. Yet their discovery will depend, in a great measure, upon accident, as the germ may have developed and disappeared a century before its