POLYPORUS DRYADEUS, A ROOT PARASITE ON THE OAK

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Bulliard (1789, 1791) [1] figured and described under the name *Boletus pseudo-igniarius* a fungus which most European mycologists believe is the plant now called *Polyporus dryadeus*. Apparently the next record of this fungus is by Persoon (1799), where it is described as *Boletus dryadeus*. Again it is described by the same writer in his Synopsis Fungorum (1801), where Bulliard's fungus is listed as a synonym. It is first named *Polyporus dryadeus* by Fries (1821), who describes the plant and cites as synonyms the names given by Bulliard and Persoon. Hussey in Illustrations of British Mycology (1849) gives a fairly good figure of the sporophore and a most excellent mycological description of the fungus, with its habitat.

Since 1849, repeated references to this fungus are found in European mycological literature, but nothing was written concerning the rot produced by it in the oak until Robert Hartig in his epoch-making work on the true nature of the rots of woods (1878) described a heart rot of the oak which he attributed to *Polyporus dryadeus*. A careful study of Hartig's figures and the description of the sporophore which he found associated with the white heart-rot so accurately described by him is sufficient to convince anyone who is familiar with the true *P. dryadeus* that Hartig's fungus was not *P. dryadeus*. It is undoubtedly identical with the heart-rotting fungus known in America as *P. dryophilus* and found by Hedgcock (1910 and 1912) to be associated with a whitish piped rot in oak.

Polyporus dryophilus has one character, a hard, granular, sandstone-like core, that is unique and not possessed by any other polypore known to the writer. The sporophore of this plant, represented by numerous specimens collected by Hedgcock and the writer in western and southwestern United States, shows this hard, granular core exactly as figured and described by Hartig in his article on *P. dryadeus*. This core extends back some distance into the tree in oaks; it is usually irregularly cylindrical while in the tree, but on its emergence from the tree it swells into a tuberous or spheroid mass and finally occupies the central and rear part of the sporophore. (Pl. XXI, fig. 1.) If the sporophore is formed from a large branch hole, it is usually of the applanate type, with a small core, but when the sporophore forms directly on the body of the

[1] Bibliographic citations in parentheses in the text of this article refer to "Literature cited," p. 248.

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tree, as it usually does, the shape is tuberous, ungulate, or even subglobular (Pl. XXI, figs. 2 and 3), with the bulk of the sporophore composed of a hard, granular core. This core usually has white mycelial strands. (Pl. XXI, fig. 3.) The sporophore of *P. dryophilus*, therefore, has normally three distinct kinds of structures: (1) The hard, granular core, (2) the fibrous layer which surrounds this core except at the rear, and (3) the layer of tubes on the lower surface. Specimens are often found, however, especially from the western part of the United States, in which this fibrous layer may be entirely absent between the tubes and the granular core. (Pl. XXI, fig. 3.)

The sporophore of *Polyporus dryadeus* never has this granular core, but its context is fairly homogeneous and of a fibrous-corky structure. (Pl. XXI, fig. 4.) Another very important difference between the two species is the location of the sporophores on the host tree. In *P. dryadeus* the sporophores are always on the exposed roots or on the trunks at or very close to the ground. The reason for this is explained later in this article. In *P. dryophilus* the sporophores are higher on the trunk of the tree, and in some cases are on the branches.

The rot described and figured by Hartig is identical with the rot produced by *P. dryophilus*, but does not resemble in the least the rot produced by the real *P. dryadeus*. Since Hartig's time European mycologists have followed him in descriptions of the rot wrongly ascribed to *P. dryadeus*, but most of them have described the sporophores of the true *P. dryadeus* both as to its character and location on the tree—i. e., at the base of oaks. For instance, Von Tubeuf, in his Disease of Plants (1897), describes fairly well the sporophore of *P. dryadeus*, while his photograph of the rot is that of *P. dryophilus*. Massee, in his Diseases of Cultivated Plants and Trees (1910), states that "the largest specimens usually occur near the ground line, but it also springs from points where branches have died or been broken off." The latter statement, so far as can be ascertained by the writer, is incorrect as to the location of the sporophores of *P. dryadeus*, but is correct for *P. dryophilus*. Massee also quotes Hartig as to the character of the rot produced.

Polyporus dryophilus is known in Europe under at least three different names: *Polyporus fulvus* Fries (Pl. XXI, fig. 5), *P. friesii* Bresadola, and *P. vulpinus* Fries. (Pl. XXI, fig. 6.) According to Lloyd (1913), not only are *P. fulvus* Fries and *P. friesii* Bresadola synonyms for *P. dryophilus*, but the *P. corruscans* of Fries is also the same plant.[1] *Polyphorus vulpinus* is the name given to the form of *P. dryophilus* found on species of Populus, authentic specimens of which were seen by the writer at the New York Botanical Garden in collections from Finland and Sweden and also from

[1] Since this article was written, the writer, through the courtesy of Mr. C. G. Lloyd, has examined the specimens of *Polyporus corruscans* and of *P. rheades* deposited in the Lloyd Herbarium at Cincinnati, Ohio. Both of these plants as represented in this herbarium are *Polyporus dryophilus*. the former being the usual form found on oak and the latter the one occurring on poplar. According to Mr. Lloyd, the type of *P. rheades*, found by him in Persoon's Herbarium, is undoubtedly the plant called "*P. vulpinus*" by Fries.

Maine. In the Cryptogamic Herbarium of Harvard University there is a collection on *Populus grandidentata* Michx. from New Hampshire, while in the laboratory of forest pathology of the Department of Agriculture at Washington, D. C., there is a fine collection on *Populus tremuloides* Michx. from near Steamboat Springs, Colo. (Hedgcock, 1913).

This fungus on Populus agrees in all essential characters with the form of *Polyporus dryophilus* found on oak. The sporophores are, however, somewhat smaller than those usually found on oak and approach the applanate type. (Pl. XXI, fig. 7.) The hard granular core is always present, but is formed between the sapwood and bark (Pl. XXI, fig. 8), as the fungus is able to rot the sapwood as well as the heart of this host. It therefore does not have to depend on branch holes or other openings through the sapwood in order to form its sporophores, as it does in the oak.

Through the kindness of Von Tubeuf the writer obtained a European specimen of Hartig's so-called rot of *Polyporus dryadeus* in oaks. (Pl. XXII, fig. 1.)[1] It is unquestionably the rot produced by *P. dryophilus*. (Pl. XXII, fig. 3.)

The following discussion of the rot caused by *Polyporus dryadeus* embodies the results obtained from extensive field studies made in the forests of Arkansas, eastern Texas, Oklahoma, Maryland, and Virginia.

The sporophores of *P. dryadeus* are always found at or very near the ground at the base of the host. This first suggested to the writer that the fungus might be a true root-rotting organism. Trees with sporophores at their bases and wind-thrown oaks with and without the sporophores attached were carefully studied. Sections of the trees were cut, roots dug up and examined, and every effort made to determine exactly the character of the rot produced. The roots and stools of 20 trees attacked by this disease were examined, and sections of the various stages of the rot were studied.

The microscopic characters of the rot from each tree were found to be identical, although of the 20 trees examined 5 were in Arkansas, 3 in Texas, 2 in Oklahoma, 4 in Maryland, and 6 in Virginia. In every instance the trees were found to have a white rot which attacks first the sap and finally the heartwood of the roots. The rot originates in the lower portion of the roots and spreads in them toward the base of the tree.

The first evidence of the disease is a reddish brown discoloration of the inner bark and cambium. If the diseased roots are exposed in a damp chamber at this stage, white floccose spots of mycelium will appear on the outside of the bark, but the rot has not yet become evident in the wood. As the rot progresses, discolored, watery, reddish

[1] Figure 1 on Plate XXII was made from a photograph of a piece of the original type material used by Hartig in his description of the rot of *Polyporus dryadeus* (1878).

brown areas, which become hazel in color when the wood is dried, appear on the surface of the sapwood and in its outer layers. At this stage a cross section of the root has a mottled appearance, and this discoloration gradually spreads till the root is affected to its center. The earliest discolored spots have by this time turned white. (Pl. XXII, fig. 2.) Later, as the rot ages, especially in the larger roots which lie near the surface of the ground, this white changes to a cream and finally to a straw color. The lower portion of the smaller diseased roots, those 2 inches or less in diameter, become completely rotted and white throughout before the advancing rot has reached the stool of the tree. On these small rotted roots the bark separates easily from the wood, since much of the living bark has been destroyed. The bast fibers, however, remain intact, which gives the inner bark a loose, shredded appearance. The rot gradually moves up the roots till the stool is reached. This is also attacked by the fungus, but the rotted area ends abruptly at the surface of the ground.

A radial-longitudinal section of the rot in a fresh state has a sodden, watery appearance, with white longitudinal and transverse lines somewhat like the rot produced by *Polyporus hispidus* in oaks. These white lines or bands are not cellulose, however, but are spaces filled with air and the mycelium of the fungus in the region of the large vessels. When the rotted wood is thoroughly dry, these white lines disappear, and the uniformly creamy-white rot is left. The rot in all the trees examined did not extend for any appreciable distance into the heartwood of the trunk proper above the collar of the tree, even when the large, completely buried roots, 6 to 12 inches in diameter, were rotted throughout.

The thoroughly rotted wood when dry is very light in weight and, superficially, looks and feels like pith. If a freshly dug root in the advanced stage of the rot is twisted, it will split into concentric layers and also into longitudinal blocks, giving the broken end of the root a coarse, fibrous appearance. The lower ends of the diseased roots may be in a thoroughly rotted condition, easily splitting into these concentric layers and rough, fibrous masses, while that portion of the root next to the base of the tree remains comparatively sound. The roots of several of the trees overthrown by the wind were thus affected. The presence of this rot is often indicated by irregular white mycelial patches on the outside of the bark of the root or of the stool of the tree.

In a radial-longitudinal section through the heartwood of a diseased root the advancing line of the rot first appears as a watery dark-brown zone 1 to 3 inches wide. This dark area terminates rather abruptly in the ultimate cream-colored rot on one side and in the sound heartwood on the other. A microscopic examination of the diseased wood shows that the starch and other cell contents of the roots are first extracted; then the walls of the wood elements are gradually destroyed, especially the walls of the tracheids and vessels adjacent to the large medullary

rays. The bordered pits in the vessels are usually reduced to long, elliptical openings running transversely across the walls, and the bordered pits of the tracheids become large, round holes, which often coalesce, thus splitting the tracheids longitudinally. The pits of both large and small medullary rays are somewhat enlarged, while their radial and tangential walls are perforated with holes.

Even in the early stages of the rot, when the discolored spots are beginning to show in the sapwood of the roots, the vessels have colorless hyphæ in them, while in the later stages many of the vessels become filled with a mass of colorless hyphæ having filaments 4μ or less in diameter. The wood-parenchyma fibers show enlarged pits and perforated radial walls, and the pits in the wood fibers are also enlarged. The walls of the medullary rays are much corroded and often disappear entirely.

Only very slight evidence of delignification is shown by the chloriodid of zinc test. After standing 24 hours in this reagent there is a slight cellulose reaction in the walls of the vessels, tracheids, and wood fibers but none in the medullary rays. In making free-hand sections of the diseased wood the medullary rays and vessels are easily ruptured, owing to the thinning and weakening of the walls by the solvent action of the fungus.

The concentric splitting of the rotted wood usually occurs in the zone of the larger vessels, which are weakened by the corrosion of their bordered pits and walls. The longitudinal splitting is caused by the coalescence of the enlarged bordered pits of the tracheids and the thinned walls of the medullary rays. The discolored areas seen in the earlier stages of the rot are due to the presence in the cells of the medullary rays, wood parenchyma fibers, and sometimes in the lumen of the wood fibers of a brownish liquid, which disappears before the white stage of the rot is reached. In the final stage of the rot the wood is somewhat spongy in texture and when dry is easily crushed between the fingers.

Old sporophores were often found at different places on the collar of the diseased tree, due probably to the gradual rotting of the roots upward toward the stool of the tree and the formation of sporophores whenever a rotted area reached the collar of the tree or the underside of a root whose upper surface was exposed to the air. The sporophores are usually attached to the trunk of the tree at the surface of the ground, but they were also found on the exposed roots or even in rare cases on the ground, having been produced from hyphæ issuing through the soil from diseased roots lying a short distance below. Only one sporophore was found on the trunk at a distance above the collar of the tree, and in this case two trees had grown together at the butts for a distance of 12 inches. The rot had extended from the diseased roots upward in the injured sapwood of the oak along the juncture of the two trunks, and a small sporophore had formed 10 inches from the ground.

The sporophores when old and mature usually have a hard fibrous-corky to corky-woody context and a very rough, uneven, tuberculate upper surface, owing to the leaves, twigs, and other foreign substances falling on the upper surface of the growing pileus. (Pl. XXII, fig. 4.) After weathering for some months, the color of the pileus is a chestnut brown or sometimes becomes almost black and rimose. The old sporophores as a rule are partially destroyed by insects, especially the subhymenial layer and the adjacent ends of the pores. Portions of the outer pore surface, the central part of the context, and the base of the sporophores usually persist and can be found attached to the bases of the diseased trees for several years after maturity.

The mouths of the pores in the weathered sporophores are stuffed to a depth of 0.5 to 1 millimeter with a firm, brown mycelial mass, thus completely hiding all trace of the pores from a surface view. This stuffed pore layer becomes hard and brittle and gradually cracks in weathering and peels off from the deeper and more insect-eaten portion. Immature specimens shipped before being thoroughly desiccated have the tubes loosely stuffed with a delicate, white arachnoid mycelium, which appears on the spore surface as a thin creamy layer about 0.5 of a millimeter thick. This condition is probably due to a growth developed in the sporophore while in transit in a damp state. The stuffed mouths of the pores in old weathered sporophores is apparently a normal state of old specimens from certain sections of the United States. However, this stuffed condition of the pores in old sporophores is not always present, as several specimens both from America and Europe were seen by the writer in which the mouths were entirely free and open.

The tubes in all the specimens examined—both American and European—contain characteristic setæ. They are dark chestnut brown, thick walled, curved, cat's claw to hawk beaked in shape, giving them a somewhat bulbous-shaped base when seen in side view. They are 7 to 12μ thick at base, 15 to 24μ long, and usually project 10 to 20μ beyond the hymenial surface into the tube cavity.

The sporophores vary greatly in shape and size, ranging from 9 cm. long, 5 cm. wide, and 1½ cm. thick to 20 cm. long, 15 cm. wide, and 10 cm. thick, and may be simple or imbricated, depending to a great extent on the environment and food supply. In many of the thick sporophores growing from the collar of the tree the pore surface is borne at an angle of 40° to 60° to a horizontal plane. In the thinner and broader specimens the pore surface approaches more nearly the normal angle of other dimidiate sporophores. The margin is very thick and rounded in most of the specimens. The cavities left in the upper surface of the pileus by the drops of water which exude during the rapidly growing period of the sporophore are plainly discernible even in many of the old sporophores. The pore surface extends entirely to the point of attachment to the substratum even when the sporophore has a rounded substipe, as is often the case when it forms on the upper surface of exposed roots.

When sporophores are developed at the collar of trees growing in sandy land, the soil for 4 to 6 inches wide and 2 to 3 inches deep immediately at the base of the sporophore is often cemented into a hard, compact, bricklike mass, apparently by hyphæ, as many colorless fungous threads were found ramifying through it.

Polyporus dryadeus has been found attacking the roots of *Quercus texana* Buckl. and *Q. nigra* L. in eastern Texas. Some of the diseased trees were dying, while others were evidently in poor health. It has been found on *Q. alba* L. and *Q. velutina* Lam. in the Ozark National Forest, of Arkansas. The majority of the trees in the Ozarks affected with the disease caused by *P. dryadeus* were growing on sandy ridges and southern slopes where the soil was thin and conditions were unfavorable to rapid, vigorous growth. Two trees of *Q. minor* (Marsh) Sarg. were found with this disease in Oklahoma; one was dead and the other in apparently fair health.

Polyporus dryadeus also occurs in *Q. alba* L., *Q. rubra* L., and *Q. prinus* L. in Virginia, where seven trees were found with this rot; five were growing in crowded, unfavorable conditions, while one was standing at some distance from other trees and was apparently in good health. Yet at least two large roots of this lone tree—a white oak—were thoroughly rotted, while sporophores were found on three sides of the tree, one growing from the top of an exposed root. This sporophore was over 1 foot tall and at least as wide, judging from the old weathered remains. It was from this root that figure 5 of Plate XXII was taken. Of the five crowded trees one was much suppressed and would probably have died in a year or two. This tree was dug up, and studies were made of its roots, stool, and trunk. All of its roots, except three large lateral ones which ran near the surface of the ground, were completely rotted by *P. dryadeus*. The three living roots were partially rotted on the lower side and at the ends, but were still alive and strong enough to hold the tree in the ground. Old sporophores were found on all sides of this tree at the ground line.

The trees of *Quercus prinus* which were attacked by this root rot were found by Mr. G. F. Gravatt, of the Office of Investigations in Forest Pathology, who made the following statement concerning the diseased trees:

> Early in July at Bluemont, Va., three small trees of *Quercus prinus* were found which had been killed while in full leaf and which from a distance were mistaken for chestnut trees that had been girdled by the chestnut bark disease (*Endothia parasitica*). Whitish spots of mycelium were found on the bark of nearly every root, while the lower portions of the roots were so thoroughly rotted that the two smaller trees were easily pulled up by hand. The two small trees were somewhat suppressed, but the largest (3½ inches in diameter) was situated in an open space in the woods. These three trees were about 100 yards distant from each other.

The writer examined the rot from the roots of these diseased trees and found that it was caused by *Polyporus dryadeus*.

Four trees of *Quercus alba* were found affected with this disease in Maryland. All had been uprooted by the wind, two very recently, so that the character of the earlier stages of the rot and its progress in the roots was easily observed. In both of these trees the rot was only in the lower ends of the roots and had not reached the stool nor formed sporophores. Three of these uprooted trees were growing in dense stands and were much suppressed.

Oaks which have been uprooted by the wind may be separated into two classes: (1) Those whose root system has been weakened by insect or fungous attack and (2) those with a very shallow root system, due to the presence of impermeable layers of rock in the subsoil or to the ground-water being constantly near the surface of the ground (within 1 to 2 feet). Trees uprooted by wind owing to rotten roots have very little soil adhering to the upturned stool of the tree, as most of the roots break off within 1 to 2 feet of the base of the tree. On the other hand a tree with a sound root system brings with it when uprooted a large mass of earth several cubic yards in size. Bearing this in mind one can often distinguish, even at a distance, wind-thrown trees with sound roots from those overthrown on account of root-rot.

In every instance where the sporophores of *Polyporus dryadeus* were found on trees the roots were diseased with the same type of root-rot. In wind-thrown trees where the disease was not far enough advanced to produce sporophores the rot was identical with that obtained from the roots of trees which had sporophores of *P. dryadeus*. The rot in such uprooted trees evidently began at some point on the lower end of the roots and advanced up the roots toward the base of the tree, stopping, however, when it reached the surface of the ground. Roots lying very near the surface of the soil, especially large ones with their upper surfaces exposed to the air, are not entirely rotted or even killed by this fungus. Many instances of such superficial roots were found in which the part underground was rotted while the upper portion remained alive. The cross section of the root illustrated in Plate XXII, figure 6, shows the upper part alive, while the lower and more deeply buried portion is rotted. This root forked some 2 feet from the tree; one root, 10 inches in diameter, went down deep in the soil and was thoroughly rotten and dead; the other fork was 2 to 4 inches deep and was perfectly sound 2 feet from where the rotted root joined it.

The inability of the fungus to rot exposed roots and the trunk above the surface of the soil, coupled with the further fact that the sporophores usually are attached to what superficially appears to be sound wood, probably explains why the connection between this rot and the fungus causing it has not been previously noted. Trees in all stages of this disease were seen; some were already dead, others dying, others on the decline, while some showed no evidence of the disease until they were overthrown by the wind and the decayed roots were exposed. Some of

the trees bearing sporophores were apparently in a healthy condition, yet an examination of the root system showed in every case one or more large roots completely rotted Two stumps of *Quercus alba* were found with sporophores of *Polyporus dryadeus* springing from the rotted roots. In no instance were trees which were attacked by this fungus found in groups or even adjacent to each other The majority of the trees with this disease in their roots were growing under unfavorable environments. The boles of some of them were also attacked by various heart-rotting fungi, while others were perfectly sound above the collar, although they bore sporophores of *P. dryadeus* at the ground line.

No rhizomorphs of any kind were found associated with this rot, either beneath the bark, on the surface of the roots, or ramifying in the adjacent soil. How the lower part of the smaller roots became infected is not known.

The identity of the fungus causing this root-rot with the European fungus known as *Polyporus dryadeus* may be questioned. Through the courtesy of the officials in charge, the writer was permitted to examine all the American and European specimens of *P. dryadeus* in the following herbaria:

Pathological and Mycological Collections of the Department of Agriculture, at Washington, D. C., Herbarium of the New York Botanical Garden, and the Cryptogamic Herbarium of Harvard University.

Authentic specimens of *Polyporus dryadeus* from America, England, France, Germany, and Austria were examined, and a careful comparison of each with the material used as the basis of this article showed that the American plant under discussion is undoubtedly identical with the European fungus known as *P. dryadeus*.

There are three collections in the laboratory of the Office of Investigations in Forest Pathology, at Washington, D. C., of a Polyporus on *Tsuga heterophylla* from three widely separated localities in the State of Washington. These specimens were collected by C. J. Humphrey, of this office, and the legends accompanying them indicate that the sporophores were attached to the host at or near the surface of the ground and that the plant is a true parasite that kills the trees it attacks. These specimens agree in all essential characters, both gross and microscopic, with *Polyporus dryadeus*, and although the writer has not seen the rot produced in this host, he believes the fungus is this plant.

SUMMARY

(1) *Polyporus dryadeus* is a root parasite of the oak, producing a white sap rot and a heart rot in the roots.

(2) In all the trees examined this rot did not extend upward into the tree as a true heart or sap rot of the trunk, but was limited to the underground parts of the tree.

(3) The rot and sporophore described and figured by Robert Hartig do not belong to *Polyporus dryadeus*, but to *Polyporus dryophilus*.

(4) In the majority of cases only old or much suppressed trees or trees growing under very unfavorable conditions were found attacked by this disease.

(5) The disease does not seem to spread readily to adjacent trees.

(6) The disease is widely distributed both in America and in Europe and is probably found in these countries throughout the range of the oak.

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DESCRIPTION OF PLATES

PLATE XXI. Fig. 1.—*Polyporus dryophilus:* A median-longitudinal section of a sporophore on *Quercus alba* from Arkansas, showing the granular core and the white mycelial lines in the central and rear portion.

Fig. 2.—*Polyporus dryophilus:* Side view of the ungulate type of sporophore on *Quercus californica* from California.

Fig. 3.—*Polyporus dryophilus:* Median-longitudinal section of the globose type of sporophore on *Quercus garryana* from California, showing the large granular core and prominent white mycelial lines.

Fig. 4.—*Polyporus dryadeus:* Median-longitudinal view of a young sporophore on *Quercus texana* from Texas, showing the fibrous, non-granular nature of the context.

Fig. 5.—*Polyporus fulvus* Fries: Median-longitudinal view of a sporophore on *Quercus* sp. from Sweden, showing the granular core characteristic of *P. dryophilus.*

Fig. 6.—*Polyporus vulpinus:* Median-longitudinal view of sporophore on *Populus* sp. from Sweden, showing the granular core characteristic of *P. dryophilus.*

Fig. 7.—*Polyporus dryophilus:* Front view of the applanate type of a sporophore on *Populus tremuloides* from Colorado, showing the faint zones on the pileus where the hairs have disappeared.

Fig. 8.—*Polyporus dryophilus:* Median-longitudinal view of sporophore on *Populus tremuloides* from Colorado, showing the granular core originating between the sapwood and bark and extending into the center of the sporophore.

XXII. Fig. 1.—*Polyporus dryophilus:* Radial-longitudinal view of the rot occurring in *Quercus* sp. from Europe and said to be the rot produced by *P. dryadeus.*

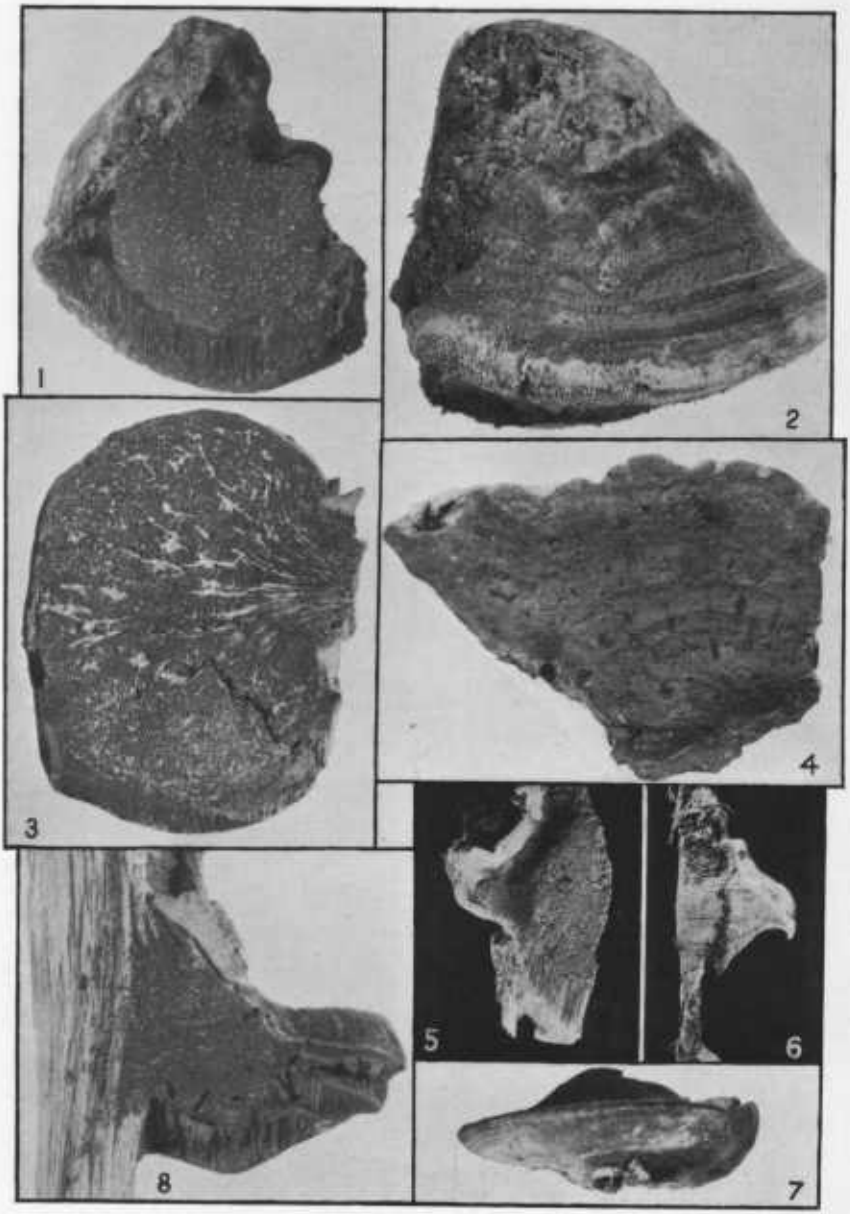
Fig. 2.—*Polyporus dryadeus:* Cross section of a small root of *Quercus alba* from Maryland, showing the mottled appearance of the diseased wood in the middle stages of the rot.

Fig. 3.—*Polyporus dryophilus:* Radial-longitudinal view of the rot appearing in *Quercus alba* from Arkansas, showing the advancing line of rot in a branch.

Fig. 4.—*Polyporus dryadeus:* Upper surface of a sporophore on roots of *Quercus texana* from Texas, showing the rough tuberculate pileus.

Fig. 5.—*Polyporus dryadeus:* Rot occurring in an apparently sound root of *Quercus alba* from Virginia, showing cross section of a diseased root, immediately adjacent to the point of attachment of a large sporophore of *P. dryadeus*, 1 foot high and 1 foot wide. Some sound, living wood is still present.

Fig. 6.—*Polyporus dryadeus:* Cross section of diseased root of *Quercus alba* from Virginia, showing the nearly sound, living upper half of the root and the badly diseased lower half.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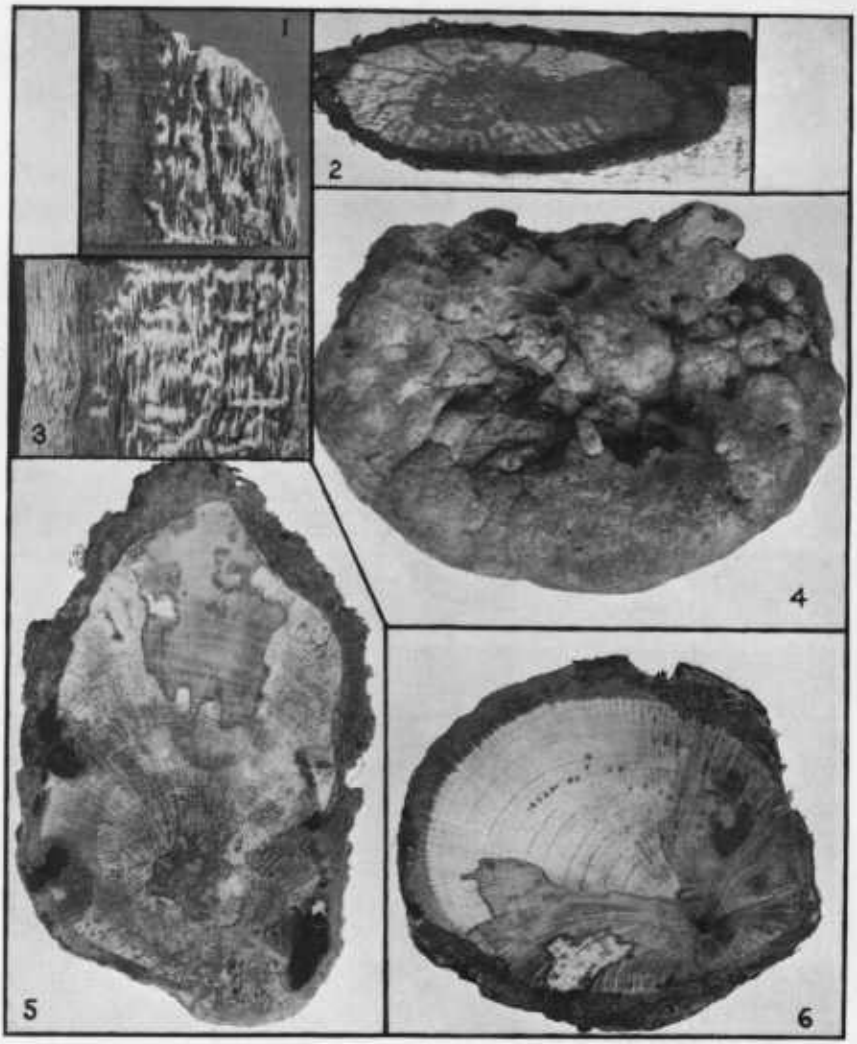
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