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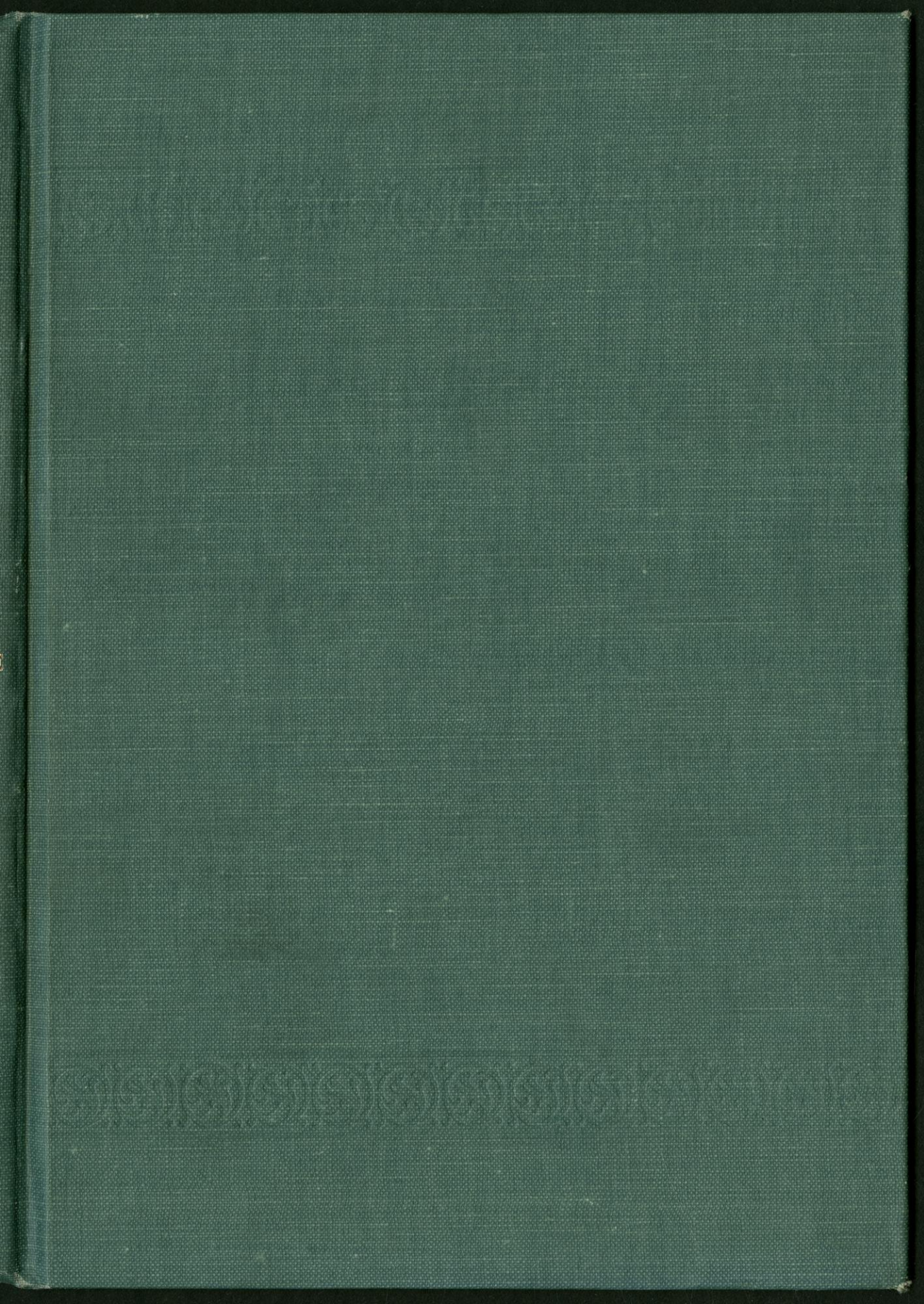
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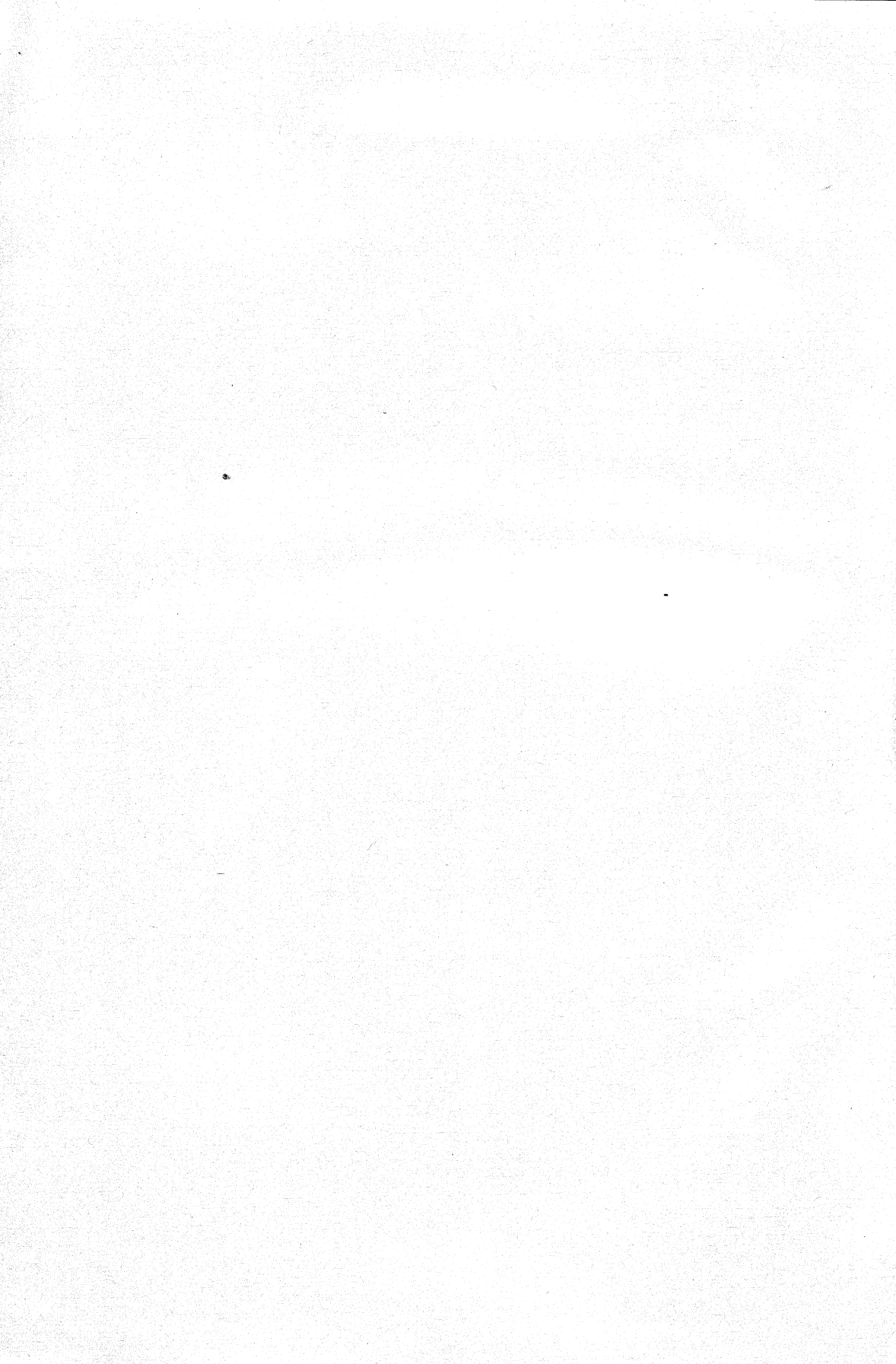
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WISCONSIN GEOLOGICAL AND NATURAL HISTORY SURVEY

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BULLETIN NO. XXXIII

SCIENTIFIC SERIES NO. 40

THE
POLYPORACEAE OF WISCONSIN

BY

J. J. NEUMAN

MADISON, WIS.
PUBLISHED BY THE STATE
1914

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THE POLYPORACEAE OF WISCONSIN

J. J. NEUMAN.

This great family of fungi is represented in Wisconsin by a large number of species, belonging to all the commonly accepted genera except *Cyclomyces*. Many of them are common in all parts of the state but a few have so far been found only in certain regions. *Polyporus volvatus*, for example, is of course found only in the northern part of the state where its host, the pine, grows in considerable abundance. Many other species that have been collected only in the northern part of the state will probably also be found in the southern part, as their hosts, and the conditions necessary for their growth, are present in both regions. For example, *Fomes marginatus* grows on various deciduous trees, but it has thus far not been collected in the southern part of the state with the exception of one specimen which was found growing on a hickory stump in Madison.

The group includes parasitic, saprophytic and terrestrial species.

To the latter belong the *Boleti*, *Boletini*, *Strobilomyces* and *Poria terrestris*. The great majority, however, belong to the first two groups and it is not yet clear as to many wood inhabiting species whether they are in a strict sense parasitic or saprophytic.

The collections on which the following account is based are now in the herbarium of the University of Wisconsin. They were made during a period of six or seven years by a number of collectors. By far the largest number of species was collected by the writer on special excursions into our northern forests. The brief account of the distribution and relation of the polypores to various decays in timber trees is largely the result of a special study of certain of our northern forest regions which were worked over in the summer of 1904, while the author was employed as a special agent of the United States bureau of Forestry. Abundant specimens of wood in various conditions of decay were collected and later worked over microscopically.

Following are the names of some of the principal collectors who have contributed material for the present work: F. E. McKenna, Blanch-

ardville, Iowa County; Prof. L. S. Cheney, Lake Superior Region; B. O. Dodge, Algoma, Kewaunee County; Dr. R. H. Denniston, Dane and Sauk Counties; Dr. C. E. Allen, Dane and Sauk Counties and Madaline Island; Dr. J. B. Overton, Brule River Region; Dr. R. A. Harper, Dane and Sauk Counties.

A large number of specimens have been sent to specialists for determination and comparison, and I am especially indebted to Dr. C. H. Peck, Prof. J. B. Ellis, Prof. A. P. Morgan, Dr. N. Patouillard, Prof. G. Bresadola, and Dr. Paul Henning for numerous identifications and notes on difficult and obscure species. I am also indebted to Prof. R. A. Harper for numerous suggestions and assistance in many ways.

**The Distribution and Abundance of Polyporaceae causing the
Decay of Timber Trees in certain Regions of
Northern Wisconsin.**

The territory in which I more specially studied the relations of the polypores to the decay of timber trees, lies in Oneida, Vilas and Ashland counties, all of which are in the northern third of Wisconsin. In Oneida county seven townships were quite thoroughly covered. Here the most careful study was made of the Yawkey Lumber company's stand of timber. In Vilas county about two townships north and west of Star Lake were studied, consisting largely of the Merrill Lumber Company's and Longely and Alderson's timber. In Ashland county a little over one township was covered and practically all the work was done in the Nash Lumber Company's forest near Shanagolden.

In Oneida county most of the land has been cut over and much of it is covered with a young growth of poplar, birch and maple with here and there a sprinkling of red and white pine. The forest which has not been cut consists of white and red pine (*Pinus Strobus* L. and *Pinus resinosa* Ait.), hemlock [*Tsuga canadensis* (L.) Carr] a little fir [*Abies balsamea* (L.) Mill.], and now and then a group of jack or gray pines (*Pinus Banksiana* Lamb). In the swamps, spruce [*Picea mariana* (Mill.) BSP], arbor vitae (*Thuja occidentalis* L.) and tamarack [*Larix laricina* (Du Roi) Koch] abound. Some deciduous trees are also found here but not in great abundance except in the new growth. Chief among these are sugar maple (*Acer saccharum* Marsh.) a little red maple (*A. rubrum* L.) red oak (*Quercus rubra* L.) yellow and red birches (*B. lutea* Michx. and *B. nigra* L.), American

aspen (*Populus tremuloides* Michx.), and at rare intervals an ironwood (*Ostrya Virginica* Willd.).

In the region around Star Lake the same kinds of trees were found but the proportion of deciduous trees is greater. Birches, poplar and scarlet oak (*Quercus coccinea* Muench) make up a very large part of the forest here. In some districts the forest is made up entirely of deciduous trees, with here and there a white or red pine and a few dwarfed firs. The swamps in this region are covered with spruce, tamarack and arbor vitae.

About Shanagolden, Ashland County, there are very few pines, some hemlock, and in the swamps, spruce, tamarack, willow and arbor vitae are found. The bulk of the forest here consists of red birch (*Betula nigra*), elm, (*Ulmus Americana* L.) and hard maple. In all of these districts the standing timber, the new growth, burned areas and fallen trees were carefully studied, since all of these furnish data as to the prevalence and destructiveness of timber diseases.

The age of the trees in the uncut forests is quite variable. In the older stands, the Norway pine often attains an age of one hundred to one hundred and fifty years, while large white pine stumps have two hundred rings of growth. Some of the largest of these trees have diameters of from twenty-five to thirty-six inches. The firs and spruce seldom reach a diameter of twelve inches at ages of not more than ninety-five years. Arbor vitae were measured at Shanagolden that had diameters of fifteen and sixteen inches at ages probably over one hundred fifty years. (As the center was decayed entirely in these trees their precise ages could not be determined.) These trees were seldom more than fifty or sixty feet in height. The birch, as in the sandy soil of Oneida and Vilas counties, was scrubby and not good for lumbering purposes, rarely exceeding from eight to eleven inches in diameter, and ranging in age from seventy-five to one hundred and twenty years. In the much richer soil of Ashland county, the red birch is considered one of the most valuable of the trees for lumbering purposes. Here the trunks often attain diameters of from one and one-half to two feet at ages not over one hundred twenty-five years. The elm grows very large here and is very valuable. The maple never acquires a great size or high age in any of these counties and much of it cannot be used for lumbering purposes, for reasons to be mentioned later. It acquires the largest size and best shape in Ashland county, the largest ones here measuring about fifteen inches in diameter and from fifty to sixty feet in height. The ages of these trees vary from eighty to one hundred years. Much of the maple at Shanagolden is cut into cord wood. Tamarack and spruce rarely attain

great size here. The largest tamarack trees were found near Razorback Lake in a small swamp in the Star Lake Region. Some of these measured thirteen inches in diameter, with an altitude of about seventy feet and an age of one hundred and ten years.

It is a conspicuous and very important fact that in the region studied, the soundness and healthiness of the trees vary greatly with the locality and with the kind of tree. Certain diseases are, or seem to be, confined to limited localities. One foreman of the Yawkey Lumber Company who has had many years' experience in the woods told me that in the two forties lying between Carr and Horsehead lakes, which are just being cut over, there is a great deal of "ring rot", or "dry rot", while in the cuttings several miles west of these there is very little. A train load of twenty-two cars of logs were counted one day and the proportion of logs showing signs of decay was obtained. In all there were three hundred and one logs of red and white pine of all sizes ranging from seven inches to about thirty inches in diameter. Of these sixty-two showed more or less signs of the ring rot, or twenty and one-half per cent. Six logs had rot produced by *Polystictus abietinus*, or a little less than two per cent. Very little of this rot was found on red pine. The percentage of infected red and white pines in the Star Lake Region is somewhat less.

A large proportion of the hemlock is infected by *Polystictus abietinus*, especially near the edges of the forest and in the more exposed parts of it. Fir is comparatively healthy in the Carr Lake region. There is very little here and it is widely scattered. Firs of more than four or five inches in diameter and sixty or seventy years of age are comparatively rare. In the Star Lake region at least eighty per cent of the fir trees are infected, chiefly with *Fomes unguilatus*.

Birch is very much infected with *Fomes fomentarius*, *F. nigricans* and *Polyporus betulinus*, especially in Oneida and Vilas counties. In a small area of about ten acres, out of ninety-seven trees forty-three were infected, or forty-eight and three-tenths per cent.

The spruce is relatively free from rot. Near McNaughton several larger trees were found infected, one with *Trametes pini* and several with *Polystictus abietinus*. In some swamps a large number of spruces, especially young ones, were infected with a leaf rust which often kills young trees from two to ten years old. The older trees seem to be more or less immune from this disease, or have only the lower branches infected. In one swamp near Star Lake a few witches' brooms were found on spruce; the cause of these is as yet uncertain.

The per cent of tamaracks which are diseased is very variable. In some of the little swamps scarcely a pileus can be found on a tam-

arack, while in others often as high as seventy trees out of one hundred are infected. Near Razorback Lake there is a little tamarack swamp of about twelve acres. There are many large trees here having diameters of over eleven inches and ages of from eighty to one hundred and twenty years. Here a very large proportion is infected with *Trametes pini*, *Fomes unguatus*, *Lenzites sepiaria*, *Fomes roseus* and a very few with *Polystictus*.

Of the arbor vitae nearly eighty-five per cent of the older trees are hollow in all of the regions gone over, but no fungus was found which could have been assigned with certainty as the cause, although several hundred trees were minutely examined. The decay extends over half way up into the trunk and usually down into the larger roots. In these large roots there are often loose whitish or greyish white wood fibres but in the upright trunks the cavities are usually empty. The early stages of the rot could not be found in any of the specimens examined. The youngest tree found infected was about two inches in diameter and about eighteen years old. This tree had a well formed cavity nearly an inch in diameter, but this cavity did not extend down into the roots. Judging from the appearance of the cavities and the rotten wood, this disease seems to be very similar to the disease caused by *Fomes juniperinus* described by Von Schrenk, on red cedar.

In the region studied, maple, at least the hard maple, is seldom fit for lumber. The trunks are quite universally cracked, apparently by frost. This opens the door for wholesale infection. *Fomes conatus*, *Hydnum septentrionale* and *Polyporus resinus* are also found in living trees.

Elm was found only in Ashland county. These trees are tall and graceful, the largest being from two feet to two and one half feet in diameter and at least one hundred and fifty years old. Most of these trees are said to be "shaky" in the butt to the height of about four feet, that is, they are checked and cracked. This, however, does not seem to be due to infection. *Fomes nigricans*, although not as abundant as on maple, produces a rot in the elm similar to that produced in maple by the same fungus. One large pileus which has at least thirty strata was found on a living elm whose interior was quite decayed. *Polystictus conchifer* is often found in the lower dead limbs of the elm, but it was not evident that the fungus was the cause of the death of these limbs. *Lentinus Lecomptei* grows quite abundantly out of old elm logs or dead standing trunks, but nothing was determined as to its possible presence in living trees.

In Oneida and Vilas counties the birch is nearly all defective except the young growth, which covers the cut-over areas. Many trunks, both living and dead, show numerous pilei of *Fomes fomentarius*, *F. nigricans* and *Polyporus betulinus*. Frequently they are also infected with *Fomes marginatus*, *Polystictus pergamenus* and *Fomes applanatus*. The last named, however, was never found on a living birch, but only on much decayed trunks. *Fomes applanatus* is quite frequently found growing out of wounds in the trunks of living oaks. I have found such specimens near Horicon in Dodge county, Oakfield in Fond du Lac county, and Bangor in La Crosse county.

In Ashland county the birch is healthier and here it forms one of the most valuable trees for lumbering purposes. In this region *Polyporus betulinus* is quite rare. *Fomes nigricans* seems to be the usual cause of disease in the birch here also. Two dead trees were found infected with *Armillaria mellea*.

Poplar in all of these regions is infected to quite an extent with *Fomes nigricans. populinus*, *F. fomentarius*, *Polystictus pergamenus* and *F. applanatus*. *Fomes nigricans* and *Polystictus pergamenus* were frequently found growing on living trees with every appearance of being active parasites.

Polyporus Schweinitzii is a frequent cause of disease in hemlock, fir and white pine, especially in the Shanagolden district. This is the only fungus in the whole region whose mycelium seems to enter the tree through the roots. The rest seem for the most part to gain an entrance through wounds.

Many other polypores as well as agarics and hydnums were collected from decayed logs, stumps, chips and roots, but evidence was not available as to the nature of the decay they produce. One species, *Polyporus maculatus* Pk., was frequently found on pine stumps partly or wholly decayed by *Fomes unguatus*. *Fomes lucidus* was found on hemlock stumps near Glidden, apparently producing a rot peculiar to itself. However, it was never found on standing trunks and the decay was of limited extent. *Trametes odorata* was found associated with a brown rot not unlike that produced by *Fomes carneus*, on hemlock logs. I have found this fungus very abundant under bridges and sidewalks at Horicon, Dodge county, Sparta, Monroe county and Bangor, La Crosse county, always associated with the same brown rot, sometimes on pine timber but more often on hemlock planks. I have not found it on living trees. *Lenzites sepiaria* was found on various species but chiefly on hemlock and tamarack, producing a brown rot apparently not unlike that of *Trametes odorata*.

Fomes carneus was found abundantly on logs of white pine, spruce and tamarack. No specimens were found on living trees. One small distorted specimen was found on the under side of an arbor vitae log.

In a small area of less than an acre in the Yawkey Lumber Company's stand there were twelve red pine and two white pine trunks which showed numerous pilei of *Polyporus volvatus* Pk. growing out through the bark. Two of these trees (red pines) were living. A few had apparently been dead several years while most of them had been killed by a fire the year before. Near Lake Catharine was a large living white pine which showed several pilei of the same fungus. Whether this fungus ever causes the death of trees was not determined. It is possible, however, that it does have some effect upon the wood, especially in the immediate neighborhood of the holes produced by bark borers, out of which its pilei seem almost always to grow. Still, the mycelium sometimes spreads under the bark and this may be sufficient to injure the tree.

In their abundance and relative destructiveness to timber the species show a wide range of variation. I shall next describe in more detail those forms which in the region studied were evidently of the greatest economic importance in destroying the living or dead trunks of the more valuable timber trees.

Polystictus abietinus (Dicks) Fries.

This fungus looks very much like *Polystictus pergamenus* in color, shape, habit, and pores, but the latter grows only on deciduous trees, while the former grows only on the conifers. The zones are often quite distinct as concentric sulcations. The pores are larger than those of *P. pergamenus*, but shallower. When growing the pores are violet and they retain much of this color in drying. When old, the hymenium becomes torn into teeth and the pileus becomes more and more incurved. Trees are often covered from the ground upward for from twenty to fifty feet with the pilei which grow out through the bark.

Infection takes place through wounds. In all the trees examined that were infected with this fungus it was perfectly plain that the entrance of the fungus was through a wound. The pilei are found growing out of the region of the trunk where the tree was wounded, and from this region as a center, they spread, appearing successively in some cases for fifty feet or more up and down the trunk. They are found on trees of all sizes and ages whenever there is an opening through the bark made so that the spores can gain an entrance. Oc-

asionally the pilei grow out of holes made by bark borers. One spruce tree in a swamp near McNaughton had been barked for an area four feet long and from three to five inches in width, by the felling of a pine tree nine years before. On this wound numerous pilei were growing. A few scattered pilei were growing also out of the bark above this wound for a distance of twenty feet. Wood specimens were cut out as far as the pilei extended and the characteristic decay of the wood was evident. We have thus the evidence as to the rate at which the fungus spreads when once it gains a foothold in a tree. The remainder of this tree was alive and the top comparatively thrifty. In all, seven living trees were found infected whose tops indicated a greater or lesser degree of thrift.

Near Carr Lake a red pine stump was found infected with this fungus. The tree, which was perfectly sound and healthy, had been cut the year before. On one side, the wood had been somewhat slivered by the felling of the tree. Here infection took place. This infection was only *one year old* and minute pilei were just forming. no rot was noticeable to the naked eye. The mycelium that was growing out of the wood and bark to form pilei was white and velvety. It was plain that the first three rings of growth contained mycelium since it was out of these rings that the pilei were growing. Infection seemed to have taken place in the side through the split surfaces and not from the top through the sawed surface of the wood. This white cottony mycelium was also found spreading under the bark to some extent.

Infected dead trunks both standing and prostrate are abundant in some areas. This is especially true in exposed parts of the forest, viz., near the edges of the forest bordering on clearings or the shores of the lakes. In these places, there are many wind-felled trees lying in different directions and many cases of wounding can be traced to the falling of these trees. This probably accounts for the abundant infections in such localities. In an area of about an acre between Little Tomahawk and Carr Lake, thirty to thirty-five standing trunks were found infected out of a total of one hundred and twelve trees, besides many prostrate trunks. All of these were hemlocks with diameters varying from eight to fifteen inches. These trees were especially exposed to winds from two directions. I cut one tree about eleven inches in diameter and one hundred and fifty years old to determine the extent to which the wood was affected. The pilei were found present to the very top, which was dead. About thirty feet from the top there were about half a dozen living branches. On the side on which the living branches were found,

there was a narrow strip of wood not yet infected, extending from the base of the trunk to the living branches. On the other side, the characteristic rot was co-extensive with the fungus. Frequently the tops are dead in trees infected with this fungus, but in all of these cases it was found that the fungus had actually spread to the top instead of encircling the trunk at the point of infection. Another tree which was wounded some thirty feet from the base was cut down to determine whether the fungus spreads downwards. Upwards from the wound traces of the fungus were found to a distance of some twenty feet, but downwards it had spread less than ten feet. From this it would seem that the fungus spreads upwards more rapidly than downwards.

Trees killed by the fungus often remain standing for many years before they are blown down. This is because the heartwood is usually sound. One tree trunk was found near Star Lake in which the sapwood was decayed by *P. abietinus* and the heartwood by *Fomes pinicola*. This trunk was about twelve inches in diameter but I easily broke it off and by stepping on it, crumbled it into minute pieces.

The general effect of *P. abietinus* on fir, spruce, and tamarack, is the same as that on hemlock, but the percentage of infected trees is much less than for hemlock, being least in white pine. Stumps and branches of red pine were quite frequently found infected. Very often the white mycelium was found spreading in strands between the bark and the wood. In these cases the bark loosens easily from the wood. Often when the pileus grows out of a hole made by a bark borer, the white mycelium is found spreading in every direction between the bark and the wood, the greater growth being upward. The cambium being destroyed, the bark becomes loosened and that part of tree dies.

Whenever there are cracks in the wood, it is found that the mycelium follows them very readily and pilei are formed at the openings of the cracks where the mycelia issue in strands. This would seem to show that the mycelium spreads most easily in the direction of least mechanical resistance. The hyphae which run lengthwise through the cells are always the largest and best developed. These large hyphae pierce the end walls of the tracheids quite easily. The end walls are perhaps less resistant than the lateral walls. Whether the path of sap flow has something to do with the direction of the growth of the hyphae, is difficult to determine. There does not seem to be any spread of the fungus in the bark.

The rot produced by the fungus is characteristic and unlike any other rot I have observed, though in some respects it resembles the

rot produced by *Polystictus pergamenus*. The latter, however, as noted, is found only on deciduous trees. Both fungi produce rot in the sapwood. Neither seems to penetrate more than an inch or two into the wood. When branches are infected, the rot may soften them through their entire diameter, if they are not too thick.

My observations support the generally accepted view that the breaking down of the wood cells is due to an enzyme produced by the fungus. The lignified walls seem first to be changed to cellulose and the latter is then dissolved.

There is hardly a change in the wood visible to the unaided eye, when the fungus first begins to spread, after infection. Wood of a red pine that had been infected for less than a year appeared somewhat greyish in color in and about the regions where young pilei were growing out. Otherwise nothing could be seen of rot or decomposition with the unaided eye. Sections under the microscope, however, showed unmistakable signs of decomposition. Here and there the inner lamellae of the large tracheids as well as of the smaller wood fibers showed traces of reduction to cellulose when tested with zinc chloriodide. Staining with ruthenium red showed the middle lamella unaffected. The ray-cells also showed the action of the fungus, the walls of many having been broken down more or less completely. The inner layers of the cell wall seem to be attacked first and slowly changed to cellulose, as is shown by their more or less deep blue color when treated with zinc chloriodide. The inner surface of the lamellae becomes irregular as though it were dissolved unequally.

The wood, when it begins to decay, may become a trifle paler in color. Sometimes the very earliest stages are characterized by a dark or grayish color, as stated above, but this is not a constant characteristic. Again there may be irregular black lines in the wood next to the bark, but this is also not constant. The cells in these black lines seem filled with a dark brownish substance insoluble in alcohol. Mycelium is usually abundant in cells near these lines.

A little later there are numerous white streaks passing through the summer wood of the rings of growth, both tangentially and longitudinally, thus marking off the wood into more or less rectangular areas. Near these white lines the microscope reveals numerous hyphae running generally in the direction of the streaks. Later, the wood fibres break down along these lines, making little pits and holes which increase in size as the decay advances.

Some tracheids break down quite completely, while others are intact and form anastomosing strands which intersect at right angles and are full of air, giving them a white appearance. The wood

thus becomes filled with small holes and becomes soft and brittle. The fall wood is left more or less intact as a thin brittle shell, making the growth rings more or less easily separable.

The larger and more vigorous hyphae are usually found growing lengthwise up and down the cells but are not as much tangled and matted as the hyphae of *Polyporus borealis* figured by Hartig. The horizontal hyphae are fewer in number, straighter and much thinner than the others. They seem to be able to penetrate the radial walls more easily than the tangential ones. Probably most of the radial distribution of the fungus takes place through the ray cells. The hyphae in the ray cells are always quite small and never abundant, although their action on these cells is always prominent.

The hyphae do not always pass through the pits of the cells but appear to be able to penetrate the walls at any point.

Polystictus pergamenus Fries.

This is one of the commonest forms of the *Polysticti*, growing on maple, willow, oak, birch and poplar. It is easily recognized by its leathery consistency and purplish hymenium. The dissepiments are usually torn into teeth or plates so that older specimens might often be taken for species of *Irpeex*. The hymenium turns brown with age. The pilei are thin, profusely imbricated and laterally confluent.

This species seems to be closely related to *P. abietinus*, described above. The latter, however, is smaller, more hirsute and concentrically sulcate and grows only on Coniferae, while *P. pergamenus* grows only on deciduous trees.

P. pergamenus is quite frequently found in living oak, maple and poplar. The trees thus infected are always in a poor condition of health and are often found in the last stages of life. On one side of an oak tree even some of the large branches had pilei growing out of their sides. The larger part of the tree was dead, and the rest was not very vigorous. It was evident that this tree would soon be entirely dead. On the side infected, the bark was cracking and loosening.

Infection of living poplar is more rare, and then it is usually found to be confined for the most part to the areas immediately surrounding a wound. Nor does the bark seem to crack and loosen in poplar as in oak and maple. It would seem that in the poplar the spread of the fungus through the wood occurs after the death of the tree, or at any rate the spread here is very slow.

In all cases where living trees are infected it was found that they had been wounded, and in most cases pilei were growing out of the wound or out of the bark in the immediate neighborhood. In one case the fungus had evidently gained an entrance through a wound caused by the breaking of a limb and from here had spread into the trunk.

This species is found abundantly in all parts of the state, and is confined chiefly to the hosts named above. In the northern part of the state where birch is plentiful, it is most abundant on dead birch logs and limbs. I never found it on living birch trees.

In the southern part of the state it is most abundant on oak and poplar. The poplar is apparently usually attacked when dead, pilei on living trees being quite rare.

In all cases which I have observed, trees infected with this fungus were found to have been wounded and usually pilei were growing out of the wounds and about them. A typical case was that of the poplar (*Populus deltoides*) from which specimen No. 226 was taken. The tree was about eight inches in diameter and could not have been more than twenty years old. About two feet from the ground there was a wound about ten inches long and three to four inches wide. The process of healing had progressed for several years. The exact time was not determined. In and about this wound there were numerous pilei of *P. pergamenus*. The disease had not spread very far, for pilei were found only a few inches above and below this wound. I have found no more exact data regarding the rapidity of spread in either poplar or oak. However, since oak trees are frequently found covered from top to bottom with pilei, one is inclined to think that the disease spreads more rapidly in oak.

In general, the decay is a sap rot and is somewhat similar to that produced by *P. abietinus* in the Coniferae. Only the sapwood is affected, and this only to a depth of an inch or two. The wood, especially that of the oak, becomes much lighter in color and weight. Oak wood thus decayed is of the color of poplar but the grain of the wood still appears unchanged. The resistance of the wood fiber is completely destroyed, so that it is possible to rub most of it into a white powder between the fingers and thumb. If sections of this wood be treated with phloroglucin and hydrochloric acid, they will show abundant lignose still present; but sections treated with zinc chloriodide show also some traces of the cellulose reaction.

These changes do not show quite so clearly in poplar. This may be due to the fact that the color of poplar is naturally light and the texture of the wood is soft and spongy.

The specimens of this rot especially studied were taken from a scarlet oak (*Quercus coccinea*) about one hundred and fifty years old, in the vicinity of Bangor, La Crosse County. The pilei grew out of a large wound and out of the bark just above the wound. Although the wood was decayed to a depth of an inch to one and one-fourth inches, or through twelve to sixteen rings of growth, yet the decay had not progressed more than an inch or two above the wound. Laterally the fungus had spread very slowly also. Some dead bark remained on the wounded part. Out of this abundant pilei were growing. The new wood formed in the healing part was not affected by the fungus and was gradually covering the decayed wood. The ring of growth next to the one affected was almost entirely sound, forming an abrupt boundary line between the decayed and the healthy wood. From this it would seem that it is difficult for the fungus to penetrate the wood radially, from one ring of growth to the next, and that when a ring has been penetrated the infected region is almost completely destroyed before the next ring is attacked.

The effects on the walls of the cells are about the same in poplar as in the oaks. The ray cells are among the first to be attacked.

In the poplar the hyphae are quite abundant in all the cells, but in the oak they are less abundant. Here, as in the case of *P. abietinus*, the largest and the most abundant hyphae go through the cells lengthwise. They give off smaller branches, which penetrate the lateral walls. Sometimes the hyphae go through the pits.

Lenzites sepiaria Fries.

Though not a polypore, I shall describe this fungus here because of its similar habit and relation to decay of timber. This fungus is easily recognized by its sepia brown color with lighter margin. At every rain, during the first part of the season, this margin seems to revive and grow. The gills when first formed are of a light cream color like the young margin but on maturing the whole fungus grows dark.

L. sepiaria is a very common fungus in all parts of Wisconsin, growing chiefly on hemlock, pine, spruce and tamarack. During wet seasons the pilei are found growing abundantly out of bridge timbers, planks in sidewalks and sleepers. In the forest the pilei were found on fallen trunks of tamaracks, white and red pine, and spruce. They were more rare on dead standing trunks and were never found on living trees.

Since neither the pilei of the fungus nor its characteristic rot was found in living trees, it appears that it is strictly saprophyte attacking the wood only after the tree is dead. The effect, however, on the cells is not much different from that of *Fomes pinicola* as described by Von Schrenck and by Hartig.

In general, the pilei seem to grow out of cracks in the wood, and the decay also follows these cracks to some extent. Wherever there is abundant mycelium, and especially in the neighborhood of pilei, the wood is often colored a sepia brown by a coloring matter which appears also to be dissolved out by the rain. This coloring matter is very soluble in ammonium hydrate. Wood containing the mycelium or the coloring matter turns very dark, almost black, when treated with ammonia, as does also the pileus.

The wood destroyed by this fungus becomes brown, paler than in the case of the rot produced by *Fomes carneus* and *F. pinicola*, but otherwise it looks quite similar. The wood becomes cracked and shrunken. This cracking occurs for the most part transversely and longitudinally, sometimes also radially, forming irregular cubical fragments. In advanced stages the wood can be rubbed to a fine powder with the fingers. The cracking is evidently due to the shrinking, as Hartig suggests, probably because of the removal of moisture and cell-wall substances by the fungus.

Nothing definite can be stated about the method and time of infection, nor as to the rapidity of development. It seems certain, however, that infection takes place in the openings that occur in the wood, such as cracks and holes, and in the porous ends of rough transverse cuts. In such places the pilei will be found, and in the neighborhood the wood shows the effects of the fungus. Bridge timbers that become checked from weathering are always in danger of attack by this fungus. I have never found it on well painted timber, unless it showed cracks or holes.

The earliest stages of decay that were studied were found in a piece of hemlock out of which a pileus one and one-half inches broad, and one inch long was growing through a hole in the bark one-quarter inch deep, made by a bark borer. The wood underneath this pileus for a distance of three inches above and below this hole, and one inch in width, showed stages of decay. To a depth of about one-quarter inch the wood was turning brown but showed white spots and stripes. Underneath this to a depth of nearly three-quarters of an inch the wood had its natural color but was mottled with whiter spots and stripes. These white spots and stripes are in the summer wood, and the darker

ones in the fall wood, as though the thick-walled cells were more resistant.

The wood during this stage is comparatively brittle and can be broken into small pieces with the fingers, but cannot be pulverized as in the later stages. Later, all the wood affected turns to a pale brown and is very brittle. The effect on the wood cells is well marked, and similar to the effect produced by *Fomes pinicola*, *Trametes odorata* and *Fomes carneus*.

The hyphae appear strong and vigorous, light colored and much tangled. They develop chiefly lengthwise through the cells, not penetrating through many layers of cells. This perhaps is why the decay and the development of mycelium follows the cracks and chinks in the wood, the lines of least resistance. Strong and vigorously growing hyphae usually contain large bluish-green granules, as shown in Fig. 9, which are soluble in alcohol, but are made clearer and somewhat darker with ammonia.

Trametes pini (Thore) Fries. Ring Rot. Dry Rot.

Looked at from above, the pileus appears hoof-shaped or ungulate, but the lower surface is concave and usually uneven. The base is usually decurrent, and out of it very often several small pilei spring, so that the sporophores thus become imbricated and confluent. The young actively growing portion is of a rich golden brown color, soft and velvety, but soon changes to dull ferruginous and becomes rough, almost strigose. The surface finally becomes black and covered with moss and lichens. The concentric furrows or sulcations are narrow and numerous. The margin is thin and acute; the substance of the pileus hard, of a rich yellowish brown. The pores are small and regular in the younger parts but become larger and more irregular, almost sinuous, in the older portions. The tubes usually become more or less white-stuffed. From the walls of the tubes project numerous large awl-shaped cystidia, which are sometimes one-fifth of the diameter of the tube in length and of a deep red-brown color.

T. pini was found on tamarack, white pine and hemlock. In Oneida and Vilas counties it was found most abundant on tamarack and white pine, and in Ashland County on hemlock and tamarack. The fruiting bodies were rather rare on white pine but abundant on tamarack. They were found on both living and dead trees. In the case of hemlock only, were they found on fallen trunks.

Although the sporophores were rare on white pine, yet I believe that white pine was abundantly infected—more than any of the others.

Many large white pine trunks when cut down show the characteristic rot due to this fungus, but when the trunk is examined minutely one fails to find the fruiting bodies. Occasionally swellings or lumps called "punk knots" by the lumbermen are seen some distance up the trunk on infected trees. When cut open, it is found that these knots are found by the healing over of the ends of broken branches. These old branch stubs are usually very much decayed, and together with a mass of yellowish-brown mycelium, fill the cavity of the knot. In a few instances small sporophores were found growing out of the end of the punk knots. In all instances where pilei were found on white pine, they occurred at places where a branch had been broken off. On hemlock and tamarack the pilei appeared at other places on the trunk as well. This agrees with Von Schrenk's observations (Bull. 25, page 36). Another striking feature is the fact that no matter how much or how little the trunk is decayed, or over how great an area the infection had spread in the white pine, the sporophores, if found at all, are never very large. They seldom exceed an inch in length and an inch and a half in width. On tamarack, on the other hand, pilei were found measuring five inches long by twelve inches wide, and attached by a base at least six inches in thickness, the tubes showing in some cases eight strata. Probably the tamarack is more prolific than the white pine in producing fruit bodies, because its sapwood is less resistant than that of the pine and the growing mycelium easily gets close to the periphery, so that there is only a thin shell through which it must break in order to get to the surface. The question remains why the sapwood of the pine should be more resistant. The main difference between the sapwood and heartwood is the greater abundance of free resin in the former. This free resin seems to be an obstacle to the spread of the fungus, probably because it quite effectively shuts off the supply of air and moisture without which the plant cannot grow. As a matter of fact, there is always more or less resin flowing out of old punk-knots and places where old branches have been broken off and are in the process of healing over.

Atkinson mentions that the "gum running from all the knot-holes" is regarded as a sure sign of heart rot. When, then, the mycelium does get to the surface, which usually occurs through the small heartwood of a dead branch, only a limited amount of growth takes place and the resulting pileus is small. On the other hand, the mycelium easily penetrates the sapwood in the tamarack and the decay extends to the bark. Between the bark and the wood there are sometimes formed cushions of brown mycelium with pore-bearing surfaces, but

more often the mycelium pushes through cracks and holes in the bark, and forms the numerous fruit bodies so often found.

The amount of timber injured or destroyed by this fungus has already been indicated above in speaking of the "ring rot" or "dry rot". Very little of this fungus was found on hemlock and spruce, and none was found on balsam fir. Von Schrenk finds that fir is rarely attacked by it in the New England states.

Von Schrenk has already fully described the rot produced by this fungus in tamarack, spruce, and fir, and the results of my observations confirm his account on practically all points.

The rot of hemlock seems to differ only slightly from that of tamarack. The wood fibers, being changed to white cellulose fibers, are not so much absorbed, leaving holes or pits as in tamarack, but retain their shape, size and structure in this altered condition. The change to cellulose takes place on both sides of a ring of growth. The irregular black lines spoken of by Von Schrenk are not so numerous as in the tamarack, but wherever there are cracks or holes in the wood, there is a great deal of the brown incrustation which is soluble in caustic potash or ammonia.

The appearance of the rot in white pine is quite different from that in hemlock and tamarack. It is known here by the names of "ring rot" or "dry rot". One tree studied was between one hundred and eighty and two hundred years old, and measured nearly two feet in diameter. It was felled by the loggers about two days before my observations were made. It was found that the rot extended from the ground upward about fifty-one feet through the center of the trunk, making the trunk for nearly fifty feet practically worthless, except for a comparatively thin shell of sapwood. The top of the tree for about sixty feet was practically sound and healthy. The rot was most widely spread between ten and thirty feet from the ground, and it extended only slightly into two of the larger roots. At about thirty feet from the ground a few small pilei were found growing from the stubs of broken and much decayed branches. Other branches extending into the decayed part of the trunk were not affected.

Lumbermen regard this ring rot as one of the commonest and most destructive of the enemies of the white pine. In an area of twenty-five square feet there were three large white pines, averaging at least two feet in diameter, that were at least as badly decayed as the one described above.

Infection in the above-described case must have taken place through one of the broken branches which was about one and one-quarter

inches in diameter. On the knobs so formed the small pilei were found, and these were the only places at which the rot communicated with the surface. No other wound was found. In this region the rot had developed most vigorously, all of the heartwood being affected and here and there places in the sapwood also. From here the rot spread upward and downward. The horizontal spread is peculiar. At the place of infection the mycelium spreads horizontally as well as up and down, but not so rapidly. When this mycelium has succeeded in getting a good foothold in a ring of growth or a number of rings, it follows the ring around the tree and at the same time grows up and down in the same ring or rings. This gives the rot the ring form which is so common, and shows that the mycelium spreads more easily tangentially and longitudinally. Another white pine twenty-five years old was studied. This tree, to all appearances, seemed to be perfectly sound and healthy. However, at the end of a branch stub one foot above the ground a very small pileus was found, measuring about one-half inch in width and a little less in length. At this place there had been a wound which had healed over pretty well. The tree, which was about forty feet high with a diameter at the base of eight inches, was cut down and split through the center. The characteristic greyish brown decay was found, extending from a few inches under the ground to nearly four feet above the ground.

The decayed area was widest about a foot above the ground, where the pileus and the wound were found, being nearly one inch in diameter. The tree had been wounded about eighteen years previously, when it was only seven years old. If infection took place at once the fungus was of very slow growth. However, it may have taken place during any of the succeeding eighteen years, there being nothing to show when it did occur. In this case the rot was not distributed in rings, as in the log described above. Only the heartwood in the center was decayed to a height of nearly four feet. Usually the wood turns to a dull pale brown color, but in this case it was a light grey-brown, lighter than the sound heart wood. The little holes and cavities mentioned by Von Schrenk for tamarack and spruce were just being formed.

The mycelium is quite vigorous in hemlock, but less so in the pine. On the whole, it seems that the growth and spread of the mycelium is much slower in white pine than in any of the other conifers. So that if the trunk of a tree like the big one described above is almost entirely decayed within, it must have taken the greater part of a century to accomplish the work.

The rot produced by *Trametes pini* advances very slowly in white pine but much more rapidly in tamarack and hemlock. One tamarack about ninety-five years old, measuring twelve inches in diameter four feet above the ground, had its interior wholly destroyed to a height of nearly fifty feet, except a thin shell underneath the bark about one-half inch in thickness. This, perhaps, accounts for the fact that the pilei are so abundant on tamarack and so rare on white pine. It is very probable that the formation of pilei is dependent not so much on the amount of mycelium produced within the wood as upon its ability to get to the surface. I am of the opinion that this is the case with several other forms. While at Hazelhurst I wounded a birch infected with *Fomes nigricans* cutting into the wood until the decay was reached. In less than two weeks small pilei were forming on the wound. The same result can be obtained with *F. fomentarius*, *Polystictus pergamenus*, *Fomes applanatus* and probably also with *Trametes pini*.

Fomes unguulatus (Schaeff.).

This is a large woody fungus. It is possible that at least four forms of it have been described under as many different names: *F. pinicola* (Schwartz), *F. unguulatus* (Schaeff), *F. marginatus* Fries and *F. pini-canadensis* Schw.

The form most commonly found here agrees best with Fries' description of *Fomes marginatus*. This is the large applanate form, often growing to one foot or more in width. The upper surface of this form is hard, rough, concentrically sulcate, and the oldest portion is black. The youngest sulcation is blood red with a creamy white margin. The context is corky or hard, wood-colored and zonate. The tubes are stratified and about one centimeter in length, and of the same color as the context. The young growing margin, as well as the pores, stain reddish or pink when touched or bruised.

This fungus is widely distributed, especially through northern Wisconsin, but it has been found as far south as Madison, where one specimen was found in 1899 growing on hickory. It was found especially abundant in the Star Lake region, where as stated before, about eighty per cent of the fir trees are infected. One fir tree only ten years old and a little more than an inch in diameter, when cut down, was found decayed at the center, from the roots, into which the decay extended for about six or seven inches to about three feet above the ground. This tree was simply cut down at random and bore no marks or signs of infection or wounds above ground. Although there was so much

rot in the fir trees produced by *F. unguatus*, yet there were few sporophores found on these trees, either living or dead. The most abundant sporophores were found on hemlock, tamarack, and birch; next in order comes white pine and spruce; and lastly red pine. On all of these trees sporophores were found on both living and dead trees. Large pilei were found only on tamarack, birch and hemlock. Those on the other trees were always small.

The pilei were never found higher than four or five feet from the ground; usually a foot or two above the ground. Frequently there were a half dozen large pilei found at the base of a tamarack or hemlock. White and red pines are often decayed at the center but do not show any sporophores or other signs of infection or disease on the outside. Sometimes the pilei do not form on the trunks until they are prostrate. In that case they usually grow out near the place where the trunk broke.

The decay produced by *F. unguatus* differs from any of the others so far described, in that it is not distinctively either a heart rot or a rot of the sapwood, but may destroy either or both; in fact, it ultimately does in most cases destroy both, no matter in which region it starts. This, however, is true in a lesser degree of the firs. There is nearly always a shell of sound sapwood of greater or lesser thickness in them, although the whole interior may be changed to a brittle brown substance. In tamaracks, the fungus apparently spreads with as much ease in the sapwood as in the heartwood.

Wood that is destroyed by this fungus turns to a light brown, lighter than that produced by *Lenzites sepiaria* or *Fomes carneus*. It is light, dry, and extremely brittle, often collapsing at a touch. It is much cracked in all directions, as if dried suddenly. Sheets of white leathery mycelium spread through the cracks in every direction, especially in the cracks between the rings of growth.

The brown decayed wood turns red when treated with phloroglucin in presence of hydrochloric acid, from which it appears that the lignin has not been reduced. In the earlier stages of decay there is some cellulose still present, as can be shown by staining with zinc chloriodide.

On the road to Razorback Lake, near Star Lake, a tamarack tree fifty-seven years old, and about ten inches in diameter near the ground, was found infected with *Fomes unguatus*. On one side was a large wound produced by the falling of a white pine not more than twelve years previously. This wound was nine inches wide at the base and extended upward for about four feet. Out of the wound and out of the bark beside it five small pilei of the fungus were growing. The

tree was felled and sections were cut out. Rot like the above described was found extending from the base to about eight feet upward. At a height of about seven feet only a few "strands" of decay were found between the heartwood and the sapwood on the side of the tree which was wounded. The center and the rest of the tree here were sound and normal. Four feet above ground the rot had extended over half way around the center, which was still quite sound here, but in the sapwood it reached the surface, where little knots of white mycelium indicated the beginning of pilei. About one foot above the ground the entire heartwood and most of the sapwood, except that on the side opposite the wound, were reduced to the brittle brown condition. On the side opposite the wound, the tree was supported by a shell of sound living sapwood, about one inch in thickness and nine inches in width. Numerous small pilei were growing out of the wound at this height. The roots were sound also, except one or two of the largest ones into which the rot extended for several inches.

The top of the tree was green but had a sickly appearance. Some of the lower branches were dead and others were losing their needles. The growth of the year of the twigs and tips was less than that on other trees near by, as though the tree was lacking in strength and nourishment. It was plain that even if the tree escaped the storms, it would be dead in a few years. From the evidence in this case we may conclude that:

First:—Infection may take place in wounds, and the decay is greatest in the region of infection, if the wounds are near the base. This was shown by the fact that near the base where the wound was largest, there was the most rot. At that point the mycelium first penetrated and hence had had a longer time to produce its effect. Here also were most of the pilei.

Second:—The spread is upward, radially and tangentially, and downward. The spread directly upward is very much more rapid than in any other direction, and downward it is least rapid. The spread is more rapid tangentially than radially, following the rings of growth. It spreads to the center only when most of the rings in which it is found are used up. This is evident from the section at a place four feet above the ground, where the sound center was nearly surrounded.

Third:—The decay spreads only very slowly into the roots of the tree.

Fourth:—The spread and reduction of wood is quite rapid, as all of this rotting must have been completed within a period of twelve years.

Fifth:—Quite a little mycelium must form before pilei are produced, as none of the pilei were more than three years old.

Other similar examples were found but none so striking as the one described. The place of entrance in the pines and fir trees is not always easy to determine. One small fir was cut down and examined. It was forty-five years old and three inches in diameter. In the stump, one inch under the ground, was a wound about an inch in diameter. From this place the rot extended upward into the trunk about three and one-half feet, through the center and a few inches into four of the larger roots. No pilei had as yet been formed, as the rot had not reached the surface at any place except near the wound, and that was under ground. However, the rot was unmistakably that of *F. unguatus*. In several red and white pines the small pilei were growing through holes in the bark, and it is possible that infection took place here.

The carbonization of the wood by this fungus is quite complete. In the advanced stage it does not burn with a flame but smoulders like charcoal, giving off a comparatively small amount of smoke.

The transition from decay to healthy wood is remarkably abrupt, there being apparently no intermediate stage between the decayed and the sound wood. One ring of growth may be healthy and vigorous, and the next one to it may be entirely broken down.

In small areas here and there, traces of cellulose may be found. In these spots the secondary lamellae do not have the spiral cracks found in the other parts. In most of this tissue no cellulose reaction can be found. It all stains bright red with phloroglucin, even when in the last stages of decay. The secondary lamellae crack spirally, and finally the middle lamella also becomes brittle, so that the whole wood structure can be easily rubbed into a fine powder with the fingers. In many cells there are numerous holes through which hyphae pass. There seems to be little absorption of the wood after change, and no cavities appear as in the ring rot. However, the medullary cells show some absorption. This may account for the radial cracks in which the mycelium grows, as suggested by Von Schrenk.

Polyporaceae.

Fleshy, leathery or woody fungi, the carpophore variously shaped or wanting. Hymenophore typically porose and on the underside of the pileus. Pores rounded or angular sometimes sinuous or lacerate.

The following key to the genera is based on that of Fries.

KEY TO THE GENERA.

1. Fructification consisting of *tubules* only, the receptacle entirely wanting; tubules *gregarious* on substratum, at first closed.....*Solenia* Hoffm.
2. Pileus expanded, membranaceous; tubules at first *papilliform*, becoming elongate*Porothelium*.
3. Pileus effused, membranaceous, pores mere pits formed by reticulating folds.*Merulius* Hall.
4. Tubes in a *gelatinous layer distinct* from the pileus; dimidiate or effuso-reflexed.*Gleoporus* Mont.
5. Pileus semi-stipitate, pores alveolar, arranged in radiating series from the stipe.*Favolus* Fries.
6. Pileus dimidiate, coriaceous; pores sinuous, labyrinthine. *Daedalea* Pers.
7. Pileus usually woody or corky; tubules unequally sunk into the substance of the pileus, round, or elongate, entire.....*Trametes* Fries.
8. Pileus wholly resupinate; sometimes obsolete.....*Poria* Pers.
9. Tubules at first punctiform, developed from the center outwardly; hymenophore coriaceous, or membranaceous.....*Polystictus* Fries.
10. Stratum of tubes distinct from hymenophore, but not separable; usually stratose, woody, sessile, dimidiate.....*Fomes* Fries.
11. Stratum of tubes distinct from hymenophore, but not separable, *not* stratose; flesh, tough, stipitate or sessile.....*Polyporus* Michx.
12. Stem lateral or wanting; tubes distinct from each other but crowded together at first resembling warts.....*Fistulina* Bull.
13. Tubules not easily separating from the pileus nor from each other, formed by numerous radiating broader lamellae everywhere connected by narrower anastomosing plates.*Boletinus* Kalchb.
14. Tubules longer, with difficulty separating from the pileus; not radiate. *Strobilomyces* Berk.
15. Tubules long, easily separable from the pileus and from each other. *Boletus* Dill.

Description of Species.

1. *SOLENIA* Hoffm.

Plants belonging to this genus are without a pileus. They are simply a collection of tubules united at their base by a few loose mycelial hyphae. Masee, Hennings and others have placed the genus near *Cyphella* under the *Thelephoraceae*. Fries was the first to put it with the *Polyporaceae* on the assumption that in *Solenia* "only the layer of pores is present without a real fruit body."

Solenia anomala (Pers) Fries. (Plate I, fig. 1).

Tubules usually crowded, short-stiped, pyriform, regular, pilose, yellowish to ferruginous; margin of the tubes usually incurved. Inner surface of the tubes whitish; spores egg-shaped, hyalin, 4 x 6 microns.

Found at Ladysmith and at Madison on the bark of fallen oak twigs, on the bark of fallen alder twigs near Mud Lake near Crandon, Forest County, and on alder twigs near Bangor, La Crosse County.

The patches measure from 2 to 10 cm. in length and from 0.5 to 2 cm. in width. The tubules measure from 1 mm. to 2 mm. in height and from .5 to 1 mm. in diameter. The spores measure 2 by 7 microns. They are rod-like and slightly curved. The basidia which line the tubes are whitish, closely packed long and narrow, measuring 20 microns in length, and from 2 to 3 microns in diameter.

Following are the characteristics upon which identification is based:

Color: Golden brown to dull ferruginous.

Pileus: None.

Tubes: Small, crowded, pyriform, mouths usually closed, but open on being moistened.

Habitat: Encrusting fallen twigs.

Syn. *Cyphella fasciculata* (Schw.) B. & C.

Solenia villosa Fries (Systema, II, p. 200).

Tubules nearly cup-shaped when young, later cylindrical, growing in groups, clearly pilose, whitish. Growing on decayed wood.

Apparently rare. One specimen was found near Madison, and one near Mud Lake near Crandon. The tubules in this species are not crowded as those in the preceding one, nor are they as large. They

do not form distinct patches but are more or less scattered in little groups. The tubes are often nearly spherical. They measure about 1 mm. in height, and from .5 mm. to .75 mm. in diameter. They are very delicate and brittle. This species is probably often passed by, being mistaken for a slime-mould.

Following are the distinctive characteristics:

Color: White to grayish white.

Pileus: None or consisting of a few whitish delicate floccose mycelial strands joining the small groups of tubes.

Tubes: Small, slightly gregarious, spherical to cylindrical, pilose, whitish; on decayed wood.

2. POROTHELIUM.

Porothelium fimbriatum (Pers.) Fries (Plate I, fig. 2).

Wide spreading, (or effused) membranaceous, thin, white, margin fimbriate or ragged, tubes crowded in the center, confluent, becoming more scattered toward the margin, superficial.

Specimens were found at Blue Mounds, Bangor, on an old stump near Hazelhurst, Star Lake, and Crandon on pine stumps and logs. The longest specimen is 15 cm. in length and about 4 cm. in width. The substance is white, very thin and paper-like. The margin is thin and ragged. The pores start in little papillae or wart-like structures which finally become depressed in the center into tubes and thus ultimately form pores. Very young specimens do not have pores and are thus often overlooked.

3. MERULIUS Hall.

This genus is characterized by the loose, soft, mucedineous consistency of the resupinate or reflexed pileus; the wax-like or subgelatinous hymenium; the anastomosing folds forming the shallow, irregular and often sinuous pores.

§1. CONIOPHORI. Hymenium powdered with the rust-brown spores.

Merulius lacrymans (Wulf).

Pileus widely effused, often .3 to .8 meters in extent, of membranaceous, or spongy-fleshy or leathery consistence, ochre-yellow or ferruginous with white tomentose border. Pores large, unequal, gyrose meshes; orange-yellow, becoming cinnamon-brown from the spores. Spores egg shaped, one sided, intensely yellow-brown, 10 microns by 6 microns.

On decaying wood, especially timbers in damp buildings and cellars.

Massee (17, p. 186) says that it grows "On trunks, worked wood, carpets, etc., the patches varying from 2 to 3 inches to a foot and more in diameter, $\frac{1}{2}$ inch or more, thick at times. Very variable, but distinguished by the slightly gelatinous substance, irregularly rugulose hymenium, and bright rusty orange spores. Exuding drops of water when growing."

This is the so called "Dry rot" or "Hauschwamm" of Europe. Winter (28, p. 395) calls it the "foe of the homes, whose woodwork it destroys". According to the same author the folds usually lengthen in old age into teeth, giving rise to the following names: *Boletus obliquus* Bolton; *Sistotrema cellare*, Persoon; and Wallroth's *Boletus hydnoideus*.

Localities: Madison, Bangor. Some specimens were found in the woods in the fall of 1903 growing on a charred stump, and some small specimens were found growing on the ground in a lumberyard, under the lumber and on pieces of lumber lying on the ground.

The specimens are all very irregular and thin and show well the long strands or threads of white mycelium which run through the wood. The margin is white, soft tomentose, not at all reflexed. The hymenium begins about 4 mm. from the margin in very shallow pores of a rusty yellow color. Toward the center the pores are much larger and deeper, becoming almost brown. The folds are sometimes toothed.

Syn.: *Xylomyzon destruens* Pers.; 23, vol. 2, p. 27.

§2. LEPTOSPORI. Hymenium naked or lightly powdered with the white spores.

Merulius aureus Fr.

Effuse, thin, membranaceous, adherent, golden-yellow, margin thin, villous, of the same color; hymenium plicate-porose, gyrose; spores globose or subglobose, yellowish, 8 microns in diameter.

Several well developed specimens were found at Bangor which were identified by Bresadola as belonging to this species. It may well be more abundant in the state than this would indicate.

Merulius corium (Pers.) Fries (Plate I, fig. 3).

Resupinate effused, soft, sub-papyraceous at length reflexed with the margin free, villose, beneath white. Hymenium reticulate-porose flesh-colored becoming paler; spores oblong-lanceolate, hyaline 10 x 3 microns.

Macbride (15, p. 4) says that this species when fresh is noticeable for its delicate tints and soft velvety snow white margin. Masee says it is very variable, but known by its white, silky pileus and the reticulato-porose, ochraceous hymenium.

This species seems to be rare in Wisconsin. Our only specimens were collected at Bangor, LaCrosse Co., in October, 1905. The specimens grew on the under side of an alder branch lying on the ground. The stick was covered for a distance of about 30 cm., the fungus averaging in width about 2.25 cm., and .5 mm. in thickness when dry. The pileus is reflexed about 5 mm.

The pileus and margin are white or whitish, but the hymenium is pale ochraceous with more or less of a rosy tinge. On drying the rosy tinge disappears, leaving it a pale straw color.

When fresh the substance is soft and waxy, but on drying it becomes brittle and papyraceous.

The pores are very shallow near the margin but are deeper in the center. They seem to be arranged more or less in concentric circles, around rather definite centers. This characteristic is shown quite well in the figure. This species seems to be closely related to *M. aurantiacus* Klotsch., differing only in the paler color of the hymenium, the less reflexed pileus and the thinner substance.

Identification is based on the following characteristics:

Color: Whitish pileus and pale ochraceous hymenium tinged with rose.

Substance: Thin, waxy, becoming brittle when dry.

Pores: Small, very shallow, irregular giving the appearance of being arranged in concentric circles around various centers.

***Merulius aurantiacus* Klotzsch (Plate I, fig. 4).**

Effuso-reflexed 2.5 to 4 cm. across, subcoriaceous, tough, dingy white, yellowish or gray, coarsely tomentose, indistinctly zoned; hymenium minutely rugulose, somewhat porose, orange.

"Pileus 2.5 cm. broad; zones obsolete, hirsuto-tomentose. Nearly allied to *M. corium*." Berk.

Only two specimens were found on a fallen oak branch in Parfrey's Glen. The largest specimen covered the stick for about 18 cm. The pileus was reflexed to a width of one centimeter at its widest part. The surface is nearly white without any suggestion of yellow—verging perhaps more toward a grayish-white. The margin becoming incurved on drying, is smooth or somewhat wavy and not at all denticulate or radiate as in *M. tremellosus*. The tomentum on the pileus is dense and coarse. It is well described by Berkeley (17, p. 190) when he calls it "hirsuto-tomentose". The zones on the pileus form quite conspicuous concentric ridges.

The hymenium is of a reddish-orange verging toward ochraceous. The substance seems to be leathery and tough. The pores are very shallow, small and irregular.

The hymenium appears to be thrown into circular ridges around slightly raised centers which make it seem as though the pores are arranged in concentric circles around these centers. This characteristic is more striking in this species than in the following.

M. aurantiacus is closely related to *M. tremellosus* and *M. corium*. From the former it is distinguished by its tougher substance, small pores, darker colored hymenium and smooth margin. From the latter it differs in its thicker substance, darker colored hymenium, more reflexed pileus and the coarser tomentum.

***Merulius tremellosus* Schrader.**

Resupinate; margin becoming free and more or less reflexed, usually radiato-dentate, gelatinoso-cartilaginous; hymenium variously rugose and porose, whitish and subtranslucent, becoming tinged with brown in the center; spores cylindrical, 4 by 1 micron.

On wood. From 2.5 to 7.5 cm. across remaining pale when growing in the shade. Margin sometimes tinged with rose, radiating when well developed.

Common in Wisconsin on the underside of old logs, and charred stumps. Specimens were found near Madison, Blue Mounds, Horicon, Dodge County, Hazelhurst, Oneida County, Crandon, Forest County, Sparta, Monroe County, Bangor, La Crosse County, and Milwaukee.

The pileus of the older specimens usually becomes more or less reflexed especially if they grow on the side of a log. The pileus is then snow-white above, except at the margin covered with a soft tomentum when dry. The margin is thin, fimbriate, toothed or radiate, red, turning reddish-brown. The underside is made up of shallow irregular pores formed by the anastomosing folds of the subgelatinous red to reddish-brown hymenium. The pores are usually arranged radially.

When dry the substance is quite leathery or more brittle in old specimens. Young specimens are quite thin—often 0.5 mm. to 1 mm. in thickness. These are quite gelatinous, subtranslucent, more or less orbicular; the margin very thin, soon becoming free and more or less reflexed.

The hymenial layer appears to consist of fine filaments, embedded in a gelatinous substance, not much interwoven but running more or less parallel with each other, bending downwards into the folds which form the pores. The filaments seem to enter the hymenium from the pileus in strands or bundles. In this respect it differs from *Gleoporus conchoides*, the young of which it resembles somewhat in appearance and consistency. In the latter the pileus passes more gradually into the denser hymenium which, however, is also made up of more or less parallel fibres embedded in a jelly-like substance when young. Mature specimens of *G. conchoides* are of course at once distinguishable by the minute, elongated, round tubes.

M. rubellus, a near relative, is never resupinate but always sessile, more tenacious, less tomentose.

The larger specimens found measured from 4 to 8 cm. in width, reflexed to about 4 cm. The pileus is about 3 to 4 mm. thick, the pores scarcely 0.5 mm. in depth.

Following are the distinctive characteristics:

Color: White above when reflexed; pale rose, red or reddish-brown underneath.

Hymenium: Gelatinous or waxy, soft, translucent when young.

Pores: Irregular shallow, made by the folds of the hymenium.

Syn. *Xylomyzon tremellosum* Pers.; 23, 2, p. 30.

4. GLOEOPORUS Mont.

Pileus with a coriaceous, floccoso-cellulose context, usually white. The distinctive characteristic is the tremelline-gelatinous hymenium with its at first punctiform impressions and which contracts on drying.

Gloeoporus conchoides Mont. (Plate I, fig. 5).

Conchiform, pileus coriaceous, thin, pliant, dimidiate, sessile, convex, unequal, velutinous then somewhat glabrate, tawny, margin acute; pores flesh-colored, white when wet, round, minute, superficial, gelatinous.

"Pileus varies from white to tawny; from dimidiate to resupinate. Appeared to Berkeley and Cooke to be a form of *P. nigropurpurascens* Schw. or *P. dichrous* Fr." (Sac., 26, vol. 6, p. 403).

This species seems to be quite common on decayed poplar logs, running lengthwise and laterally confluent, like *P. adustus*, and may cover the whole side of the log. It grows in late summer and fall, even after frost has come.

When young the hymenium is markedly gelatinous. This character, however, is entirely lost when old. The pores become brown elongated tubes, sometimes 1 cm. in length.

The pilei are either dimidiate and sessile or strongly reflexed; coriaceous, thin with a thick base; very convex above and concave below—and hence said to be conchiform. The margin is acute, uneven and usually lighter when growing.

The pores are at first small, roundish, shallow, unequal, apparently formed by folds of the hymenium. When moist and growing, the hymenium is white-primrose; otherwise it is of a dark-brownish purple near the base becoming lighter toward the margin where it may be almost orange, especially in growing specimens.

Old specimens of both *G. conchoides* and *Merulius tremellosus* were found at Elkhorn and carefully compared. From some specimens the hymenium had rotted or been eaten away. On the underside of the pileus of *Merulius tremellosus* were found reddish radiating fibres, probably the bundles of mycelial hyphae which go to form the hymenium as mentioned above. Under the grayish weathered pilei of *Gloeoporus conchoides* these red fibres are not found. The underside is smooth, gray to grayish white.

G. candidus Speg. is closely related. It is thinner and the hymenium is very much lighter in color. It may be only a variety of *G. conchoides*.

The species may be recognized by the soft, white conchate pilei and the thin gelatinous, partly separable hymenial layer.

Specimens have been found near Madison, Elkhorn, Bangor; Shanagolden and Star Lake.

5. FAVOLUS Fries.

Hymenium reticulate-cellular to alveolate. Alveoli formed from densely anastomosing lamellae, radiating from the point of attachment. Spores white. Fungi dimidiate, substipitate, fleshy tough, annual.

This genus differs from others in the form of its pores produced by the anastomosing lamellae.

Favolus europaeus Fries. (Plate I, fig. 6).

Pileus fleshy, soft, thin, orbicular, smooth, white; stipe short, lateral; alveoli deep, reticulate, subrotund; spores 12 x 4 microns.

Macbride (15, p. 6) says among other things that "they are not exactly in concord with the above description. Our specimens are yellow or orange above, white below and while not scaly above, yet might be described as appressed-squamose or fibrillose, and in these respects conform to descriptions of *F. boucheanus* Kl. The latter again seems not to differ from *F. canadensis* of the same author".

Specimens found in Wisconsin vary in color. Young and growing specimens are usually of a pale tan color. Sometimes the color is of a deeper brownish but scarcely orange. Old bleached specimens are white. The color of the hymenium is usually the same as that of the pileus. The fibrillose scales are not always present. The form of attachment may be sessile, lateral stiped or rosetted, and occasionally excentrically stiped. The stipe when present is, however, always very short.

F. europaeus is one of our most common types of polypores, having been collected in every county visited so far. The most favorite substratum is a hard wood stick lying on the ground—especially oak and hickory branches.

The largest specimen measured is 10 cm. broad and 8 cm. long. The pileus is only a few mm. thick, while the pores are about 4-5 mm. deep. The largest pores measured were about 3 mm. long and 2 mm. wide. In size however they vary very much in the different specimens.

Sometimes there is more or less of a depression at the point where the stipe is attached.

When moist or growing the pileus is leathery tough and flexible and it dries very hard and becomes brittle.

The species may be recognized by the smooth, leathery pale-tan pileus with the large angular or alveolar pores.

Syn.: *Hexagona alveolaris* (D. C.) Murrill, 19, vol. 31, p. 327.

Favolus rhipidium Berkeley (Plate I, fig. 7).

Pileus coriaceous, reniform, concentrically sulcate, alutaceous or white, cuticle seceding in small furfuraceous areoles; stipe lateral, short, tapering downward, primrose, becoming yellow when dry; pores small, white, angular, denticulate.

This species resembles *Panus stipticus* so much that doubtless it is often passed by collectors of polypores. Like that species, it grows in small densely cespitose tufts, the pilei being of about the same size and color as those of *P. stipticus*. Even the stipe is of about the same shape and size.

The pilei are nearly always reniform, smooth and leathery in substance, alutaceous when growing, pale tan when dry. The stipe is short, curved, lateral and tapers downward, of the same color as the pileus. The pores are small and have the alveolar shape characteristic of the genus.

Specimens when fresh or moist measure from 1.5 cm. to 2.5 cm. broad, and from 1 cm. to 2 cm. long, 3 mm. thick; the stipe from 1 to 1.5 cm. long and 2 to 3 mm. thick. When dry, the pores are scarcely visible. A few specimens were found on much decayed oak wood by Mr. B. O. Dodge in Juneau County, and a few specimens were found near Blue Mounds.

Favolus Curtisii Berkeley.

Pileus orbicular, umbilicate, thin; margin ciliate; stipe central, thickening downward setulose; pores oblong, medium.

Carolina, Curtis. "Pileus 18 mm. broad, pellucid; stipe 2.5 cm. high, 3 mm. thick at the base; 1.5 mm. at the top. Pores roundish 0.5 mm. broad. Similar to *Polyporus arcularius*, but more delicate". Sac., vol VI, p. 391.

Several specimens of this apparently rare species were found in August 1902, near Oakfield, Fond du Lac County, growing from twigs under the leaves on the western slope of a limestone ridge. They agree very well with Berkeley's description and thus are easily identified.

The largest specimen measures about 2.5 cm. in diameter; the substance of the pileus is scarcely 0.5 mm. thick and is translucent when moist. The color is somewhat brighter than that of *F. europaeus*.

The pores are deep and alveolar as those of *F. europaeus* but not so large, a little darker in color than the pileus. The stipe is attached centrally. It varies in length from 2 to 3 cm., averaging about 3 mm. in diameter. It tapers upward and is covered with brownish furfuraceous scales.

When dry the plant is hard and brittle.

The distinguishing characteristics are the thin, circular, umbilicate pileus, the favoloid pores and the slender central stem.

From *Polyporus arcularius*, which it strongly resembles, it may be distinguished by its lighter color and its delicacy.

Syn.: *Polyporus arculariellus* Murrill, 19, 31, p. 36.

6. DAEDALEA Persoon.

The genus is readily recognized in most cases by its sinuous and labyrinthine pores. When young the pores are firm and roundish but soon break down into teeth or lamellae, usually woody and hard.

Daedalea unicolor (Bull.) Fries.

Pileus leathery, tough, flexible, villous-strigose, ashy zonate, the zones concolorous; pores labyrinthine, flexuous, acute, at length lacerate, dentate; lamellae white; sometimes yellowish.

This is the commonest representative of the genus and is found in all parts of the state. The species is very variable and occurs on different hosts. It is most often found on old and partly decayed logs and stumps of deciduous trees, but chiefly on poplar, willow, and maple. Occasionally specimens are found on living maple and willow trees, growing out of the wounds. The wood on which the specimens grow becomes white and brittle. But whether the trees are killed by the plant I cannot state.

The pileus is usually soft leathery, hirsute and concentrically sulcate, resembling *Polystictus hirsutus* when seen from above. Sometimes the pubescence is wanting, especially on specimens growing on living maple and willow. The margin is usually rounded. The color of freshly growing specimens is normally yellowish-white or alutaceous. Specimens growing on maple trunks and willow are grayish-white. Older specimens become grayish or grayish-black. Old spe-

cimens often become greenish. This is due to an abundant growth of an alga.

The hymenium also varies in color from white through ashy-gray to tawny and almost rusty-brown.

The tubes are short, very sinuous with toothed dissepiments which soon become torn into teeth.

In form the pilei may be resupinate, reflexed, sessile, imbricated or laterally confluent. Old specimens become black, hard and less hirsute.

The distinguishing characteristics are the leathery, velvety-hirsute, sulcate pileus, and the whitish to grayish shallow sinuous pores which become cut into teeth.

Syn.: *Boletus unicolor* Bulliard; 7, vol. I. p. 365-501, fig. 3.

Cerena unicolor (Bull.) Murrill, 15, vol. 32, p. 97.

Daedalea confragosa. (Bolt.) Persoon (Plate III, fig. 12).

Pileus sessile, somewhat imbricated, slightly convex, of corky-leathery, almost woody consistence, rough, reddish-brown with indistinct concolorous zones, wood colored within, becoming brown; pores narrow, labyrinthine, torn, at first gray-pruinose, later reddish-brown.

The pilei are either plane pale above or slightly convex, and always convex beneath. The surface is usually rough-scabrous, or concentrically corrugated. The color varies from gray to reddish brown. The margin is acute, and even.

The pores are at first trametoid, white, then they become darker and more sinuous, finally in old specimens they break down into thin fuscous lamellae. If horizontal sections be cut through even the most lenzitoid specimens, the top of the hymenium will still be seen to be daedalioid, showing that this breaking down into lamellae is only superficial. A series of pores, from the trametoid type to the lenzitoid form is shown in figures 12 b to g. The top of the pileus is shown in figure a.

Sometimes the surface of the pileus becomes roughened toward the base, while toward the margin it is marked by narrow regular concentric sulcations which in turn are crossed by slight radial rugae. In a few specimens the margin is wavy and lobed.

Peck (22, 30 p. 71) says that *D. confragosa*, *Trametes rubescens*, *Lenzites Cookei*, *L. crataegi*, *L. proxima* and possibly *L. Klotzschii* are one species. Prof. Macbride also includes *Lenzites corrugata* and *L. bicolor* with *Daedalea confragosa*.

The species is very common in the southern, eastern and western parts of the state. Specimens were also found in Oneida, Forest and Ashland Counties. The species grows most abundantly on dead willow, but is also found on living willow, dead oak and poplar. The upper surface of the pilei is always nicely horizontal no matter in what position the wood is on which they grow. Sometimes they are clustered but usually each plant grows separately.

The largest specimen found measures about 14 cm. in width, 8 cm. in length and nearly 3 cm. thick behind. Most specimens, however, are smaller.

The hymenium of a growing specimen turns to a dull brick-red when wounded or bruised.

Syn.: *Daedalea confragosa* (Bolt.) Fries, 3, plate 160.

Boletus labyrinthiformis Bulliard; 7, plate 491, fig. 1.

Agaricus confragosus (Bolt.) Murrill; 19, vol. 32, p. 86.

***Daedalea albida* Fries; Obs., I, p. 107.**

Pileus corky to leathery, smooth, flat, zoneless, milk-white, with delicate tomentum appressed silky smooth, pores entire and of the same color.

Very well developed specimens of this fungus were found at Cranston and were identified by Bresadola, who puts them here rather than in the genus *Lenzites*. These specimens are certainly typically daedaleoid.

***Daedalea obtusa* (Berkeley) (Plate II, fig. 11).**

Pileus thin, pulvinate, fleshy, spongy, soft, tomentose, white; margin obtuse; pores unequal, wide, irregular, subgyrose, becoming brown when dry.

This species was placed under the genus *Polyporus* by Berkeley but is here placed with *Daedalea* because of the large labyrinthine pores and because the substance of the pileus passes unchanged into the trama.

Peck, to whom a few specimens were sent, writes:—"It seems to me a better *Daedalea* or *Trametes* than *Polyporus*."

Macbride (15, p. 22) says: "Perhaps no one at first sight would consider a specimen a *Polyporus* at all; it looks more like a *Daedalea* perhaps. The pores are very large, irregular, almost labyrinthine and very long——— Furthermore the hymenophore descends

as a trama between the pores in such a fashion as to suggest a *Trametes* and the context is delicately zoned."

This is one of our handsomest and most showy polypores. It is easily recognized by its massive structure, very *obtuse* margin; straw-yellow, tomentose or rough velvety surface; very large sinuous pores which sometimes reach a length of from 3 to 3.5 cm. The substance is corky-fibrous. Part of these fibres pass down into the trama, and part upward into the pubescence. I have seen none that are glabrate. When old and weathered the pileus cracks and forms bunches of stiff hairs which become gray or blackish. The flesh is pale alutaceous as are also the pores. The latter become darker on drying.

Specimens vary much in size. My largest specimen measures about 24 cm. in width and 15 cm. in length. The flesh of the pileus is 4 cm. in thickness and the tubes vary from 3 to nearly 4 cm. in length. The figure shows part of the hymenium of a specimen enlarged and is a good representation of the labyrinthine pores.

The specimens are usually sessile dimidiate or crescent-shaped, growing backward so that they seem to clasp the tree upon which they grow. Two specimens were collected by Mr. F. E. McKenna in Iowa County. These are orbicular, growing from the underside of a fence rail. The pores are closed or stuffed in these. This is a common condition in younger specimens.

Quite common on dead or living black oak and hickory trees. Specimens have been collected in Dane, Walworth, Iowa, Monroe, LaCrosse, and Chippewa Counties.

Berkeley describes the species as "thin," but our specimens never appear so; they are always thick. The long tubes and the incurved margin make the species *thick pulvinate* and *obtuse*.

Syn. *Polyporus obtusus* (Berk); 26, vol. VI, p. 134; 15, p. 22.

Trametes unicolor (Schw.) Murrill; 19, vol. 32, p. 638.

Polyporus unicolor Schweinitz; 26, vol. VI, p. 131.

7. TRAMETES Fries.

Fries describes the genus as follows: Pores subrotund, obtuse, entire, usually of equal depth not forming a heterogeneous stratum, appearing as if sunk into the flesh of the pileus; the trama continuous with the flesh of the pileus and similar to it. From woody to suberose, hard, not stratose, commonly scented.

The most prominent characteristics of this genus are the lignatile pileus, the pores, with obtuse dissepiments, which are usually subro-

tund or lengthened radially; tubes of unequal length with the trama of the same substance as the pileus. The dissepiments are seldom toothed or torn.

§1. *Context white or whitish.*

***Trametes sepium* Berkeley.**

Pilei effused, at base reflexed, often laterally confluent, finely tomentose, successively zonate, pale wood color, leathery, sometimes when young three cornered, substance white; pores slightly sinuous, about $5/6$ mm. in diameter.

Found in North and South Carolina on oak, pine, and cypress; in Alabama on laurel and sassafras; in Connecticut, Ohio and New Jersey on oak. (26, VI, p. 342.)

This small, large pored *Trametes* is quite common on oak fence posts, fence rails and on oak trunks. It has been found at Elkhorn, Horicon, Madison, Bangor, Sparta, Crandon and Oakfield. The largest specimen was 3 cm. broad, 1 cm. long; flesh of the pileus 2—4 mm. thick, tubes from 4—8 mm. in length.

The pilei are white, pulvinate, leathery, more or less imbricated, confluent, margin acute, inflexed and finely tomentose when young. The pores are large, angular or sinuate, sometimes decurrent upon the soft white tomentose mycelium below. In some specimens the pores are nearly alveolar or hexagonal, reminding one of *Favolus*. The color of the pores varies from white, to straw-yellow and yellowish brown. Sometimes the pores become torn into lamellae and teeth.

The zones are not very apparent on young specimens but are more so on mature ones, on which also slight concentric sulcations sometimes appear. The tomentose pubescence disappears with age and weathering.

This species is closely related to *Trametes serialis* Fries, and *Trametes serpens* Fries. It is, however, less resupinate and has larger pores than either of these species.

Syn. *Daedalea sepium* Rav.; Fung. Car., fasc. I, no. 21.

Coriolellus sepium (Berk.) Murrill; 19, vol. 32, p. 481.

***Trametes serialis* Fries (Plate III, fig. 13).**

Pilei laterally confluent, effuso-reflexed, corky-coriaceous, yellowish to straw color, with obtuse margin. Pores small, white, unequal, in the reflexed part roundish, in the effused part irregular, oblique, toothed.

On the wood of conifers. Pilei 1—1½ cm. broad, confluent lengthwise for ⅓ meter.

Not common; a few specimens were found on a fallen alder trunk at Bangor, and a few near Stone Lake, Forest County, on an old pine log. The largest specimen, made up of a number of confluent pilei, was effused for about 15 cm. in length, and 5 cm. in breadth, the reflexed margin bent back not more than 1½ cm. The color is a peculiar reddish-yellow, "scherben farbig" or tile color, and is more or less persistent.

Young specimens are orbicular and entirely resupinate. The pores being longer and larger in the center, become smaller and shorter toward the margin. On the whole, the pores can be called large, irregular and unequal. In older resupinate forms they are often sinuous or labyrinthine, and often become split into teeth.

The chief characteristics of this species are the tile-colored, confluent pilei and the large, irregular toothed pores.

***Trametes suaveolens* (L.) Winter (Plate II, fig. 9).**

Pileus thick, pulvinate, 5—12 cm. broad, fleshy-corky, tomentose, azonate; white, with strong anise odor; pores large, roundish, at first white becoming brownish, dissepiments obtuse. Spores oval, colorless, 9 microns long and 4 to 5 microns thick. On willow trunks.

This large showy *Trametes* is not very common. Some specimens were found at Bangor growing from the dead and decayed parts of living willows and from willow stumps. Two large reflexed specimens and one *resupinate* specimen were found near Crandon, Forest County, on a fallen fir, and a small specimen at Devils Lake. The pores in these specimens were somewhat smaller with thinner dissepiments than in the specimens from willows.

The pilei are pure white, soft corky, somewhat uneven, finely tomentose; margin blunt, flesh pure white, smelling strongly like anise, the odor being more or less persistent. The pores are large roundish, at first shallow then lengthening. The mouths of the pores are at first snow-white but darken to smoke color later.

The largest specimen found, measured 10 cm. in breadth, 7 cm. in length and 1.5 cm. in thickness, with tubes nearly 1 cm. in length. The specimens found near Crandon were thicker in proportion to their length and width.

Easily recognized by the soft white corky substance, the large darkening pores and the strong persistent anise odor.

Trametes gibbosa (Pers.) Fr. (Plate I. fig. 8.)

Pileus sessile, with gibbous base, 8 to 15 cm. broad, corky, elastic, strigose, obsoletely zonate, whitish, becoming gray with age. Pores linear, short, and narrow, usually straight, sometimes slightly sinuous. Odorless.

On trunks of various trees.

Only a few specimens were found growing from the decayed side of a living apple tree in Horicon, July, 1905. The largest specimen measures about 8 cm. wide, 3 cm. long and from 2 to 3 cm. thick. The color varies from whitish to grayish and pale brown. The upper and lower surfaces are convex, the base being more or less decurrent. The context is corky and has a wood color.

The pores are large, narrow, unequal and more or less sinuous. The young pores near the growing margin are small, but they become larger and sinuous with age.

Trametes Trogii Berkeley.

Fuscous, subolivaceous; pileus convex, subzonate, clothed with bunches of rigid hairs; margin acute, context white; pores unequal, subangulate, dentate.

This looks like *T. Peckii*, but is smaller, thinner, and lighter in color, the context being white; the pores also are smaller and much lighter in color, being almost white with a brownish tinge. They are more decurrent than in *T. Peckii*. One specimen which was sent to Professor C. H. Peck and identified by him was almost resupinate.

This species is not so common as the preceding. Several specimens were collected at Horicon on a cottonwood stump and another near Elkhorn on a poplar stump. These specimens are much imbricated and laterally confluent. The larger one measures 8 cm. in width and 3 to 4 cm. in length. The pileus is about 0.25 cm. thick and the pores vary in length from 1 mm. to 1 cm. The diameter of the pores is about 0.3 to 0.4 mm.

Trametes Peckii Kalchbrenner (Plate IV, fig. 15).

Pileus suberose, dimidiate sessile, subdecurrent, hirsute, azonate, ferruginous-fuscous, at length faded, margin acute; pores rather large, rotund-angulate, concolorous with the pileus, becoming fuscous with age; context wood-colored.

This species is quite common growing on poplars, and oak. Specimens have been collected at Sparta, Bangor, Madison, Horicon and on Madaline Island. Dead poplar trunks and stumps seem to be the favorite substrata.

The pileus is dimidiate-sessile and sometimes even crescent form, very often imbricated, and laterally confluent. The substance is dark wood color, corky to fibrous, and about one half as thick as the length of the pores, and, as McBride (15, p. 10) says—"it passes by imperceptible transition into the matted hirsute outer coat."

The margin is usually acute, but in a few specimens quite obtuse, especially in younger specimens. It usually curves down when dried. The pores are large, irregular, long, sometimes almost sinuous and in old weathered specimens torn into teeth. In color they vary from grayish brown to very dark brown. The pilei are variable in size, being from 2 to 20 cm. in width; from 1 to 8 cm. in length and from 0.25 to 1.5 cm. thick with pores from 0.5 cm. to 2 cm. in length.

This species is closely related to *T. Trogii*, from which it differs in its larger size, larger pores and darker color. It is easily recognized by its seal-brown strongly strigose-hirsute pileus and the large irregular subdecurent pores.

Syn.: *Funalia stuppens* (Berk.) Murrill; 19, vol. 32, p. 356.

Trametes heteromorpha (Fries) Bres.

Pileus effuso-reflexed, thin, tubercular, fibrous-wrinkled, leathery, pale-whitish; lamellae very broad, crowded, more or less anastomosing, white, growing beyond the margin thus making it appear dentate. On conifers.

The above is Fries's description of *Lenzites heteromorpha*. Peck (Report no. 42, p. 120) says that *L. heteromorpha* exhibits three forms; the daedaloid, the trametoid and the lenzitoid. Bresadola places them all in the genus *Trametes*. Our specimens belong to the daedaloid and trametoid forms.

The specimens are nearly pure white, thin but leathery-tough, much effused and narrowly reflexed. The pores are large, shallow, varying from roundish to labyrinthine. The leathery substance is easily separable from the substratum and becomes hard and brittle when dry.

Our specimens were found growing on fallen limbs, sticks and logs at Shanagolden, Crandon and Ladysmith. The largest specimen measured nearly 10 cm. in length and 3 to 4 cm. in width, 1 to 2 cm.

in thickness. One side was reflexed about 1.5 cm. The surface of the pileus in this case was minutely tomentose.

Syn.: *Lenzites heteromorpha* Fries, 9, Taf. 177, Fig. 3; 28, vol. 1, p. 490.

***Trametes stereoides* (Fries) Bres. (Plate III, fig. 14).**

Pilei imbricated, leathery, thin, stiff, effuso-reflexed, reniform, at first tomentose, then glabrate, grayish-brown, with concolorous zones, 1 to 1.5 cm. long, 0.5 to 1 cm. broad. Pores short, quite large, obtuse, variously formed, white.

Trunks of conifers.

This species seems to be quite abundant in the forests of Northern Wisconsin. Our specimens were collected in pine and mixed woods in Oneida County, near Hazelhurst, at Shanagolden, Ashland County, and in the Star Lake region. The specimens were found chiefly on fallen hemlock or spruce branches and decayed logs. They were much imbricated, effused and reflexed and laterally confluent, so that the largest specimen measured about 12 cm. in length and 5 to 6 cm. in breadth, being reflexed to about 2 to 3 centimeters.

The pilei are thin, leathery but stiff; the surface very uneven, and of a dark gray-brown. The zones are sometimes blackish, making the surface look very much like that of *Polystictus planus* Pk., from which, however, this species differs in its larger and coarser structure and the larger pores.

Fries (9) places the species in the genus *Polyporus*, but Bresadola (in litt) calls it a *Trametes* and regards it as identical with *T. mollis* Fries.

This species is easily recognized by the very uneven, thin leathery grayish-brown pileus and the large, shallow white pores which soon turn gray.

Our specimens agree very well with Fig. 3, Taf. 187 of Fries Icones II, page 86.

Syn.: *Polyporus stereoides* Fries; 28, I, p. 415.

Polystictus stereoides Fries Sac.; 26, VI. p. 267.

***Trametes scutellata* Schw.**

"Pileus pulvinate, narrow, zonate, yellowish-white, tomentose, but at length lacate-glabrate, context thin, almost concolorous; hymenium concave, white; pores punctiform, dissepiments wide, rigid."

This is another small whitish *Trametes*. The pileus is pulvinate, hard corky; sometimes scutellate or even hoof-shaped with a narrow

base. It is white to pale tawny, the old parts becoming black, and the context, at first white, becomes darker wood-color and never very thick. It is usually more or less glabrate, zoned, often concentrically sulcate; the white margin smooth, more or less acute, spreading. The hymenium is white or pale tawny and nearly always concave. The pores are small even, regular, with thick dissepiments. The tubes are of unequal length.

Some of the older specimens seem to be quite distinctly stratified, and look like No. 1010 of Fungi Columbiani (*Fomes scutellata*). Perhaps the two forms should be placed together in the genus *Fomes*. *T. scutellata* is said by Macbride (15, p. 10) to be the same as *Trametes Ohiensis* Berk.

An entirely resupinate form occurs on the underside of old fence rails. This is dry, whitish, thin, closely incrusting the surface of the wood. The tubes are short with small mouths and thick dissepiments. The hymenium is the same as that of the dimidiate forms. The pileus follows the unevenness of the wood surface, with here and there slight indications of becoming reflexed. This is not always evident, however.

T. scutellata is a quite common form growing on old fence rails and posts. I have never seen it on trees and logs lying on the ground. Specimens have been collected in Monroe, Walworth, Dane, Fond du Lac, Dodge, Iowa and La Crosse Counties. They are from 2 to 3 cm. wide; 1 to 4 cm. long; flesh 4 to 6 mm. thick. The tubes are 1 mm. long in resupinate forms, and in others form 3 to 10 mm.

The distinguishing characteristics of the species are the hoof-shaped pileus, the white dry substance, the concave hymenium with small pores and thick dissepiments.

Syn. *Fomes scutellatus* (Schw.); 26, vol. VI, p. 192.

Trametes ohiensis Berk.; 26, vol. VI, p. 342.

§2. Context yellowish.

Trametes rigida B. & Mont.

Pileus corky, undulate, by far the greater part resupinate; the margin narrow, acute, subzonate, tawny brown; pores medium, round, equal, obtuse, whitish.

Only a resupinate form was found growing on the underside of a poplar log at Madison. The specimen was about 15 cm. long, 2 to 4 cm. wide, and nearly 1 cm. thick. The color varied from whitish to tawny. The substance was quite hard and tough.

The tubes were small, equal, and about 4 mm. in length with thick dissepiments.

Syn. *Polystictus rigens* Sacc. et Cub., 26 vol. VI, p. 274.

§3. *Substance tawny or ferruginous.*

Trametes odorata (Wulff.) Fries (Plate II. fig. 10).

Pileus pulvinate, 5 to 8 cm. broad, corky, somewhat soft, shaggy, during the first year brownish-yellow, later blackish-brown, widened, concentrically furrowed, wrinkled, tomentose, with cinnamon colored margin; pores roundish, or oblong, cinnamon.

On old spruce trunks.

Common. In the woods on spruce logs; otherwise on spruce planks and timbers. A small but very common form grows on the planks and sleepers of sidewalks made of hemlock lumber. Here the species produces a brownish rot in the wood which causes it to crumble into a fine brown powder, not unlike that produced by *Lenzites sepiaria* and *Fomes unguolata*.

Our specimens were found in Oneida County, on hemlock logs, and in La Crosse County, Monroe County and Dodge County, on sidewalks and bridge timbers. The largest measure about 7 cm. broad and 6 to 8 cm. long; in thickness they vary from 0.5 to 3 cm.

The pilei may be dimidiate sessile or entirely resupinate. Usually the specimens grow only one season, but many specimens especially resupinate forms growing on the underside of bridge timbers have from two to three strata. The specimens found on spruce trunks in the woods also show several years growth.

The pores and margin when growing are almost cream-yellow, but soon change to cinnamon brown. At first they are soft and moist, staining brown where bruised, but they become corky and brown, and at last blackish and hard. At first the specimens are tomentose shaggy but by weathering they become glabrate and rough. The pores are medium, equal, thick-walled, about as long as the thickness of the pileus. The specimens growing on worked timbers are usually softer in substance and richer in color.

The odor is not very pronounced. When fresh they have merely a disagreeable fungus smell, but on drying the odor becomes stronger and sweetish. In habit and appearance the younger specimens strongly resemble *Lenzites sepiaria*.

The distinguishing characteristics are the rich cinnamon-brown

color, the soft corky substance, the equal to medium-sized pores, and its habitat which is almost invariably hemlock.

Syn. *Boletus annulatus* (Schaeff.); 27, Taf. 106.

Trametes pini (Thore) Fries (Plate IV, fig. 16).

Pileus pulvinate or bracket-shaped, sometimes resupinate, 8—16 cm. broad, very hard, of corky-woody consistence, concentrically sulcate above, rimose-scrupose, rusty-brown becoming black, within yellowish-brown. Pores large, roundish or oblong, reddish-yellow. Spores broadly oval, only more rarely globose, 5—6 microns long, 4—5 microns broad.

On living trunks, especially of pine, but also on other conifers.

Massee says that the flesh is thick behind, that the pores are $\frac{1}{4}$ inch deep the first year, but that the species is perennial and eventually the strata collectively become 1 inch or more thick. He describes them also as having a slight but pleasant odor.

Specimens submitted to Patouillard were identified by him as *Polyporus piceinus* Peck. Henning, to whom specimens were also submitted, expresses the opinion that *P. piceinus* and *Trametes abietis* are the same as *T. pini*. *Polyporus piceinus* (22, 42, p. 25) is described by Peck as follows: "Pileus 1-2 inches broad, thin subcorky, sessile, often concrescent, and imbricated, sometimes resupinate or effuso-reflexed, tomentose, concentrically sulcate, and adorned with intervening elevated tomentose lines or narrow zones, tawny-brown or subspaceous, the thin margin at first golden-yellow, soon tawny, then colorous; the hymenium plane or concave, tawny-cinnamon, the pores minute, subrotund, long, the dissepiments thin but entire; spores minute, subglobose, 4 microns broad."

In further notes on the same species, Peck says that *P. piceinus* grows on spruce only and that its color resembles that of *Lenzites sepiaria*. "*T. pini*," he says, "is a little paler or more tawny." He notes further that it revives the second year and resembles *Fomes pectinatus*, but that it belongs rather to the *Polysticti*.

Our specimens were collected in Milwaukee, La Crosse, Oneida, Vilas, Forest and Ashland Counties on white and red pine, living and dead, on tamarack, living and dead, on dead spruce and dead hemlock. The species is most abundant on tamarack, living and dead, in the northern part of the state and on living white pine. In the pines it produces the well known "dry or ring-rot." Hartig calls it "red rot" (Rothfäule).

The largest specimen was found on a tamarack near Star Lake. This measured about 24 cm. broad, 14 cm. long and 6 cm. thick behind. The base was strongly decurrent and many smaller pilei were growing out of it. The tubes were about 1 cm. long, distinctly stratified and in some places made up of 2 and 3 strata. The specimens collected from the pines and spruces are always much smaller and agree more exactly with Professor Peck's description of *P. piceinus*. Specimens collected on hemlock logs are larger than those on pines but not so large as those on tamarack. Von Schrenck has found the species on fir trees in the New England states, but says that it is rare.

The specimens when dry are very hard and somewhat brittle. In color and general appearance they resemble somewhat *Fomes conchatus* but the color inclines more to reddish-brown and the pores are much longer and more irregular. The older part becomes black, rimose and moss-covered. When young and growing, the margin is of a golden-brown and is covered with a soft velvety tomentum.

The La Crosse County specimens were found on the exposed root of a living white pine.

Syn. *Polyporus pini* Pers.; 23, vol. 11, p. 83.

Porodaedalea pini (Thore) Murrill; 19, vol. 32, p. 367.

Polyporus piceinus Peck; 22, no. 42, p. 25.

Trametes abietis Karst.; 56, vol. VI, p. 346.

8. PORIA.

This genus is made to include all forms which are entirely resupinate. They may be thin membranaceous, fleshy or almost corky expansions or incrustations. A true *Poria* should never be reflexed. This is the tribe *Resupinatae* under *Polyporus* of the older authors. It is considered by some to consist of simply young or abnormal forms of *Polyporus*.

Forms whose pores break up readily into teeth are with difficulty separated from *Irpez*, and thus endless confusion arises.

The genus is abundantly represented throughout the state.

KEY TO WISCONSIN SPECIES OF PORIA

- Pale or white forms.....1
- Darker or bright colored forms.....2
- 1. Growing on the ground.....*P. terrestris*
- 1. Not on the ground..... 3
- 2. Yellow from the start.....*P. nitida*
- 2. Pale yellow, soft.....*P. vitellina*

2. Pale yellow, hard, dry.....*P. xantha*
 2. Violet, thin*P. violacea*
 2. Purple with white margin.....*P. purpurea*
 2. Ferruginous with white margin.....*P. marginellus*
 2. Purple tubes long.....*P. crocicipora*
 2. White becoming yellow and fuscous.....*P. Andersoni*
 2. Brown, soft*P. contigua*
 2. Brown, harder*P. ferruginosa*
 2. Purplish brown woody.....*P. laevigata*
 3. Fleshy, somewhat moist..... 4
 3. Flesh more or less dry..... 5
 4. Very thin, white.....*P. Gordonienstis*
 4. Substance of radiate flocculose strands.....*P. radula*
 4. Soft, pores small, thin.....*P. mollusca*
 4. Dry, thin, pores medium, oblique.....*P. viridans*
 4. Pores lengthened, torn.....*P. subacida*
 4. Pores very long, forming almost the entire thickness of the plant
 *P. medulla-panis*
 4. Pores sinuous *P. sinuosa*
 4. Pores minute, pale yellow or pinkish.....*P. attenuata*
 4. Pores minute, yellowish or tawny.....*P. crassa*
 5. Pores small, blunt.....*P. vulgaris*
 5. Pores larger, torn.....*P. corticola*
 5. Pores large, shallow.....*P. vaporaria*
 5. Pores small, short, stratified.....*P. obducens*
 5. Pores minute irregular.....*P. subfusco-flavida*
 5. Pores minute, regular, angular.....*P. pulchella*

Poria terrestris (D. C.) Fries.

Effused, very thin, composed of delicate byssoid hyphae, white, evanescent; pores central, very minute, white, then rufescent.

Only one specimen has been found in the state. It was growing on the ground in the greenhouse at the University of Wisconsin in December 1899. It was thin, whitish and moist and measured about 3 cm. in length, 2 cm. in width and scarcely 1 mm. in thickness. It was irregular in outline. The margin was somewhat fringed, and the surface was uneven. The pores in the center, were small, irregular, and shallow, becoming a faint reddish-brown. The plant was held to the ground by rhizomorphous strands which were about 8—9 cm. long and from 1—2 mm. thick. They penetrated the ground in various directions for their full length. The spores are subglobose about 4 microns by 3.5 microns.

Syn.; *Polyporus terrestris* (D. C.) Fries, 28, 1 p. 410; 8, p. 576.

***Poria gordoniensis* B. & Br.**

Effused, membranous, very thin, separable, persistently white; margin shortly fimbriate, pores minute, unequal, angulate; dissepiments very thin, fimbriate-dentate.

One lot of specimens of this very small fungus was collected at Parfrey's Glen. The largest pileus is about 1 cm. in diameter, very thin and delicate. The margin is fimbriate, white; the pores scarcely visible to the naked eye, shallow, angulate.

The whole plant has a waxy, white appearance. It grows on very much decayed wood.

***Poria vitellina* Schw**

Widely effused, loosely adnate, thick, uneven, soft and fleshy, vitelline, with a byssine margin. Pores very large, elevated, unequal, thin, angular.

Morgan (18, VI, p. 175) says of this species: "A soft and fleshy fungus of unequal thickness and large and unequal pores. The color is very elegant and persists even in drying. The egg-yellow pervades the whole mass. The long pores vary from round to angular and even sinuous. Strings of yellow mycelium penetrate the rotten wood beneath."

Specimens from the underside of sidewalks at Madison are not quite as thick as described for the species; the margin is thin and cobwebby, like that of *Polyporus bombycinus*. Specimens from Horicon on poplar are perhaps more typical.

The whole substance is soft-brittle. The pores are thin-walled, nearly 3 mm. long with a diameter of about 0.75 mm.

The species looks very much like *Polyporus bombycinus* and like the large-pored forms of *Poria mollusca*.

***Poria radula* (Pers.) Fr.**

Effused, thin, white, formed entirely from the loose, dry mycelium, villous below; pores medium sized, angular, dissepiments toothed, pubescent when young.

One specimen was found growing on the under side of a box in the greenhouse at the University of Wisconsin. The whole bottom of the box was covered by strands of dryish flocculose white mycelium which

radiated in every direction. Here and there they combined to form a thin separable pileus upon which the irregular thin-walled pores were formed. The hymenium is very uneven, due to the fact that the older and central pores become somewhat elongated as in *P. mollusca*. On drying the whole fungus shrinks and becomes a tawny-yellow color. When the plant body is peeled off from the substratum it feels soft and velvety.

This species seems to be very closely related to *P. mollusca* and may be distinguished from it by its larger pores, its looser substance and its loose radiating fibres.

Dudley (22, 41, p. 86) says that this species produces much of the rot found in lumber piles.

When dry the pileus is thin and soft, almost like white tissue paper. The pores vary from 0.4 to 1 mm. in diameter; from 0.3 mm. to 3 mm. in length.

Syn.: *Polyporus radula* (Pers.); 28, p. 407.

***Poria mollusca* (Pers.) Fries.**

Fructification effused, thin, soft, white and a byssoid, radiating-fibrillose border; pores developed from various centers, small, thin, round, unequal, lacerate.

This is a thin soft form more or less easily separable from the substratum, the soft white mycelium creeping over the substratum forms centers for the development of the small very thin-walled pores, and makes the so called "fibrillose-radiating" margin. The pores at length become elongated and torn into teeth.

Comparatively common. Specimens were found on the under side of a sidewalk, on pine chips and running over dead leaves in the woods, at Madison; on an old, partly decayed boat at Sparta; and one specimen in a growing condition on December 28, 1899, under a poplar log at Horicon. It seems abundant in fall and early winter. One specimen collected by Professor Cheney near Brule river in 1897 is perhaps the finest and most representative I have seen, and agrees pretty well with no. 1706 North American Fungi and no. 1013 Fungi Columbiani. The pores have a slightly pinkish tinge. They are short, slightly angular, and shallow with very thin walls. The radiate-fibrillose margin is especially well marked and beautiful. This margin and the thin-walled pores are the distinctive features of the species.

The largest specimen collected was 30 cm. long, 10 to 12 cm. broad, and the subiculum very thin. The pores vary in diameter as well as

in length. The longest ones measured 3 mm. The younger pores are mere depressions in the subiculum.

Syn.: *Polyporus molluscus* (Pers.); 28, I, p. 408.

***Poria viridans* Berk. and Br.**

Effused, crustaceo-adsate, thin, at first white, later pale-greenish, with the margin pulverulent tomentose; pores small; angular, dissepiments thin.

On decayed wood, with the habit of *P. vulgaris*

“On rotten wood. Effused, forming patches a few inches long, perfectly white at first, but in drying assuming a delicate pale green, with honey-like tinge in parts; border pulverulento-tomentose, very thin; pores minute, angular, dissepiments thin. This pretty species has the habit of *P. vulgaris* (B. & Br.) (17, p. 204.)”

Specimens of this species were found near Madison, October 5, 1901, on very rotten wood. It was very thin, dirty-yellowish with a pale-greenish tinge. The margin is very thin, lighter in color. The pores are small; if oblique they are irregular, sinuous; when not oblique they are angular, small.

The species may be known by its thin substance and pale-greenish tinge.

Syn. *Polyporus viridans*. Berk. & Br.; 28, I, p. 410.

***Poria attenuata* Peck (Plate IV, fig. 19).**

Resupinate, effused, very thin, separable from the matrix, pinkish-ochre, the margin whitish; pores minute, subrotund, with thin acute dissepiments.

Comparatively common on bark, sticks and fence rails. Specimens have been found near Madison, Oakfield, Horicon and Sparta. The largest are about 20 cm. long and 10 cm. wide; the subiculum is less than 1 mm. thick. The pores are 1 mm. or less in length and are extremely small.

The margin is irregular, white, and somewhat tomentose, as is also the subiculum. This is only slightly separable from the substratum. The color of the pores is pinkish or yellowish-pink when fresh; in some cases verging towards lilac. In drying it changes to a reddish-tan. The surface is smooth and even, the pores being round, regular and sometimes oblique. Easily recognized by the thin even substance, the white border and the color of the pores.

***Poria violacea* Fries.**

Effused, determinate, usually orbicular, thin, smooth and glabrate, adnate, without much subiculum; violet; pores short, cellular, as if formed by upraised veins, entire.

“Allied to *Merulius*, for which a young specimen might be taken.”

Very thin, closely adnate; pores small, irregular, shallow, soft. Color varying from violet to violet purple. When young the violet, moist mycelium which is sometimes almost gelatinous, covers the substratum very closely and the pores seem to be formed by upfoldings as in *Merulius*, to which it is said to be related. The young specimens may indeed be mistaken for resupinate forms of *Merulius tremellosus*, the color and structure being much the same. Mature specimens may be confounded with resupinate forms of *Polystictus abietinus*. From *Merulius* this species may be separated by the smaller pores with acute dissepiments and the innate thin pileus. *Polyporus abietinus* has longer, more torn pores and a firmer body. (It is also closely related to *Poria purpurea*, but this is usually darker in color and has a white flocculose border.

Our specimens were collected near Palmyra on very rotten wood. The specimens are not large—being about 8—9 cm. long; 2—4 cm. wide; diameter of pores varying from .3 to 2 mm. The mature specimens have a reddish-violet color and the younger ones turned a darker purple-violet on drying.

Syn: *Polyporus violaceus* Fries 28, I, p. 412.

***Poria purpurea* Fries.**

Broadly and irregularly effused, the white flocculose mycelium creeping over the surface of the rotten wood and producing here and there groups of minute, unequal, purple-lilac pores about one line deep.

Morgan (18, VIII, p. 106) says that it occurs on the bark of sugar maple; that it is thin and delicate, occurring in straggling patches, with groups of purple pores on the white mycelium. Some of the dried specimens bleach out white. He also says that this species is the same as *Polyporus lilacinus* Schw.

This is more broadly and irregularly effused than the preceding species. It is very thin, closely innate, with a more or less white-flocculose border, the white mycelium creeping over the rotten wood producing here and there groups of minute unequal purple-lilac pores. The color is decidedly darker than the preceding species; the pores

are the same in size, very irregular, almost sinuous when old, because of the breaking down of the thin dissepiments.

Quite rare. A few specimens were collected at Horicon in 1899 on a rotten willow; and some specimens were collected near Blue Mounds. The largest specimens are about 16 cm. long, 3 cm. wide; the whitish margin is very thin and sometimes even obsolete.

This species is closely related to *P. violacea*, but is darker in color and is distinguished by the white margin. The color is well preserved in our specimens.

Syn. *Polyporus purpureus* Fries; 28, I, p. 412.

Poria crocipora Berk. Curt.

Effused, pulvinate, thick in drying blackish-rufous; margin obtuse; tubules elongate, medium, dissepiments thin, flaccid, saffron.

On decayed wood.

The specimen referred to here was found near Blue Mounds on very much decayed wood. It is about 10 cm. long and 4 cm. wide. In color it is dark-red; the pores short and very small; the flesh thick. It is darker in color than *P. rufa* Schrad., and has thicker flesh. This species was identified by Bresadola.

Poria marginella Peck.

Resupinate, effused, forming extensive patches 2—6 mm. thick; subiculum distinct, firm, subcinnamon, the extreme margin white, becoming dark-ferruginous with age; pores at first short sunk in the tomentum of the subiculum, then longer, minute, rotund, often oblique, brownish ferruginous; glaucous within; dissepiments thick, obtuse.

Not common. Some specimens were found under old pine logs near Ladysmith in August 1905. Specimens collected on *Picea mariana*, in September, were remarkable for, and very distinct by reason of the narrow downy white margin that borders the growing plant.

The largest are 8 cm. long, 3 cm. wide and about 3 mm. thick. When fresh they are soft, moist, pale cinnamon except the margin which is white or pale yellowish-white, tomentose. The pores are very small equal, pale cinnamon and pruinose. When old and while drying they become dark brown.

The species is easily recognized by the cinnamon-colored pores and substance surrounded by the bright white or pale-yellowish margin.

***Poria subacida* Pk. (Plate IV, fig. 18.)**

Effused, separable from the matrix, tough, flexible, unequal, determinate; margin pubescent, narrow, white; pores minute, subrotund 2—6 mm. long, often oblique, white, verging toward tawny, flesh becoming dirty-yellow; dissepiments thin, minutely dentate; odor strongly subacid.

This is perhaps our commonest *Poria*, and is found everywhere under decayed logs. I have specimens from Madison, Sparta, Elkhorn, Horicon, Bangor, Crandon, Hazelhurst, Star Lake, Brule, Ladysmith and Shanagolden, on poplar, maple, tamarack and pine logs.

The color varies from snow white to cream, dirty-yellow and tawny. It always deepens on drying. The surface is always uneven, the margin very narrow and irregular. One large-pored specimen has a broad, soft tomentose sterile margin from which the white mycelium creeps over the surface of the substratum on the leaves and grass.

The pores cannot always be called minute—they are more often medium and sometimes quite large and irregular, varying from 0.3 to 0.9 mm. in diameter. The length varies from 2 to 6 mm. The dissepiments are thin, slightly dentate but often becoming torn. The subiculum is thin and brittle when dry. The odor is quite strong and disagreeable when fresh but becomes less strong and sweeter on drying. One specimen found under a much decayed tamarack log near Hazelhurst had a strong anise-like odor, which is quite persistent.

Old weathered forms have been found almost entirely covered by new growths. The old portions varied in color from dirty-yellow to cinnamon. The tubes in these were unusually long.

Most of my specimens were found on much decayed wood—usually poplar, or oak. The white felt-like mycelium was found everywhere in the cavities of the wood and looks like that of *Polyporus adustus*, but is less firm.

Von Schrenk (Bull. 25, U. S. Dept. Agric.) gives an extended account of the destruction caused by this fungus. It appears that it attacks living trees and its mycelium grows through the soil to infect the roots. Von Schrenk says it is very destructive especially to dead wood.

***Poria medulla-panis* (Pers.) Fries.**

Effuse, determinate, subundulate, firm, smooth, white; slightly margined with a sterile border almost the entire thickness of the plant made up of the rather long pores which are of medium size and entire.

On rotten wood in a greenhouse, also on the underside of a pine drain cover at Madison. Probably fairly common in the state. The specimens found were very well developed forming broad soft almost doughy masses which peel off from the substratum very readily.

***Poria crassa* Karst. (Plate IV, fig. 17.).**

Corky, about 1 cm. thick, pores very small stratose, white, yellowish on drying.

Not very common but the specimens from Shanagolden and between Carr Lake and Little Tomahawk are abundant and well developed on very rotten wood. The largest specimens from Shanagolden are about 2 cm. thick and form massive crust like expanses which are quite plainly stratified. The pores are very minute and the surface and outer strata of old specimens are distinctly yellowish-tawny while the deeper layers are white and chalky.

***Poria sinuosa* Fries.**

Effused, innate, partly separable from the substratum, coriaceous, persistent, arising from a subradicating evanescent mycelium, at first white, then yellowish; beneath naked, brownish; the margin slightly pubescent when young. Pores wide, usually elongated, bent, of different shapes; dissepiments acute, torn.

The specimens agree with no. 2408 North American Fungi, but differ from the above description in that they are not "brownish" underneath, but rather a dirty yellow, as is also the whole plant. At first sight, these forms might be taken for *Irpex tulipifera*, and for this reason, perhaps, they are not collected; but the polyporoid characters are quite distinct.

The few specimens collected were found near Madison growing on oak bark. They were broadly effused and thin, about 15 cm. long and 10 cm. wide. The subiculum which is slightly separable near the margin is about 0.5 mm. thick, and the pores vary from .5 to 1.5 mm. in diameter and are about 2 mm. deep. The dissepiments are thin and toothed at first then torn. The pores are irregular and evenly sinuous. Old specimens are nearly emarginate. The very young ones which start as small papilliform bodies have a wide margin made up of white almost membranaceous mycelium, the pubescence being scarcely perceptible.

The color of the fungus is at first white but becomes a dirty-yellow on drying or maturing. The fungus is leathery and tough when fresh but is brittle when dry.

***Poria vaporaria* (Pers.) Fries.**

Effused, innate, the white flocculent mycelium creeping in the wood; pores large, angulate, whitish-pallid, crowded in a firm persistent stratum.

This is one of the thinnest of our white *Porias*. The pileus is often so thin that it appears as if the pores grow directly from the substratum. The pores are comparatively large, irregular, shallow, seldom more than 1 mm. deep, the dissepiments often breaking down. The innate mycelium starts in little patches here and there.

Not very common. A few small specimens have been found at Madison on fallen oak branches and at Horicon and Bangor. The color changes to cream on drying.

Hartig, in his work on timber diseases, classes this with the most destructive forms, regarding it as the cause of a sort of "dry rot" of pine timber and as infecting also the trees themselves.

Our specimens measure about 7 to 8 cm. long, and 2 cm. wide. The pores usually not more than 1 mm. in diameter.

The species differs from *Poria papyracea* Schweinitz, and *Poria macer* Som., in its habitat rather than in any very definite morphological characteristics. The former is found on dead *Vitis*, the latter on *Populus*. *P. papyracea* is also somewhat thinner than either of the others.

***Poria corticola* Fr.**

Very broadly effused, equable, firm, white or pallid; mycelium interwoven into a subcoriaceous stratum. Pores naked, superficial, commonly obsolete, punctiform.

Not common. Found on oak wood in Madison. One specimen partly covers a decaying *Nummularia*. The largest is about 14 cm. long, 4.5 cm. wide and scarcely 1 mm. thick. When young it is easily separable. The whitish margin is thin and tends to become reflexed. The pores are small and shallow at first and appear to be merely irregular depressions. Later they lengthen somewhat and then become torn so as to resemble an *Irpe*x, or an old *Poria sinuosa*, but are harder and more brittle.

The specimens agree well with no. 1014 Fungi Columbiani and no. 3002 North American Fungi. This species is supposed by Morgan to include the following, which differ perhaps only in the degree of evolution of the substerile pores and the substratum on which they grow: (a) *Poria populina*; (b) *P. faginea*; (c) *P. quercina* (Pers., Myc. Eur.,

p. 141); (d) *P. salicina*, (Seer., 2, p. 174); (e) *P. tulipiferae*, which is broadly effused, white, reflexed; pores subprominent, rough.

Morgan (1) suggests that "perhaps all are only degenerates of other species."

***Poria vulgaris* Fries.**

Broadly effused, white, flesh obsolete, consisting almost entirely of closely packed, minute, round, subequal tubes, about 1 to 2 mm. deep; margin soon even and smooth.

Our specimens were collected on the bark of a poplar log at Madison; at Devils Lake, Bangor, Ladysmith, Blue Mounds, Algoma, and under the roof of a barn near Oakfield. The specimen on the log covered nearly one-fourth of the log and was limited in its development apparently by a profuse growth of *Polystictus pergamenus*. In color it is grayish-white. It is dry, firm, even. The very small pores extend to the very margin. They seem to be mere depressions and are closely packed. They are less than 1 mm. in depth and their diameter varies from 0.1 mm. to 0.2 mm.

The subiculum is scarcely separable from the substratum except in small pieces, and is somewhat thicker in the center than near the margin. In a thicker form the pores are longer, varying from 1 to 5 mm. in depth and the margin is more conspicuous. The specimens found under the roof boards were more separable and the tubes more or less stratified.

This species is closely related to *P. medulla-panis* but is less separable and has smaller pores.

***Poria xantha* Schw.**

Resupinate, effused, unequal, subplicate, rugose, determinate; margin undulate, tumid, substerile; pores minute, regular, angular, tubules suboblique superficial.

On bark. Whole fungus flavescent, hard, dry, 2.5 cm. broad.

A specimen was found on charred wood in August 1903, near Blue Mounds. It is 12 cm. long; 3 cm. broad and 1 mm. thick, and is dry, hard, pale yellow becoming brownish in spots. The pores are very small, dissepiments thin; tubes short, oblique. Margin very narrow.

The species may be known by the pale yellow substance, the narrow margin and the very small pores.

***Poria nitida* (Pers.) Alb. & Schw. (?)**

Effused, subadnate, determinate, margin villous, yellow or almost golden; pores short, minute, round, equal, shining. "On rotten wood. Recognized by its bright yellow color. Crust-like, adnate."

Probably not common. Specimens were found near Madison on oak bark and decaying poplar trunks and at Crandon on maple. They are 5 to 12 cm. long, 2 to 5 cm. broad; the subiculum very thin; it seems to arise from a loose whitish mycelium which can often be found in cavities underneath. The pores are small—perhaps 2 mm. in diameter and vary in depth from 1 mm. to 6 mm. When deep they are often oblique. The mouth of the pores is roundish; the dissepiments obtuse when young but more acute in older specimens. The pores often tear apart on drying. The margin is soft velvety in young specimens but almost disappears in older ones.

The color is bright golden when fresh but becomes duller on drying; some fade almost to whiteness. Young layers of pores are sometimes formed over the older ones so that the plants are somewhat stratose. This condition occurs in one small specimen only. The specimens were somewhat moist when fresh.

***Poria contigua* (Pers.) Fries.**

Effused, about 8 cm. long, 2.5 cm. broad and about 1.5 cm. thick, firm, glabrate, submarginate, cinnamon-brown when young, margin tomentose. Pores large, equal, obtuse, entire.

On decaying wood.

Not common. Specimens were found on a charred pine stump at Bangor, and a few small specimens were found on decaying sticks near Crandon.

The specimens are not large, measuring about 4 cm. by 2 cm. and only 1 to 2 mm. in thickness. They are all dry and of a rich cinnamon-brown when fresh, soft or felt-like, and separable. The pores are large, shallow, quite equal but rather thin-walled. Our specimens do not agree with the description in that they are thin, and the dissepiments can hardly be called obtuse. However, Henning and Patouillard both determined the specimens submitted to them as belonging to this species.

***Poria ferruginosa* (Schrad.) Bres.**

Effused, firm, thick (2.5 cm.) uneven, yellowish-brown, old specimens chestnut—or rusty-brown, with sterile margin. Pores medium, very long, rotund and torn, cinnamon-brown.

Specimens were found at Horicon on an oak rail, but are not common in the southern part of the state. In Oneida, Vilas, Ashland and Forest Counties this species is quite common on the bark of dead arbor vitae.

When young the specimens are soft-felt-like but they soon become hard and firm. The color is a rich rusty ferruginous when fresh, approaching cinnamon in older specimens. The surface is very uneven, being usually higher in the center. The pores are unequal, varying from small, near the margin to large in the center. The tubes also vary in length from 1 mm. near the margin to 5 mm. in the center. The pores are usually rotund, but may be irregular and even sinuous.

The subiculum is inseparable. The margin is not always conspicuous; in young specimens it is often of a golden-brown and velvety. The tubes are lined with many large cystidia.

***Poria laevigata* Fries.**

Broadly effused, leathery rigid, determinate but immarginate, separable from the substratum when mature, even, cinnamon, pores very small, round, entire.

Well-developed specimens were found on birch at Crandon and Muscallonge Lake. The largest were 3 mm. thick by 12 or more cm. broad and were plainly stratified and very woody so as to possibly resemble a resupinate effused specimen of *Fomes nigricans*. The surface is very uneven almost nodular due to irregularities in the bark and the color a deep almost purplish-brown.

***Poria Andersoni* (Ellis & Everhart).**

A resupinate plant with golden yellow spores, covering large areas of decaying wood; mycelium thin, dirty white, forming an almost imperceptible subiculum; pores at first whitish-yellow folds of the subiculum, leaving scarcely any margin not occupied by various stages of imperfectly formed pores, at length appearing yellowish from the abundant spores; pores finally yellowish-brown or dark russet, slightly angular, small (0.25 mm.) becoming cristate at the mouth, 1 cm. or less

deep when fully mature, or with occasional longer masses of pores rising above the general surface, 2 to 2.5 cm long; spores copious, brilliant yellow, oval, smooth, 6 by 4 or 5 microns.

Large growths of this plant were found in November 1889 on pieces of bur-oak which were broken out of the top of a large tree, by the wind, near the shore of Lake Mendota. The fungus grew under the bark and in the fissures of the wood. At places near the top, about 60 feet from the ground it seemed to have completely surrounded the trunk.

The plant is entirely resupinate; the subiculum—whenever it is found—is extremely thin, dirty-white becoming brownish; it more often appears to be obsolete. The pores are angular, at first appearing as shallow folds, whitish then lengthening into teeth or tubes forming a somewhat uneven surface. As my specimens grew around an upright trunk the tubes are very oblique. They become yellowish-black with age. The spores which are characteristic here are golden-yellow and very abundant, covering the plant and wood near by, giving all a yellow color. They measured about 6 microns by 4 to 5 microns and were nearly oval in outline.

Old specimens might be taken for an *Irpea*. The tubes are about 1 to 1.5 cm. in length and are very brittle. Its habit is similar to that of *Irpea obliquus*.

This species is the same as *Poria xanthospora* described by Underwood (28) in 1893. Ellis and Everhart (8) described it under the name *Mucronoporus Andersoni* in 1890. Our specimens agree quite well with no. 910 Fungi Columbiani.

***Poria obducens* Pers.**

Effused, incrusting, innate, firm, white, formed wholly of the pores. Pores minute, crowded, equal, distinctly stratified, the older strata pale alutaceous.

Morgan says that the first year it consists of a thin white separable stratum of crowded pores which become alutaceous later; further, that it is rather humid when young, thus differing from *P. vulgaris* which is always dry and inseparable.

Our specimens were collected under a decaying log at Blue Mounds, August 18, 1903. They are large, sometimes encrusting the entire trunk, irregular, 2—3 mm. thick. They consist almost entirely of tubes. The best preserved specimens are pale alutaceous, while the older parts are somewhat discolored and verge towards reddish-brown.

The distinguishing features seem to be the hard, brittle substance which is inseparable from the substratum, and the stratified tubes.

***Poria subfusco-flavida* Rostk.**

Confluent, broadly effuse, thin, leathery, dry, adnate, from white to yellowish-tawny; margin thin, white, thready, determinate; pores minute, irregular.

On oak wood.

We have well developed specimens from Stone Lake and Crandon. The Crandon specimens are pronounced by Bresadola to be identical with Fries' type. The spores of the specimens from Stone Lake are less globose.

***Poria pulchella* Schw.**

Resupinate-effuse, unequal, sub-plicate, rugose, with determinate margin, outline undulate, nodular, substerile pores minute, regular, angular, tubules somewhat oblique upon the ridges of the surface.

Found at Madison on quite rotten poplar, forming thin expanses of a delicate ashy-gray tinge.

9. POLYSTICTUS Fries.

May be known by the coriaceous, membranaceous or sometimes spongy thin pileus, with a thin, loosely fibrous cuticle. The tubes first appear in the center or near the place of attachment and develop towards the margin; at first superficial punctiform, then becoming deeper. Never hard, woody nor very thick, nor should the pores ever be stratified.

The genus *Trametes* its nearest relative, may be distinguished from it by the unequal length of the tubes; *Fomes* and *Polyporus* by structure and pore-formation.

§1. MESOPODES. *Context and spores ferruginous.*

***Polystictus subsericeus* Peck.**

Pileus coriaceous, subumbilicate, silky-shining with soft appressed ferruginous radiating fibres; stipe slender concolorous, tomentose; pores small, concolorous, angular.

This handsome little fungus was first called *P. splendens* by Peck (22, 33, p. 37); as the name was preoccupied, he changed it to *P. sub-*

sericeus. This species is the same as *P. oblectans* Berkeley, and *P. cinnamomeus* Sacc.

In habit and appearance it is often confused with *P. perennis*, from which, however, it seems quite distinct. The surface is always shining with soft, silky, radiating fibres; the stipe is of a richer color than that of *P. perennis*, and the plant is smaller and more delicate than *P. perennis*. Like *P. perennis*, this species grows on the ground from small roots, preferably those of conifers. Specimens of the two often grow side by side, and the differences are then apparent.

Our specimens have been collected near Blanchardville, Blue Mounds, Sparta, Hazelhurst, Star Lake and Crandon. The largest was about 4 cm. in diameter; the stipe 2.5 cm. long and 4 mm. thick. The pileus is scarcely 1 mm thick. The pores are about the same as those of *P. perennis*.

***Polystictus perennis* (L.) Fries.**

Pileus plano-infundibuliform, 2.5 to 7.5 cm. across, thin, coriaceous, tough, velvety, becoming smooth, zoned, clear cinnamon, then yellow to brick-red; stem firm but not hard, 1.5 to 5 cm high, thickened below, minutely velvety; pores very short, minute, angular, dissepiments becoming torn; at first with a white bloom, then naked; spores elliptical, hyaline, 4 to 5 by 2.5 microns.

Found on the ground under trees, especially in sandy regions, in fall and winter, and it is said to remain in growing condition through the following summer.

Collected at Sparta, Blanchardville, (McKenna), Blue Mounds, Hazelhurst, Star Lake, Crandon, Ladysmith, Shanagolden and in the Lake Superior region (Cheney). Whenever excavations are made in the northern part of the state in the woods, there this fungus makes its appearance, like *P. subsericeus*, growing from minute rootlets that become exposed.

When young the plant is soft, velvety, but not shiny, cinnamon brown and tough. Older specimens become harder, glabrate, grayish brown and zoned with concentric darker circles, ridges or sulcations. The pileus is usually somewhat depressed in the center, although I have some specimens that are nearly plane. The flesh is thin, fibrous and brown in color. The margin is very thin, more or less fimbriate, and darker than the rest of the pileus. The plants are often confluent—the pilei and even the stipes growing together. The stipes are short, slightly velvety, bullose at the base, cinnamon. The pores are large, short at first, very irregular, almost sinuous, with very thin dissepiments.

iments, at length torn and wavy, sometimes becoming oblique. They are of the same color as the stipe. Dimensions of largest specimen 12 cm. in diameter; stipe 4 cm. long, flesh about 2 mm. thick.

This species is related to *P. subsericeus* Peck. from which it is distinguished by its coarser and larger structure as well as its duller pileus.

§2. DISCIPEDES. *Clustered, stipe short, scutate-dilated at base, subreniform or spatulate, coriaceous.*

***Polystictus conchifer* Schw. (Plate IV, fig. 20).**

Small, spongy-coriaceous, thin, white; pileus conchiform, very smooth, shining; pores medium, dentate.

Young specimens are quite common in autumn on fallen twigs, especially those of elm. Older and mature specimens are not so common. A few of the latter have been collected at Horicon, Madison, Bangor, Hazelhurst, Crandon. The largest of these is about 4 cm. wide, 3 cm. long and from 1—4 mm. thick. They are mostly dimidiate or flabelliform, a few are scarcely substipitate. The margin is very acute, either smooth and rounded or lobed and wavy. The pileus is smooth, or it may in some cases be roughened by scales or tubercles; it is often radiately rugose and has narrow concentric sulcations. The base is usually more or less thickened and narrowed.

The color varies from white to pale-tawny or straw-color. The flesh is thin, soft, somewhat fibrous, white. The pores are hardly medium in size, equal, irregular, of the same color as the pileus. The dissepiments are thin and slightly dentate. The length of the tubes is nearly twice the thickness of the pileus—averaging about 2—2.5 mm.

The mature specimens are very different from the young ones. These usually arise in the form of small cup or saucer-shaped bodies—with a longer or shorter stipe, or wholly sessile; resembling in various stages small *Pezizas* or *Thelephoras*. Within, the cups or saucers are dark brown with more or less shining zones or bands. These bands soon fade when exposed to the weather, if the specimen is dead, and the plant becomes a lusterless grayish-white. At the saucer-stage the pores first make their appearance on the outside under the rim. Then the lower edge of the saucer grows out into a pileus. The saucer may persist in its entirety, or in part; it may break up and the fragments be distributed over the surface of the pileus as tubercles or scales; it may simply leave a depression, or it may disappear entirely.

These tubercles and scales are perhaps the most striking characteristics by which to distinguish the older specimens from the allied species *P. versicolor*, *P. gossypinus* and *P. virgineus*.

Syn. *Poronidulus conchifer* (Schw.) Murrill, 19, vol. 31, p. 426.

***Polystictus virgineus* Schweinitz.**

White. Pileus coriaceous, thin, tough, zonate, glabrous, radiately wrinkled, tuberculose; the margin thin, undulate; the context floccose-fibrous, white. Pores medium, round, entire; becoming thin, angular, acute.

Not common. A few specimens were collected at Star Lake by Timberlake. The largest specimen is 8 cm. wide, 5 cm. long; flesh 1 mm. thick; pores about 2 mm. long. The specimens are more or less cespiteose, attached by a narrow somewhat decurrent base. They are of a reddish-straw color; densely concentrically sulcate; at first somewhat velvety then glabrous; depressed behind. The margin is very acute, more or less lobed. The pores, at first white, become tawny on drying. They are small, irregular, with thin slightly dentate dissepiments. The specimens grew on a much decayed piece of poplar.

Macbride (15, p. 17) says this beautiful species is to be included under *P. conchifer* Schw., but it seems to me to be a larger, darker-colored species, with larger, more irregular pores. Neither do we find any scales nor tubercles on the pileus. Still the two species are doubtless closely related.

§3. CORIACEI. *Pileus leathery, villous, concentrically zoned.*

***Polystictus versicolor* (L.) Fries.**

Pileus coriaceous, thin, rigid, applanate, depressed behind, smooth, velvety, shining, marked by diversely colored zones; pores minute, round, acute, lacerate, white then pallescent-yellowish.

Next to *P. pergamenus* this is the most common *Polystictus*. It is found everywhere throughout the state on all sorts of wood. The species is quite variable in color as well as in form and size. It may be wholly resupinate, effuso-reflexed, dimidiate-imbricated, rosetted, laterally confluent or even substipitate. One small specimen found on a stump near Elkhorn was apparently centrally stiped with the pores decurrent.

The pileus is always more or less silky with several darker, shining, concentric zones, which, however, are sometimes absent in certain darker varieties. They are quite thin—1 to 3 mm.—but sometimes as much as 7 or 8 mm. thick at the base. The margin is always very acute, wavy, rounded or lobed; sometimes lighter in color—as in var. *albo-marginatus* Pk., or concolorous, or darker; either incurved or explanate. The pores are either white or yellowish; very small and shallow, but become lengthened and torn with age.

One resupinate specimen which had vesicular pores, thus being a *Myriadoporus*, was found on a log near Lake Mendota. The reason for this distorted growth seemed to be that the log had been turned over so that the hymenium faced upwards, and thus in the endeavor to readjust itself to its changed conditions, it formed the cellular pores.

Var. *albo-marginatus* Fries.

Specimens of this variety are sometimes found. It is described thus: "Pileus as in type but the margin rather broadly covered by white hairs often definitely separated from the darker part by a glabrous zone; pores white, often lacerated."

Closely related to *P. zonatus*, *P. planus*, *P. hirsutus*, and *P. velutinus*. It is thinner and smaller than any of these except *P. planus*. None of them, however, have the characteristic shining zones. Von Schrenk discusses the destructive work of this fungus on timber and describes the heart rot of living catalpa due to it which ultimately brings about the death of the tree and the destruction of the trunk. The white mycelial strands are said to enter the tree through the roots, causing them to rot off, and in a few years the tree dies. It is recommended that wounds in the roots be covered with pitch or coal tar and also that the base of the trunk should be protected in this way.

Syn.: *Boletus atro-rufus et variegatus* (Schaeff.); 27, Taf. 268 and 263.

Coriolus versicolor (L.) Quél.; 19, vol. 32, p. 642.

Polystictus zonatus (Nees) Fries.

Pileus coriaceous to suberose, convex, tuberculose and gibbous behind, subzonate villous; margin becoming white; pores minute, round or angulate, obtuse, whitish.

Probably not very common. A few specimens were found near Horicon in December 1899, and some at Elkhorn and Bangor and a few

near Hazelhurst on a shrub; the first on poplar, the others on oak. The largest specimen is about 4 cm. wide, 3 cm. long, and 3 mm. thick, but the base is much thicker. The pilei are usually imbricated or laterally confluent; the base is thick and somewhat decurrent. Young specimens are a pale yellow, while older ones may be grayish or ochraceous. The margin is acute, even, usually incurved on drying and a little lighter than the pileus. The whole pileus is covered with very soft pubescence and has usually from 1—3 slight concentric sulcations. The pores are medium, from white to tawny, or in some instances they become slaty; usually irregular, about twice as long as the thickness of the white floccoso-fibrous substance of the pileus. Dissepiments not as obtuse as in *P. hirsutus*.

Closely related to *P. versicolor*, *P. hirsutus*, *P. velutinus* and *P. balsameus*. The shining zones distinguish the first; it is thinner than *P. hirsutus* and has larger, less obtuse pores; *P. velutinus* is thinner, with a more acute margin, and smaller, more rounded pores. The last species has also slighter villosity which is distributed in patches or zones.

***Polystictus velutinus* Fries (Plate IV, fig. 21).**

Pileus corky-coriaceous, plane on both sides, soft-velvety, indistinctly zoned, white becoming yellowish, margin plane, acute; pores round, minute, dissepiments thin, white.

"About 5 cm. broad, moist when young, then hard, not shining like *P. versicolor*, zones sometimes a little obscured." (Sac.)

This species is not very common. Specimens found on Madaline Island and at Star Lake on birch logs. Largest specimen 4 cm. broad, 3.5 cm. long, 7 mm. thick; tubes 4 mm. deep. The specimens belong to the var. *glabriusculus* Bres. They are glabrate or nearly so, rough-tuberculate near the base which is narrowed so as to make the pilei substipitate or flabelliform. The substance is white, the surface yellowish, subzonate; the margin plane, acute. The pores are small, whitish with thin dissepiments.

The species is distinguished from its allies *P. hirsutus*, *P. versicolor* and *P. zonatus* by being more delicate, lighter in color and weight, and less zonate.

***Polystictus hirsutus* (Schrad.) Fries.**

Pileus suberose-coriaceous, convexo-plane, rough with rigid hairs of one color, whitish, but zonate with concentric furrows; pores round, obtuse, whitish or sub-fuscous.

Very common on all sorts of wood.

My largest specimen is 10 cm. wide, 6 cm. long and 5 mm. thick; the pores are 3 mm. in length. Some specimens are very much thicker, especially when young. One specimen measures 3 cm. in width, 1 cm. in length and 2 cm. in thickness; the pores in this one are 0.4 mm. long. This form seems to be more typical for young pilei, which are often truly unguulate.

Older or mature specimens may be dimidiate, helicoid, rosetted and very much imbricated or they may be single and centrally attached on the upper side of a limb. In color they vary from straw-yellow, through tawny to gray, becoming black when weathered. They are covered with a dense velvety pubescence and show few or many concentric furrows or sulcations.

The margin becomes acute; it may be even, wavy or lobed and is sometimes a little lighter than the pileus. The flesh is white and soft but tough. The pores are small, round, obtuse when young, but become more acute with age and sometimes even torn. In color they vary; some are white, some straw color, or tawny or slaty. In a few specimens all of the pores are of a slaty gray, and in some there is a band of slaty pores near the margin while the rest are yellow. However, it appears that the mouth only has this color, the rest of the tube is white.

The present species may be distinguished by its hirsuteness and the more or less obtuse dissepiments. It is larger and thicker than *P. zonatus* and has smaller pores; it is more densely hirsute than *P. velutinus*; and *P. versicolor* differs in its shining zones, thinner substance and more acute dissepiments.

Polystictus abietinus (Dicks) Fries (Plate IV, fig. 22.)

Pileus thin, coriaceous, flaccid, effuso-reflexed, or sometimes entirely resupinate, silky-villous, grayish white or with an ochraceous tinge, indistinctly zoned; pores shallow, unequal; dissepiments torn, violet, becoming pale; spores elliptical-oblong, 4 by 1.5 microns.

Quite common throughout the pine belt of the north. Our specimens have been collected from Crandon, Hazelhurst, Star Lake, Lady-smith and Shanagolden, chiefly on hemlock, dead and living, also on various pines, fir, and tamarack. It is usually smaller than *P. pergamenus*, which it resembles very much; however, it probably never occurs on any other than coniferous trees. The surface is zoned with concentric sulcations. The pores are larger, more delicate, and shal-

lower than those of *P. pergamenus*. The color of both species is the same.

P. abietinus is a very destructive fungus in our northern woods, attacking especially the hemlock and tamarack and producing decay. These trees may become infected through wounds in the bark from which infection spreads around the tree through the sapwood, producing a peculiar decay to a depth of about two inches. Eventually the fungus kills the tree.

Syn. *Coriolus abietinus* (Dicks.) Quél.; 19, vol. 32, p. 654.

Polystictus planus Peck.

Pileus thin, coriaceous, plane, suborbicular, about 2.5 cm. broad, sometimes confluent, dorsally attached, minutely villose or velvety, brown or brownish, fawn colored, variegated with narrow darker glabrous zones, margin whitish, pores minute, obtuse, short, subrotund, whitish or pallid; flesh pallid. Colors of *P. scutellatus*.

This little species seems to be rare and has been collected twice. The specimens were found near Madison on oak branches and twigs near the ground. They are darker and thinner than *P. versicolor*, not sericeous nor shining. On one specimen the zones are almost black. The pileus is explanate, the thin margin slightly reflexed. One specimen is drawn out into a sort of irregular lateral stipe, another is sessile—both of these are gibbous behind. The color varies from brown to almost black. Substance thin, coriaceous, white. The margin very thin, lighter than the rest of the pileus.

The pores are small, shallower than in *P. versicolor*, from whitish to pale tawny. The dissepiments are at first quite obtuse; later they become thinner.

§4. STUPPOSI. *Dimidiate-sessile, pilei floccose, glabrate or appressed-villous, uneven, azonate; context fibrous to lignose.*

Context white.

Polystictus fibula Fries.

Pileus leathery, soft, tough, velvety-hirsute, azonate, whitish, often radiate-rugose, snow-white within, with entire acute margin; pores small, roundish, acute, at length lacerate, yellowish.

On fallen oak branches. Pilei variously shaped; flabelliform, orbicular, shield-shaped or rosetted.

Common on fallen oak or hickory branches. Specimens have been found near Madison, Oakfield, Hazelhurst, Crandon, and Bangor. The largest specimens are about 4 to 5 cm. in breadth, 2 to 3 cm. long and 2 to 4 mm. thick. The specimens are usually more or less concentrically sulcate, with a very acute margin. The pubescence is thick and soft, whitish when young but turning to a pale brownish gray, especially when exposed to sunlight while growing.

The pores are smaller and more acute than those of its nearest relative—*P. hirsutus*. The substance of the pileus is white, corky and of very light weight.

This species is often mistaken for a small form of *P. hirsutus*. It differs, however, in the more acute margin, the smaller lighter colored pores, the softer context and in its color.

***Polystictus molliusculus* Berk.**

Whitish, pileus corky, thin, radiately wrinkled, zonate, velvety-strigose; margin often lobed; the context floccose, white. Pores medium, subrotund, then thin, acute, lacerate.

Morgan says of this species that the pilei are "usually imbricated and usually effuso-reflexed; the zones of soft strigae are sometimes a little deeper colored. The dried plants are very light and of an isabelle or alutaceous hue." *P. fibula* Fries, an allied form, he says, differs from it in its uniform and more conspicuous pubescence not arranged in zones.

Two specimens were found at Bangor in the fall growing on elm; a few old and discolored ones were found at Sparta on birch. Some of them are imbricated but none effuso-reflexed. The best formed specimen measures about 4 cm. wide and 1.5 cm. long; the white, zonate flesh of the pileus is about 4 mm. thick or as thick as the length of the longest tubes, and looks about the same as that in *P. hirsutus*. Some of our specimens are somewhat thickened behind. The zones are marked by glabrous, somewhat brownish bands. The margin is thin and somewhat curved downwards; in older specimens it is often waved and lobed.

This species seems closely allied to *P. hirsutus*, *P. zonatus*, and *P. fibula*. It differs from them in its glabrous zones and the shorter and softer pubescence.

Syn.: *Coriolus biformis* (Kl.) Pat.; 19, 32, p. 653.

Polystictus pergamenus Fries.

Pileus coriaceous-membranaceous, rigid, tomentose, concentrically sulcate, white; pores seriate (palescent), changing at length into very thin dentate lamellae.

This is probably our commonest *Polystictus*, occurring on the wood of very many species of deciduous trees and found at all times of the year; even in winter beginning to grow with every warm spell of weather.

It is quite variable, being resupinate, reflexed, dimidiate or imbricated. The color varies from almost snow white to gray; sometimes without zones, and sometimes with variously colored zones or more or less shining bands; soft velvety; tomentose or glabrate. The margin is always acute but may be even or lobed; it may be of a fuscous color, or violet or whitish. It is usually violet when growing but not always.

The pores are small, irregular, seriate, produced at length in the form of very thin, dentate, more or less concentric lamellae. Their color varies. It is usually violet when growing but changes to some shade of brown on drying. However, some are never violet, but may be pale tawny or straw-color.

Old pilei seem to grow from the margin so that one frequently finds specimens concentrically sulcate, with a broad whitish margin while the rest of the pileus is darker gray.

According to Peck. (22, Rept. 33, p. 36) the synonymy includes *P. elongatus* Berk., *P. pseudopergamenus* Thüm., and according to Berkeley and Curtis *P. Mendanianus* and *P. laceratus* also belong here.

I have collected a small form—narrow and long—usually growing on birch, which is perhaps Berkeley's *P. elongatus*. It is almost glabrous from the beginning with delicate concentric shining zones and with radiate striations.

P. pergamenus varies much in size and shape, the resupinate forms often covering the whole underside of a log. My largest dimidiate specimen is about 10 cm. wide, 5 cm. long and from 2 to 4 mm. thick. Of the small variety the largest is about 3 cm. wide, 4 to 5 cm. long and not more than 1 mm. thick.

The soft white mycelium creeps through the wood and produces very destructive decay. We find it on wood that is comparatively sound as well as on very rotten wood. In nearly all cases the mycelium can be found throughout the infected piece of timber. Von Schrenk has described the decay in detail.

Syn.: *Coriolus pergamenus* (Fries) Pat.; 19, 32, p. 654.

***Polystictus biformis* Klotz.**

Imbricate; pileus effuso-reflexed, coriaceous, soft, villose-tomentose, white, zoneless at first, even, then concentrically sulcate; margin entire acute; pores rather large acute pale wood color, finally lacerate dentate.

Well developed specimens of this species were found at Crandon and Ladysmith. The largest measured 2 to 3 cm. in width by 8 to 10 cm. in length.

***Polystictus cinnabarinus* (Jacq.) Fries.**

Pileus suberose, convexo-plane, subzonate, rugulose, from pubescent to glabrate, cinnabar-red, fading, within floccose, brighter; pores round, medium, bright cinnabar.

Specimens have been collected from Madison, Blue Mounds, Horicon, Sparta, Hazelhurst, Shanagolden, Crandon, and the Lake Superior region (Cheney).

Common on hickory, poplar, wild cherry and oak. My largest specimen is about 14 cm. wide, 6 cm. long and 1.5 cm. thick. The tubes are about 4 mm. long.

Very easily recognized by its bright red or cinnabar color, which weathers to a reddish-gray on top but is persistent below. Young pilei and the growing parts of older ones are very softly pubescent but the older parts become rough with wrinkles and pits and are more or less glabrate. The flesh is soft, pulpy, lighter in color and delicately zoned. The pilei are convex above and plane beneath, dimidiate, sometimes laterally confluent; margin acute.

The pores are small, roundish, bright red. The dissepiments not very thick, slightly dentate. In one old specimen the tubes are distinctly stratified. It seems there was a renewal of the hymenium which, however, did not extend entirely to the margin. The tubes in the old layer are 2 mm. long, and in the new, 2.5 mm.

P. sanguineus L. seems to be the only species that looks very much like this handsome fungus; it is thinner, less pubescent, has smaller pores and is said to be substipitate.

This species is often placed in the genus *Trametes*, but the pores I think show more of the characteristics of *Polystictus* than of *Trametes*.

Syn.: *Boletus coccineus* Bull.; 7, tab. 501.

Pycnoporus cinnabarinus (Jacq.) Karst.; 13, p. 18; 19, 31, p. 420.

10. FOMES Fries.

This genus is characterized by its woody-indurated pileus, (rarely soft), floccose interwoven texture, covered with a rigid crust, azonate at first but becoming concentrically sulcate; perennial, the successive strata being formed by the further growth from the surface of the last formed stratum.

Here is where the large, hard, woody bracket fungi belong, easily recognizable by their hard crust and stratified pores.

A number of closely related species having their tubes lined with spines and spinules are placed by some authors in the genus *Mucronoporus* E. & Ev., but are here retained in the genus *Fomes*.

KEY TO WISCONSIN SPECIES OF FOMES

- | | |
|---------------------------------|-----------------------|
| 1. Stipitate, laccate | <i>F. lucidus</i> |
| 2. Sessile | |
| a. Substance dark-brown | <i>F. applanatus</i> |
| | <i>F. fomentarius</i> |
| b. Substance rust-colored | <i>F. Everhartii</i> |
| | <i>F. Bakeri</i> |
| | <i>F. igniarius</i> |
| | <i>F. nigricans</i> |
| | <i>F. rimosus</i> |
| | <i>F. conchatus.</i> |
| | <i>F. ribis</i> |
| c. Rose-colored | <i>F. carneus</i> |
| | <i>F. roseus</i> |
| d. White or pale | <i>F. unguatus</i> |
| | <i>F. marginatus</i> |
| | <i>F. populinus</i> |
| | <i>F. connatus</i> |
| | <i>F. officinalis</i> |
| 3. Resupinate-reflexed | <i>F. salicinus</i> |

§1. LIGNOSI. *Hard, lignose, covered with a thin rind.*

Fomes populinus Fries.

White, pileus between corky and woody, rigid, zoneless, villose, margin obtuse; white within; pores minute, short, rounded.

Rare. Collected on dead *Populus tremuloides*. The largest specimen is about 6 cm. broad, 4 cm. long and 2 cm. thick. Most of them, however, are smaller. The pilei are imbricated and grown together

at the decurrent base. They are said to be floccoso-mealy at first, and not stratose; however, I find my largest specimen to be somewhat stratified. The pubescence is between hirsute and villous. The hairs become stiff and ragged (Zottig) with age. Young specimens look much like young specimens of *Trametes Peckii* (Kaleh.), but the color of the latter is darker and the pores are longer and larger. The pores are small and short, not more than from 1 to 2 mm. in length with thick dissepiments.

Distinguished from *F. Neesii* Fr. by the obtuse margin and the persistent pubescence and from *F. ulmarius*, another near relative, by being smaller, less stratose and by the pubescence.

§2. FOMENTARIUM. *Punky, not fleshy not spongy; incrusting with a horny rind. Pores stratose.*

(a). Substance white or pale.

***Fomes connatus* Fries (Plate V, fig. 23).**

Between corky and woody, effuso-reflexed, densely imbricated, laterally confluent, velvety, grayish-white; flesh white, zoned, tubes stratose, pores minute, roundish, white.

Common on maple and elm, on living and dead trunks.

Localities: Horicon, Blue Mounds, Baraboo, Shanagolden, Crandon and Algoma (Dodge). The species grows out of wounds and cracks on maples, elms and beeches and produces a rot in the heartwood of these trees. The method of infection and spread of the fungus in these trees is a subject for further study. The largest specimen is 12 cm. in width and 10 cm. long; the total thickness is 10 cm. The tubes in the strata are from 4 to 8 mm. in length.

The surface of the older parts of the pilei is rough, grayish-white and usually moss-covered. The younger portions are white, soft, almost spongy, when fresh, somewhat velvety. On drying this part as well as the pores and flesh become a pale wood-color. The substance is somewhat soft, fibrous-corky. It is indeed the softest *Fomes* in our collection and the lightest in weight. The margin is somewhat acute and turns down. The pores are small, equal, with acute dissepiments.

Can be easily recognized by its white color, soft substance, the densely imbricated and confluent pilei and the short, even, stratified tubes.

Related to *F. cystisinus* Berk., but distinct by reason of the softer substance and smaller pilei, however, like *F. cystisinus*, the pilei are sometimes tuberculated.

Fomes roseus (Alb. & Schw.) Fries.

Pileus suberose-lignose, hard, triquetrous, smooth, clustered, within and without rose-color, the color obscured without by a grayish-black bloom, within floccoso-fibrous; pores minute, rotund, concolorous; spores 6 microns long.

"Pileus 5—12 cm. broad, base 1—3 cm. thick. Subcespitose. *Poria stalactites* Hoffm. is a subterranean monstrosity of this fungus." Saccardo (26, VI, p. 189).

Common. Found chiefly on tamarack, hemlock, spruce and pine. Localities: Hazelhurst, Shanagolden, Star Lake, Crandon, Ladysmith, Brule, Horicon and Blue Mounds. Largest specimen 6 cm. broad, 3 cm. long, 2 cm. thick. The pileus is hard-corky, glabrous, smoky, or grayish-black toward the base, the rose tints becoming more and more marked toward the margin. The substance is fibrous-corky, pale rose-color, as are also the tubes. Pores small with obtuse dissepiments, tubules stratified. This species is closely related to *F. carneus* Nees, from which it may be distinguished by the hard, smooth, unguulate pileus. The flesh and tubes are of a slightly paler color.

Peck (22, Rept. 54, p. 154) gives further notes on *F. roseus* as follows: "The pores have nearly the same color, and size as in *F. carneus* and the young pileus and newly grown margin also resemble those of *F. carneus* in color, but the shape of the pileus is different. It is thicker, triquetrous or unguulate, not imbricate, nor laterally confluent, the surface more even and covered with a corneous crust after the first year. The pileus becomes blackish or cinereous and is somewhat marked by concentric furrows or depressions showing the limits of the yearly increments. The substance is similar to that of *F. carneus*, but the color is slightly paler."

Syn.: *Fomitopsis rosea* (Alb. et Schw.) Karst.; 13, p. 18.

Fomes carneus Nees.

Pileus effuso-reflexed, lignose, hard, thin, rugose, glabrous, azonate, carneus or flesh-colored, concolorous within; pores minute, round decurrent at the base.

Pilei longitudinally effused, imbricate, rarely solitary, 8 to 10 cm. long, 2.5 to 4 cm. broad, 5 to 7 mm. thick.

Peck (22, Rept. 54, p. 169) makes the following observations on this species: "Very abundant on decaying trunks of spruce trees in Adirondack region. It is perennial, the upper surface of the pileus gen-

erally becomes more or less blackened after the first year. Occasionally a new flesh-colored growth overspreads it either wholly or in part. Two forms occur which depart somewhat from the type. In one the pileus is more or less zonate, especially toward the margin, though often indistinctly so. Sometimes the margin is zonate and the rest tuberculate. This seems to me to be worthy of varietal distinction, and I propose for it the name *Fomes carneus subzonatus* n. var. Its pilei are often imbricated, and the color is paler than in the common form. In the other the surface of the pileus is uneven and scabrous with minute tufts of short, erect hairs or fibrils. To the naked eye the surface appears somewhat granular. To this variety I apply the name *Fomes carneus granularis* n. var."

This species is quite common on larch, pine and spruce logs. Localities: Milwaukee, Hazelhurst, Star Lake, Shanagolden and Ladysmith. Largest specimen 10 cm. wide, 8 cm. long and 8 mm. thick.

The species differs from *F. roseus*, whose color and substance are about the same, by being thinner, very much imbricated and laterally confluent, and its lack of the horny crust that is found in old specimens of *F. roseus*.

***F. carneus* Nees *subzonatus* Pk.**

This variety as described above by Peck, is also quite common.

Our specimens of the above two species agree well with the descriptions, still I am inclined to question whether *F. carneus* may not be merely a variety of *F. roseus*.

***Fomes unguulatus* (Schaeff.) Sacc. (Plate V, fig. 24 a and b; Plate VIII fig. 28.)**

Pileus unguulate, 10 to 12 cm. broad, thick, concentrically sulcate, rufous to ochraceous, subzonate, rugulose (not at all varnished); margin yellowish-tawny; pores minute, short, whitish-yellow.

Saccardo (26, VI, p. 126) says: "perhaps an unguulate, sulcate-zonate variety of the preceding." (*Fomes pinicola*).

I include here most of the forms which Peck, Von Schrenk and others have included under *F. pinicola* Fries.

Writing of *F. pinicola* Fries, Peck (22, 54, p. 169) says: "This species is very common in the Adirondack region, growing on old trunks of coniferous trees. If rightly limited it is a most variable species not only in shape and color but also in size. It is usually 7.5 to 12.5 cm. in diameter, but sometimes much larger. Two specimens were found

growing on a hemlock stump near Gansevoort that were more depressed than usual and were from 25 to 30 cm broad. A form growing on wood of deciduous trees is less common and is destitute of the red and yellow colors that are generally present in forms on wood of coniferous trees."

This species is very common in the northern half of the state and very variable in form, color, size and host. It grows on pine, tamarack, spruce, hemlock and birch. Localities: Gagen, Crandon, Hazelhurst, Star Lake, Ladysmith, Shanagolden, Brule river (Overton) and the Lake Superior Region. (Cheney.) One specimen was found on a hickory stump at Madison by McKenna.

Schweinitz (24, p. 157) describes a form as *Fomes pini-canadensis*: "suberose, almost entirely resupinate, the margin of the pileus not conspicuous, inseparable from the wood, hard and contracted, grayish-brown, adpressed-fibrous, subzonate; ovate-orbicular in outline; margin acute, 10—15 cm. in diameter; tubes long, toward the margin sterile, tawny-reddish, within grayish, pores minute, angular, reddish-fleshcolor. On trunks of *Pinus canadensis*."

This is in my opinion a resupinate form of *F. unguatus* and is found on the underside of pine logs on which the reflexed forms are also present. A specimen was found near Hazelhurst which was 31 cm. long, 12 cm. wide and 2.5 cm. thick, consisting of six strata which averaged about 4 mm. in thickness. One specimen found at Montreal by Cheney is 12 cm. long, 9 cm. wide and 8 cm. thick. In this resupinate form as well as in the type form, red colors are regularly lacking from the surface of the pileus.

Fomes unguatus pinicola (Sw.) (Plate V, fig. 24 c and d).

I include here less common unguulate forms with bright red margin. Pileus at first pulvinate then unguulate, covered with a rind, glabrous, unequal, tawny becoming blackish, margin of the adult cinnabar, within hard, pallid; pores minute, dissepiments obtuse, from pallid to ochraceous.

Specimens belonging to this form are most common on coniferous trees, but are found also on birch. They are thick, less appanate than *F. marginatus*, the zones more narrow, the tubes shorter and the substance harder than that of *F. marginatus*. The variety differs from the type in the thicker pilei and in the bright red color of the margin. The newest growth is yellowish and the next a narrow zone, is red; the rest of the pileus is grayish or blackish. The largest specimen, which

grew on a tamarack stump, was 12 cm. long, 13 cm. wide and 13.5 cm. thick, and was composed of 22 strata of tubes, the average thickness of each stratum being about 6 mm.

It seems to me that *F. pinicola* (Swartz) and *F. pini-canadensis* Schw. should be treated as above. Their characters are certainly not definite enough to be distinctive of species. Whether they indicate the existence of well marked varieties is perhaps also a question.

Fomes marginatus Fries No. 1204 of Fungi Columbiani E. & E., is what we have identified as the resupinate form of *F. unguulatus*. Schaeffer's figures (27, tab. 137) agree quite well with our specimens of *F. unguulatus*, especially with the variety *pinicola*.

Murrill (19, 32, p. 487) makes *F. pini-canadensis* Schw. a synonym of *F. Pilotae* of the same author. However, we have specimens which agree well with the description of *F. Pilotae* which grow on much decayed wood of deciduous trees, and specimens which agree with the description of *P. pini-canadensis* which were found on pine. The two types appear to be widely different.

Syn.: *Boletus unguulatus* Schaeff.; 27, 2, taf. 137, not 138.

Boletus fulvus Schaeff.; 27, 3, taf. 262.

Fomitopsis pinicola (Swartz) Karst. pr. p.; 13, 3, p. 18 (1881.)

***Fomes marginatus* (Fr.) (Pl. VI, fig. 25).**

Pileus suberose-lignose, subapplanate, covered with a rind, concentrically sulcate, glabrate but grayish-pruinose, margin pallid, of various colored zones, alutaceous within; pores round straw-colored, when rubbed turning reddish.

Saccardo gives the following substrata for this form: "On oak trunks, beech, birch, pine, etc., in Europe and near Conception, Uruguay, South America." Fries says the pileus gets a different-colored zone every year; the first is whitish-gray; the second tawny-bay, the third blood-red; older zones are blackish.

The specimens which we include here are large explanate, concentrically sulcate, rugose and glabrous. The colors are very characteristic; the most recent growth pale yellowish; this is followed by a broad bright red zone and this in turn in the most rapidly grown specimens by a dark purple-red zone. The older parts are grayish-black. The substance and the tubes are pallid or straw-color as in the preceding species. The young margin and tubes turn pale flesh-color when bruised, as do also those of *F. unguulatus* and its varieties. Largest pileus 35 cm. wide, 28 cm. long and 8 cm. thick. One specimen, con-

sisting of five layers of tubes, was 20 cm. wide, 11 cm. long and 6 cm. thick; the strata averaged about 6 mm. in thickness. This shows the relation of the thickness of the strata to the width of the zones of growth. The relation of the width of the pileus to the number of zones of growth shows most clearly the difference between *F. marginatus* and *F. unguatus*.

The young specimens of *F. marginatus* regularly have a red varnished appearance. The freshly growing margin and tubes often exude drops of a clear colorless liquid which has a slightly subacid taste.

No. 54 [*F. unguatus* (Schaeff.)] of Sydow's *Mycotheca Germanica* agrees well with the above forms. *Polyporus pinicola* (Swartz) of Ellis and Everhart's *North America Fungi* also agrees with our *F. marginatus*. I have also compared a full series of herbarium specimens of these species from the Adirondacks with our forms and find that they show the same types as do the Wisconsin forms. *Boletus semiovatus* Schaeff. (27, tab. 270) seems to be like a young partly resupinate form of *F. marginatus*.

I have retained the two species *F. unguatus* and *F. marginatus* because the forms as found in Wisconsin seemed to be quite different in color, shape, size and relative rate of growth in width and thickness. They are alike, however, in general habit, substance of the pileus, pores, and color of the substance and it is possible that the whole series should be included in one very variable species. Murrill (19, 30, p. 328.) takes this view.

(b.) Substance rust-colored or ferruginous brown.

Fomes salicinus Fries.

Woody, very hard, undulate, the greater portion usually resupinate, with a narrow indurated, smooth, free margin, that is obtuse and patent, cinnamon, then grayish; pores minute, rounded, ferruginous-cinnamon, as is also the flesh; spores 5 x 3 microns; cystidia plentiful 12 to 35 by 6 microns.

Comparatively common on willow. Found also on dead and living trunks of oak and iron-wood. All the specimens but one are entirely resupinate. The longest one was about 20 cm. long, 5 to 7 cm. wide. They vary in thickness. A young unstratified specimen is about 5 mm. thick. One specimen with eight strata measures about 1.4 cm. in thickness. The reflexed portion of the pileus is 1.5 cm. wide.

The substance is very hard and thin, of a dull yellowish-cinnamon color. The tubes usually are more than 2 mm. in length. A very thin layer of the hymenophore is usually present between the layers.

The whole plant is more or less pulvinate, smooth, with a rather broad sterile margin, at least when young. The pores are usually oblique with exceedingly small gaping mouths. In our forms cystidia are not as plentiful as might be expected from the description.

This species can readily be separated from its near allies by its resupinate habit, and it is never as thick as *F. igniarius* and *F. nigricans*. Winter states that perhaps *P. plicatus* Persoon, and *P. loricatus* of the same author, belong here. Our specimens agree well with no. 111 of Shears' New York Fungi.

Fomes ribis (Schum.) Fries.

Horizontal, imbricated, coriaceous, rigid, flattened, almost even, velvety, ferruginous then umber, margin acute; pores short, minute naked, and with the substance fulvous.

Not common. My specimens were found on gooseberry bushes on the University farm, near Madison. They are said to grow on currant bushes and rose bushes.

This species is very much like *F. conchatus*. The pilei are, however, less sulcate, less hard, more velvety when young, less resupinate; color of the substance slightly darker; the mouth of the pores more yellowish-brown. The tubes are of the same size as in *F. conchatus*. The surface is very uneven, but not much sulcate. One specimen is almost unglulate.

Syn.: *Pyropolyporus Ribis* (Schum.) Murrill 19, 30, p. 118.

Polyporus ribesius Persoon; 23, 2, p. 80.

Fomes conchatus Fries.

Thin, rigid, effuso-reflexed, the reflexed portion somewhat shell-shaped; pileus dark brown, concentrically grooved, minutely silky, margin acute; pores short, very minute, colored like the pileus; spores 4 x 5 microns; cystida scanty, 15—30 x 9 microns.

Fries says this species is "closely allied to *F. igniarius* but is smaller and thinner, closely concentrically sulcate, concave below, margin acute." And Berkeley says: "The principal distinction between this and *F. ribis* appears to reside in the harder substance, and smoother pileus. It varies in the degree in which the surface is grooved."

Common on willow trunks about Madison. The largest part of the specimen resupinately incrusts the trunks; reflexed about 6 cm. or more; 30 cm. or more broad, 7 to 9 mm. thick. Closely concentrically sulcate, yellowish-brown becoming black on top, often covered with moss. The pores are minute, short, stratose. The under surface is usually uneven. The "silky pubescence" is scarcely noticeable. Most of our specimens are convex below instead of concave. This may be due to the fact that they grow on the under-side of leaning or fallen trunks. Cystidia or spines are large and plentiful.

Very much like *F. ribis*, its nearest ally. *F. igniarius* is thicker and less resupinate, and *F. salicinus* is more pulvinate and less reflexed, also darker in color. The species also grows on living *Crataegus* and on lilac bushes. In these forms the pilei are small and scarcely reflexed.

Syn.: *Pyropolyporus conchatus* (Pers.) Murrill pr. p.; 19, 30, p. 117.

Fomes Ellisianus Anders.

Pileus dimidiate, unguiform, 5 to 6 cm. thick, radiate-rugose and zonate; surface whitish and subpulverulent at first becoming yellowish and glabrate, rimose, and finally of a dark weather-beaten wood color; margin subobtuse or rounded, in the plane and concave specimens frequently with a distinct edge along its center; pores stratose, sub-cylindrical, about three to a millimeter (including dissepiments). Margin sub-acute, color at first white, finally creamy, or faintly yellowish, fragile, easily bruised and rubbed off, leaving the surface ochraceous; surface concave becoming plane or convex in age. Pores extending nearly through to the upper surface of the pileus, being covered above only by a thin (2 to 4 mm.) corky, pale-ochraceous layer. Spores hyaline, elliptical-globose or oblong, 5 to 6 by 4 to 5 microns.

On *Shepherdia*.

The specimen referred to this species was determined doubtfully by Bresadola.

Fomes Everhartii Ellis & Gall. (Plate VI, fig. 26). (Pl. VII, fig. 26).

Pileus dimidiate, zonate-hoof-shaped, attached by a broad base, convex above, subplane below but convex near the base and concave toward the margin, crust opaque, then brownish black; 9 to 12 cm. wide, 6 to 8 cm. long, margin subobtuse, finely tomentose and of a rhubarb-brown color; pores rhubarb brown, equal, round, 0.11 to 0.12 mm. in

diameter, 1 cm. long, substratose, cystidia numerous 15 to 25 microns long, 6 to 10 microns thick inflated at the base; spores ferruginous, globose, varying toward ovoid-globose, 3 to 3.5 microns. Context suberose to coriaceous. Pores not decurrent but separated by a definite margin.

In habit and context it is like *Fomes igniarius*. The color seems to verge more toward cinnamon in some of our specimens. Specimens referred to this species were collected near Madison, Blue Mounds, and Ladysmith on oak and maple logs or stumps. The largest specimen is 15 cm. broad, 8 cm. long and 5 cm. thick. The pores change color when viewed while turning the specimen in the light.

Syn.: *Pyropolyporus Everhartii* (Ell. & Gall.) Murr.; 19, 30, p. 114.
Mucronoporus Everhartii (Ell. & Gall.); Journ. Myc., vol. 5, pp. 141—142.

Fomes Bakeri (Murr.) (Plates VI and VII, fig. 27).

Pileus woody, compressed-ungulate to applanate, dimidiate, slightly decurrent, 4 to 10 by 8 to 20 by 3 to 5 cm.; surface smooth, anoderm becoming glabrous, 2—3 times deeply sulcate, isabelline to gray or umbrinous; margin very broad and rounded, ferruginous, finely tomentose, perfectly smooth; context woody, dark-luteus, somewhat shining, 1.5 to 2 cm. thick; tubes distinctly stratified, 5 to 7 mm. long each season, avellaneous to fulvous within, mouths circular, four to 1 millimeter, edges obtuse, entire, light-yellowish to fuliginous; spores globose, smooth, hyaline, 5 microns.

Common on black birch along the Wisconsin river near Kilbourn and Sauk City. Perhaps it is only a form of *F. Everhartii*.

Fomes igniarius (Linn.) Fries.

Pileus at first tuberculose-globose, with a thin light covering, appressed-flocculose, canescent, then unguulate, blackening; the margin rounded; the context zonate ferruginous; pores very small, convex, stratose, cinnamon, at maturity white-stuffed, at first canescent.

On oak and birch.

Very common and abundant on living oak trees at Horicon and Madison. The specimens on birch come from Monroe County. The largest specimen was found on birch. It measures 24 cm. wide by 18 cm. long and 12 cm. thick in the thickest part near the base. It has four distinct sulcations and four strata of tubes—the oldest ones be-

ing somewhat indistinct. The tubes in this specimen are about 1 cm. long, smaller than in *F. fomentarius* and with thinner dissepiments; their color like that of the flesh, is a yellowish ferruginous, and there is a layer of hymenophore separating each stratum. The pilei are dimidiate and frequently imbricated. The older part of the surface is blackened, and opaque, rimose; the margin is yellowish-rust color, even, tomentose. Specimens of this large type are not common. The usual form is unguulate, about 10 cm. wide, 8 cm. long and 7 cm. thick. The tubes stratified but continuous, each layer about 5 to 7 mm. in length and like the hymenophore of a rich ferruginous color. The substance of the pileus is distinctly zonate. Young nodular specimens appear to be made of concentric shell-like layers which are often partially separable.

A few specimens of this smaller type were sent to Peck. He identified them as *F. igniarius*, but not typical. They seem in fact to approach in appearance the variety of *F. nigricans* which is found so commonly on poplar in this region. The resemblance is so close that it is often difficult to keep the two separate. *F. nigricans*, however, is much darker in color and harder; the sulcations are also more numerous and narrower. Its pileus is more triangular in cross-section and the margin in young plants is not so much rounded as in *F. igniarius*, nor has it ever the yellow tomentum. *F. salicinus* is also closely related but this is always distinguishable by its harder substance and the resupinate form.

Syn.: *Pyropolyporus igniarius* (L.) Murr.; 19, 30, p. 110.

Polyporus igniarius (L.) Winter; 28, p. 424.

Fomes nigricans Fries (Plate VIII, fig. 29).

Hoof-shaped or pulvinate, very thick, pileus densely and concentrically sulcate, cuticle very hard, with a crusty varnished surface layer, black, smooth, shining, margin very obtuse, ferruginous; flesh very hard, ferruginous; tubes elongated, distinctly stratose ferruginous; pores 0.3 mm. across, obsoletely angular, naked from the first; spores elliptical, both ends rounded, brown, 5 by 3 microns.

Fries describes a form of this species with the "pileus triangular, rugose, opaque, which approaches *Fomes igniarius*." He might have added "and radially rimose," to complete the description for our specimens.

Very common on poplar, birch, maple and elm. Localities: Horicon, Bangor, Sparta, Madison, Hazelhurst, Crandon, Star Lake, Shanagolden and Ladysmith.

The form growing on maple, elm and birch is the type-form and is easily recognized by the black rimose surface. The largest of these measured 12 cm. in width, 9 cm. in length and 3 cm. in thickness. The shape is, however, very variable. Another specimen measured about 10 cm. in length, 10 cm. in width and 15 cm. in thickness. This specimen grew from the trunk of a living rock elm and had 22 strata. It is quite common on living elm and birch at Shanagolden.

The usual form which grows on dead or living poplar is quite different. It is duller in color, and irregularly orbicular. The largest specimens being about 9 cm. long, 9 cm. wide and from 3 to 5 cm. thick. Many grow immediately beneath small branches, along which they spread upwards a distance of 10 or 12 cm., thus appearing resupinate, but in nearly all cases the lower surface is ascending, never horizontal. They also grow into, and push up the bark of the trunk so that it is difficult to tell where the bark ends and the fungus begins, for the color of the top of the pileus is very much like that of the bark. This color is an opaque grayish-black instead of a varnished black. Below, the fungus is a dark cinnamon brown. The substance and the tubes are also dark cinnamon brown and very hard. The surface is densely sulcate and much checked. The margin is smooth, gray, and where the hymenium meets it, brown. It is quite obtuse in resupinate forms but more acute in others. In cross-section these specimens are always triangular. Sometimes young specimens are nodular with a thick, brown rounded margin like our *F. igniarius*; but the forms can usually be distinguished from the latter by their intimate connection with the bark, and by the darker, harder and more brittle substance which is only faintly zonate.

The tubes are small, stratose and not more than about 5 mm. in length, soon becoming white stuffed. The pores are extremely small, roundish, regular, with thick dissepiments. Since this form is quite constant and easily distinguishable I shall describe it as a variety.

***Fomes nigricans populinus* n. var.**

Irregularly orbicular or sessile, triangular, opaque, rugose, radially rimose with very small pores, common and abundant on poplar.

The above species, especially the variety, is closely related to *F. igniarius*, but can usually be distinguished by its habit of growth and by its hard, black, densely rimose surface. The substance of the pileus is never as thick as that of *F. igniarius*.

Fomes rimosus Berk.

Pileus woody, very hard, pulvinate, unguulate from the annual strata, at length rimose, subumbrinous, deeply sulcate, the growth of the year velvety-pruinose, cinnamon; context very hard, fibrous; pores very long, thin, fulvous-ferruginous with the mouth indistinct, rhubarb color.

Not common. A few specimens were found on oak and on locust near Madison. The largest is about 12 cm. wide, 8 cm. long, and 3 to 4 cm. thick. Most of the specimens are very rough and uneven. The specimens are very hard but not "deeply" sulcate, although some have two and three strata of pores. The color is very much like that of *Polyporus gilvus*—perhaps a little darker—and it becomes black with age, the surface cracking in every direction. The plant is convex on both sides with a somewhat acute margin.

The tubes are long, 1 cm. or more, and indistinctly stratified. The pores are very minute, roundish, equal; the mouth indistinct.

Young and unstratified specimens can hardly be distinguished from *Polyporus gilvus*, but the older are easily recognized by the checked surface, the stratified tubes and usually the deep sulcations.

Fomes fomentarius (L.) Fries (Plate IX, fig. 30).

Pileus unguulate-pulvinate, thick, glabrous, remotely concentrically sulcate, from sooty to canescent, within soft floccose, fulvous; the crust thick, hard, persistent; margin and pores prolonged, the latter minute, distinctly stratose, at first glaucous-pruinose, then rusty.

Common westward and northward. Localities: Monroe County, on dead birch; Madaline Island (Allen); Lake Superior (Cheney); and in Dane, Oneida, Vilas, Ashland, Forest and Clark Counties.

Largest specimen is 9 cm. broad, 6 cm. long and 9 cm. thick, being strongly hoof-shaped. Another flatter type is 9 cm. wide, 9 cm. long and 2 cm. thick. The pileus in all of the specimens is comparatively thin. In the largest specimen the pileus is 2 cm. thick near the base, near the margin it is only 0.5 cm., the rind is about 1 mm. thick, and the tubes vary from 3 to 6 cm. in length. In the flatter specimens the pileus averages 0.75 cm. thick and the tubes vary in length from 2 mm. near the margin to 1.5 cm. near the base. The tubes are indistinctly stratose and somewhat white-stuffed. They have about the same color as the pileus—a ferruginous brown, the mouths are paler and duller. The rind is dark brown in substance with a gray surface, concentrically

sulcate. The older parts are darker than the newer ones. The margin in most cases is very obtuse sometimes lobed or wavy. The substance of the pileus is composed of a fine-grained punk, rather lighter in color than the substance in *F. applanatus* but firmer. The tubes are unequally sunk into the flesh, suggesting the habit of a *Trametes*. The mouths of the pores are round, small, equal and frequently stuffed. The dissepiments are obtuse. The surface of the hymenium is usually concave.

This species is regarded by Fries as the type of the genus and has long been known for the excellent punk obtained from it.

Related to *F. applanatus*, but distinguished by the thicker crust, hoof-shaped pileus and the longer tubes. It is also quite distinct from its other near allies, *F. igniarius* and *F. nigricans*. Both of the latter are harder in substance and the color verges more towards the yellowish.

Syn.: *Elfvigia fomentaria* (L.) Murr.; 19, vol. 30, p. 298.

Boletus unguulatus Bull.; 7, tab. 491, fig. 2, C. D. E, and tab. 401.

Fomes applanatus (Pers.) Wallrath (Plate IX, fig 31).

Pileus dimidiate, flat, somewhat thickened behind, nodose, indistinctly zoned, and sulcate, glabrate, or pulverulent, at first brown then gray or ashen with a rigid but fragile crust; context soft, flocculose; margin tumid; pores very small, ferruginous, the mouths whitish, brown when rubbed.

Localities: Horicon, Bangor, Sparta, Milwaukee, Algoma, Elkhorn, Madison, Blanchardville (McKenna), Hazelhurst, Star Lake, Shanagolden, Crandon, Ladysmith, Milwaukee, Dells (Holden).

This is our commonest *Fomes*. Found chiefly on oak stumps, also on trunks of poplar, basswood and elm. One small specimen was found on a young and living apple tree at Horicon. The tree had been looking sickly for the past two or three years, but I found no external fungus growths upon it until a pileus of this species appeared on the trunk. The heartwood of the tree is badly decayed and probably the mycelium has been in the wood for some time. I also find pilei of this fungus growing out of the base of living oak and cottonwood trees, without apparently any effect on the trees. I find, however, that in all of the cases examined the pilei arise in regions where the tree has been wounded, but they do not always grow from the dead wood in such places. The specimen which I took from the apple tree mentioned above was attached to the *living bark* of the tree as though it was a parasite. The pilei are also found on living willows.

Largest specimen found was on a poplar at Horicon and measured nearly $\frac{1}{2}$ meter in width, about 24 cm. in length and 15 cm. in thickness near its base. It shows about 10 or 12 strata, the older ones somewhat indistinct. The pilei are usually sessile, sometimes substipitate—especially those growing from the roots of stumps and trees—often imbricated. The young growth is pure white, soft, moist and turns brown when injured. It then hardens into a whitish-gray crust which soon becomes brown-pulverulent due to the numerous spores which are scattered on the pileus either by currents of air or by overhanging pilei. Sticks and stones lying beneath are usually likewise covered. The spores are ovoid and about 6 to 7 microns in diameter.

The species varies in form from very thin explanate to thick unguulate; it is easily recognized by the whitish horny crust, the white-pruinose hymenium which turns brown when bruised, and the dark ferruginous context made up of the two layers of horny fibers—one going upwards to form the crust and the other turning down to form the tubes. In most stratified specimens examined there are traces of the hymenophore between the strata (Pl. IX., fig. 31). Old specimens are often black and rimose.

Related to *F. reniformis*, *F. fomentarius* and *F. vegetus*. Distinguished from the first by its thicker crust and harder consistency; from the second by its smaller and shorter pores and by being flat instead of unguulate; from the last it is said to be distinct because it has thicker flesh and is not supposed to have the "floccose layer" separating the strata.

With Atkinson I cannot follow Lloyd (12 p. 60) in the conclusion that the American forms referred to this species are in reality to be identified with *F. leucophaeus* Mont., and that *F. reniformis* Morg., is *F. applanatus* (Pers.). Lloyd's view is that in general the two species are very much alike, but that *F. applanatus* has softer tissue and echinulate spores, while our common form (*F. leucophaeus*) has smooth spores.

The forms of *F. applanatus* as I have identified them agree very well with the specimen of *F. applanatus* No. 302, Sydow's *Mycotheca germanica*, from the Hartz mountains. The spores of the German specimen also are smooth like those of ours and of the same shape. The tissue is no softer in Sydow's specimen than in ours, except in the case of very old forms which may become unusually hard in some cases. I also find that our common forms often interpose a new stratum of hymenophore between the first and second year's growth, as Morgan says is the case in *F. reniformis*; still I am inclined to think that Morgan's form is distinct.

I have compared our specimens with no. 302, Sydow's *Mycotheca germanica*; which with no. 801 North American Fungi; *Polyporus applanatus* (Pers.) from West Chester, Pa., agrees well with our forms and with No. 339, P. S. F., *F. applanatus* (Pers.), Stanford University, Cal., (identified by Peck). In this latter specimen the tubes are long and the strata hardly visible, like the tubes in *F. fomentarius*, but the spores agree with those of our forms. No. 114, C. A. F., *Fomes applanatus* (Pers.), from Castillo, Nicaragua, has a thinner cuticle and softer substance than our forms, except some of our younger specimens which agree quite well with these southern types. Specimens from Berlin, Germany, from the Palmhouse in the Botanic Garden, determined by Magnus, agree in every other respect except that they have a whitish instead of a dark ferruginous hymenophore.

Syn.: *Elfvíngia megaloma* (Lev.) Murr.; 19, 30, p. 300.

Fomes megaloma (Lev.) Cke.; 11, p. 18. 1885.

Fomes leucophaeus Mont.; 26, VI, p. 173.

***Fomes officinalis* (Vill.) (Plate X, fig. 33).**

Hoof-shaped thick; surface nodulose, corky to fleshy, when fresh soft but tough when dry; porous, friable, with yellow and brown zones and concentric furrows, glabrous, yellowish white, with hard rimose rind; pores delicate, short yellowish, when older brownish.

On Larch.

A gigantic specimen of this fungus is preserved in the University herbarium. Its origin is unknown; but it is probably from the northern part of the state. It measures about 65 cm. in height and 105 cm. in circumference at its thickest part. It shows about 70 strata.

The fungus has been reported by various collectors as found on larch in the northern part of the state and a doubtful specimen is reported by Dodge from Algoma.

***Fomes lucidus* (Leys.) Fries (Plate IX, fig. 32).**

Horizontal, flabelliform or subreniform, laterally stipitate, pileus 5—15 cm. across; corky, then hard and woody, sulcato-rugose, blood-red with a chestnut tinge, polished, shining; pores 6 mm. to 12 mm. long, minute, whitish then cinnamon; stem variable in length, rugose, colored and polished like the pileus; spores 7 by 5 microns, brown.

Quite common on various woods. Localities: Florence (Miss Riley); Lincoln County (Dr. F. S. Forbes), on hemlock logs; Lake Superior region (Cheney); Crandon, Ladysmith, Shanagolden, Star Lake, Horicon, and Madison. The specimens collected at Horicon were growing on a maple stump, and the Madison specimens on an oak stump. In the northern part of the state the species usually grows on hemlock or tamarack.

Our largest specimen is about 30 cm. wide, 17 cm. long and 2.5 cm. thick. The specimens are dimidiate-sessile, laterally stipitate, or apparently excentrically stiped. In all cases where the stipe is excentric it is found that the pileus has grown backward surrounding a lateral stipe, thus making it seem excentric.

The context is made up of two layers, both soft, velvety-fibrous, but the upper one firmer and much lighter in color than the lower one next to the tubes. The flesh is comparatively thin. The pilei are covered by a dark-red shining crust. In one specimen it is considerably wrinkled and more or less concentrically sulcate, its margin wavy, acute and turned down. *All of my specimens are stiped* except two found on a maple stump; these are dimidiate, sessile and stratified. All of the others are unstratified.

The pores are small, equal, varying in length from 1 to 2 cm. In the larger and older specimens the color of the tubes is dark cinnamon, and in the younger ones it is paler.

The context is of the same soft floccose consistency as in *F. applanatus* and *F. reniformis* except that it is a little lighter in color. The tubes also are very much the same as in these species but lighter in color. The species is very easily recognized by its red laccate crust.

Murrill (19, 29, p. 602), following the lead of Patouillard and Quélet, places this species in the genus *Ganoderma*, formed by Karsten in 1899 for *Fomes lucidus*, based on the laccate pileus and stipe. Under this genus Murrill lists the following related species: *G. parvulum* Murr., *G. tsugae*, Murr., *G. pseudoboletus* (Jacq.) (this is *F. lucidus*), *G. sessile* Murr., *G. Oerstedii* (Fries), *G. zonatum* Murr., and *G. sucatum* Murr.

Syn.: *Ganoderma pseudoboletus* (Jacq.) Murr.; 19, 29, p. 602.

Polyporus lucidus (Leyss.) Fries; 28, p. 442.

Polyporus laccatus Pers.; 23, 2, p. 54.

Boletus variegatus Schaeff.; 27, tab. 263.

II. POLYPORUS.

The chief characteristics of this genus are as follows: Central or lateral stemmed, or sessile. Pileus fleshy, tough, rather soft and moist, at length becoming harder; neither sulcate nor zoned externally, but the internal texture consisting of radiating fibres, often more or less zoned. Pores never stratose but forming an inseparable distinct stratum. A few species of this genus are edible.

KEY TO THE WISCONSIN SPECIES OF POLYPORUS

Dimidiate or sessile	1
Cespitose	2
Stiped	3
1. Flesh white	4
1. Flesh yellowish to ferruginous.....	5
1. Flesh reddish-orange	6
4. Tubes smoke to sooty	<i>P. adustus</i>
4. Tubes faintly smoky	<i>P. fumosus</i>
4. Tubes scarcely smoky, fragrant	<i>P. fragrans</i>
4. Tubes whitish, not fragrant.....	<i>P. pubescens</i>
4. Tubes whitish, pileus very moist.....	<i>P. chioneus</i>
4. Tubes whitish, turning bluish when bruised.....	<i>P. caesius</i>
4. Tubes whitish, pileus grayish.....	<i>P. sordidus</i>
4. Tubes whitish, turning brown when bruised.....	<i>P. fragilis</i>
4. Tubes whitish, pileus tomentose.....	<i>P. lacteus</i>
4. Tubes whitish, pileus thick, hirsute.....	<i>P. spumeus</i>
4. Tubes whitish, pileus tough, strigose.....	<i>P. borealis</i>
4. Tubes whitish, pileus brown.....	<i>P. resinosus</i>
4. Tubes whitish, large, pileus fleshy-fibrous.....	<i>P. delectans</i>
4. Tubes whitish, pileus hoof-shaped.....	<i>P. stipticus</i>
4. Tubes whitish, turning pinkish when bruised.....	<i>P. guttulatus</i>
4. Tubes whitish, not turning pinkish, subcespitate.....	<i>P. epileucus</i>
4. Tubes whitish, pilei grayish, subcespitate.....	<i>P. tephroleucus</i>
5. Flesh yellowish brown	<i>P. gilvus</i>
5. Flesh ferruginous, soft	<i>P. nidulans</i>
5. Flesh ferruginous, hard	<i>P. radiatus</i>
5. Flesh ferruginous, pileus golden	<i>P. aureonitens</i>
5. Flesh ferruginous, pileus cuticulate.....	<i>P. cuticulans</i>
6. Pores large	<i>P. aurantiacus</i>
6. Pores smaller	<i>P. Pilotae</i>
2. Scarcely cespitose, white	<i>P. salignus</i>
2. Scarcely cespitose, small	<i>P. floriformis</i>
2. White, heavy	<i>P. osseus</i>
2. Alutaceous, fleshy to leathery.....	<i>P. distortus</i>
2. Yellow	<i>P. sulfureus</i>
2. Grayish-white, frondose	<i>P. frondosus</i>

2. Grayish-white, pilei broad *P. anax*
 2. White, pilei central stemmed..... *P. umbellatus*
 2. Greenish tawny, scarcely connate
 2. Brown, hard, fragrant..... *P. graveolens*
 3. Laterally stiped 7
 3. Not black at base..... 8
 3. Black at base 9
 7. Small, with veil *P. volvatus*
 7. Larger, no veil..... *P. betulinus*
 7. Pores large *P. hispidellus*
 8. Stipe central, pores large..... *P. arcularius*
 8. Stipe central, pores small..... *P. drumalis*
 8. Pores large, pileus whitish..... *P. lentus*
 8. Pores small, pileus white to greenish..... *P. flavovirens*
 8. Substance brown, in two layers..... *P. circinatus*
 8. Brown, not in two layers..... *P. tomentosus*
 8. Brown, large, fleshy *P. Schweinitzii*
 8. Whitish, pileus irregular, fleshy..... *P. ovinus*
 9. Lateral stiped *P. squamosus*
 9. Stipe punctate *P. picipes*
 9. Stipe not punctate *P. elegans*
 9. Stipe rooting *P. radicans*

***Polyporus adustus* (Willdenow) Fries.**

Pileus fleshy, soft, thin, villous, ashy-pallid, effused-reflexed behind; margin straight, blackening; pores small, short, round, obtuse, whitish-pruinose presently ashy-fuscous, the marginal obsolete. Spores colorless, 4 to 5 microns.

Morgan (18, VIII, p. 106) says that the typical villous form is seldom met with, but that a form velvety, isabelline in color, thin and coriaceous when dry, like *P. isabellinus* Schw., is common. Among other things, Macbride says: "Our specimens are not villous unless when young, generally soft, velvety or pulverulent."

I have seen no specimen that can be called villous. They are glabrous when old, and velvety or soft tomentose when young.

The characteristic feature of the species is the dull smoky or blackish hymenium. The pores are very small, short, obtuse, whitish-pruinose, blackening when bruised; the whole hymenium, which is of a soft, semi-gelatinous consistence when young, turns black with age.

This species is very common in the southern part of the state on poplar and oak, but is not so abundant in the north. Specimens have been collected at Cudahy, County Line, Madison, Horicon, Bangor, Sparta, Blue Mounds, Blanchardville (McKenna); Star Lake, (Timberlake and Denniston); Crandon, and Shanagolden. The largest specimen

measured about 5 cm. in width, 4 cm. in length and 5 mm. in thickness. The tubes are rarely more than 2 to 6 mm. in length.

P. adustus is closely related to *P. fumosus* and *P. fragrans* Pk. It is thinner than *P. fumosus*, and darkens more. *P. fragrans* is distinguished by its odor, and its hymenium does not blacken.

Syn.: *Bjerkandera adusta* (Willd.) Karst.; 19, 32, p. 634.

Myriadoporus adustus Peck; 19, 11 p. 27.

Polyporus fumosus (Pers.) Fr.

Pileus fleshy, corky, azonate, sericeous, becoming glabrate, sooty, pallid, dilate-adenate behind, within fibrous, subzonate; pores small, short, round, entire, whitish-smoky, becoming darker when rubbed.

This species has not been found abundantly in the state. Two specimens were found in November 1899, at Madison, growing on the trunk of a living locust tree. A specimen was found at Star Lake, and several small ones were found at Bangor growing on old logs. The largest one is about 6 cm. wide, 3.5 cm. long, and from 1 to 1.5 cm. thick.

The pilei are imbricated and effused behind; soft and fleshy when fresh but become corky when dry. When young the pileus is somewhat corky but it soon becomes glabrate. The hymenium is thinner than in *P. adustus*, white-pruinose, but does not turn as dark when bruised. The pores are very small and obtuse, scarcely ever more than 2 mm. in length. As in *P. adustus*, there is always a wide sterile band at the margin.

The species may be distinguished from *P. adustus* by the thicker pileus and the lighter colored hymenium.

Syn.: *Bjerkandera fumosa* (Pers.) Karst.; 19, 32, p. 635.

Polyporus fragrans Peck.

Fragrant; pileus fleshy-tough, effuso-reflexed, imbricating, 2.5 to 5 cm. high, 5 to 10 cm. broad, rather thin but sometimes thickened behind, velvety to the touch and clothed with a minute tomentum; pale reddish gray or alutaceous, the thin margin concolorous and sometimes a little roughened, often sterile beneath; flesh slightly fibrous, zonate, concolorous; pores minute, unequal, angular, about 2 mm. long, dissepiments thin, acute, toothed or lacerated, whitish becoming darker with age, and blackish-stained when bruised.

This little species is rarely collected in Wisconsin and is also reported as "rare" in Iowa by Macbride. Only two specimens have thus far been

found; one by Cheney in the Lake Superior region, and one by myself at Ladysmith on a small stump.

The largest specimen is about 5 cm. wide and 2 cm. long, but less than 5 mm. thick except at the base where it is somewhat gibbous. In color, shape and general habit it strongly resembles *P. adustus*. However, the pores are larger and longer and more irregular, the dissepiments are toothed, and do not become smoky or black when bruised, but merely darken somewhat in color. The dried specimen on the whole is more yellowish than either *P. adustus* or *P. fumosus*. From both of these species it can also be distinguished by its pleasant odor which is quite persistent after drying.

Syn.: *Bjerkandera fragrans* (Peck) Murr.; 19, 32, p. 636.

Polyporus aurantiacus Peck (Plate XI, fig. 35).

Pileus soft, thin, sessile, dimidiate, sometimes confluent, fibrous-tomentose, obscurely zoned, orange-color; pores small, angular, acute, unequal, at length lacerated, pallid inclining to orange; flesh tinged with orange; obscurely zoned. Pileus 2.5 to 5 cm. broad, pores 2 mm. long. On old logs, July. Related to *Polystictus biformis*.

Not common. Collected at Blue Mounds, Brule River (Overton), at Crandon on a birch log, and Ladysmith on a maple log. Largest specimen 8 cm. broad, 3 cm. long and 3 cm. thick in its thickest part. Most of the specimens, however, are small. The pilei are soft-spongy at first, becoming coriaceous. The color is orange-red at first, but becomes an orange-brown with age.

The pores in our specimens are quite large, irregular and unequal. The dissepiments are thin and often torn. When growing they are cream-color inclining to reddish-orange. In form, the pilei may be sessile, imbricated, rosetted or confluent. The surface is rough-tomentose and uneven.

The orange tints and the large irregular, soft, cream-colored pores are the chief distinguishing characteristics. It may be the same species as *P. fibrillosus*. Karst.

Polyporus Pilotae Schw.

Crimson-orange. Pileus very large, pulvinate or subungulate, nearly glabrous, spongy, fibrous, becoming hard and corky; the substance within uneven, zonate. Pores long, medium dissepiments at first round and thick, then thin and angular.

Morgan (18, VIII, p. 101—102) says that the pileus is from 10 to 15 cm. or nearly 30 cm. in diameter; that the color varies greatly with age, being at first a gorgeous crimson-orange, then growing paler through orange to alutaceous; the hymenium growing darker through brownish crimson to dark brown. The substance, he says, varies to reddish and pale wood color and is remarkably zonate.

Collected at Devil's Lake in July and August of 1903, 1904 and 1906. It was growing on very rotten oak logs and stumps. It was a bright orange when fresh, of a soft spongy consistency. The color fades very much in drying. The distinctly concentrically zonate substance is pale wood color, with reddish stains. The rough somewhat pitted surface is grayish with reddish-brown spots. It is covered with a very slight tomentum.

The pileus is thick and irregularly triangular in cross-section. The pores are not very long, round; dissepiments thick, wood color. The pileus projects about 8 cm. and is about 8 cm. thick through the thickest part.

Its soft, fleshy substance when fresh and its bright color are the chief distinguishing marks.

Syn.: *Aurantiporus Pilotae* (Schw.) Murr. pr. p.; 19, 32, p. 487.

***Polyporus pubescens* (Schumacher) Fries (Plate XI, fig. 36).**

Pileus fleshy becoming tough, suberose, soft, convex, subzonate, pubescent, white throughout; margin acute, at length yellowish; pores short, small, nearly round, even.

Our specimens probably belong to the variety *grayii* E. and E., which differs from the type in the elongation of the tubes; but Bresadola thinks that this variety is the same as *Polystictus velutinus*. As a matter of fact, I have found it difficult always to distinguish easily between the two species, except that *Polyporus pubescens* is thicker and more hirsute than *Polystictus velutinus*. In substance and habit they are alike.

When growing, *P. pubescens* is of a moist, soft, almost leathery consistency but dries into a light, brittle, corky, substance. It is pure white within and without, but becomes yellowish in drying. The pubescence is quite as dense and coarse occasionally as that of *P. hirsutus*, but usually it is much softer and finer making the pileus agreeably velvety to the touch.

The pilei are always very convex above and concave below, more or less gibbous and decurrent at the base and more or less laterally confluent.

The pores are medium, becoming lengthened, so that they equal the thickness of the pileus, whitish, becoming pale straw-yellow on drying. The dissepiments are thin and more or less toothed.

Common on birch logs and alder. Specimens have been found at Bangor on birch and alder; at Hazelhurst, Cudahy, Shanagolden, Ladysmith and Star Lake. A few specimens were found at Sparta on an old oak stump.

The largest specimens measured 5 cm. in width, 6 cm. in length, and 8 mm. in thickness at the base. The tubes were as long as the thickness of the pileus. The species is commonly infested by larvae.

Syn.: *Coriolus pubescens* (Schum.) Murr.; 19, 32, p. 645.

Polyporus chioneus Fries.

Pileus white, fleshy, soft, smooth, glabrate, azonate, frequently extended behind; the margin incurved; pores short, slender, round, equal, dissepiments entire.

When fresh and moist the whole fungus becomes hygrophanous, and when dried specimens are thrown into water, they become swollen and somewhat hyaline but not as brittle as are fresh specimens. When dry they are soft and brittle.

The species is quite common in wet weather, growing on sticks, old logs and stumps. Localities: South Milwaukee, Horicon, Madison, Blue Mounds, Crandon, Hazelhurst, Star Lake, Gliddon, Ladysmith, Bangor and Sparta. The largest specimen measures about 9 cm. in breadth, 8 cm. in length and 2 cm. in thickness. When dry they assume a slightly alutaceous hue.

The hygrophanous texture of the growing plant makes it quite distinct among the common white polypores. When dry, the light, soft brittle substance, the regular pores and the smooth pileus distinguish it.

Polyporus caesius Schrad.

White here and there with a bluish tinge. Pileus fleshy-soft, tenacious, unequal, silky. Pores small, unequal, long, and flexous, dentate, lacerate.

Morgan (18, VIII, p. 106) says that this species grows in the "woods on sticks. Pilei $\frac{3}{4}$ to $1\frac{1}{2}$ inches broad and long; simple, subimbricate sometimes substipitate, color assumed by my specimens is bluish-gray. Pores rather small become toothed and lacerate."

The species is not very common. One specimen was found at Madison, one at Crandon, several at Oakfield on sticks and stumps; one at Horicon growing at the base of a dead oak trunk, and one at Bangor growing under an old sidewalk. This latter specimen was perhaps of the small white variety *forma minor et albida* as described by Bresadola.

Largest specimens about 6 cm. wide, 4 cm. long and 1—2½ cm. thick. In color they are of a pale bluish gray, with a rough surface. Only the young specimens can be called silky; the older ones are glabrate. The flesh is whitish, soft and moist when fresh, corky when dry. The pores are medium and not flexuous in all the specimens.

The species seems to be closely related to *P. sordidus* Cke., and *P. tephroleucus*. It is distinguished from both by the tendency to become bluish or greenish blue when bruised. In some specimens this change in color, however, is slight. It probably depends upon the age and condition of the specimen; the younger and more active the stage of growth, the greater is the change in color. The small white specimen (*forma minor et albida* Bres.) changed very distinctly to a greenish blue.

***Polyporus sordidus* Cooke.**

Pileus fleshy-soft, firm, pulvinate, attenuated behind, finely velvety sordid-fuliginous, glabrate around the margin; context white; subzonnate; tubules medium, 5 mm. long; pores white, unequal angular, 0.25 to 0.5 mm.; dissepiments thin, entire.

On trunks of old trees. Pileus 4- to 5 cm. in diameter, 2.5 cm. thick.

Rare. Only a few specimens were collected at Horicon on a very rotten log. The largest of these was about 2 cm. broad, 2.5 cm. long and 1 cm. thick. The surface is gray, rough and little if any silky. The pileus is convex above and below and narrowed at the base. The pores are small, roundish, fairly equal, short, whitish. The flesh is whitish, of a cheesy consistency and usually infested with larvae. When fresh the pileus gives out a vile odor.

Morgan (18 VIII, p. 106) thinks this is only a form of *P. tephroleucus*, as he says in a letter. However, it may be distinguished from that species by its grayish color, smaller size and the disagreeable odor. Still it is possible that the odor is due to the larvae which usually infest it.

Polyporus fragilis Fries.

Pileus kidney-shaped, flat, depressed, convex beneath, sometimes attenuated at the base, stipitate and pendant, rugose, whitish, becoming brown-spotted when touched, of fleshy-fibrous substance, brittle. Pores delicate, long, bent and flexuous.

On diseased wood of the conifers.

Quite common in the northern part of the state. Specimens have been collected at Crandon, Ladysmith and Shanagolden, chiefly on decayed pine logs. The largest specimens are about 5 cm. wide and 6 cm. long. There is also a type which is effuso-reflexed and laterally confluent. This form, by far the commonest, is very soft, fleshy when young but dries harder than the typical form. It may be a distinct species.

The type form when freshly growing looks very much like *P. guttulatus* Peck.; however, it is smaller, more delicate and brittle. Its color is whitish becoming rusty-brown almost the instant that it is touched. When drying the whole specimen becomes brownish and very light. This change of color is the most reliable and distinctive characteristic.

Polyporus lacteus Fries.

White, pileus fleshy-fibrous, fragile, triquetrous, pubescent, azonate; margin inflexed, acute, pores thin, acute, dentate, at length labyrinthine and lacerate.

This small species is not very common. Specimens were collected on pine stumps near Hazelhurst and Crandon. They are not typical and are somewhat doubtfully referred here. The largest specimen is about 3 cm. wide and 2 cm. long. The thickness of the pileus is about 8 mm., and the tubes are about 4 mm. in length.

The pilei are convex above and concave below; the base is decurrent. There is very little pubescence except in very young specimens. The color is white throughout.

The species is closely related to *P. chioneus* and *P. stipticus*. The hyaline structure of the former distinguishes it. The latter species is larger and thicker, and usually has a reddish band on its surface.

Polyporus stipticus (Pers.) Fries.

Pilei imbricated, pulvinate, up to 12 cm. in width, 2½ cm. thick, with gibbous base, fleshy-corky, brittle, smooth, glabrate, whitish with blunt reddish margin. Pores long, roundish, equal, white.

This species is occasionally found on pine trunks and stumps. Our specimens were collected at Hazelhurst. Largest specimen 6 cm. wide, 2 cm. long and 2 cm. thick.

The pilei are usually white with a pale reddish zone near the margin; pulvinate, smooth, the blunt margin somewhat incurved. The flesh pure white-fleshy then corky and brittle. The tubes are long and equal.

The distinguishing features are the whitish pulvinate pileus and the reddish zone near the margin. This, however, fades on drying.

Polyporus borealis Fries (Plate XI, fig. 39).

Horizontal, subspatulate, or reniform, either attenuated behind into a short more or less distinct stem, or thick and sessile, 5—7.5 cm. across, whitish then dingy yellow, spongy, then corky, compact, hairy, flesh thick, composed of parallel fibres, whitish; tubes 4—6 mm. long, pores unequal, flexuous, dissepiments thin, torn, white; spores colorless, subglobose, 4 microns in diameter.

The following forms or varieties occur: *montanus*; Pileus fleshy, thick, hairy, margin obtuse; pores obtuse, entire; *spatulatus*; pileus thin, villous, margin acute, extended into a short stem, dissepiments thin, much torn.

Specimens of this species were collected at Madison, November, 1899, at Horicon, Oakfield and Blue Mounds, on very much decayed poplar logs.

Largest specimens about 15 cm. wide, 3—5 cm. long and 1.5—2 cm. thick. The pilei are usually much imbricated and laterally confluent. When fresh they are fleshy but become corky. The substance is white, composed of parallel fibres running horizontally through them. The color above is whitish to straw color; below, a little paler with a suggestion of pink. The surface is very rough in places, being covered with scale-like processes which are probably the remains of a strigose pubescence.

The tubes are long, 1—1.5 cm. but of unequal length like those of *Trametes*. The pores are irregular, sinuous, somewhat radially elongated, when old, white-stuffed. The dissepiments are thickish and toothed. When fresh the specimens are inodorous but on drying give out a faint sweetish odor.

The species may be known by its hispid surface, the fibrous substance and the obtuse, irregular, medium sized pores.

Syn.: *Spongipellis borealis* (Fr.) Pat.; 19, 32, p. 475.

Polyporus resinus (Schrad.) Fries (Plate XI, fig. 37).

Pileus fleshy becoming suberose, flocculose-pruinose, rusty-fuscous, the cuticle adnate, rigid, wrinkled, resinaceous; within azonate, pallid; pores minute, equal, pallid.

Quite common on various kinds of decayed logs especially basswood and on living elm and maple. Specimens have been collected at Wauwatosa, Horicon, Sparta, Elkhorn, Madison, Blue Mounds and Bangor, Oakfield, Crandon, Hazelhurst, and Shanagolden. At Shanagolden the specimens were found growing out of living maple and elm trees, which had a diameter of from 37 to 45 cm. In these cases the entire center of the trees was in such an advanced state of decay, that the wood could easily be torn out with the hand. This decay extended upwards into the trunk for a distance of from 10 to 20 feet, and down into the stump. The trees had a shell of sound sap-wood varying from 5 to 7.5 cm. in thickness. The pilei grew out through the so-called frost-cracks in the wood, through which, possibly, infection took place.

This is a large species. Largest specimen 45 cm. wide, 24 cm. long, and from 3 to 4 cm. thick. Usually, however, the pilei are smaller. When vigorously growing, the pilei exude a transparent, brownish, tasteless liquid, which on drying on the finger is somewhat sticky.

Peck (22, 33, p. 21) says it closely resembles *P. benzoinus* Wallr., which occurs on hemlock trees while *P. resinus* occurs on frondose trees. *P. benzoinus* has an odor like *Trametes odorata*, and is probably only a subspecies of *P. resinus*. *P. rubiginosus* is hardly different, but it is tomentose instead of flocculose-pruinose, and the pores are cinnamon.

The species may be known by its large size, rusty-brown cuticle, rugosely wrinkled when dry, the pallid, brittle substance and the pale liquid oozing out of the growing margin and pores.

Polyporus delectans Pk.

White, becoming yellowish. Pileus fleshy-fibrous, firm, simple or subimbricate, azonate, subtomentose. Pores large, unequal, at first subrotund and obtuse, then thin, angular and dentate.

"In woods on fallen trunks; common. Pileus two to four inches in breadth, with a projection of one to two inches, or, confluent, several inches in width. The stratum of pores is about half the thickness of the pileus." (Morgan 18, VIII, p. 128).

Collected at Star Lake in August 1901. It measures about 5 cm. long, 4.5 cm. wide, and scarcely 1 cm. thick. The base is somewhat narrowed behind and drawn down, thus differing a little from the type. The surface is rough and tomentose. The margin is thickish and drawn inwards on drying so that there seems to be a broad sterile band.

The pores are medium, at first shallow and obtuse, then deeper and dentate, appearing lacerate in places, tawny.

Polyporus spumeus (Sowerby) Fries.

Pileus compact, pulvinate, gibbous, strigosely-hispid, with stem-like base, margin incurved, whitish, fleshy-spongy, about 8 cm. broad; pores small, round, sharp, entire, separable from the pileus.

On old trunks of various deciduous trees.

Massee (17, p. 253) says that the species grows "on living or dead trunks. The plants are 3—4 inches across, oozing out of a tree in a very soft mass which hardens in a day, and if it dries favorably the pileus becomes hispid."

Only a few specimens were found, one at Madison on hickory and a few growing out of chinks in the end of an elm log at Shanagolden. The largest specimen when fresh measured about 8 cm. in width, 4 cm. in length and 2.5 cm. to 3 cm. in thickness, but it shrunk to about two-thirds its former size.

The specimens were quite soft, moist hispid, obtuse, and of a reddish straw color when fresh. They could hardly be said to have a stem-like base, however, unless the mycelium by which they were attached in the chinks of the log be called the stem. In color and shape the fresh specimens looked very much like *Daedalea obtusa*. The pores are medium, toothed and irregular.

Syn.: *Spongipellis spumeus* (Sow.) Pat.; 13, 3, p. 17; 19, 32, p. 474.

Polyporus guttulatus Peck (Plate XI, fig. 38).

Pilei of a cheesy consistency, broad, flattened, sometimes confluent, sessile or narrowed into a short stem, slightly uneven, white or yellowish-white, marked with darker zones and watery spots; pores minute, subangular, short, whitish sometimes tinged with brown; flesh white; 10 to 15 cm. broad, 12 to 16 mm. thick. Trunks, July.

In texture and shape this species is related to *P. sulphureus*, but the pores are smaller than in that species. Plants are sometimes cespitose,

sometimes single. The spots in dried specimens have a smooth, depressed appearance.

The species is quite common in the northern part of the state growing from pine and hemlock stumps and logs. Specimens were collected at Hazelhurst, Star Lake and Shanagolden. At Star Lake a few specimens were taken out of a pine stump decayed by *Fomes pinicola*.

The largest specimen measures about 12 cm. wide, 5 cm. long and 1 cm. thick. Some of the specimens are stipitate, some sessile-dimidiate, and some cespitose. In color they are pale yellowish-white, with faint reddish-brown zones and spots. The flesh is pale yellowish-white, brittle when dry. The pores are of the same color, short, angular and small.

When fresh, the substance is soft, moist and cheesy. The growing margin and pores become spotted with a faint pinkish-flesh color whenever touched or bruised, and often exude drops of colorless, viscid, tasteless liquid.

This species seem to be allied to *P. epileucus* and *P. tephroleucus* on one hand and to *P. sulphureus* on the other.

From *P. epileucus* and *P. tephroleucus* it may be distinguished by the softer substance, the brownish spots and pits in the surface of the flat uneven pileus.

Syn.: *Polyporus maculatus* Peck; 22, 26, p. 69.

***Polyporus tephroleucus* Fries.**

Pileus fleshy-cheesy, triquetrous, obtuse, villous, unequal, gray, within white, zonate; pores round, elongate, obtuse, entire, whitish.

“Distinguished by its snow-white hymenium and context. The pores are longer than in any other of our white-pored species, one cm. at the maximum. Not uncommon on rotten logs in marshy places where it sometimes extends many centimeters.” Macbride.

Not very common. One specimen was found at Sparta growing from an old log in a pond, and several small specimens have been collected at Oakfield and Horicon. The largest specimen is about 8 cm. wide, 6 cm. long and 8 cm. thick. The pilei are flat, villous when young, more or less glabrate when old, grayish-white. The pores are even, equal, small, round, as long as the thickness of the pileus.

The species is allied to *P. epileucus*, Fr., *P. guttulatus* Peck, and *P. pallescens* Fries. The last named is scarcely distinct except that it is “glabrate”; the others differ in color and in their shorter pores.

Polyporus epileucus Fries.

Pileus dimidiate, semicircular, concave below, at first cheesy-soft later firm, but not fibrous within, shaggy-rough, whitish, subzonate; pores small, round, entire, whitish.

"Not uncommon on birch and willow, not likely to be mistaken for any other species; when fresh soft, rather echinate above, when dry very hard and heavy like putty" (Macbride, 15, p. 26).

Not common. Specimens have been found near Blue Mounds, near Madison and at Shanagolden on old logs and stumps.

The largest specimens are about 10 cm. wide, 6 cm. long and 1 to 1.5 cm. thick, the tubes being about three-fourths as long as the thickness of the flesh. When fresh the specimens are of a pale yellowish white color, cheesy-moist and almost leathery. The upper surface is uneven and sometimes tubercular, sometimes nearly hispid. The pilei are usually flat above, slightly convex below; sometimes sessile-dimidate; sometimes cespitose.

When dry the substance is hard and bony, heavy like putty, thus resembling *Polyporus osseus*. The pores often contract and become torn on drying. The shaggy pubescence often disappears with age, the pilei becoming glabrate.

Polyporus gilvus Schw.

Pileus corky, woody, dimidiate-sessile, or effused behind, yellow-ferruginous, azonate, rough, uneven, the margin tomentose, acute; pores very small, crowded, entire, brownish, changeable, context yellow-ferruginous.

"The pileus may remain thin," says Morgan (18 VIII, p. 105), "or it may become excessively thick and subungulate; the surface soon becomes scabrous, and sometimes it is furnished with warty granules; it is often very uneven or scrupe. Specimens occur that are distinctly zonate. The reddish-yellow of the growing margin soon changes to ferruginous, and very old specimens have assumed a canescence."

Very common in the southern part of the state especially on dead oak, but also on basswood, poplar, maple and hickory. Less abundant in the northern part of the state where it is found on maple, elm and basswood. The largest specimen is 12 cm. broad, 7 cm. long, and 6 cm. thick. Most of the specimens are quite thin. They are usually hard; the substance is rhubarb color, as is also the growing margin. The young growth is usually quite tomentose; sometimes the margin is ob-

tuse, sometimes acute. The surface may be either smooth, even, or uneven and rough. The base is often decurrent. Resupinate and reflexed forms are also found. The thicker forms are distinguished with difficulty from young *Fomes igniarius* and *F. rimosus*. *Polyporus gilvus* is more yellow and somewhat softer. Moreover, it is never stratified.

Some of the thick forms were submitted to Professor C. H. Peck, who regarded them as well within the limits of the species.

The species is very destructive to young oaks and hickory, attacking the living trees and producing a rot in the sap-wood, immediately under the bark. Infection seems to take place in wounds produced by breaking off branches or in exposed roots. The mycelium spreads upward as well as downward, ultimately killing the tree. This disease needs further investigation.

Syn.: *Hapalopilus gilvus* (Schw.) Murr.; 19, 31, p. 418.

***Polyporus nidulans* Fries (Plate XI, fig. 34).**

Pileus fleshy, very soft, subpulvinate, villous then smooth, azonate, reddish-gray, of the same color within. Pores long, medium, unequal, angular, tawny-reddish.

Common, on broken branches lying on the ground. Specimens have been found at Madison, Bangor, South Milwaukee, Star Lake, Crandon and Ladysmith. The largest specimen is about 12 cm. broad, 6 cm. long and 2—3 cm. thick. The pilei are somewhat imbricated and in general appearance resemble those of *P. cuticularis*. The color, however, is rather a pale gilvous or even cinnamon, sometimes with reddish tints. The surface becomes rough with age and uneven. The margin is acute and slightly incurved. The substance is very soft and spongy. This is especially noticeable when the pileus is soaked in water for a few minutes.

The hymenial surface is very convex; the upper surface is usually plane. The tubes are a little longer than the thickness of the flesh and unequal, resembling those of a *Trametes*. The mouths are medium and angular. The tubes are grayish brown within; the mouths are a little darker than the pileus.

This species is a little softer than *P. rutilans*, its nearest ally, and *P. gilvus*, some forms of which it resembles; besides it has larger pores than either of these species.

Syn.: *Hapalopilus nidulans* (Fr.) Karst.; 13, 3, p. 18.

Hapalopilus rutilans (Pers.) Murr.; 19, 31, p. 416.

Polyporus radiatus Sowerby.

Pileus corky, coriaceous, rigid, radiately wrinkled; at first velvety, tawny; afterward glabrate, ferruginous-brown; margin spreading, repand. Pores minute, pallid silvery-shining, at length ferruginous.

Common in the northern part of the state on old maple and elm logs. Collected at Star Lake, Crandon, Ladysmith, Shanagolden, on maple and elm logs, and at Bangor on broken alder trunks; at Sparta on birch trunks.

Variable. Usually effuso-reflexed, imbricated and laterally confluent. The rigid pilei are reflexed about 1 to 3 cm. Those collected on the alder at Bangor are flabelliform measuring about 3 cm. in width and 3.5 cm. in length. The surface is rough, usually glabrate, tawny yellow when young changing to ferruginous-brown. When dry they are hard and brittle.

The species may easily be known by the brown radiately-wrinkled pileus and the silvery sheen of the pores when turned in the light. Very closely related to *P. aureonitens* Pat.; but it is harder and duller in color.

Syn.: *Inonotus radiatus* (Sow.) Karst.; 13, 3, p. 19; 19, 31, p. 599.

Polystictus radiatus (Sow.) Fr.; 8, p. 565; 26, VI, p. 247.

Polyporus aureonitens Pat. et Pk.

Pileus 6—18 cm. broad, rather thick, corky, sessile, variously conerescent and imbricated, minutely velvety-pubescent, when young, soon glabrate, radiately fibrous-striate, the young plant and growing margin at first sulphur yellow, then golden tawny, finally tawny-ferruginous.

“Generally conerescent, marked with darker lines or zones, somewhat shiny, substance tawny; pores minute, subrotund, short, ferruginous with silvery lustre; spores whitish or very pale, yellowish, elliptical, naviculoid, .2 x 1.6 microns. Birches, alder and maple. August and September. Related to *P. radiatus*; but paler, lineate-zonate and pale spores.”

Not common. A few small specimens were found near Mud Lake, Crandon, on birch branches and stump.

The specimens were much imbricated, hard, small, the largest being about 3 by 2 cm. and 8 mm. in thickness.

The specimens much resemble *P. radiatus*, but the margin is covered by a band of bright golden yellow, shining like silk.

This species, as well as the preceding, is placed by Saccardo in the genus *Polystictus*, but is here retained in the genus *Polyporus* because

of the tough and fleshy character of the pileus, which becomes hard and corky.

Polyporus cuticularis Fries.

Pileus thin, spongy, fleshy, later dry, applanate, hirsute and tomentose, rusty-brown becoming blackish, within loosely parallel-fibrous. Margin fibrous-fimbriate, incurved. Pores longer than the thickness of the flesh, small, rust-color. Imbricated pilei sometimes growing into each other. Tomentum strigose or velvety, disappearing at length.

"The pores in fresh specimens," says Morgan (18, VIII, p. 105), "are cinereous-pruinose, glittering when turned in the light. Spores very abundant, Indian yellow, 5.6 microns long."

Not common. A group of specimens was found growing on a poplar stump near Oak Center in July 1902. The pilei were very much imbricated and at first were confused with those of *P. gilvus*; however, on closer examination they appear quite different.

The largest pileus is 7 cm. broad, 4 cm. long, and 2 cm. thick. The pilei are plane above and convex below. The younger specimens are light-tawny and covered with a velvety pubescence. When they get older the pubescence becomes more hispid and the color becomes more ferruginous. The margin is thin but incurved. The flesh is at first soft, but becomes very hard. It is composed of fibers of a dark ferruginous color.

The pores are medium, irregular and long; the spores are produced in abundance and soon cover the old pileus giving it the characteristic yellow-rust color.

Easily recognized by the plano-convex pileus, the hispid surface, and the yellow-rust colored spores which always cover the lower pilei.

Polyporus salignus Fries.

Pilei imbricated, dimidiate, effused, kidney shaped, soft-leathery, appressed-hairy, whitish, depressed around the wavy, swollen margin or furrowed. Pores delicate, close, lengthened, sinuous, white.

On old willow trunks.

Not common. A few specimens were found at Sparta on a willow stump, and one small specimen was found at Star Lake on a poplar log. The largest of these measured 6 cm. in width, 3 cm. in length and 6 mm. in thickness.

The specimens are usually imbricated and confluent; gibbous, with a concentric depression near the margin. When young the surface is

covered with a thin appressed pubescence which disappears with age. The pilei are white when young and soft fleshy; they become grayish with age and more or less corky. The thin margin is incurved. The pores are white and small.

Polyporus floriformis Quél.

Imbricato-multiplex; pileus tough, fleshy, subcoriaceous, sessile, dimidiate, longitudinally radiate-wrinkled, from white to grayish, sometimes the margin grayish-subzonate, 2—3.5 cm. broad; pores small, subrotund, then oblong-lacerate or fimbriate, white; flesh white, rather bitter or subacid; spores hyaline, subcylindrical, 4 x 2 microns; basidia clavate 56 x 15—20 microns.

On fragments of larch wood near the ground in mountainous regions. Externally resembling *P. candidus*; also like *P. osseus*, but its habit and growth are different and the flesh is never "osseous."

This is a small species plainly belonging to the tribe of the *Merismoidii*. A few specimens were found near Shanagolden in August 1904, and a few on the university grounds, Madison, August 18, 1906, both specimens were growing on very rotten wood. The largest specimens are 2 cm. long and 2 cm. wide; pure white. When moist, tough, fleshy, soft. When dry they become hard and brittle. Not all the specimens are radiately wrinkled nor are they all grayish-subzonate near the margin, but this may be because our specimens are young and rather immature.

Closely related to *P. osseus*, but smaller and more imbricated.

Polyporus osseus Kalchb.

Imbricated, multipileate, white; pilei variously formed, nearly dimidiate, concave or depressed, variously confluent, elastic, tough, later firm, glabrate, smooth, white within. Stipes short, out of a common bulb. Pores decurrent, small, later torn, discolored.

Rare. Found only once growing out of the top of a pine stump. The specimens are immature. The largest pileus was 5 cm. broad and 7 cm. long. The average thickness is about 1.5 cm. They are pale greyish-white, but darkened a little when dry. When fresh they are fleshy-tough, elastic, heavy like putty. When dry they are hard and heavy. The surface is smooth, and the margin slightly incurved. The spores are small, white; tubes short. Stipe very short, thick.

Easily distinguished by the heavy, elastic substance of the pileus.

Polyporus distortus Schw.

Pileus rather fleshy, circular, often aborted and very irregular or entirely resupinate, alutaceous to whitish; flesh white; pores decurrent, snow white, variable in size.

Localities, Algoma (Dodge) and the Dells.

Polyporus sulphureus (Bull.) Fries (Plate XII, fig. 40).

Cespitose, multiple, moist, cheesy; pileoli very wide, imbricate and undulate, smoothish, yellow with a tinge of red; pores small, plane, sulphur-yellow; pores ovoid, papillate 7 x 5 microns.

Peck (22, 48, p. 301) describes the species in the following manner: "Pileus broad, somewhat irregular and wavy, growing in tufts and closely overlapping each other, uneven, reddish or orange color when young and fresh, fading with age, flesh white; tubes very small, short, sulphur yellow; spores elliptical, white, .0003 inches long,——. In using the sulphury *Polyporus* for food, only the young and fleshy grown caps were taken. These thinly sliced and fried in butter were much better than I expected to find them. Mature specimens would probably be tough, dry, disagreeable and indigestible."

"Specimens when dried," says Masee (17, p. 240)," are often more or less incrustated with a deposit of crystals of binocalate of potash."

The species is quite common all over the state, growing on old logs and stumps of various trees, as well as from trunks of living oaks and maples. Specimens have been collected at Madison, Horicon, Bangor, Elkhorn, Algoma, Milwaukee, Hazelhurst, Star Lake, Blanchardville, Crandon and Shanagolden. Specimens can be collected from June to September. Tufts have been found with a diameter of 40 cm. The individual pilei may grow to 10 cm. in width, 15 cm. in length and 1 to 2 cm. in thickness. The color is sometimes sulphur yellow, sometimes orange-red. The pores are always yellow when mature, whitish when young. This color soon fades on drying and the whole plant takes on a pallid wood color. The substance on drying becomes brittle and corky.

The species attacks living oak, maple and hickory trees. It enters the tree through wounds or exposed roots. It spreads chiefly through the heart-wood upward as well as downward. However, a tree infected may live many years. An oak tree near the Northwestern tracks near Bangor had several pilei growing from the broken ends of exposed roots.

Polyporus imbricatus (Bull.), *Polyporus anax* and *P. Berkeleyi* Fr. are near relatives, but the sulphur polypore can always be distinguished by the yellow and orange colors.

Syn.: *Polypilus sulphureus* (Fr.) Karst.; 13, 3, p. 17.

Laetiporus speciosus (Batarr.) Murr.; 19, 31, p. 607.

Polyporus anax Berk (Plate XII, fig. 41).

Intricately branched; branches passing over into variously formed pileoli, of various sizes, imbricate and confluent, obscurely gray or lead-color, sometimes subtomentose and fibrillose; pores white, variously formed, generally large and angular; flesh coriaceous, fragile when dry with the odor of anise.

Peck (22, 51, p. 299) says that this species is often confused with *P. intybaceus*, and that the spores of *P. intybaceus* are described as elliptic or ovoid, while those of *P. anax* are globose. McIlvaine (16 p. 482). gives the spores of *P. anax* as "subelliptic, 7—8 microns long." The fresh spores in our specimens are globose and 5 microns in diameter.

At the base of an oak stump on a lawn in Madison. Tuft 40 cm. by 25 cm. high; largest pileolus 15 cm. broad, 20 cm. long, 9 mm. thick. The pileoli grow densely imbricated, branching out from a common massive stalk, the pilei thin, flabellate, white underneath, dirty-white, grayish-pruinose above; glabrate or finely tomentose, more or less wrinkled and rough. Substance white, fibrous, leathery, becomes brittle when dry. Pores small, dissepiments thin, white; spores white, globose, with a single large oil drop.

This species differs from *P. frondosus* in its larger and broader pilei and the larger pores and globose spores, and from *P. intybaceus* in its globose spores and the color of the pores.

Polyporus frondosus Fries (Plate XII, fig. 43).

Very much branched, fibrous, fleshy, rather tough; pileoli very numerous, dimidiate, rugose, lobed, intricately recurved, smoky-gray; stems white, growing into each other; pores very small, acute, white round, or torn when in an oblique position.

Growing in large tufts from 15 to 30 cm. in diameter; the pileoli 2 to 3 cm. broad and 2 to 3 cm. in length; the thickness varying from 5 to 12 mm.; the tubes about one-third as long as the thickness of the flesh.

Not as common as *P. sulphureus*. Specimens have been found near

Madison growing at the base of a living oak tree; at Blue Mounds and at Crandon, growing on the roots of small tamaracks. Most of the specimens are some shade of gray, but sometimes they are white throughout.

P. frondosus differs from the other white Merismatae in the abundant branching and interlacing of the stems. The substance of the stems and pileoli is soft leathery and tough. When young and growing vigorously the pileoli are not rugose but smooth.

The pores are snow-white, delicate, as large as those of *P. sulphureus*, and usually lacerate. The pilei are attached laterally to the stipe and thus differ from those of *P. umbellatus*.

Syn.: *Grifolia frondosa* (Dicks.) S. F. Gray; 19, 31, p. 336.

Polypilus frondosus (Dicks.) Karst.; 13, 3, p. 17.

Polyporus umbellatus (Pers.) Fr.

Pilei numerous, more or less depressed, umbilicate, 1 to 4 cm. in diameter, entire, or the larger ones lobed and cut, of fibrous-fleshy substance, somewhat tough, united to form tufts one span high. Stems lengthened, separate but united at the base, white like the small unequal pores. On the ground under deciduous trees and at the base of trunks.

Not common. One tuft was collected by Mr. B. O. Dodge near Algoma. It measures about 10 cm. in diameter, and is made up of numerous small more or less central-stemmed pileoli. These pileoli are thin, umbilicate, more or less circular and measure about 2 to 2.5 cm. in diameter. The stipes vary from 5 to 8 cm. in length and from about 5 to 8 mm. in thickness. When dry the whole plant is of a brownish-gray color. It has also been found at Devils Lake and Parfrey's Glen.

The species is closely related to *P. frondosus*, with which it is sometimes confused. However, it can easily be distinguished from that species by the fact that the pileoli are more or less central-stemmed and umbilicate.

Syn.: *Grifolia ramosissima* (Scop.) Murr.; 19, 31, p. 336.

Boletus umbellatus Pers.; 23, p. 519.

Polyporus cristatus (Pers.) Fr.

Branching, fleshy-solid, fragile; pilei entire and dimidiate, imbricate, depressed, subpulverulent-villous, finally rimose scaly, greenish tawny; stipes, connate irregular, white; pores minute, angular and lacerate, whitish.

Specimens from Horicon and Blue Mounds. Largest specimen 12 cm. long and wide, 1.5 cm. thick.

Polyporus graveolens Schweintz (Plate XIII, fig. 44).

Corky or woody, extremely hard, very closely imbricated and connate forming a subglobose or polycephalous mass. Pileoli innumerable, inflexed, appressed, plicate, brown. Pores concealed, very minute, round, pale brown; dissepiments thick and obtuse. In woods, on old dead trunks.

As I have not seen any fresh specimens of this species, I subjoin Mr. Morgan's observations: "This remarkable fungus consists of innumerable pileoli forming a subglobose or elongated mass 3—6 inches in diameter and often many inches in length especially on standing trunks. When fresh and growing it has a varnished or resinous appearance and often purplish or reddish tints with a paler margin. Substance within ferruginous, rather soft and floccose, but covered by a very hard brown crust. The pores are brown, but lined by an extremely minute, white pubescence. Pileoli so closely imbricate and appressed as almost to entirely conceal the pores. I am unable to separate from this *P. conglobatus* of Berkeley; this latter, Fries states to be a species of *Trametes* (Nov. Symb., p. 67) while he refers *Polyporus graveolens* to the *Merismoidii* (l. c. p. 62.) It is called "Sweet Knot" by the people, but I am unable to verify the popular notion concerning the wonderful fragrance perceptible at a great distance from the tree on which it grows. When fresh it has a strong disagreeable odor, as described by Schweintz."

Localities: Mauston (Dodge). This specimen is about 7 cm in diameter. The pileoli are very closely imbricated and measure about 1 to 2 cm. in width and 2 to 2.5 cm. in length. They are glabrate, smooth, and covered with a hard, dark-brownish crust. The interior is hard ferruginous-brown, floccose. The tubes are very small and short. The specimen gives out a faint sweet odor.

The distinguishing characteristics are the closely imbricated pilei forming a more or less globular mass, the short pores and the sweet odor of the substance.

Syn.: *Globifomes graveolens* (Schw.) Murr.; 19, 31, p. 424.

Polyporus conglobatus Berk.

Fomes graveolens (Schw.) Cooke.; 11, 13, p. 118 (1884); 15,

Polyporus volvatus Peck (Plate XIII, fig. 45).

Subglobose, fleshy, firm, smooth, flattened behind, and apparently sessile, but usually attached to the matrix by a small point, whitish, more or less tinged with yellow, red or reddish brown, the cuticle continuous, completely covering the hymenium like a coriaceous volva, at length, rupturing below, revealing the hymenium; pores long, whitish, minute, punctiform, the mouths yellowish, with a tinge of cinnamon; flesh white; spores elliptical, flesh-colored, 7.6 to 8.9 microns long by 5 microns broad.

This most peculiar and most interesting little fungus has been found only a few times in the northern part of the state on white and red pines, both living and dead. Our specimens were gathered in Oneida county near Hazelhurst. Most of the dead standing trunks of red pine, about 1 to 1.25 feet in diameter showed this fungus. Two specimens were taken from a living white pine which was 2 feet in diameter, and several were taken from a living red pine which was 11 inches in diameter. The dead red pine from which most of the specimens were taken had been killed by a fire the year before. On each tree infected there were a large number of pilei growing out of the trunk from a few feet above the ground to at least 100 feet up. It is not probable that all of the pilei came from one center of infection; it is more likely that each is the result of a separate infection. Most of the pilei grew out of holes in the bark made by bark-borers.

The cuticle and the substance of the pileus is like that of *P. betulinus*. The hymenium, at first yellowish-brown, soon becomes pale cinnamon. The tubes are long, their length exceeding the thickness of the flesh. The pores are small, round, equal, and obtuse. The most interesting and distinguishing feature of the species is the volva. This is formed by the continuation of the cuticle, thus completely enveloping the whole specimen, tubes and all. When mature, the volva breaks down, forming an oval opening for the exit of the rust-colored spores which sometimes form a small conical heap on the inner side of the volva.

Largest specimen 2 cm. broad and 1.25 cm. long. The tubes were 8 mm. long; the white flesh 5 mm. thick; and the cavity formed between the pores and volva was 4 mm. in depth.

Syn.: *Cryptoporus volvatus* (Peck) Shear; 19, 30, pp. 423—424; 19, 32, p. 490.

Polyporus betulinus Fries. (Plate XIII, fig. 46).

Pilei circular, hoof or kidney-shaped, with obtuse margin, the base narrowed into a short stipe, fleshy becoming corky, azonate, glabrate covered with a thin separable brownish to brownish-red cuticle, size variable. Pores short, small, unequal, white, separable when old.

On trunks of *Betula*.

The birch polypore is one of the commonest of polypores wherever the birch grows. It is found on living as well as dead birch. Localities: Lake Superior region (Cheney), Star Lake, Shanagolden, Crandon, Ladysmith, Sparta and Bangor.

Largest specimen measured 24 cm. in width, 14 cm. in length and 3 cm. in thickness. It was kidney-shaped and showed the short thick, curved stem so peculiar to the species.

The substance when fresh is white, soft cheesy-fleshy, but becomes soft-corky on maturing and drying. The pilei are usually more or less circular, umbonate and hoof-shaped. The obtuse margin is incurved, and projects all around beyond the pores. The pores are at first white but darken somewhat on maturing. From the hymenium project numerous spines, thus giving it a bristly appearance. The cuticle is usually of a grayish color, darkening with age. Sometimes there are darker colors on the top of the pileus.

This fungus produces a white-rot in the wood of the birch. Infection probably occurs by the spores lodging in the cracks of the bark.

Syn.: *Piptoporus suberosus* (L.) Murr.; 19, 30, p. 425.

Piptoporus betulinus (L.) Karst.; 13, 3, p. 17.

Polyporus hispidellus Peck.

Pileus fleshy, tough, dimidiate, pale fawn-colored or grayish-brown, clothed with short stiff hairs, flesh white; pores small, short, subrotund, white, the dissepiments thin, the edge uneven, dentate or lacerate; stem short, lateral, solid, often irregular, clothed like the pileus; spores fusiform 12.5 microns long and 4 microns broad.

Locality: Star Lake. The pileus has a very bitter taste. It is grayish-brown on top, with a tawny hymenium. The pileus measures 5 cm. long and 7 cm. broad with an average thickness of about 7 mm. The surface is rough with short hairs. The pores are medium, equal, toothed and somewhat decurrent. The stipe is excentric, unequal, bent, a little lighter than the pileus, measuring about 7 cm. long and 1 to 1.5 cm thick. The substance of the pileus is somewhat fleshy but is thin and brittle when dry.

Polyporus arcularius (Batsch) Fries.

Pileus coriaceous, tough, convex, subumbilicate, zonate, brown scaly at first, then glabrous, yellowish, the margin strigose; the stipe short, slightly squamulose, brownish; pores oblong, thin, entire, whitish, fairly large; spores 3 by 8 microns.

Macbride (15, p. 30) says of them "Lignatile, not rare in early summer in wooded regions, easy to recognize by the depressed pileus, thin context and large rhomboidal pores at first whitish then on drying yellowish."

Quite common on sticks and logs in the woods. Localities: Madison, Horicon, Oakfield, Bangor, Crandon and Ladysmith. The largest had a diameter of 3 cm.; the stipe 4 cm. in length and 4 mm. in diameter. The length of the stipe varies from 1 to 5 cm.

The species is very closely related to *P. brumalis* from which it is not always easy to separate it. It is usually lighter in color, thinner and more depressed in the center than *P. brumalis*. Its most distinctive features are the large rhomboidal pores and its prevailing occurrence in spring and early summer. *P. lentus* Berk., is very much like *P. arcularius*, but its pores are white, roundish or subquadrate and much more decurrent, running sometimes down to the base.

The stem may be excentric but is usually central.

The specimen in North American Fungi agrees well with ours but the C. A. F. specimen no. 58 is a little darker.

Polyporus brumalis Fries (Plate XIII, fig. 47).

Pileus 3 to 12 cm. across, thin, pliant, then coriaceous and rigid, more or less umbilicate, during the first year umber and densely villos, in the second year minutely scaly, becoming smooth, and paler; pores shallow, large, angular, and usually elongated radially, white, then yellowish, dissepiments thin, very minutely toothed at the margin; stem colored like the pileus, velvety or squamulose, spores colorless, linear oblong, sometimes slightly curved, 5 to 6 by 2 microns.

Winter characterizes the species as follows: "A very variable species, and hence having many synonyms which are in part doubtful. It appears that the well marked form characterized by small roundish obtuse pores—*Polyporus tomentosus* Rostk., in Sturm, Deutschl. Flora 3, p. 25, Taf. 13, and *Polyporus trachypus* Rostk., (l. c. p. 27, Taf. 14) belong to *P. brumalis*, while *P. intermedius* Rostk., (l. c. IV. Bd., p. 69, Taf. 33) and *P. alveolarius* Rostk., (l. c. 27/28 Heft, p. 29, Taf. 15) had better be referred to *P. arcularius* Batsch." (28, p. 450.)

Quite common in fall and late summer growing on railroad ties, fallen branches in the woods and decayed logs and fence posts. Localities: Bangor, Sparta, Milwaukee, Madison, Elkhorn, Crandon and Star Lake. The largest specimen was 7 cm. in diameter with a stipe 2 cm. long and 6 mm. thick.

The pileus is usually circular but sometimes irregular and wavy. The color varies from almost black to yellowish brown. Most of them are of a dusky brown, often becoming lighter towards the margin. A few specimens found at Bangor were of a pale cream color.

The stipe is usually short, central or excentric, sometimes scaly but more generally hirsute. The pores vary in size from very small and round, to 0.5 mm. in length. When large, they are usually radially elongated. The species is closely related to *P. lentus* and *P. arcularius*. Both of these have larger pores.

Polyporus lentus Berk. (Plate XIII, fig. 48.)

Pileus fleshy, tough, then coriaceous, umbilicate, minutely scaly; pale ochraceous; stipe short, incurved, hispid, and furfuraceous, concolorous. Pores decurrent, irregular, white.

Morgan (18, VIII, p. 93) says that the pores are deep, roundish or subquadrate.

Not common. Blue Mounds (Dodge) on ground; probably growing on wood underneath. This specimen is Dodge's *Polyporus* sp.

Largest specimen: diameter 5 cm.; stipe about 11 cm. long and 5 mm. thick. The substance is leathery-tough, drying hard but rather fragile. The pores are rather large for a *Polyporus*, angular or quadrate, decurrent upon the stipe. The species seems to be affiliated with *Fomes europeus*, but is centrally stiped and the pores are smaller.

Polyporus tomentosus Fries.

Pileus irregular, up to 12 cm. in diameter, often several pilei confluent and imbricated, of corky hard consistency, zoneless. Stipe sometimes central, sometimes lateral, short, colored like the pileus. Pores small, irregular, obtuse, entire, at first white-pruinose. On the ground in woods of coniferous trees.

Not common. A few specimens were collected at Brule river, and some were collected near Shanagolden and Algoma. The largest specimen measured about 12 cm. in breadth and 9 cm. in length, with a thickness of about 10 mm. The stipe is 2 cm. long and 2 cm. thick. In

color they are paler than *P. circinatus* and more yellowish. The pilei are very irregular, from circular to kidney-shaped. Stipe excentric or lateral, thick and irregular, and attached to twigs and roots in the ground. The surface is uneven and soft tomentose as is also the stipe.

The pores are medium, irregular, shallow near the sterile margin, but deeper near the center, pruinose when young.

This species is closely related to *P. circinatus* but differs in the paler color, the irregular pileus and the lateral stem.

Syn.: *Coltricia tomentosa* (Fr.) Murr.; 19, 31, p. 346.

Polyporus dualis Peck; 22, 30, p. 44.

Polyporus circinatus Fries (Plate XIII, fig. 49.)

Pileus circular, flat, compact, thick, zoneless, velvety, yellowish-brown, composed of two layers; the lower layer continuous with the stem and woody to corky, the upper soft, felt-like. Pores decurrent, small, entire, grayish-brown. Stipe thick, inflated, colored like the pileus, velvety.

On the ground, under conifers.

Not common. Localities: Star Lake, Brule river (Overton) and Crandon.

Largest specimen 8 cm. in diameter and 1.5 cm. thick. The stipe is irregular, about 2 cm. long and 1 to 1.5 cm. thick. Both stipe and pileus are yellowish-brown, a little paler than *Polystictus perennis*. The small, somewhat decurrent pores are grayish-brown.

The chief distinguishing feature is the double-layered pileus. The upper layer is made of a yellowish-brown soft, felt-like substance which is thicker near the somewhat depressed center. The lower layer is of a brownish-wood-color, hard and corky. In general appearance it resembles a young *P. perennis*, but is larger, thicker and with smaller pores.

Polyporus Schweinitzii Fries (Plate XIV, fig. 50).

Pileus 15 to 22 cm. broad, rugged strigoso-tomentose, scrupose, dark-brown with ferruginous tinge, flesh thick, spongy and soft, fibrous bright brown, sometimes almost obsolete; tubes about 6 mm. long, openings large irregular and variable in form, yellow with tinge of green; spores elliptical obliquely apiculate, pale yellow 7 to 8 by 4 microns.

"Distinguished from *P. hispidus*, *P. spongia*, etc., by the central stem which is however sometimes obsolete; it is never attached by a broad lateral base." (Masse, 17, p. 231.)

Common on pine, spruce and hemlock. Localities: Star Lake, Shanagolden, and Bangor. The specimens from Bangor were taken in August from the roots of a living white pine; the rest from stumps or dead trunks. This species attacks the living trees through the roots, spreading upwards for a short distance. It produces a brown rot, not unlike that produced by *Fomes pinicola*, making the wood very brittle, and ultimately killing the tree.

The largest specimen found had a diameter of about 30 cm., the flesh being about 3 cm. thick near the center. The stem is short and thick.

The pileus is rough above, dark brown when dry, lighter when fresh. The center is usually somewhat depressed. The flesh is of a bright brown, soft, fibrous and very brittle. The pores are large, yellowish-brown, decurrent and irregular. When freshly growing the pores are quite delicate and stain darker where bruised and touched. Wood containing fresh mycelium of this species is phosphorescent.

Syn: *Polystictus Schweinitzii* (Fr.) Karst.; 13, 3, p. 18.

Polyporus hispidoides Peck pr. p.; 22, 33, p. 21.

Romellia sistotremoides (Alb. et Schw.) Murr.; 19, 31, p. 339.

***Polyporus flavovirens* B. & Rav.**

Pileus soft, irregular, cushion-shaped or depressed, finely tomentose, yellowish-green; stipe pale, nearly the same color, thick. Pores irregular, dissepiments thin, yellow. Pileus 8 to 10 cm. broad, stipe 5 cm. long, 12 mm. thick. Pores 0.5 mm. broad.

In Grevillea vol. 1, p. 38, the same species is described as follows: "Pileus irregularly lobed, subreniform, subtomentose dirty yellow marked with yellowish green zones. Context white. Stipe central and lateral, same color as pileus. Hymenium yellowish-green, deeply decurrent. Pores decurrent angular, irregular, lacerate when old. Related to *P. rufescens*. Like *P. cristatus*."

Most of our specimens came from Blue Mounds. A few were found on Cradle Bluff, Sparta and at Milwaukee. These agree best with the second description given above. Their pores are much smaller than those in the Blue Mounds specimens, and longer.

The largest of our specimens measured about 10 cm. in diameter, scarcely 1 cm. thick. The stipe is 6 cm. long and 1 cm. thick.

When fresh the color of the pileus varies from creamy-yellow to greenish-yellow, and they often seem almost glabrous. The margin is very irregular and lobed, curling downwards on drying. The zones

are not clearly marked. The stipe is thick, irregular, excentric. The pores large, irregular, shallow, decurrent.

The plants grow on the ground usually in groups, often cespitose and confluent.

When dry the color becomes a dull seal-brown, the hymenium remaining lighter.

Syn. *Scutigera radicans* (Schw.) Murr.; 19, 30, p. 430.

Polyporus squamosus (Huds) Fries (Plate XIV, fig. 51; Plate XV, fig. 51).

Pileus generally very large (0.5 meter broad,) flabelliform, tough-fleshy, ochraceous, with broad, appressed, dark colored scales; stipe excentric or lateral, thick, reticulated above, becoming black below; pores thin, at first small, then angular and torn, pale. Spores ovate, colorless, 12 by 15 microns.

Not common. Localities: Madison, Oakland Park. The largest one is laterally stiped and is about 23 cm. wide, 14 cm. long and not more than 1 cm. thick. The stipe is about 4 cm. long and 3 cm. thick. Two smaller specimens are nearly centrally stemmed, the pileus being somewhat depressed above. The stipes here are cespitose and longer than in the large specimen—about 4.5 cm. long and 1 cm. thick and are reticulated above.

The color is pale ochraceous. The scales are dark-brown and radially arranged. The margin is thin and curved down. The flesh is thin, soft and white.

The pores are angular, very shallow in the young specimens, not very large. In the larger specimens the pores are deeper and look very much like the pores in *Favolus europaeus*. At length they become torn, the dissepiments being very thin.

This species is easily recognized by the large dark-brown scales and the very large angular pores which are usually decurrent on the short thick stipe which is more or less reticulated.

Syn.: *Boletus Juglandis*, Schaeff.; 27, Taf. 101–102.

Polyporus caudicinus (Scop) Murr.; 19, 31, p. 40.

Polyporus ovinus (Schaeff.) Wint. (Plate XII, fig. 42.)

Pilei very variable in form, compact but fragile, fleshy, when young smooth, but soon scaly cracked, whitish. Stipe short and thick 2.5 to 3 cm. long, sometimes bulbous, unequal, white. Pores small, round, equal, at first white then yellowish.

Common at Standing Rock near Kilbourn, September 1910.

Polyporus radicans Schw. (Plate XV, fig. 54).

Pileus fleshy-tough, pulvinate, depressed, sooty-pale, sub-tomentose. Stipe excentric, long, tapering downward, rooting, black below. Pores somewhat decurrent, very large, obtuse, equal white.

In his notes on this species, Morgan (18, VIII, p. 94) says:—"I find this plant as Berkeley says, of various sizes, from the small plant which Schweinitz described to five inches or more across with the stipe six inches or more in length. The long tapering stipe penetrates the earth several inches the tip always being attached to some portion of an old root. The pileus is brown or blackish and more or less tomentose; the upper part of the stipe is colored like the pileus, whitish at the top; the lower rooting portion is black and more or less crooked or deformed. The pores are very large averaging .65 mm. in diameter. *P. Morgani* Frost appears to me to be this plant."

Localities: Madison, Blue Mounds, Milwaukee, White Fish Bay. The largest specimen found measures 30 cm. in diameter, the pileus being 4 to 5 cm. in thickness. The stem is 14 cm. long, the thickest portion being 6 cm. in diameter. The black radicating part is 7 cm. long and tapers irregularly downwards. The pores are angular nearly 1 mm. in diameter, and 3 to 4 mm. long, turning brown when bruised. The pileus is a bright red-brown in color, finely scaly or subsquamulose. The margin is thin, recurved. The flesh is white with rather acrid taste. Its weight when fresh was four and one-half pounds. This is the specimen figured.

The species may be easily recognized by the black radicating stipe.

Syn.: *Polyporellus brumalis* (Pers.) Karst.; 19, 31, p. 33.

Polyporus polyporus (Retz.) Murr.; 19, 31, p. 33.

Polyporus subradicans (Murr.) (Plate XIV, fig. 53).

A rather large thin plant with light-brown, almost glabrous, surface, small white serrated tubes and short black stipe. Pileus irregular in outline, convex to plane, 12 by 9 by 0.5 cm.; surface fibrillose, drab-colored to isabelline; margin very thin, inflexed when young, irregularly undulate at maturity: context fleshy-tough, 1 to 7 mm. thick, pure milk-white even when dry; tubes mere areoles at first, short and small at maturity, scarcely 1 mm. in length, 3 to 4 to a mm., decurrent to the blackened part of the stipe, white, yellowish when dry, mouths polygonal, regular, at length much elongated by a confluence or otherwise irregular, edges thin, toothed or fimbriate when mature: spores

ovate to ellipsoidal, smooth hyaline, not abundant, 3 to 4 by 5 to 7 mic-stipe short, thick, central, tapering, and attached at the base. sooty-black up to the pores, 4 by 2.5 cm.; context milk-white, firm, fleshy-tough, surface minutely tomentose, rugose-reticulate when dry.

Algoma (Dodge,) August 15, 1909. The specimen figured was identified by Murrill.

***Polyporus picipes* Fries (Plate XIV, fig. 52).**

Pileus fleshy, becoming rigid, thin, glabrous, smooth; depressed behind; stipe excentric or lateral, firm, at first velutinous, then naked, punctate, black to thin, small, white then yellowish or gilvous.

"Distinguished from *Polyporus varius* by the even pileus and velvety stem" (17, p. 235).

Common on willow trunks, living and dead, and on oak and maple logs. Localities: The Dells (Holden), Blue Mounds, Blanchardville, Madison, Elkhorn, Horicon, Algoma, Milwaukee, Bangor, Sparta, Crandon, Ladysmith, Star Lake, Palmyra, Shanagolden.

The largest specimen 18 cm. in diameter, 1 to 2 mm. thick; the stipe 4 to 6 cm. long and from 0.5 to 1.5 cm. thick.

The thickness of the pileus is variable. The thinnest pilei are scarcely 1mm. in thickness, and the thickest is 1.2 cm. When dry the pileus is thin, hard, brittle, dark-brown, with spots or granules; the margin is sharp, usually undulate and often lobed. Towards the margin the color becomes lighter, whereas, the disk is almost black.

The color of the hymenium varies from straw-color to dark yellow. The pores are very small, round, equal; dissepiments thin; tubes short, usually more decurrent on one side of the stipe.

The stipe is thickest at the base; firm, black, more or less velvety, depending on their age and stage of growth, being more so when young and growing vigorously; usually punctate.

Distinguished from *P. varius* by the velvety stipe, the subglobose spores, and the pileus which in the latter is streaked; *P. elegans* is smaller, not depressed and lighter in color.

***Polyporus varius* (Pers.) Wint.**

Pileus variable in form, tough, fleshy soon becoming woody, thin, smooth, slightly streaked; stipe excentric lateral or wanting, smooth, becoming grayish-black below. Pores decurrent small, shallow, round unequal, at first whitish then brownish.

Not rare. Shanagolden, Star Lake and Kewaunee County (Dodge).

Polyporus elegans (Bull.) Fries.

Pileus fleshy, but soon hardened, becoming woody, explanate smooth; the stipe eccentric, or lateral, glabrate, pallid, becoming abruptly black below, rooting; pores small, roundish, even, white, becoming yellowish.

Very common on sticks and twigs buried in the ground or on old logs. Localities: Algoma, Bangor, Wauwatosa, Madison, Elkhorn, Hazelhurst, Oakfield, Crandon and Shanagolden. The species is variable in shape and size. The largest specimen measured 10 cm. in diameter, and 8 mm. thick; the stipe is 3 cm. long. The longest stipe measured was 10 cm. long and 3 mm. thick. The smallest pileus was 8 mm. in diameter.

The pileus is smooth, thick becoming thin abruptly at the margin. The shape is variable; it may be circular and central stiped or irregular with the stipe excentric, the most usual form; or it may be flabeliform with the stipe lateral. The color varies from a clear cinnamon brown to a pale grayish-brown. With weathering, the pileus becomes gray or grayish-white. The pores are quite small and not unlike those of *P. picipes*.

Distinguished from *P. varius* and *P. picipes* by the smooth thickish pileus which becomes abruptly thin at the margin, and by the long, slender stipe.

12. FISTULINA Bull.

The hymenium is formed on the under surface of a fleshy pileus, at first warty and then developed into cylindrical tubes. These tubes remain free from each other. Somewhat fleshy fungi.

Superficially resembling a *Polyporus*, but distinguished by the pores, which are distinct and free from each other; when young they seem to be mere warts, but they lengthen and open up forming cylindrical tubes.

Fistulina hepatica (Huds.) Fries.

Pileus roundish, dimidiate, or subspatulate, attached by a broad base or substipitate, blood-red, fleshy and soft, streaked internally; tubes at first pallid, then red; spores broadly elliptical, salmon-color, 0.005 to 0.006 mm. by 0.003 to 0.004 mm. Conidia 0.006 to 0.010 mm., by 0.005 mm.

Rare. Only two specimens have thus far been found, one on a log near Lake Mendota, and one growing from an oak stump near Oakfield. The larger measured 4 cm. in width and 6 cm. in length, with a thickness of about 1 cm. Both specimens are subspatulate, attached by a narrow base. They were old, dry and leathery-tough when collected. The colors had all changed to dark-reddish-gray. The tubes were distinct, reddish-brown, about 4 mm. in length and 0.5 mm. in diameter.

The fungus is popularly known by the names Oak-tongue, Chestnut tongue, Beef-tongue and Beefsteak fungus. It is edible. It can readily be recognized by the free cylindrical pores.

13. BOLETINUS Kalchbrenner.

"Hymenophore not even (as in *Boletus*) but extended in sharp ridges or lamellæ descending like a trama among the tubes. Tubes not easily separable from the hymenophore and from each other, stem annulate, spores pale yellowish." Saccardo, vol. 6, p. 51.

Peck (21, 2, 8, p. 75) gives the following description of this genus: "Hymenium composed of broader radiating lamellæ connected by very numerous narrower anastomosing branches or partitions and forming large angular pores. Tubes somewhat tenacious, not easily separable from the hymenophore and from each other, adnate or subdecurrent, yellowish."

Boletinus pictus Peck (Plate XV, fig. 56; Plate XVI, fig. 56.)

"Pileus convex or nearly plane, at first covered with a *red fibrillose tomentum which soon divides into small scales revealing the yellow color of the pileus beneath*, flesh yellow, often slowly changing to dull pinkish or reddish tints where wounded; tubes tenacious, at first pale-yellow, becoming darker or dingy ochraceous with age, sometimes changing to pinkish-brown where bruised, concealed in the young plant by the copious whitish webby veil; stem equal or nearly so, solid, slightly and somewhat evanescently annulate, clothed and colored like or a little paler than the pileus, yellowish at the top; spores ochraceous, 9 to 11.4 microns long, 4 to 5 microns broad. Pileus 5 to 10 cm. broad; stem 4 to 9 cm. long, 6 to 13 mm. thick. Woods and mossy swamps." Common in the northern part of Wisconsin in low grounds and on gravelly soil. Localities: Crystal Lake, Crandon, Star Lake, Algoma, Durward's Glen, Madison, Hazelhurst, etc.

The largest was 8 cm. in diameter; the stipe 7 cm. long and 1 cm. thick. The pileus when young is nearly conical, but becomes more flattened with age; the color is dark red at first, becoming areolate showing a grayish or yellowish tomentum in the cracks; the margin is thin, sometimes appendiculate. The pores are large, irregular yellow, adnate; spores rust-color.

The veil is flocculose, whitish or grayish, leaving a more or less persistent grayish-white annulus. The stem tapers upward, and is gray with red-fibrillose scales, tough. The flesh is yellowish, tasteless and with out any changes in color.

Syn.: *Boletus Spraguei* B. & C.; 11, 1, p. 35.

Boletinus decipiens. Peck.

Pileus dry, minutely silky, whitish-yellow or pale buff, 8 mm. thick; hymenium plane or somewhat concave, yellow, consisting of large, unequal flexuous radiating tubes resembling multiseptate lamellae; stem equal, solid but spongy; veil floccose, evanescent, adhering for a time to the margin of the pileus; spores rather minute, oblong, ochraceo-ferruginous, 7.6 to 10 microns long, 3.5 to 3.9 microns broad.

Pileus 5 cm. broad; stem 5 to 7 cm. long, 6 to 8.4 mm. thick.

Collected near Lake Mills in November. I have not seen fresh specimens. The dried ones are of a dark brown color above and below. The stem is somewhat flexuous and in some cases excentric. The distinguishing feature seems to be the large radiating pores which are scarcely separable from the pileus. The spores are of a brownish rust color.

There seems to be considerable variation in the color of the pileus as well as in the size of the pores. One specimen has a sort of rose color, and several others have a shining almost tan-colored pileus. The pores in the latter are rich cinnamon in color and quite small.

Boletinus porosus (Berk.) Peck.

Pileus fleshy, viscid when moist, shining, reddish-brown, flesh 6.3 to 19 mm. thick, the margin thin and even; hymenium porous, yellow, formed by radiating lamellae one to two mm. distant, branching and connected by numerous irregular veins of less prominence and forming large angular pores; stem lateral, tough, diffused into the pileus, reticulated at the top by the decurrent walls of the tubes, colored like the pileus; spores semiovalate. Pileus 5 to 10 cm. broad; stem 12.6 to 35 mm. long, 8.4 to 12.5 mm. thick.

This species, which is reported by Bundy under the name *Boletus lateralis*, does not seem to be very common. A few specimens were collected by B. O. Dodge at Algoma, and a few were found at Bangor in September, '05.

The species grows in low damp ground. The Bangor specimens were found in a marsh growing under willows. The largest specimen measured 8 cm. in diameter; the stipe 3 cm. long and 1 cm. thick. In color they were of a dull yellowish brown, only slightly viscid.

The species may be easily recognized by the distinctly lateral stipe and by the prominently radiating lamellae from which the pores are formed. This feature seems to be the most prominent in *B. porosus* and *B. paluster* Pk.

***Boletinus paluster* Peck. (Plate XV, fig. 55.)**

Pileus thin, broadly convex, plane or slightly depressed, sometimes with a small umbo, floccoso-tomentose, bright-red; tubes very large, slightly decurrent, yellow, becoming ochraceous or dingy ochraceous; stem slender, solid, subglabrous, red, yellowish at the top; spores pinkish-brown, 7.6 to 8.9 microns long, 4 broad.

Pileus 2.5 to 5 cm. broad; stem 2.5 to 5 cm. long, 4.2 to 6 mm. thick.

Peck (21, 2, 8, p. 78) says further of this plant: "This is a small but pretty fungus which inhabits cold, mossy swamps and is somewhat gregarious in its mode of growth. Sometimes it grows on decaying moss-covered sticks or prostrate trunks. The color of the spores is peculiar, being dull purplish or pinkish-brown, quite unlike that of any other species. The mouths of the tubes are large for the size of the plant, and the radiating lamellae are plainly visible. The umbo is not always present. The red color of the pileus is apt to fade with age or to become tinged with yellow."

Not common. A few specimens were collected by B. O. Dodge near Algoma. The largest specimen is about 5 cm. in diameter. The stipe is about 3 cm. long by 5 mm. thick. The blood-red color of the pileus has persisted through the drying, but has perhaps darkened somewhat.

The growing plant may, at a distance, be mistaken for some red-capped *Russula*.

The species is easily distinguished by its bright red cap and the prominently radiating lamellae.

14 STROBILOMYCES Berk.

Hymenophore smooth; Tubules separable with difficulty, large, equal, pileus and stipe strongly squarrose-scaly, flesh tough.

Strobilomyces strobilaceus Berk, (Plate XXV, fig. 85).

Pileus hemispherical or convex, dry, covered with thick floccose projecting blackish or blackish-brown scales, the margin somewhat appendiculate with scales and fragments of the veil, flesh whitish, changing to reddish then to blackish where wounded; tubes adnate whitish, becoming brown or blackish with age, their mouths large, angular, changing color, like the flesh; stem equal or tapering upward, sulcate at the top, floccose-tomentose, colored like the pileus; spores subglobose, rough, blackish-brown, 10 to 12.5 microns long.

Pileus 5 to 10 cm. broad; stem 5 to 8 cm. long, 8 to 21 mm. thick.

Peck (21, 2, 8, p. 159) makes the following observations on this peculiar species: "This species has a peculiar shaggy appearance by reason of its dense coat of blackish-brown floccose tomentum which separates into more or less prominent and often angular or pyramidal scales, especially on the disk. When young the hymenium is concealed by the floccose whitish veil. *Boletus coniferus*, *B. echinatus* and *B. squarrosus* Pers. are synonyms of this species. In the description of the last one Persoon says, 'the long whitish tubes adhere quite firmly to the pileus but are not connate with it as in *Polyporus*, thus noting the essential character of this genus. In some specimens the tubes next the stem are much larger and more irregular than elsewhere."

Common at Horicon, Madison, Blue Mounds, Devil's Lake, Delafield, and doubtless throughout the state. Largest specimen 18 cm. in diameter; the stem 18 cm. in length and 2 cm. thick.

The species is easily recognized by the dry dark pileus covered with the thick blackish shaggy scales; the grayish-floccose veil and the whitish pores which become blackish with age or where wounded.

According to Fries, *S. floccopus*, its nearest ally, is larger and firmer, and according to Peck the tubes are depressed around the stem.

15. **BOLETUS** (Dill.) Linn.

Carpophore consisting of pileus with a central stipe, of fleshy consistency, putrescent. Tubules composing a stratum which is easily separable from the pileus, and the tubes also easily separable from each other.

SERIES 1. TEPHROLEUCI. TUBES AT FIRST WHITE OR GRAY.

A. *Cariosi*. *Stipe not reticulated, cavernous or stuffed within. Tubes white sometimes becoming yellowish.*

Boletus castaneus Bull. (Plate XXV, fig. 84).

Pileus convex, nearly plane or depressed, firm, even, dry, minutely velvety-tomentose, cinnamon or reddish-brown, flesh white, unchangeable; tubes free, short, small, white becoming yellow, stem equal or tapering upward, even, stuffed or hollow, clothed and colored like the pileus, spores 10 to 12.5 microns long, 6 to 7.6 microns broad. Pileus 3 to 8 cm. broad; stem 2.5 to 6 cm. long, 6 to 12 mm. thick.

Peck says, (21, 2, 8 p. 156): "The pileus and stem are often reddish-brown or chestnut colored, but sometimes they are paler, inclining to tawny or cinnamon hues. The thin margin sometimes curves upward and then dried specimens resemble *B. Roxanae*. The plant has been recorded as edible."

Common everywhere about Madison, Blue Mounds and Devil's Lake. Found also near Ladysmith, and probably widely distributed in the state. Largest specimen measuring 10 cm. broad, stipe about 10 cm. long and about 1 cm. thick. Some stems are hollow and some stuffed. Occasionally the plants are cespitose, making groups of two or three or more.

On drying, the thin margins of most specimens curve upward, especially in older specimens. The pores in most specimens are scarcely medium, more or less free, yellowish or reddish-yellow in color. The tubes are usually short but become longer and larger with age. In old specimens the color of the tubes becomes almost cinnamon.

The species may be recognized by its color, its cavernous or stuffed stem and the thin, upcurving margin.

Boletus cyanescens Bull.

Pileus convex or nearly plane, opaque, floccose-squamose or covered with an appressed tomentum, pale-buff, grayish-yellow, alutaceous or somewhat brown, flesh rigid, white, quickly changing to blue where wounded; tubes free, white, becoming yellowish, the mouths minute, round, changing color like the flesh, stem ventricose, villose-pruinose, stuffed, becoming cavernous, contracted and even at the top, colored like the pileus; spores subelliptical 10 to 12.5 microns long, 6 to 7.5 microns broad. Woods and open places.

Localities: Hazelhurst, Crandon, Star Lake, Shanagolden, and Blue Mounds. The largest measured about 9 cm. in diameter; the stipe was 8 cm. long, and 2 cm. thick. The color was grayish-yellow throughout, flesh whitish. The flesh, tubes and stipe change color immediately on being touched. At first the injured spot becomes pale violet, then reddish violet, then of a deep prussian blue. This blue finally fades to a pale greenish-yellow and sometimes disappears entirely.

This species is easily recognized by the color changes and the cavernous stuffed stipe.

B. Hyporhodium. Tubes adnate, whitish, becoming flesh-colored from the spores.

Boletus felleus Bull. (Plate XXIV, fig. 83; Plate XXV, fig. 83.)

Pileus convex or nearly plane, firm, becoming soft, glabrous, even, variable in color, pale-yellowish, grayish-brown, yellowish-brown, reddish-brown or chestnut, flesh white, often changing to flesh-color where wounded, taste bitter; tubes adnate, long, convex, depressed around the stem, their mouths angular, white becoming tinged with flesh-color; stem variable, equal or tapering upward, short or long, sometimes bulbous or enlarged at the base, subglabrous, generally reticulated above, colored like or a little paler than the pileus; spores oblong-fusiform, flesh-colored, 12.6 to 17.6 microns long, 4 to 5 microns broad.

Quite common in summer; the largest and most abundant species about Madison, usually in openings in the woods. Peck (21, 2, 8, p. 154) says it is easily recognized by its bitter taste. Many of our specimens have a mild taste, while others are quite bitter, but they all agree well with the description otherwise. When dry, the grayish-brown cuticle becomes brittle. The flesh remains whitish and is soft and cottony when dry. The tubes change to a rust color when wounded; the flesh is unchangeable.

The largest measures about 12 cm. in width; the stem 6 to 10 cm. in length and 2.5 cm. thick.

Localities: Milwaukee, Madison, Horicon, Blue Mounds, Sparta, Crandon and Hazelhurst. A few specimens were found growing on decayed wood at Crandon. These were small and had a very bitter taste.

The variety *obesus* occurs also but is rarer. It is much larger than the ordinary species. The stem is sometimes over 3 cm. thick and is reticulated nearly or quite to the base.

***Boletus indecicus* Peck (Plate XXVI, fig. 82.)**

Pileus convex or nearly plane, dry, slightly tomentose, ochraceous-brown, often wavy or irregular on the margin, flesh white, unchangeable; taste mild; tubes nearly plane or convex, adnate, grayish, becoming tinged with flesh-color when mature, changing to brownish where wounded, their mouths small, subrotund; stem minutely furfuraceous, straight or flexuous, reticulated above, pallid without and within; spores oblong brownish flesh-color, 12.5 to 15 microns long, 4 microns broad.

Pileus 8 to 10 cm. broad; stem 5 to 10 cm. long, 8 to 12 mm. thick.

This fungus bears some resemblance to *B. felleus* but Professor Peck says that the mild taste and darker colored spores will separate it from that species, while the stem which is slightly reticulated above distinguishes it from *B. alutarius*.

Localities: Blue Mounds, Wauwatosa. The cap is about 9 cm. in diameter. The stipe 12 cm. long and 1 cm. thick; it is only very slightly reticulated above.

***Boletus gracilis* Peck.**

Pileus convex, glabrous or minutely tomentose, rarely squamulose, ochraceous-brown, tawny-brown or reddish-brown, flesh white; tubes plane or convex, depressed around the stem, nearly free, whitish, becoming pale flesh-colored, their mouths subrotund; stem *long, slender*, equal or slightly tapering upward, pruinose or minutely furfuraceous, even or marked by slender elevated anastomosing lines which form long narrow reticulations; spores subferruginous, 12.5 to 17 microns long, 5 to 6 microns broad.

Pileus 2.5 to 5 cm. broad; stem 8 to 12 cm. long, 4 to 8 mm. thick. Woods.

“The slender habit,” says Peck, “separates this species from all the others here included in this tribe [*Hyporhodii*]. Its spores are not a

clear incarnate in color but incline to dull ferruginous and by this character, this and the preceding species (*B. conicus* Rav.) connect this tribe with the *Versipelles*. In color *B. gracilis* resembles some forms of *B. felleus*, but in size, habit and color of spores it is easily distinct. The tomentum of the pileus sometimes breaks into tufts or squamules. This is *Boletus vinaceus* Frost MS."

Two specimens were found near Stone Lake. They were at first mistaken for a slender form of *B. felleus*. It seems that this species bears the same relation to *B. felleus* that *B. albellus* bears to *B. scaber*.

The pileus is 5 cm. in diameter; the stem is 14 cm. long, 8 mm. thick. The pileus is convex above and below brownish-ochraceous, slightly tomentose, margin obtuse. The tubes were free, whitish, becoming pale flesh-colored, their mouths medium, roundish, the spores ferruginous, the stipe long and slender, with slightly anastomosing ridges and pale-brownish or fibrous context, forms the most available character for identifying the species.

***Boletus nigrellus* Peck.**

Pileus broadly convex or nearly plane, dry, subglabrous, blackish, flesh soft, white, unchangeable; tubes plane or convex, adnate, sometimes slightly depressed around the stem, their mouths small, subrotund, whitish, becoming flesh-colored, slowly changing to brown or blackish where wounded; stem short, even, colored like or a little paler than the pileus; spores dull flesh-colored, 10 to 12.5 microns long, 5 to 6 microns broad. Pileus 8 to 16 cm. broad; stem 3.5 to 6 cm. long, 12 to 24 mm. thick.

Peck (21, 2, 8, p. 155) says: "The blackish color of the pileus distinguishes this species. From *B. alboater* Schw., the adnate, flesh-colored tubes will separate it. The surface of the pileus sometimes becomes rimose-areolate." McIlvaine adds: "Another distinguishing mark from *B. alboater* Schw., is the velvety pileus of the latter. *B. nigrellus* is mild in taste and smell and an excellent species for the table."

Collected at Devil's Lake August 15, 1906. Largest specimen 15 cm. broad; stipe 8 cm. long, 2 cm. thick. Pileus fuliginous, very finely tomentose, margin slightly incurved. Pores subadnate, sordid, later pink flesh-color, changing to dark on wounding. Spores oblique-apiculate, twice as long as broad. Stem equal, slightly radicating at the base, very finely wrinkled, dark fuliginous, solid, fleshy. Flesh spongy, soft, sordid slowly changing to bluish then blackish. In this respect our specimens differ from the description, and therefore their reference to

this species may be doubtful. When preserved in alcohol the whole plant turns black and the alcohol is also blackened.

C. Versipelles. Pores small, round, free. Spores ferruginous.

***Boletus versipellis* Fries (Plate XXIII, fig. 81).**

Pileus convex, dry, at first compact and minutely tomentose, then squamose or smooth, reddish or orange-red, the margin appendiculate with the inflexed remains of the membranous veil, flesh white or grayish; tubes at first concave or nearly plane, almost or quite free, minute, sordid-white, their mouths gray; stem equal, or tapering upward, solid, rugose-squamose, whitish or pallid; spores oblong-fusiform, 13.8 to 17.6 microns long, 4 to 7 microns broad.

Pileus 5 to 15 cm. broad; stem 8 to 12.5 cm. long, 8 to 21 mm. thick. Woods and open places, especially in sandy soil.

Peck (21, 2, 8, p. 147,) says: "The fragments of the membranous veil, which adhere to the margin of the pileus afford the most available character by which to separate this species from *Boletus scaber*. The prevailing reddish or orange hue of the pileus scarcely differs from that of var. *aurantiacus* of that species. In American specimens the stem is precisely alike in both species. Fries says that the two appear to be distinct but are defined with difficulty on account of analogy in color and variation in stature. It is recorded as edible, but Gillet says it is scarcely to be recommended."

Specimens were collected near Milwaukee, Hazelhurst, Star Lake and Crandon. At the latter place it was the commonest type growing on the sandy banks around Sand Lake, just at the margin of the mixed forest. In the largest specimen measured, which was, however, too badly infected to be collected, the pileus was 18 cm. in diameter and 3 cm. thick; the stipe was 16 cm. long and 3.5 cm. thick. This was an exceptionally large one. The usual measurements are 5 to 8 cm. broad; stipe 8 cm. long and 2 cm. thick.

The pileus is usually of a dull reddish-orange, tomentose; the margin appendiculate; the tubes depressed around the stipe, sordid-white, small, changing first to dark-blue then inky black when bruised, however, this change is not always marked. It is more noticeable in young specimens. The stipe is very thick, white, black-punctate, scabrous like *B. scaber*. The flesh of the stipe changes color like the pores.

Boletus scaber Fries

Pileus convex, glabrous, viscid when moist, at length rugulose or rivulose; tubes free, convex, white, then sordid, their mouths minute, rotund; stem solid, attenuated above, roughened with fibrous scales; spores oblong-fusiform, snuff-brown, 13.8 to 17.6 microns long, 4 to 5 microns broad.

"Pileus 2.5 to 12.5 cm. broad; stem 8 to 12.5 cm. long, 6 to 16.8 mm. thick. Woods, swamps and open places."

This seems to be the most common *Boletus*, it having been found at every place in the state where fungi have been collected. It is also the most variable in size. Pilei have been found measuring from 3 to 20 cm. in diameter; the stipes varying from 7 to 17 cm. in length and from 1 to 2.5 cm. in thickness. They are usually smooth and dry, but in rainy or moist weather they may be quite viscid.

The varieties *aurantiacus*, *fuscus* and *mutabilis* are also represented. In the first the pileus is "orange or orange red." In the second the pileus is "brown or dark-brown," and in the third, "the flesh changes slightly to brown or pinkish where wounded."

Boletus albellus Peck.

Pileus convex or gibbous, soft, glabrous, whitish, flesh white, unchangeable; tubes convex, free or nearly so, small, subrotund, whitish, unchangeable; stem glabrous or minutely furfuraceous, substriate, bulbous or thickened at the base, whitish; spores brownish-ochraceous, 13.8 to 16.3 microns long, 5 to 6.3 microns broad.

"Pileus 2.5 to 5 cm. broad; stem 2.5 to 5 cm. long, 6 to 12 mm. thick. Woods."

This is closely related to *B. scaber*, of which it may possibly prove to be a dwarf form; but it is easily distinguished by its smooth or only slightly scurfy and sub-bulbous stem. It shows no sign of the colored dot-like squamules which are a constant and characteristic feature of that species (21, 2, 8, p. 149).

Collected in the Stone Lake region near Crandon. Largest specimen was 5 cm. in diameter; the stipe 7 cm. long and 1 cm. thick. Another specimen had a stipe that was nearly 14 cm. long; this specimen grew among tall grass in the woods. The pileus was whitish to grayish tan, slightly tomentose. The pores were free, small, roundish, white. The stipe tapers upwards, is whitish, appressed-scabrous. The flesh is whitish, unchangeable. The species looks like a small, pale form of *Boletus scaber*.

Boletus chromapes Frost.

Pileus convex or nearly plane, slightly and sometimes fasciculately tomentose, pale-red, flesh white, unchangeable; tubes subadnate, more or less depressed around the stem, white or whitish, becoming brown; stem equal or slightly tapering upward, scabrous-punctate, whitish or pallid, chrome-yellow at the base both without and within, sometimes reddish above; spores oblong, 11 to 14 microns long, 4 to 5 microns broad.

Pileus 5 to 10 cm. broad; stem 5 to 10 cm. long, 8 to 12 mm. thick. Woods.

A number of specimens of this species were found near Carr Lake in an old tote-way, and Mr. Dodge finds it also near Algoma. The largest specimen was about 5 cm. in diameter, 1 to 1.4 cm. thick; the stipe was 4 cm. long and nearly 1 cm. thick. The pileus was rose-color on top and slightly viscid when moist. The flesh was white and unchangeable; the tubes white, subfree, small, changing to pinkish then sordid when bruised. The stipe is even, slightly scabrous, whitish, chrome-yellow at the base. This color at the base seems to be constant in the old as well as the very young specimens and hence is one of the best characters by which the species may be identified.

D. *Favosi*. Pores large, angular, unequal, adnate, depressed.

Boletus viscidus Linn. (Plate XVI, fig. 57).

Pileus pulvinate, soft, glabrous, viscid, dirty-yellow, veil subannulate, lacerate, white, subappendiculate; stipe viscous, white, becoming yellow, base thickened, reticulated above; tubules adnate, pores large, unequal, greenish.

In deciduous forests. Pileus 5 to 10 cm. broad; spores black to fuscous.

"Linnaeus' name is appropriate, for not only is the pileus viscid but the stipe and veil become dissolved in viscous gluten. *B. laricinus* is a related form. The pores are radially elongated and smaller than in *B. laricinus*." (9, p. 78).

Specimens of this *Boletus* are every summer abundantly found on the University grounds at Madison. The largest is about 8 cm. in diameter; the stipe about 6 cm. long. The chief peculiarities of this species are the radially elongated pores, the thick gluten of the pileus and stipe and the dirty-yellow color. Sometimes there is a livid or greenish tinge to

the whole plant which is quite persistent even in drying. More often parts of the pileus and stipe are stained quite a bright green. The figure in Fries' *Icones* agrees very well with our specimens.

Boletus Elbensis Peck.

Pileus convex, glabrous, viscid when moist, dingy-gray or pinkish-gray inclining to brownish, obscurely spotted or streaked as if with patches of innate fibrils, flesh white; tubes at first whitish, becoming dingy or brownish-ochraceous, nearly plane, adnate or slightly decurrent, rather large, angular; stem nearly equal, annulate, whitish above the annulus, colored like the pileus below, sometimes slightly reticulated at the top; spores ferruginous-brown, 10 to 12.6 microns long, 4 to 5 microns broad.

Pileus 5 to 10 cm. broad; stem 8 to 12.5 cm. long, 8 to 12.6 mm. thick. Thin woods of tamarack, spruce and balsam.

I have not seen fresh specimens of this species. The only specimens found were collected near Algoma and identified by Mr. B. O. Dodge. The largest specimen measures in its dry state about 9 cm. in diameter; the stipe is about 8 cm. long. The pileus is quite thin, and of a clear coffee-brown, slightly streaked above. The pores are large, angular and adnate.

The distinctive characteristics seem to be the grayish pileus and the annulate stipe which is *whitish above* the annulus.

Boletus sordidus Frost.

Pileus convex, subtomentose, dirty dark-brown, flesh white, slightly tinged with green; tubes long, nearly free, at first white, changing to bluish-green; stem smaller at the top, brownish, marked with darker streaks, generally greenish above; spores 10 to 12.5 microns long, 5 microns broad.

Pileus about 5 cm. broad. Recent excavations in woods.

Morgan (18, VII, p. 7) gives the following notes on the Ohio plant: "Damp woods, summer and autumn. Pileus 5 to 7.5 cm. broad, stipe 6 to 8 cm. long, 6 mm. thick. Flesh white, tinged with red and green; tubes change to bluish green."

A number of specimens were found near Hazelhurst and Star Lake in excavations made in building logging railroads. The largest was 12 cm. in diameter; the stipe 10 cm. long and 1.2 cm. in thickness. The

color was a dark smoky-brown with an olive tinge, subtomentose near the margin; flesh thick, whitish with grayish-green colored spots. The tubes were whitish when young but dark-gray or smoky in the older specimens; they turn a dull greenish or bluish-green when bruised. The specimens were nearly always much infected with larvae and often exhaled a strong disagreeable odor. The species is closely related to *B. scaber*.

Series 2. EUCHROL. TUBES BRIGHT COLORED, MOSTLY YELLOW.

E. Luridi. Tubes depressed and free, stuffed at first, yellowish, mouths red.

***Boletus vermiculosus* Peck (Plate XXIII, fig. 80).**

Pileus broadly convex, thick, firm, dry, glabrous or very minutely tomentose, brown, yellowish-brown or grayish-brown, sometimes tinged with red, flesh white or whitish, quickly changing to blue where wounded; tubes plane or slightly convex nearly free, yellow, their mouths small, round, brownish-orange, becoming darker or blackish with age, changing promptly to blue where wounded; stem subequal, firm, even, paler than the pileus; spores ochraceous brown, 10 to 12.5 microns long, 4 to 5 microns broad.

Pileus 8 to 12.5 cm. broad; stem 5 to 10 cm. long, 8 to 21 mm. thick. Woods.

"This species," says Peck (21, 2, 8, p. 141), "is separated from *B. luridus* by its dry pileus, white flesh, even stem, which is neither reticulated nor dotted, and by its smaller spores. I cannot distinguish specimens of *B. spraguei* received from Mr. Frost, from this species. The name is scarcely appropriate, for specimens are not always badly infested by larvae."

Localities: Crandon and Ladysmith. None of the specimens was infected with larvae. The largest measured 7 cm. in diameter; the stipe 11 cm. long, and 1.5 cm. thick. The pileus was reddish-brown, convex, covered with yellowish-brown tomentum. The margin was acute with a sterile yellow band underneath, about 2 mm. broad. The tubes were nearly free, greenish-yellow with dark red almost maroon small roundish mouths.

The stipe tapered upward, was yellowish above and reddish below, somewhat paler than the pileus, solid. The flesh was whitish to yellow-

ish. The flesh and tubes change instantly to a dark dull blue, almost black where bruised. One of the specimens was minutely grayish-tomentose toward the base of the stem, suggesting kinship to *B. subvelutipes* Peck, which however, has larger spores and is velvety hairy toward the base.

F. *Edules*. Tubes depressed, nearly free. Pores at first white-stuffed.

***Boletus edulis* Bull.** (Plate XXII, fig. 78).

Pileus convex or nearly plane, glabrous, moist, at first compact, then soft, variable in color, grayish-red, brownish-red, or tawny-brown, often paler on the margin, flesh white or yellowish, reddish beneath the cuticle; tubes convex, nearly free, long, minute, round, white, then yellow and greenish; stems short or long, straight or flexuous, subequal or bulbous, stout, more or less reticulate, especially above, whitish, pallid or brownish; spores oblong-fusiform, 12.5 to 15 microns long, 4 to 5 microns broad.

Var. *clavipes*. Stem tapering upward from an enlarged base, everywhere reticulated. Pileus 10 to 15 cm. broad; stem 5 to 15 cm. long, 2 to 5 cm. thick at base.

Both the species and the variety are common here. Localities: Devil's Lake, Crystal Lake, The Dells and Blue Mounds. The species grows luxuriantly reaching a diameter of 25 to 30 cm. Deeply cracked forms resemble *B. frustulosus* Peck.

***Boletus eximius* Pk.** (Plate XXIII, fig. 79.)

Pileus at first compact, subglobose or hemispherical, subpruinose, purplish-brown or chocolate color, sometimes with a faint tinge of lilac, then convex, soft, paler, becoming smoky red or a pale chestnut color, flesh reddish-white or grayish; tubes at first concave or nearly plain, stuffed, colored nearly like the pileus, at length paler, depressed around the stem, minute, round; stem stout, generally short, equal or tapering slightly upward, abruptly narrowed at the base, minutely furfuraceous, colored like or a little paler than pileus, purplish-gray within; spores subferruginous. Pileus 7.5-25 cm. broad, 5-10 cm. long, 12-25 mm. thick. Woods. July to September.

***Boletus separans* Peck** (Plate XXII, fig. 77).

Pileus convex, thick, glabrous, sub-shining, often pitted, lacunose or corrugated, brownish-red or dull-lilac, sometimes fading to yellowish on the margin, flesh white, unchangeable; tubes at first nearly plane, ad-

nate, white and stuffed, then convex, depressed around the stem, ochraceous-yellow or brownish-yellow and sometimes separating from the stem by the expansion of the pileus; stem equal or slightly tapering upward, reticulated either wholly or in the upper part only, colored like the pileus or a little paler, sometimes slightly furfuraceous; spores subfusiform, brownish-ochraceous, 12.6 to 18 microns long, 5 to 6 microns broad.

Pileus 8 to 16 cm. broad; stem 5 to 10 cm. long, 12.5 to 25 mm. thick. Thin grassy woods.

Rare. Collected in the margin of the woods around Hemlock Lake near Crandon.

The largest specimen measured about 10 cm. in diameter; the stipe was 9 cm. long and 1.2 cm. thick. The pileus was brownish-red, slightly tomentose, convex, thick; the flesh white. The tubes convex, depressed around the stem, in one specimen they were separating from it. The stem is firm, large, paler than the pileus, especially near the top, reticulated near the top.

The distinguishing characters of this species are the whitish pores, separating from the stipe and the reticulated stem.

Boletus variipes Peck.

Pileus convex or nearly plane, soft, dry, squamulose, punctate-squamulose or minutely tomentose, grayish or pale grayish-brown, sometimes tinged with yellow or ochraceous, flesh white, unchangeable; tubes convex or nearly plane, slightly depressed around the stem, at first white, then greenish-yellow, their mouths small, subrotund, ochraceous, stuffed when young; stem firm, reticulated, whitish or pallid; spores oblong-fusiform, ochraceous-brown tinged with green, 12.6 to 15 microns long, 5 microns broad.

Collected near Oakfield. The specimens probably belong to the variety *pallidipes*. The largest was 12 cm. in diameter; the stipe 10 cm. long and 1.2 cm. thick.

The pileus was plane, grayish-brown minutely tomentose. The stipe short and bulbous at the base, pale brownish, firm somewhat fibrous in texture, not at all reticulated near the base.

G. *Calopodes*. *Stipe thick, bulbous, typically reticulated; tubes adnate, not red.*

Boletus pachypus Fries.

◊ Pileus convex, subtomentose, brownish or pale tan color, flesh thick, whitish, changing slightly to blue; tubes rather long, somewhat depressed around the stem, their mouths round, pale yellow, at length tinged with green; stem thick, firm, reticulated, at first ovate-bulbous, then elongated, equal, variegated with red and pale-yellow; spores large, ovate; pale yellowish-ochraceous, 12.5 to 14 microns long, 5 to 5.5 microns broad.

Pileus 10 to 25 cm. broad; stem 6 to 12 mm. thick. Woods, either pine or beech.

“This species is noted for its thick, stout stem, which sometimes attains a diameter of more than five cm. It approaches the *Edules* in habit, but according to Gillet it is poisonous or at least to be suspected, has a penetrating unpleasant odor and a somewhat nauseous flavor. The pores are at first whitish. The stem is sometimes intensely blood-red” (Peck, 21, 2, 8, p. 126).

Found once at Blue Mounds. The most peculiar feature of this specimen is the thick stipe which is constricted above to less than one centimeter and is covered with thick reticulations.

Boletus ornatipes Peck.

Pileus convex, firm, dry, glabrous or very minutely tomentose, grayish-brown or yellowish-brown, flesh yellow or pale-yellow; tubes adnate, plane or concave, rarely convex, the mouths small or medium sized, clear yellow; stem firm, subequal, distinctly and beautifully reticulated, yellow without and within; spores oblong, ochraceous-brown, 11.4 to 13.8 microns long, 4 to 5 microns broad.

“Pileus 5 to 12.5 cm. broad; stem 5 to 10 cm. long, 6 to 12.5 mm. thick, Thin woods and open places” (Peck 21, 2, 8, p. 125).

Only one small immature specimen was found near Mud Lake, near Crandon in August. Because the specimen was immature, the reference may be somewhat doubtful, but I believe there were enough features developed to identify it.

The chief characteristics are the yellowish-brown pileus, yellow flesh, yellow tubes and the yellow stem with the large reticulations.

H. Laceripedes. Stem elongated, coarsely pitted or deeply and lacunously reticulated.

Boletus Russellii Frost (Plate XXII, fig. 76).

Pileus thick, hemispherical or convex, dry, tomentose-squamulose or fasciculately red-pilose, yellowish beneath the tomentum, often rimose-areolate, flesh yellowish, unchangeable; tubes subadnate, often depressed around the stem, rather large, dingy-yellow or yellowish-green; stem very long, equal or tapering upwards, roughened by the lacerated margins of the reticulated depressions, red or brownish-red; spores olive-brown, 18 to 23 microns long, 7.5 to 10 microns broad.

Pileus 3.5 to 10 cm. broad; stem 8 to 17 cm. long, 6 to 12 mm. broad. Distinguished from the other species of this tribe by the dry squamulose pileus and the color of the stem.

Common. Localities: Madison, Blue Mounds, Devil's Lake and Crystal Lake.

The largest measures 6 cm. in diameter and has a stem 16 cm. long and 1.5 cm. thick. It is somewhat curved at the base and tapers upwards. The pileus is of a light leather tan, rough areolate tomentose with a shaggy margin. Color of the hymenium is greenish yellow, pores adnate, fairly large, unchangeable. The long stem with its lacerated ridges is a constant and easily recognized feature.

I. *Subpruinosi*. Tubes adnate, yellow, stipe equal. Pileus glabrous or pruinose.

Boletus miniato-olivaceus Frost.

Pileus at first convex firm, then nearly plane, soft and spongy, glabrous, vermilion, becoming olivaceous, flesh pale yellow, changing to blue where wounded; tubes bright lemon-yellow, adnate or subdecurrent; stem glabrous, enlarged at the top, pale-yellow, brighter within, sometimes lurid at the base, spores 12.5 microns long, 6 microns broad.

Pileus 5 to 15 cm. broad; stem 8 to 10 cm. long, 6 to 8 mm. thick. Woods and their borders.

Localities: Madison (Denniston) and Ladysmith. The largest specimen was 8 cm. in diameter; the stipe 8 cm. long and 8 mm. thick. The color of the pileus was brick-red to olivaceous-red, convex, a little tomentose at least when mature; the pores adnate to subdecurrent, large, irregular yellow. The stipe spreads out into the pileus and tapers downward. It is smooth, yellowish-red, tough. The flesh is whitish to yellowish. The pores change color only slightly. Most of the specimens are glabrous, and the stem is slightly red-streaked.

The red pileus and the stipe spreading out into the pileus are distinctive features. Murrill makes this the same as *B. glabellus* Peck.

***Boletus bicolor* Peck (Plate XX, fig. 69).**

Pileus convex, glabrous or merely pruinose-tomentose, dark red, firm, becoming soft, paler and sometimes spotted or stained with yellow when old, flesh yellow, not at all or but slightly and slowly changing to blue where wounded; tubes nearly plane, adnate, bright yellow, becoming ochraceous, slowly changing to blue where wounded, their mouths small, angular or subrotund; stem subequal, firm, solid, red, but generally yellow at the top; spores pale, ochraceous-brown, 10 to 12.5 microns long, 4 to 5 microns broad.

"Pileus 5 to 10 cm. broad; stem 2.5 to 8 cm. long, 8 to 12 mm. thick. Woods and open places." Peck (21, 2, 8, p. 108) says further: "The color of this plant is variable. In the typical form the pileus and stem are dark red, approaching Indian red, but when old the color of the pileus fades and is often intermingled with yellow. The surface sometimes becomes rimose-areolate. From the European *B. Barlae* this species is separated by its solid stem, from *B. versicolor* by its small tube mouths and its red stem."

Mellvaine (16, p. 425) says that it is one of the very best for eating.

Numerous specimens were found at Devil's Lake, Lake Puckaway, and Madison. Largest specimen 13 cm. in diameter; stipe 8 cm. long and 2 cm. thick. Pilei red-incarnate to purple, very finely tomentose, sometimes rimose-areolate, becoming yellowish toward the margin. Pores adnate, depressed around the stem, small, yellow, turning greenish or bluish-green when wounded. Stipe thick, swollen toward the base especially in joining specimens, sometimes minutely reticulated at the top, colored like the pileus, yellow like the pores at the top, firm, solid. Flesh yellow, sometimes with an incarnate tinge. All of the colors persist in drying and the flesh shrinks very little so that it is of the most easily preserved of the *Boleti*.

Easily recognized by the beautiful red and yellow colors of the pileus and stipe.

***Boletus alutaceus* Morg. (Plate XXI, fig. 70).**

Pileus pulvinate, glabrous, alutaceous with a tinge of red, flesh white inclining to reddish; tubes semifree, medium in size, unequal, angular, greenish-yellow; stem nearly equal, striate, reticulate at the apex, col-

ored like the pileus; spores fusiform, brownish-olive, 12.5 microns long, 5 microns broad.

Pileus 7.5 cm. broad.

Common around the Dells; a few specimens were also found at Dorward's Gorge and at Blue Mounds, September 1910.

***Boletus auriporus* Peck (Plate XXI, fig. 71).**

Pileus convex or nearly plane, glabrous or merely pruinose-tomentose, grayish-brown, yellowish-brown or reddish-brown, flesh white, unchangeable; tubes plane or slightly depressed around the stem, adnate or subdecurrent, bright golden-yellow, retaining their color when dried; stem equal or slightly thickened at the base, viscid or glutinous when moist, especially toward the base, colored like or a little paler than the pileus; spores 7.6 to 10 microns long, 4 to 5 microns broad.

Pileus 2.5 to 8 cm. broad; stem 2.5 to 8 cm. long, 4 to 8 mm. thick. Thin woods and shaded banks.

"This species is remarkable for the rich yellow color of the tubes, which is retained unchanged in the dried specimens, and for the viscid stem. This character, however, is not noticeable in dry weather and was overlooked in the original specimens. *Boletus glutinipes*, Frost MS., is not distinct" (Peck, 21, 2, 8, p. 110).

Found only once near Ladysmith, August 29, 1905. The pileus measured 7 cm. in diameter; the stipe 12 cm. long and 1 cm. thick. The pileus was convex, red to red-olivaceous, glabrous. The tubes were adnate, small roundish, brilliantly golden-yellow. The stipe equal, flexuous, smoothish yellow, red-striped, dry. The flesh white.

The most prominent feature of this species is the golden-yellow of the pores. As the specimen was collected in dry weather, the stipe was not viscid.

***Boletus pallidus* Frost (Plate XXI, fig. 72).**

Pileus convex, becoming plane or centrally depressed, soft, glabrous, pallid or brownish-white, sometimes tinged with red, flesh white; tubes plane or slightly depressed around the stem, nearly adnate, very pale or whitish-yellow, becoming darker with age, changing to blue where wounded, the mouths small; stem equal or slightly thickened toward the base, rather long, glabrous, often flexuous, whitish within; spores pale ochraceous-brown, 10 to 12.5 microns long, 5 to 6 microns broad.

Pileus 5 to 10 cm. broad; stem 8 to 12 cm. long, 8 to 16 mm. thick. Woods.

Locality: Ladysmith. The largest specimen was 11 cm. in diameter; the stipe was 14 cm. long and 1.5 cm. thick. In color the pileus was pale drab, smooth to subtomentose. The margin was thin, explanate. The tubes adnate-depressed, medium, roundish, at first pale, then brownish gray. The stipe was smooth, grayish-brown, solid, tapering upward. The flesh was dull-whitish. The tubes change to faint-bluish when bruised and later become brownish. The color change was not as marked as one might expect from the description.

The species is recognized by its dull, pale color, rather long stem and tubes changing to blue when wounded.

J. Subtomentosi. Dry, tomentose when young, sometimes becoming glabrate. Tubes adnate.

Boletus subtomentosus Linn. (Plate XXII, fig. 74).

Pileus convex or nearly plane, soft, dry, villose-tomentose, subolivaceous, concolorous beneath the cuticle, often rimose-areolate, flesh white or pallid; tubes adnate or somewhat depressed around the stem, yellow, their mouths large, angular; stem stout, somewhat ribbed-sulcate, scabrous or scurfy with minute dots; spores 10 to 12.5 microns in length, 4 to 5 microns broad.

Pileus 2.5 to 10 cm. broad; stem 2.5 to 7 cm. long, 4 to 9 mm. thick.

Peck (21, 2, 8, p. 117) also adds the following observations: "The pileus is usually olivaceous or yellowish-brown, but it may be reddish-brown, or tawny-red. When it cracks, the chinks become yellow. The stem is often attenuated downwards, but it is not always ribbed or sulcate. In one form it is marked with slight anastomosing lines which form broad reticulations as in *B. lanatus* Rost. In another form which grows on very rotten wood or stumps, the pileus is dark-brown. These may be distinct species. According to Johnson, wounds of the flesh sometimes become reddish and according to Palmer, 'the flesh tubes and stem change to blue wherever bruised or cut,' but I have not been able to verify these statements."

This species is quite common in some regions. Localities: Algoma, Milwaukee, Madison, Afton, Crandon, Horicon, Hazelhurst and Star Lake. Near Crandon several specimens were found on a very rotten log. These were dark-brown and the pores were of a brighter yellow than those of the other specimens. The specimens found at Horicon were thick-pulvinate and the tubes distinctly change to bluish-green when bruised; this color change was also noticed in the Crandon specimens. In the other specimens no color change was noticed. The largest speci-

men measured 10 cm. in diameter; 2 cm. in thickness; the stem 10 cm. long, 1.2 cm. thick. They grow in recent excavations in the northern part of the state or in rich soil in mixed woods.

Boletus chrysenderon Fries (Plate XXI, fig. 73).

Pileus convex or plane, soft, floccose-squamulose, often rimose areolate, brown or brick-red, flesh yellow, red beneath the cuticle, often slightly changing to blue where wounded; tubes subadnate, greenish-yellow, changing to blue where wounded; their mouths rather large, angular, unequal; stem subequal, rigid, fibrous-striate, red or pale yellow; spores fusiform, pale brown, 11 to 12.5 microns long, 4 to 5 microns broad.

Pileus 2.5 to 8 cm. broad; stipe 2.5 to 8 cm. long, 6 to 12 mm. thick, Woods and mossy banks.

Localities: Madison, Crandon, Ladysmith and Blue Mounds. The largest measured about 8 cm. in diameter; the stipe about 7 cm. in length and 8 mm. in thickness. The color is usually brown or grayish-brown, the pilei are dry, somewhat tomentose; the flesh pale yellow, red beneath the cuticle. The tubes are long, the mouths large, greenish-yellow, changing to bluish where wounded. The stem is rigid tough, reddish.

This species is easily recognized by the red flesh in the cracks of the pileus. Otherwise, it is very much like *B. sub-tomentosus*, though not so large and stout.

Boletus radicans Pers. (Plate XXII, fig. 75).

Pileus convex, dry, subtomentose, olivaceous-cinereus, becoming pale-yellowish, the margin thin, involute, flesh pale-yellow, instantly changing to dark blue, taste bitterish; tubes adnate; their mouths large, unequal, lemon-yellow; stem even, tapering downwards and radicating, flocculose with a reddish bloom, pale-yellow, becoming naked and dark with a touch.

Pileus 5 to 7.5 cm. broad; stem 5 cm. long, 1.25 cm. thick.

A few specimens were found at Dorward's Gorge and Devil's Lake, August, '06.

Boletus Roxanae Frost.

Pileus broadly convex, at first subtomentose, then fasciculately red-pilose, yellowish-brown, flesh yellowish-white; tubes at first whitish,

then light-yellow arcuate-adnate or slightly depressed around the stem, the mouths small; stem enlarged toward the base, striate at the apex, yellowish or pale cinnamon; spores 10 microns long, 4 microns broad.

Pileus 6 to 12 cm. broad; stem 2.5 to 5 cm. long, 6 to 11 mm. thick. Borders of the woods.

"In drying, the margin of the pileus has a tendency to curve upwards. The hairy tufts or squamules are very minute, and sometimes appear almost granular. The species seems intermediate between *B. variegatus* and *B. sulphureus*; with the latter the variety (*auricolor*) connects it (Peck, 21, 2, 8, p. 115).

Not common. One specimen was collected near Parfrey's Glen. Its pileus is 4 cm. in diameter; its stipe about 6 cm. long and 4 mm. thick. The pileus in the dry state was of a brick-red color, rough tomentose. The pileus thin with the acute margin curved up. The pores are pale yellowish, small, adnate.

K. *Pulverulenti*. *Pileus clothed with a yellow dust or a yellow pulverulent tomentum. Stem more or less purverulent, neither bulbous nor reticulated.*

Boletus hemichrysus B. & C.

Pileus convex, at length plane or irregularly depressed, floccose-squamulose, covered with a yellow powder, sometimes rimose, bright golden-yellow, flesh thick, yellow; tubes adnate or decurrent, yellow, becoming reddish-brown, the mouths large, angular; stem short, irregular, narrowed below, sprinkled with a yellow dust, yellowish tinged with red; mycelium yellow; spores oblong, minute, dingy-ochraceous.

Var. *mutabilis*. Flesh slightly changing to blue where wounded; stem reddish, yellow within, sometimes excentric; spores oblong elliptical 7.5 to 9 microns long, 3.5 to 4 microns broad.

"Pileus 3.5 to 7 cm. broad; stem about 6.5 cm. long, 6 to 12 mm. thick. The species is remarkable for its habit which is lignicolous" (Peck, 21, 2, 8, p. 103).

Several specimens of this species were collected at Shanagolden on an uprooted white pine stump, and several were found on the root of a living white pine at Bangor. The Shanagolden specimens were clearly of the variety *mutabilis*.

The largest specimen measured 10 cm. in diameter; the stipe 7 cm. long and 1.2 cm. thick. The pilei are irregular, eccentrically stiped, dry, covered with an "Indian-yellow" powder. The cuticle is velvety and separable, the margin appendiculate in some of them.

The tubes are adnate-decurrent, pores greenish-yellow, irregular, and turn greenish-black where bruised. The stem is hard and flexuous, yellow within, ferruginous to reddish without.

The species may be recognized by its yellow, dry, pulverulence, eccentric stem, and its lignicolous habit.

Boletus Ravenelii B. & C. (Plate XIX, fig. 67).

Pileus convex or nearly plane, slightly viscid when young or moist, covered with a sulphur-yellow pulverulent tomentum, becoming naked and dull red on the disk, flesh whitish; tubes at first plane, adnate, pale-yellow, becoming yellowish-brown or umber, dingy-greenish where bruised, the mouths large or medium size, subrotund; stem nearly equal, clothed and colored like the pileus, yellow within, with a slight evanescent webby or tomentose annulus; spores ochraceous-brown, 10 to 12.5 microns long, 5 to 6 microns broad.

Pileus 2.5 to 8 cm. broad; stem 3.5 to 10 cm. long, 6 to 12 mm. thick.

Localities: Ladysmith, Devil's Lake. Largest pileus 7 cm. in diameter; the stem 12 cm. long and 1 cm. thick. The pileus was scarcely viscid, strongly pulverulent, yellow. The tubes free in some specimens, depressed-free in others, small, roundish, compound, yellow. The stem flexuous, floccose-pulverulent, yellow, tough. Flesh pale yellow or whitish. The tubes change slightly to greenish-blue. When young the tubes are concealed by a veil composed of "webby powdered filaments" which at first cover the whole plant but which soon disappears from the disk. The pilei are often spotted with bright red, which disappears at maturity.

The species may be known by the bright yellow color, due to its covering of bright yellow flocculent powder, and the long stem and webby veil.

L. *Viscipelles*. *Viscid or glutinous. Pores adnate.*

Boletus piperatus Bull.

Pileus convex or nearly plane, glabrous, slightly viscid when moist, yellowish, cinnamon or subferruginous, flesh white or yellowish, taste acid, peppery; tubes rather long and large, angular; often unequal, plane or convex, adnate or subdecurrent, reddish-ferruginous; stem slender, subequal, tawny-yellow, bright yellow at the base; spores subfusiform, ferruginous-brown, 8.75 to 11.25 microns long; 4 microns broad.

Pileus 2.5 to 7.5 cm. broad; stem 3.75 to 7.5 cm. long, 4 to 8 mm. thick.

This species was quite common along paths in light mixed woods near Hazelhurst in August 1904. A few specimens were also found near Crandon, Shanagolden and Madison.

The largest was about 5 cm. in diameter; the stipe about 4 cm. long and 5 mm. thick. The pileus was of a red-ferruginous color, more yellowish below; the cuticle was slightly viscid and more or less separable, the flesh was yellowish beneath the cuticle, but otherwise white. The pores are large and long so that older pilei seem to have an obtuse margin. The tubes are adnate, the mouths pale orange-brown. The stem is slender tapering downward, smooth, yellow within, tawny-yellow without, sometimes red above. The taste is sharp-peppery like cayenne pepper. This is the most available character by which it may be recognized.

***Boletus badius* Fries.**

Pileus convex, even, soft, viscose or glutinous, shining when dry, tawny chestnut, flesh whitish tinged with yellow, bluish next the tubes; tubes large, angular, long adnate or sinuate depressed, whitish yellow, becoming tinged with green; stem subequal, even, solid, paler, brown-pruinat; spores fusoid-oblong.

Pileus 5 to 7.5 cm. broad; stem 5 to 10 cm. long, 6 to 12 mm. thick. Spores 10 to 12.5 microns long, and 4 to 5.6 microns wide.

Our specimens come from Madison and Blue Mounds, collected in August, 1903. The largest measures about 20 cm. broad. The stem measures 1.5 by 7 cm. to 12 cm.

The pileus is convex, smoky brown, smooth. The somewhat large pores are adnate, and sooty in color. The stem is equal furfuraceous, tawny above and darker below. The flesh white to rosy. Flesh and tubes change to blue where wounded.

***Boletus granulatus* Linn. (Plate XIX, fig. 65; Pl. XX, fig. 65).**

Pileus convex or nearly plane, very viscid or glutinous and ferruginous-brown when moist, yellowish when dry, flesh pale-yellowish; tubes short, adnate, yellowish, their mouths simple, granulated; stem dotted with glandules above, pale yellowish; spores "spindle shaped, yellowish orange, 7.6 to 10 microns long, 2 to 3 microns broad."

"Pileus 3 to 10 cm. broad; stem 2.5 to 5 cm. long, 8 to 12.6 mm. thick. Woods, especially of pine and in open places under or near pine trees."

Not very common. A few specimens were found near Hazelhurst in August, 1904. The largest was 11 cm. in diameter, the stipe 8 cm. long and 1 cm. thick. When young and vigorously growing the pileus is yellowish brown, but when dry and the glutinous pellicle has disappeared they are pale-yellow. The substance is softer than in most of the *Boleti*, and when dried the pileus becomes very thin.

Peck (21, 2, 8, p. 96) says that the plant is gregarious and occasionally cespitose. He gives the measurements of the spores as 7.6 to 8.9 microns long and 4 microns broad.

The brown gluten of the pileus and the granules on the pores and stipe are the chief distinguishing marks of this species.

***Boletus brevipes* Peck (Plate XIX, fig. 66).**

Pileus thick, convex, covered with a thick tough gluten when young or moist, dark chestnut color, sometimes fading to dingy-tawny, the margin inflexed, flesh white or tinged with yellow; tubes short, nearly plane, adnate or slightly depressed around the stem, small, subrotund, at first whitish, becoming dingy-ochraceous; stem whitish, not dotted, or rarely with a few very minute inconspicuous dots at the apex, very short; spores subfusiform, 7.5 microns long, 3 microns broad.

Pileus 3.75 to 6.25 cm. broad; stem 1.25 to 2.5 cm. long, 6 to 10mm. thick.

Common near Standing Rock, Kilbourn. September, 1910.

***Boletus hirtellus* Peck (Plate XIX, fig. 63).**

Pileus broadly convex, soft, viscose, golden-yellow, adorned with small tufts of hairs or fibrils, flesh pale-yellow; tubes adnate, medium size, angular, becoming dingy-ochraceous; stem subcespitose, equal, stout, glandular-dotted, yellow; spores pale ochraceous-brown, 8.75 to 10 microns long, 4 microns broad.

Pileus 5 to 10 cm broad; stem 5 to 7.5 cm. long, 8 to 12 mm. thick.

A few specimens of rather doubtful identity were found near Standing Rock, Kilbourn, September, 1910.

***Boletus subaureus* Peck (Plate XVIII, fig. 61).**

Pileus convex or nearly plane, viscose, pale-yellow, sometimes adorned with darker spots, the young margin slightly grayish tomentose, flesh pale-yellow; tubes small or medium, somewhat angular, adnate or sub-

decurrent, pale-yellow becoming dingy ochraceous; stem equal, stout, glandular-dotted, yellow without and within; spores oblong or subfusiform, ochraceo-ferruginous. 7.6 to 10 microns long, 4 microns broad.

Pileus 5 to 10 cm. broad; stem 3.5 to 6 cm. long, 8 to 12.5 mm. thick. Thin woods and open places.

Peck (21, 2, 8, p. 94) says further:—"This plant might almost be considered a stout variety of the preceding [*B. americanus*], but in addition to its thicker pileus and stouter stem, it has smaller tubes of a clearer yellow color and the exuding drops are yellow, not whitish as in that species. In habit it appears more like *B. granulatus*, from which it is distinct in color."

Localities: Sparta, on the side of a sandy bluff; Crandon, in mixed woods. The largest one was 6 cm. in diameter; the stipe 5 cm. long and 1 cm. thick. The pileus was yellow, viscid, with a few red fibrils; the pores were adnate to subdecurrent, small, angular compound, yellow. The stem was straight, punctate, yellow. The flesh yellowish. The tubes slowly change to brownish when bruised. The drops of fluid exuded are pale dirty-yellow.

In my opinion this species is closely related not only to *B. americanus* but also to *B. punctipes*. The brownish stem and paler color of the pileus of the latter distinguish it from the species.

Boletus Americanus Peck (Plate XVII, fig. 60).

Pileus thin, convex or nearly plane, sometimes umbonate, soft, very viscid or glutinous when moist, slightly tomentose on the margin when young, soon glabrous or the margin, sometimes remaining squamose, rarely squamose-spotted from the drying gluten, yellow, becoming dingy or less bright red, flesh pale-yellow, less clear or pinkish-gray on exposure to the air; tubes plane or convex, adnate, rather large, angular, pale-yellow, becoming sordid ochraceous; stem slender, equal or slightly tapering upwards; firm not at all annulate, yellow, often pallid or brownish toward the base, marked with numerous brown or reddish-brown persistent glandular dots, yellow within; spores oblong or subfusiform, ochraceo-ferruginous, 7.6 to 11.4 microns long, 4 to 5 microns broad.

Pileus 2.5 to 8 cm. broad; stem 3 to 6.5 cm. long, 4 mm. thick. Woods, swamps and open places, especially under or near pine trees.

Quite common in northern woods—sometimes under hemlock, sometimes in open sandy places. Very abundant on the east and west shore of Sandy Lake near Crandon, growing with *B. subluteus*, *B. Clin-*

tonianus, *B. collinitus* and *B. versipellis*. A few were also collected at Sparta, and one specimen by McKenna near Blanchardville.

The largest specimen of this most showy and beautiful little *Boletus* was 7 cm. in diameter; stipe 7 cm. in length and 7 mm. thick. The pileus is bright golden yellow more or less streaked with crimson. If the plants grow unsheltered in the sun, the color is somewhat darker, and the streaks of red are more numerous and prominent. The pileus is very viscid and sticky. The stem is slender, usually more or less bent, firm, dotted with dark-brownish or blackish glandules from top to bottom. Peck says in his description that the stipe is "not at all annulate," but I find frequently that they are quite distinctly annulate at first, but this annulus soon disappears. The glandules are persistent even in drying. This distinguishes it from *B. flavidus* Fr., *B. luteus* and *B. subluteus* differ in their paler color and the more persistent annulus. Reported edible by McIlvaine (16, p. 413).

***Boletus punctipes* Peck (Plate XIX, fig. 64).**

Pileus convex or nearly plane, glutinous when moist, yellow, the thin margin at first minutely grayish-pulverulent, becoming recurved with age; tubes short, nearly plane, adnate, small, subrotund, at first brownish, then sordid ochraceous; stem rather long, tapering upward, glandular-dotted, rhubarb-yellow; spores 7.6 to 10 microns long, 4 to 5 microns broad.

Pileus 5 to 8 cm. broad; stem 5 to 8 cm. long, 6 to 10.5 mm. thick.

A few specimens of this species were collected near Hazelhurst and Star Lake in August, 1904. The largest was 6 cm. in diameter, the stipe 6 cm. long and 8 mm. thick. The pileus was very viscid, pale yellow, thick; the stipe pale yellowish brown with darker dots all over; stout, tapering upwards. Pores in the young specimens pale brownish yellow like the stipe. Drops of a cloudy liquid are exuded from the pores of young specimens.

***Boletus collinitus* Fries (Plate XX, fig. 68).**

Pileus convex, even, becoming pale when the brown gluten separates from it, flesh white; tubes adnate, elongated, naked, the mouths two-parted, pallid, becoming yellow; stem firm, often tapering downwards, somewhat reticulate with appressed squamules, white, becoming brown. Woods of pine or fir.

Several specimens were found near Crandon. They were plainly different from *B. subluteus* Peck, which grew abundantly at the same place, by their yellow pores and dotless stems.

The largest was 10 cm. in diameter, with a stipe 5 cm. long and 1 cm. thick. The pileus is broadly convex, brownish-yellow, viscid, margin thin. Pores adnate to subdecurrent, small bi-compound, at first pale yellow then bright sulphur yellow. Stipe soft, brittle, flexuous, smooth; whitish, yellow above. Flesh pale yellow.

***Boletus subluteus* Peck.**

Pileus convex or nearly plane, viscid or glutinous when moist, often obscurely virgate-spotted, dingy yellowish, inclining to ferruginous-brown, flesh whitish varying to dull yellowish; tubes plane or convex, adnate, small, subrotund, yellow becoming ochraceous; stem equal, slender pallid or yellowish, dotted both above and below the annulus with reddish or brownish glandules, annulus submembranous, glutinous, at first concealing the tubes, then generally collapsing and forming a narrow whitish or brownish band around the stem; spores subfusiform, ochraceo-ferruginous, 7.6 to 11 microns long, 4 to 5 microns broad.

Pileus 3 to 8 cm. broad; stem 3 to 6 cm. long, 4 to 8 mm. thick. Sandy soil in pine woods.

This is the commonest *Boletus* near Sand and Star Lakes in Forest County during the month of August. A few specimens were also collected near Ladysmith. They grew abundantly in sandy soil at the edge of mixed woods. The largest specimen measured 11 cm. in diameter; the stipe was 8 cm. long and 1 cm. thick.

Peck's (21, 2, 8, p. 91) description characterizes our Wisconsin specimens exactly. It only remains to be noted that the glandules of the stem become blackish with age and persist even in drying. The whole plant becomes a dingy dark-brown in drying and shrinks to less than one-half its size.

Closely related to *B. luteus* and *B. punctipes*. It is smaller and more slender than *B. luteus*, and its stem is dotted from top to bottom. *B. punctipes* lacks the annulus.

***Boletus spectabilis* Peck. (Plate XVI, fig. 58).**

Pileus broadly convex, at first covered with a red tomentum, then squamose, viscid when moist, red, the tomentose scales becoming grayish-red, brownish or yellowish, flesh whitish or pale-yellow; tubes at first yellow and concealed by a reddish glutinous membrane, then ochraceous, convex, large, angular, adnate; stem nearly equal, annulate, yellow

above the annulus, red, or red with yellow stains below; spores purplish-brown, 12.6 to 15 microns long, 6.3 to 8.2 microns wide.

Pileus 5 to 12.5 cm. broad; stem 8 to 12.5 cm. long, 8 to 12.5 mm thick. Thin woods in swamps. Specimens of this species were collected near Algoma in tamarack swamps by Mr. B. O. Dodge, near Crandon in a tamarack and spruce swamp by myself in August, 1905, and at Elkhart Lake. About a dozen specimens were growing out of two tussocks having an area of about 4 square feet. A few days after they had been gathered another crop was growing at the same place. The largest specimen was 7 cm. in diameter; the stipe 7 cm. in height and 7 mm. in thickness.

The pileus was very viscid, substance soft, red with yellow cracks, becoming tomentose, grayish-red, scaly or squamose; flesh yellowish, slowly becoming duller when bruised.

The distinctive feature of the species is the reddish-gelatinous membranous, translucent veil which soon breaks down leaving a small gelatinous annulus and sometimes leaving the margin fringed or appendiculate. When mature, the specimens look very much like old specimens of *Boletinus pictus* in color, from which, however, the species is quite distinct.

Boletus albus Peck.

Pileus convex, viscid when moist, *white*, flesh white or yellowish; tubes plane, small or medium, subrotund, adnate, whitish, becoming yellow or ochraceous; stem equal or slightly tapering downward, both it and the tube glandular-dotted, white, sometimes tinged with pink toward the base; spores ochraceous, subfusiform 7.6 to 8.9 microns long, 4 microns broad, stem 4 to 7.5 cm. long, 6 to 12 mm. thick. Woods, especially pine and hemlock.

A group of this peculiar little *Boletus* was found near Hazelhurst in August 1904 growing out of some very rotten hemlock or pine. The largest pileus was 4 cm. in diameter, 1 cm. thick; the tubes 3 mm. long; the stipe 7 cm. long and 4 mm. thick.

They grew in bunches but not cespitose; the pilei were very viscid convex, the cuticle separable from the snow-white flesh. The pores were white, adnate, short, glandulose, excreting a *dirty-milky, astringent* fluid which dries on the mouths and stem giving rise to the grayish-white glandules. The stem is white, tapering upwards. The tubes and flesh sometimes change to pink very slowly, where bruised. When dry the specimens have a dull pinkish-brown color.

The pure white color, the viscid pileus, and the astringent excretion are good distinguishing marks.

Boletus Clintonianus Peck (Plate XVI, fig. 59; Pl. XVII, fig. 59).

Pileus convex, very viscid or glutinous, glabrous, soft, shining, golden yellow, reddish-yellow or chestnut color, the margin thin, flesh pale-yellow, becoming less bright or dingy on exposure to the air; tubes nearly plane, adnate or subdecurrent, small, angular or subrotund, pale yellow, becoming dingy-ochraceous with age, changing to brown or purplish brown where bruised; stem equal or slightly thickened toward the base, straight or flexuous, yellow at the top, reddish or reddish-brown below the annulus, sometimes varied with yellow stains, the annulus white or yellow, persistent, forming a thick band about the stem; spores brownish-ochraceous, 10 to 11.4 microns long, 4 to 5 microns broad. Pileus 5 to 10 cm. broad; stem 5 to 12.5 cm. long, 8 to 19 mm. thick.

Mossy or grassy ground in woods or open places, especially under tamarack trees.

This elegant *Boletus* has been collected at Madison, Beloit, Algoma and Crandon, usually near or under tamarack trees. The largest specimen found at Crandon was 15 cm. in diameter, the stipe 12 cm. long and 2 cm. thick. The pileus was first convex then concave above, yellow to chestnut, shining viscid; the margin thin becoming recurved. Pores adnate, equal, angular, medium, yellow. Annulus whitish, thick persistent. The stipe was yellow above, brownish beneath, brown-spotted, but not always. The flesh yellowish, hyaline near the tubes; the flesh as well as the pores changing to brown when bruised; however, the flesh changed only slightly.

This species appears to be so much like *B. elegans* Schum., that it might be called a variety. The chief difference is in the persistent annulus.

Boletus sphaerosporus Peck (Plate XVIII, fig. 62.)

Pileus at first hemispherical then convex, glabrous, viscid, creamy-yellow, becoming reddish-brown or chestnut color with age, flesh pale yellowish-brown; tubes adnate or slightly decurrent, large, angular, pale-yellow, becoming brown sometimes tinged with green; stem stout, equal, even or slightly reticulated at the top, the membranous annulus persists, sometimes partly adhering to the margin of the pileus; spores globose or broadly elliptical 7.6 to 8.9 microns long.

Pileus 8 to 20 cm. broad; stem 2.5 to 7.5 cm. long, 12.6 to 25.2 mm. thick. Low ravines and sandy places.

The first description that Professor Peck gave of the species was founded upon a single dried specimen sent to him by Professor William Trelease. It was found by a student of the University of Wisconsin.

Peck adds also the following: "This species has two chief characteristics——. First, the volva-like annulus at the base of the stem. It appears in the dried specimen like a volva making a cup-like annulus. Still it may be a thick, peronate sheathing veil, but it is different than that of other species of *Boleti* known to me. Second, the spores are almost globular, while in other *Boleti* they are fusiform or spindle-shaped."

In all the specimens that I have seen the veil partly adheres to the margin. The spores have a pale greenish-yellow color by transmitted light, and a rich yellow or dark-yellow by reflected light. When cut the flesh changes only slightly to a sort of purple. "Cream-yellow" when young and "reddish-brown" when old or dry give a good idea of the color.

The stem varies in length from 3 to 6 cm. and may be 2 cm. or more thick, but it shrinks to less than one-half in drying. Both stem and pileus may be said to be fleshy-tough. When dry the specimens have a very agreeable sweet odor.

Specimens are collected every year at Madison, and they have also been found at Lake Wingra, Horicon and Blue Mounds. One specimen was found at Horicon, growing in rich soil on the banks of the Rock river, in July 1899, and another was found by F. E. McKenna near Blanchardville. The species is apparently common in the state.

The description given by Saccardo is about the same as that first given by Peck and is necessarily incomplete. The species seems to have no close allies in the genus. The thick glutinous veil enclosing the entire plant like a volva is a most striking characteristic, and the globose spores are also very distinctive.

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GLOSSARY.

- Adnate—gills attached squarely to stem.
 Adpressed—growing close to.
 Alutaceous—grayish yellow.
 Alveolate—honeycombed.
 Annulate—with a ring or annulus.
 Apiculate—with a short pointed tip.
 Appendiculate—appendaged.
 Applanate—flattened.
 Appressed—lying close to.
 Arcuate—bow-shape.
 Areolate—marked by spaces.
 Attenuate—tapering to a point.
 Auriculate—eared.
 Avellaneous—drab.
 Basidium (pl. basidia)—club shaped body which bears the spores.
 Bullose—blistered.
 Byssoid—cottony.
 Cambium—a layer of formative tissue.
 Canescent—covered with hoary pubescence.
 Carpophore—stalk of sporocarp.
 Cespitose—growing in tufts.
 Cinereous—ashy.
 Conchiform—shell shaped.
 Concolorous—of uniform color.
 Concretescent—growing together.
 Confluent—blended or running together.
 Connate—joined.
 Coriaceous—leathery.
 Correcus—horny.
 Cristate—crested.
 Crustaceous—hard and brittle.
 Cuticulate—having a cuticle.
 Cystidia—large single cells among basidia.
 Daedaloid—labyrinthine.
 Deciduous—not persistent.
 Decurrent—running down the stem.
 Dentate—toothed.
 Denticulate—with little teeth.
 Determinate—ending definitely.
 Dimidiate—sessile pileus semicircular in form.
 Dissepiment—a partition.
 Echinulate—beset with short bristles.
 Effused—spread over.
 Emarginate—notched at the end.
 Evanescent—vanishing.
 Explanate—flattened.
 Favoloid—like a honeycomb.
 Ferruginous—rust colored.
 Fibrillose—covered with minute fibers.
 Fimbriate—in the form of delicate fringe.
 Flabelliform—fan shaped.
 Flaccid—soft and limber.
 Flavescent—yellowish.
 Flexuous—wavy, winding.
 Floccose—covered with cottony threads.
 Flocculose—minutely floccose.
 Friable—easily broken.
 Frondose—leafy.
 Fuliginous—dark smoke color.
 Fulvous—tawny, reddish yellow.
 Furfuraceous—scurfy, scaly.
 Fuscous—grayish brown.
 Fusiform—spindle shaped.
 Fusoid—like a spindle.
 Gibbous—with a one-sided hump.
 Gills—lamellae or hymenial plates.
 Glabrate—somewhat smooth.
 Glabrous—smooth, without pubescence.
 Glandules—sticky dots.
 Glaucous—with a whitish bloom.
 Gluten—glue.
 Gyrose—circular folds.
 Helicoid—spiral.
 Hirsute—stiff hairy.
 Hispid—bristly with strong hairs.
 Hyaline—clear, transparent.
 Hygrophanous—with a watery appearance.
 Hymenium—fruiting surface.
 Hymenophore—the hymenium bearing portion.
 Hypha—a single mycelium thread.
 Imbricate—overlapping like shingles.
 Immarginate—without a margin.
 Incarnate—pink.
 Indurated—hardened.
 Infundibuliform—funnel shaped.
 Innate—borne at the apex.
 Isabelline—dirty, tawny color.
 Labyrinthine—with winding passages.
 Laccate—milky.
 Lacerate—torn.
 Lacunose—with holes.
 Lamellae—gills of mushroom.
 Lenzitoid—like Lenzites.
 Lignatile—woody.
 Lignicolous—on wood.

- Lignin—substance impregnating wall of wood cells.
 Lignose—woody.
 Lurid—dingy brown.
 Marginate—with a margin.
 Mucedineus—cottony.
 Multiplex—many of the same.
 Mycelium—vegetative portion of fungus.
 Nodose—with joints.
 Nodular—knobby.
 Obsolete—lacking.
 Ochraceous—yellow with a tinge of red.
 Orbicular—round.
 Osseous—like bone.
 Pallescent—turning pale.
 Pallid—pale.
 Papillae—nipple shaped projections.
 Papyraceous—papery.
 Pellucid—clear.
 Peronate—rough.
 Pileoli—small pilei.
 Pileus—cap.
 Pilose—hairy.
 Plicate—folded.
 Polycephalous—with many heads.
 Polyporoid—like a polypore.
 Porose—with pores.
 Porus—a pore.
 Pruinose—somewhat powdery.
 Pruinose—powdery.
 Pubescence—hairs.
 Pulverulent—minutely powdered.
 Pulvinate—cushioned.
 Punctate—dotted.
 Punctiform—dot-like.
 Putrescent—decaying.
 Pyriform—pear form.
 Radicate—somewhat rooted.
 Reniform—kidney-shaped.
 Resupinate—spread over the substratum.
 Rhizomorph—root-like branch of mycelia.
 Rimose—cracked.
 Rivulose—channeled.
 Rufescent—becoming reddish.
 Rugose—wrinkled.
 Rugulose—minutely wrinkled.
 Saprophyte—growing on dead organic matter.
 Scabrous—rough to the touch.
 Scrupose—rough, jagged.
 Scurfy—with small scales.
 Scutate—shield-shape.
 Scutellate—like a small shield.
 Seriate—in a series.
 Sericeous—silky.
 Sessile—stemless.
 Setulose—with bristles.
 Sinuous—deeply waved.
 Sordid—dirty.
 Spadiceous—brownish.
 Spatulate—oblong, lower end smaller.
 Spinules—little spines.
 Sporophore—spore bearing portion.
 Squamose—scaly.
 Squamulose—with minute scales.
 Squarrose—with prominent reflexed scales.
 Stipe—stalk.
 Stipitate—stalked.
 Stratose—in layers.
 Strigose—covered with stiff hairs.
 Sub.—more or less.
 Suberose—corky.
 Subiculum—a cottony mycelium.
 Sulcate—furrowed.
 Tomentum—dense hair or wool.
 Tracheid—vasiform wood cell.
 Trama—hyphae at base of hymenium.
 Tametoid—like Trametes.
 Tremelline—jelly-like.
 Triquetrous—with three angles.
 Tuberculose—roughened.
 Tumid—swollen.
 Umbilicate—depressed in the center.
 Umbonate—bearing a protuberance.
 Umbrinous—brownish.
 Undulate—wavy.
 Ungulate—clawed.
 Unguliform—like a claw.
 Velutinous—velvety.
 Vesicular—composed of vessels.
 Villose—somewhat woolly.
 Villous—with long soft hairs.
 Virgate—wand shaped.
 Viscid—glutinous, sticky.
 Viscous—clammy.
 Vitelline—yellowish.
 Volva—an envelope which completely surrounds young plants.
 Zonate—with concentric bands.

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*pini-canadensis	75	Schweinitzii	113
pinicola	76	splendens	59
*polyporus	115	*stereoides	41
pubescens	91	subsericeus	59, 60, 61
*purpureus	51	velutinus	63, 64, 65, 91
radiatus	101	versicolor	62, 64, 65, 66
radicatus	115	virgineus	62
*radula	48	zonatus	63, 64, 65, 67
resinosus	96		

	Page		Page
Poria	45	*Poronidulus	62
Andersoni	57	*Porodaedalea	45
attenuata	49	Porothelium	25
contigua	56	fimbriatum	25
corticola	54	*Pycnoporus	69
crassa	53	*Pyropolyporus	77, 78, 79, 80
crocipora	51	*Romellia	113
faginea	54	*Scutigera	114
ferruginosa	57	*Sistotrema	26
gordoniensis	47	Solenia	24
laevigata	57	anomala	24
macer	54	villosa	24
marginella	51	*Spongipellis	95, 97
medulla-panis	52, 55	Strobilomyces	1, 121
mollusca	47, 48	strobilaceus	121
nitida	56	flocopus	121
obducens	58	Trametes	36, 95, 100, 107
papyracea	54	abietis	44, 45
populina	54	gibbosa	39
pulchella	59	heteromorpha	40
purpurea	50	mollis	41
quercina	54	odorata	6, 15, 43, 96
radula	47	Ohiensis	42
rufa	51	Peckii	39, 71
salicina	55	pini	4, 5, 15, 19, 44
sinuosa	53, 54	rigida	42
stalactites	72	rubescens	34
subacida	52	scutellata	41
subfusco-flavida	59	sepium	37
terrestris	1, 46	serialis	37
tulipiferae	55	serpens	37
vaporaria	54	stereoides	41
violacea	50, 51	suaveolens	38
viridans	49	Trogii	39, 40
vitellina	47	*unicolor	36
vulgaris	49, 55, 58	*Xylomyzon	26, 29
xantha	55		
xanthospora	58		

PLATE I

PLATE I.

Solenia, Porotheium, Merulius, Gloeoporus, Favolus and Trametes.

- Fig. 1.—*Solenia anomala* (Pers.) Fr. On birch, Crandon, August.
Fig. 2.—*Porotheium fimbriatum* Crandon, August.
Fig. 3.—*Merulius corium* (Pers.) Fr. Bangor, September.
Fig. 4.—*Merulius aurantiacus* Klotzsch. Parfrey's Glen.
Fig. 5.—*Gloeoporus conchoides* Mont. Shanagolden, August.
Fig. 6.—*Favolus europaeus* Fr. Madison, autumn.
Fig. 7.—*Favolus rhipidium* Berk. Algoma, autumn.
Fig. 8.—*Trametes gibbosa* (Pers.) Fr. *a*, front view; *b*, section, Horicon, July.

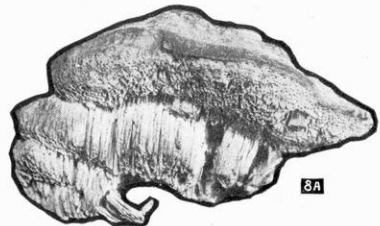
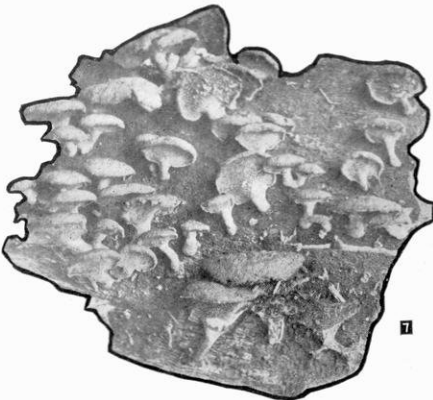
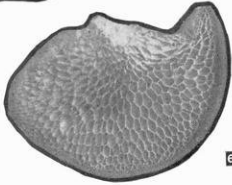
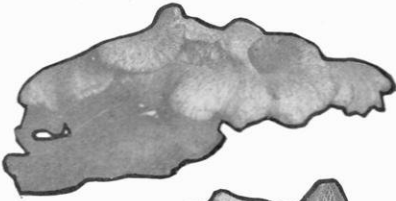
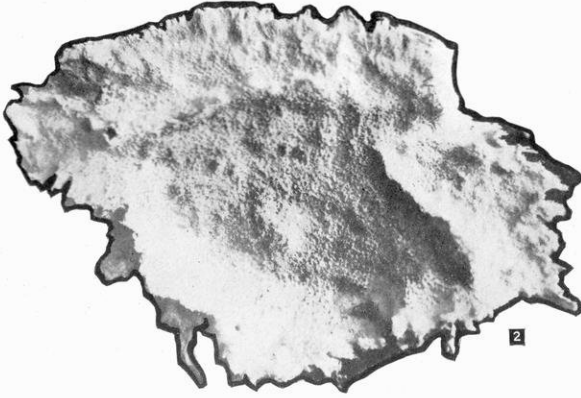
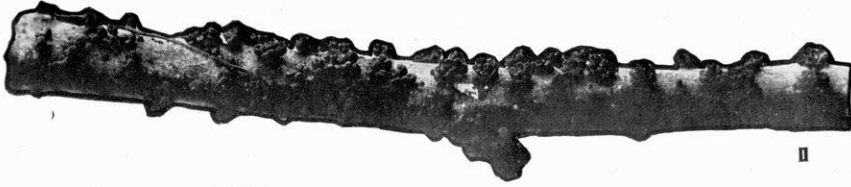


PLATE II

PLATE II.

Daedalea, Trametes.

Fig. 9.—*Trametes suaveolens* (Linn) Wint. Bangor, September.

Fig. 10.—*Trametes odorata* (Wulff) Fr. *a*, surface of pileus, *b*, pores; *c*, section. Bangor, September.

Fig. 11.—*Daedalea obtusa* (Schw.) *a*, front view of pilei; *b*, pores; *c* section. On *Quercus coccinea*, Madison.

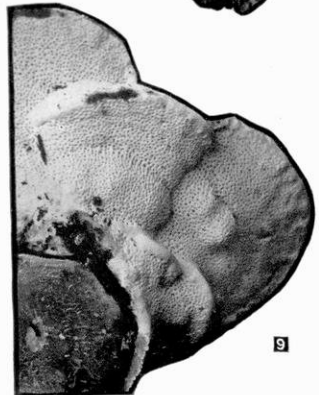
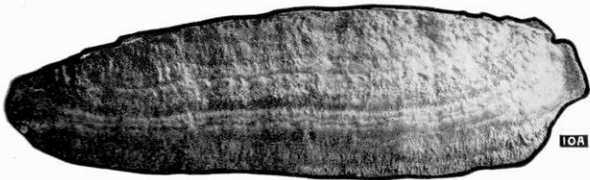
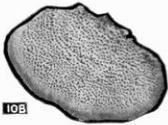
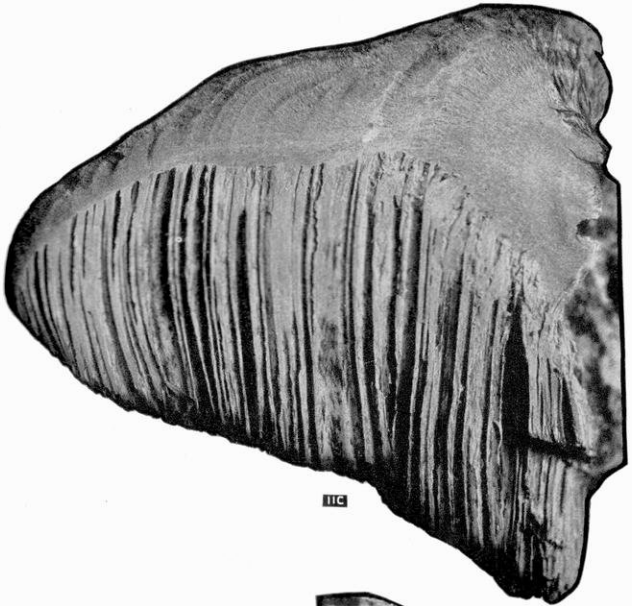
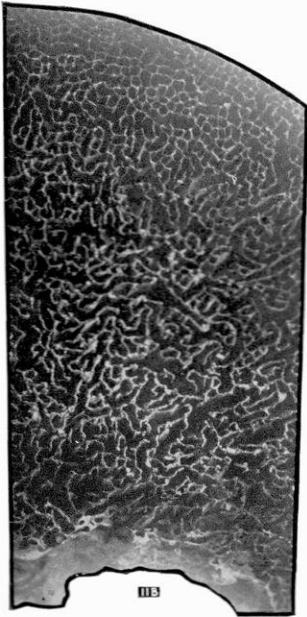
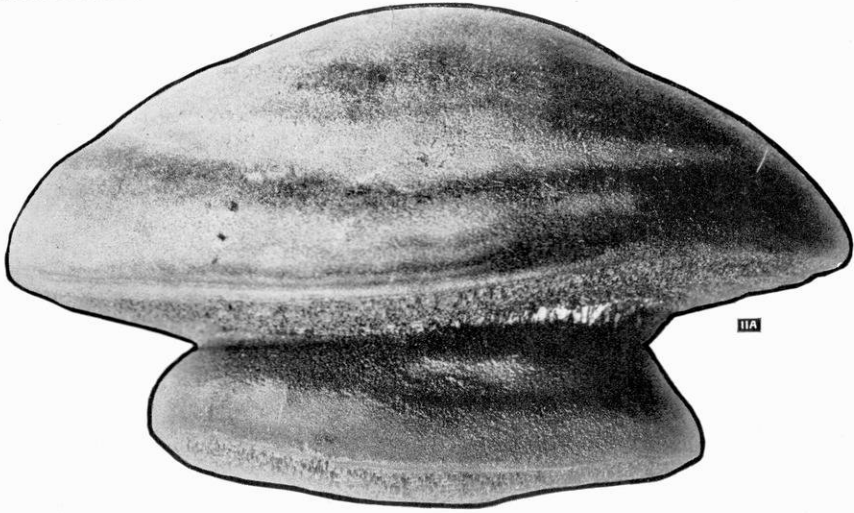


PLATE III

PLATE III.

Daedalea, Trametes.

Fig. 12.—*Daedalea confragosa* (Bolt.) Pers. *a*, surface view of pileus; *b, c, d, e, f, g*, series showing transition from pores to lamellae. On willow, Bangor, September.

Fig. 13.—*Trametes serialis* Fr. Bangor, September.

Fig. 14.—*Trametes stereoides* (Fr.) Bres. *a*, front view; *b*, section. New growth spreading over that of previous year. Shanagolden, August.

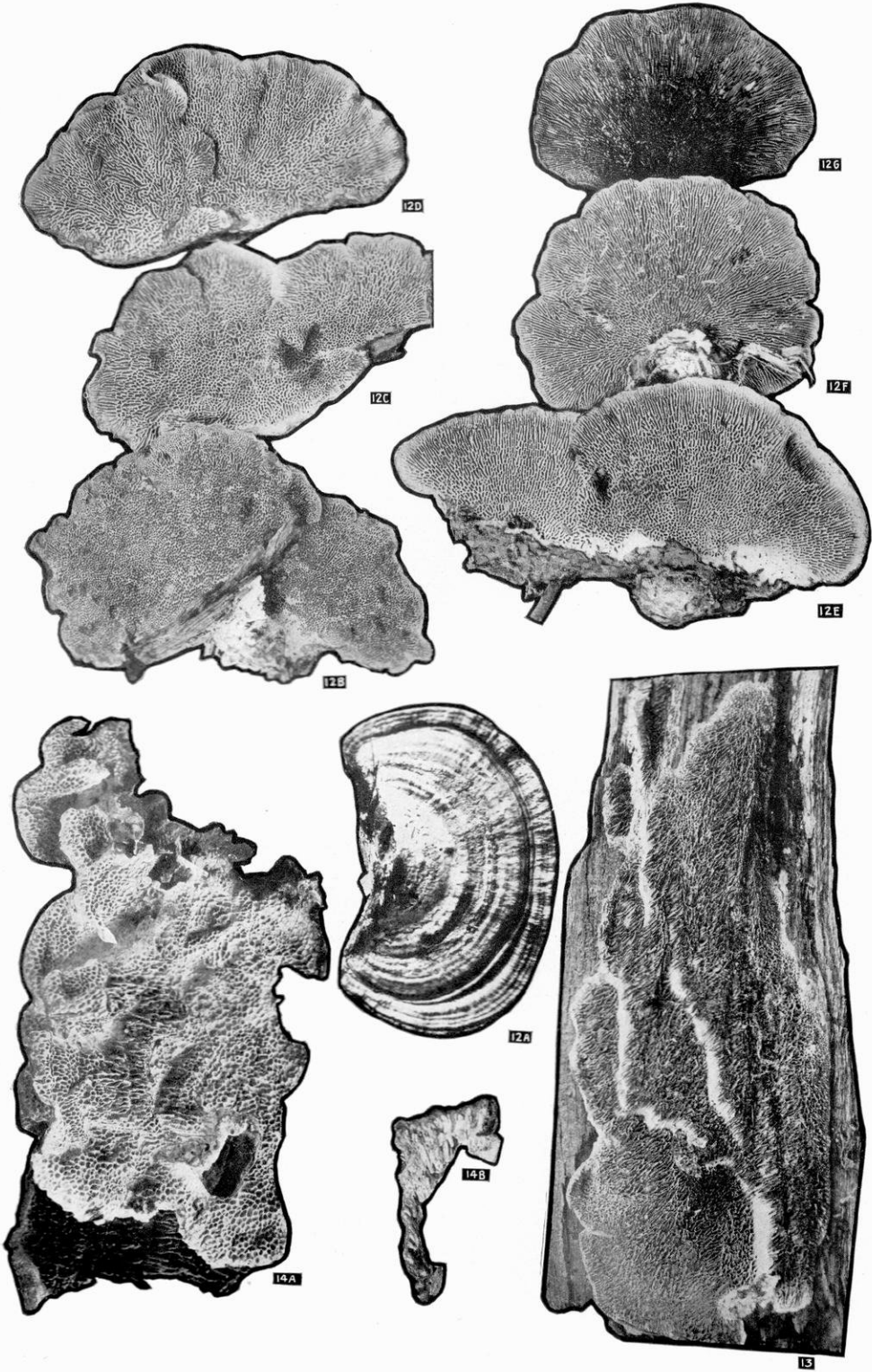


PLATE IV

PLATE IV.

Trametes, Poria, Polystictus.

- Fig. 15.—*Trametes Peckii* Kalchbrenner. Pores and section. On *Populus deltoides*. Madison, September.
- Fig. 16.—*Trametes pini* (Thore) Fr. *a*, surface of pileus; *b*, section. Star Lake, August.
- Fig. 17.—*Poria crassa* Karst. *a*, section showing strata. Hazelhurst, August.
- Fig. 18.—*Poria subacida* Peck. *a*, young; *b*, old. Pores and section showing decay produced. Hazelhurst, August.
- Fig. 19.—*Poria attenuata* Peck. Pores. Madison.
- Fig. 20.—*Polystictus conchifer* Schw. *a*, young disks; *b*, surface of mature pileus; *c*, pores. On elm, Madison.
- Fig. 21.—*Polystictus velutinus* Fr. Surface of pilei and pores. Crandon, August.
- Fig. 22.—*Polystictus abietinus* (Dicks.) Fr. Decay produced in hemlock (*Tsuga canadensis*). Hazelhurst, August.

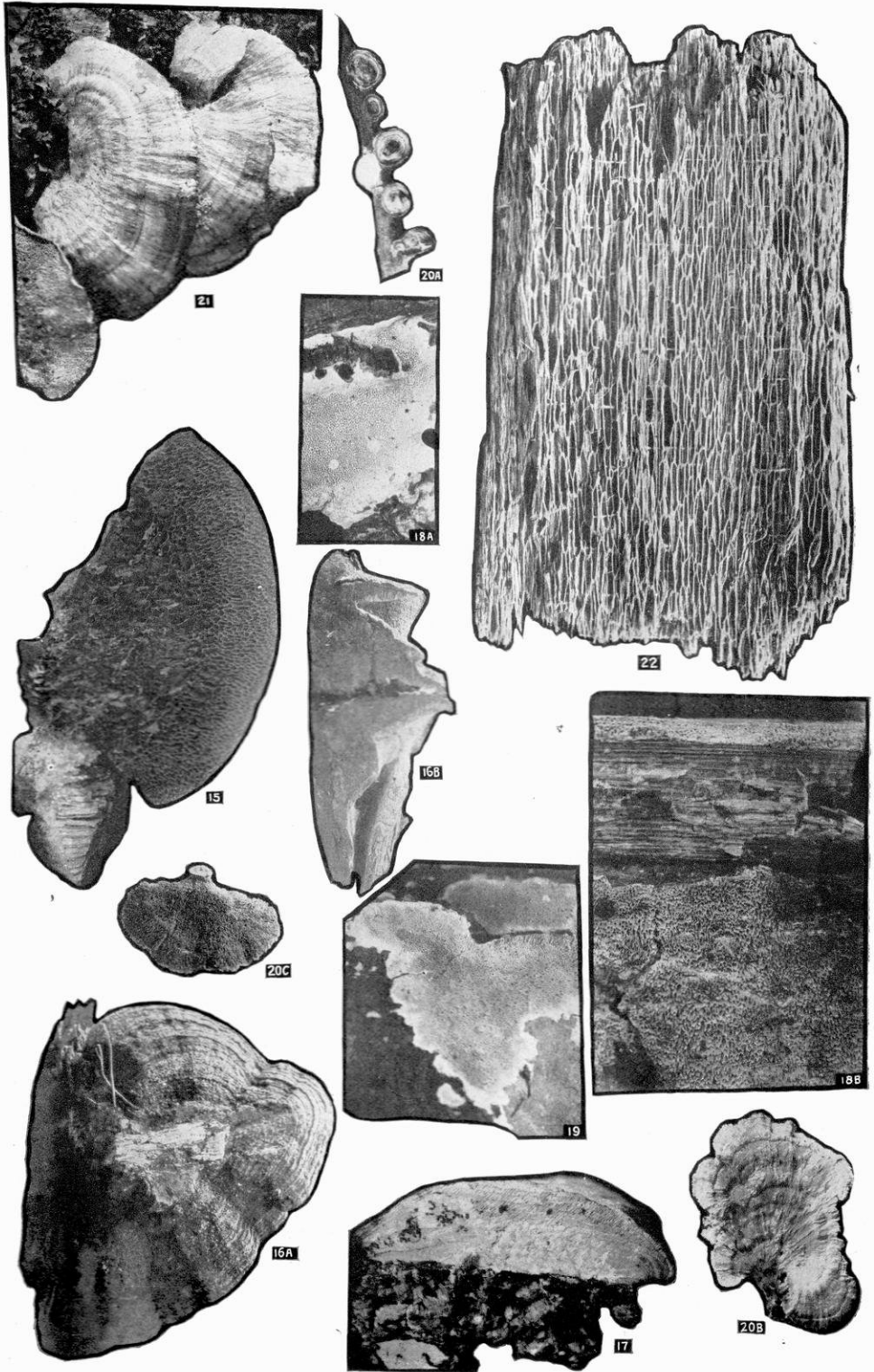


PLATE V

PLATE V.

Fomes.

Fig. 23.—*Fomes connatus* Fr. Horicon, June.

Fig. 24.—*Fomes unguatus* (Schaeff.) Sacc. *a*, surface of pileus; *b*, small form; *c*, var. *pinicola* surface of pileus, elongate form; *d*, var. *pinicola*, section.

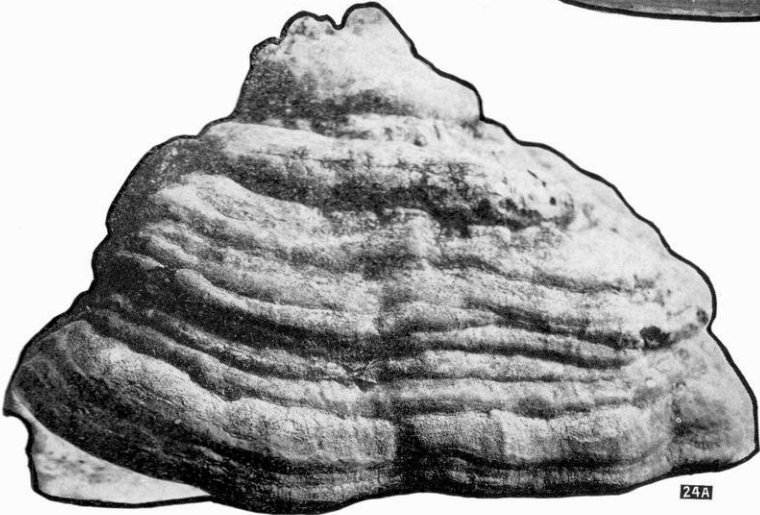
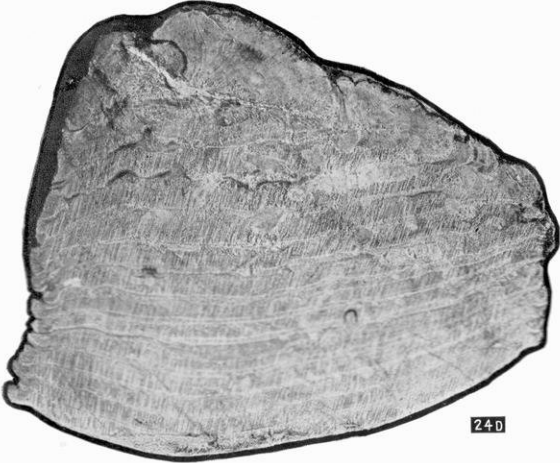
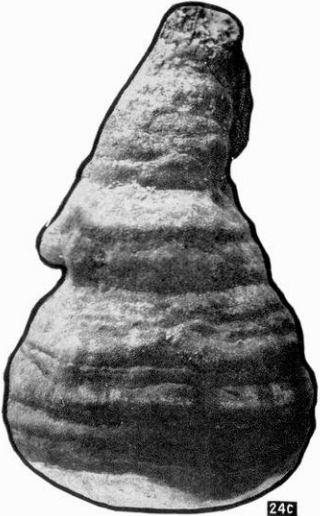
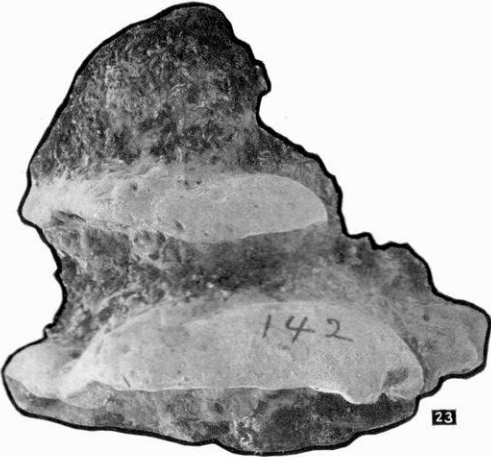


PLATE VI

PLATE VI.

Fomes.

- Fig. 25.—*Fomes marginatus* (Fr.) *a*, young pileus; *b*, surface of pileus; *c*, section. Hazelhurst, August.
- Fig. 26.—*Fomes Everhartii* Ell & Gall. *a*, section. On *Quercus coccinea*. Madison.
- Fig. 27.—*Fomes Bakeri* Murr. *a*, young pileus, two years' growth.



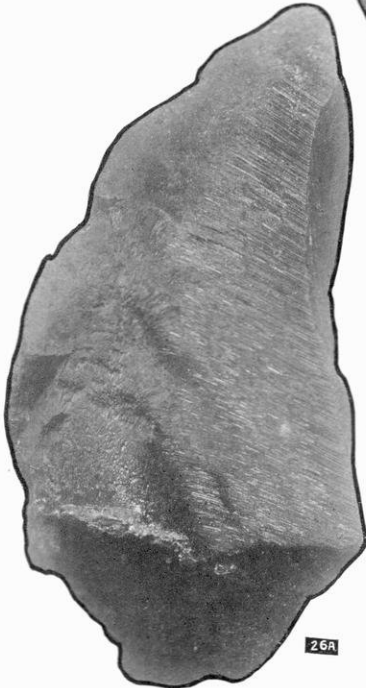
25c



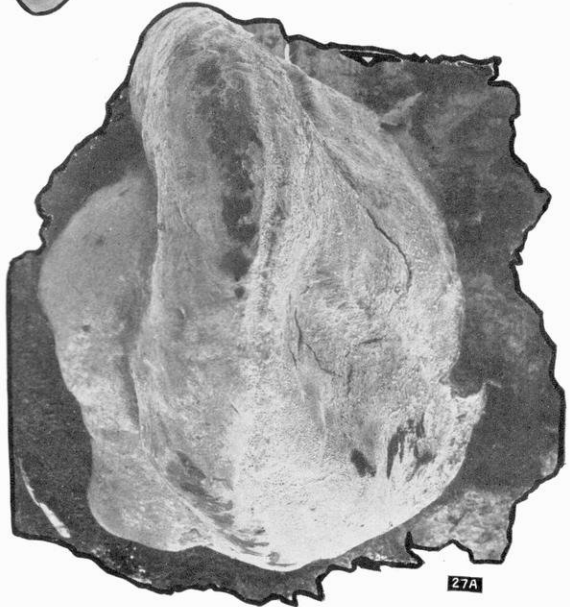
25b



25a



26a



27a

PLATE VII

PLATE VII.

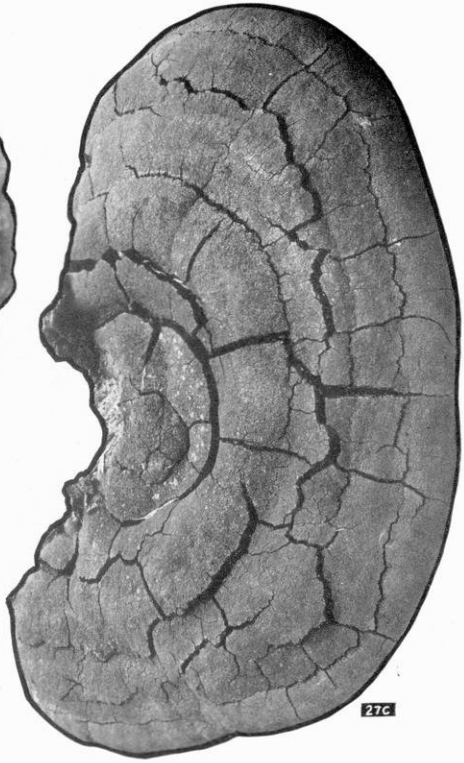
Fomes.

Fig. 26.—*Fomes Everhartii*, Ell. & Gall. *b*, front view of pileus. On *Quercus coccinea*, Madison.

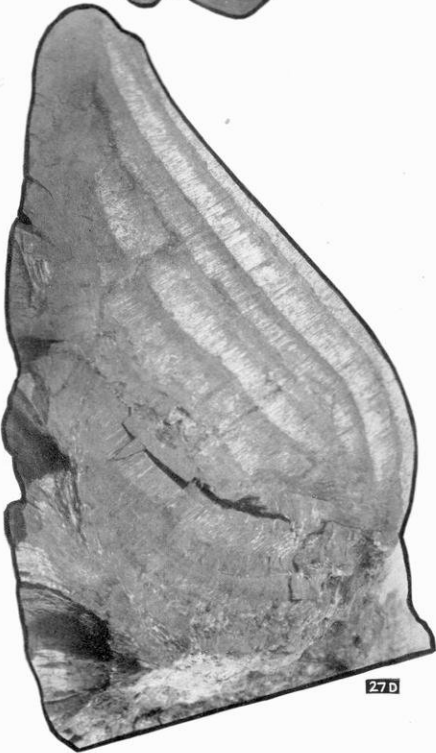
Fig. 27.—*Fomes Bakeri*, Murr. *b*, view from in front of pileus several years old; *c*, surface of pileus from above; *d*, section of pileus.



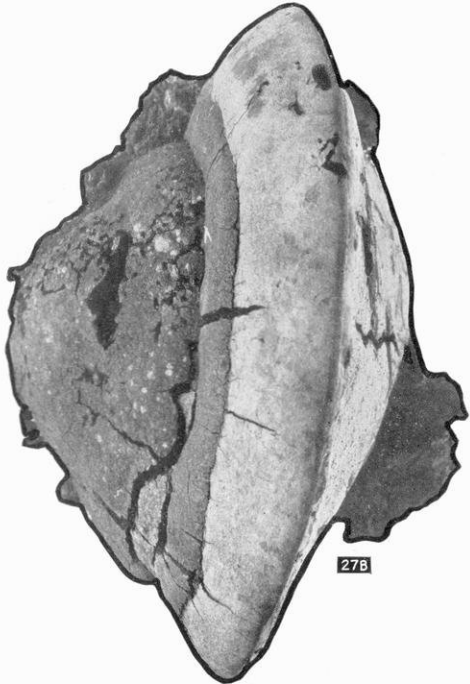
26B



27C



27D



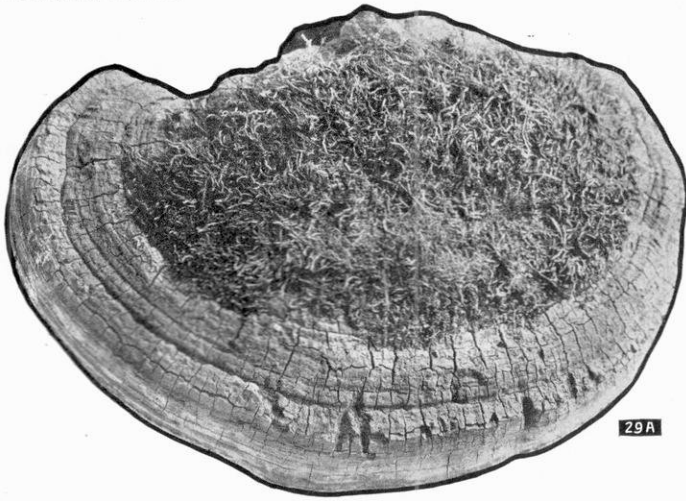
27B

PLATE VIII

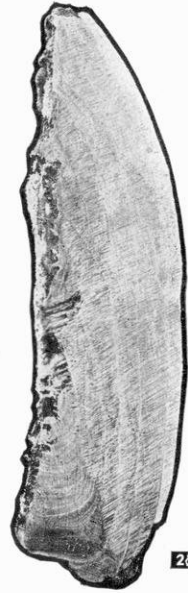
PLATE VIII.

Fomes.

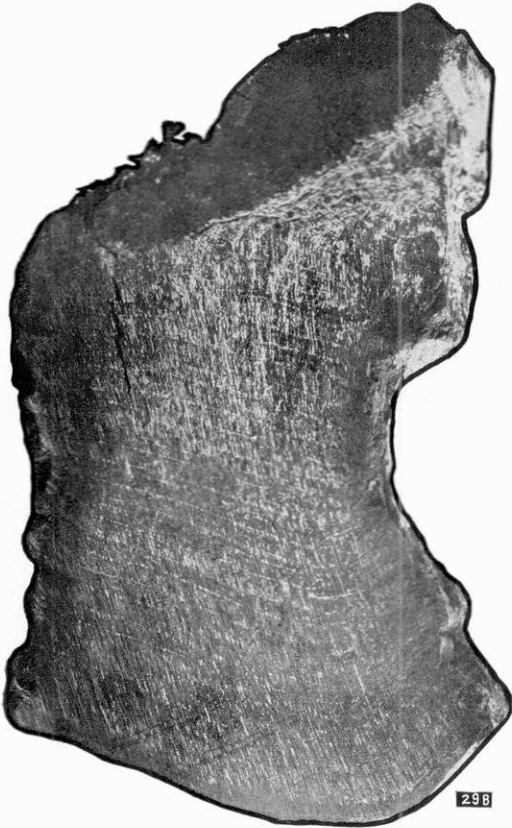
- Fig. 28.—*Fomes ungulatus* (Schaeff.) Sacc. Section of resupinate form=*F. pini-canadensis* Schw. Hazelhurst, August.
- Fig. 29.—*Fomes nigricans* Fr. *a*, surface of pileus partly covered with moss; *b*, section. On birch, Star Lake, August. *c* and *d*, var. *populinus*. On poplar, Madison.



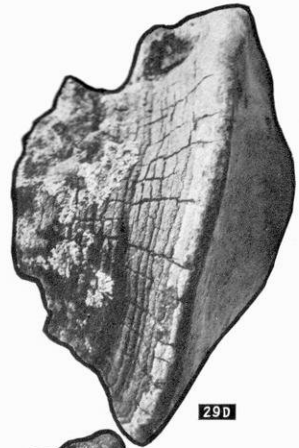
29A



28



29B



29D



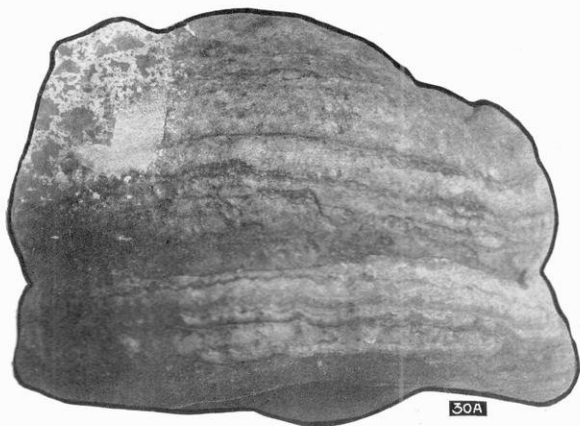
29C

PLATE IX

PLATE IX.

Fomes.

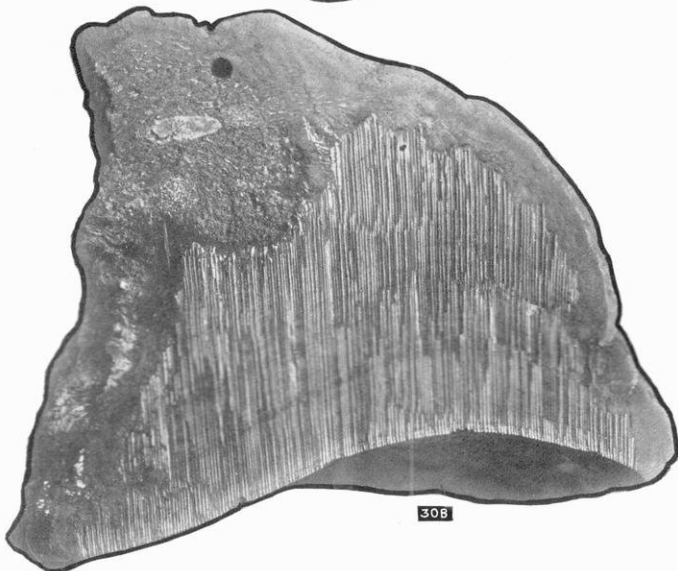
- Fig. 30.—*Fomes fomentarius* (Linn.) Fr. *a*, surface of pileus; *b*, section. On birch.
- Fig. 31.—*Fomes applanatus*. (Pers.) Wallr. Unusually thick ungulate form. Section on birch. Bangor, May.
- Fig. 32.—*Fomes lucidus* (Leys.) Fr. *a*, edge view of short stiped pilei; *b*, partially abortive long stiped form; *c*, pores and malformation of hymenium. On hemlock. (*Tsuga canadensis*). Crandon, August.



30A



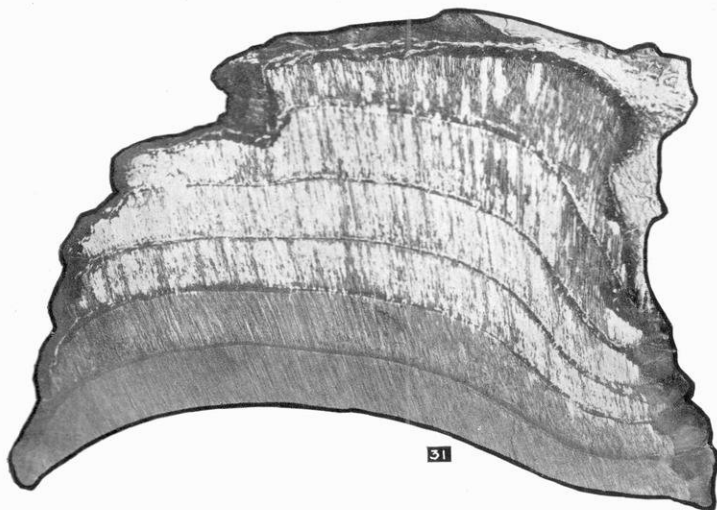
32A



30B



32C



31



32B

PLATE X

PLATE X.

Fomes.

Fig. 33.—*Fomes officinalis* (Vill.) Photograph of very large specimen much reduced. Origin of specimen uncertain, probably from Northern Wisconsin.

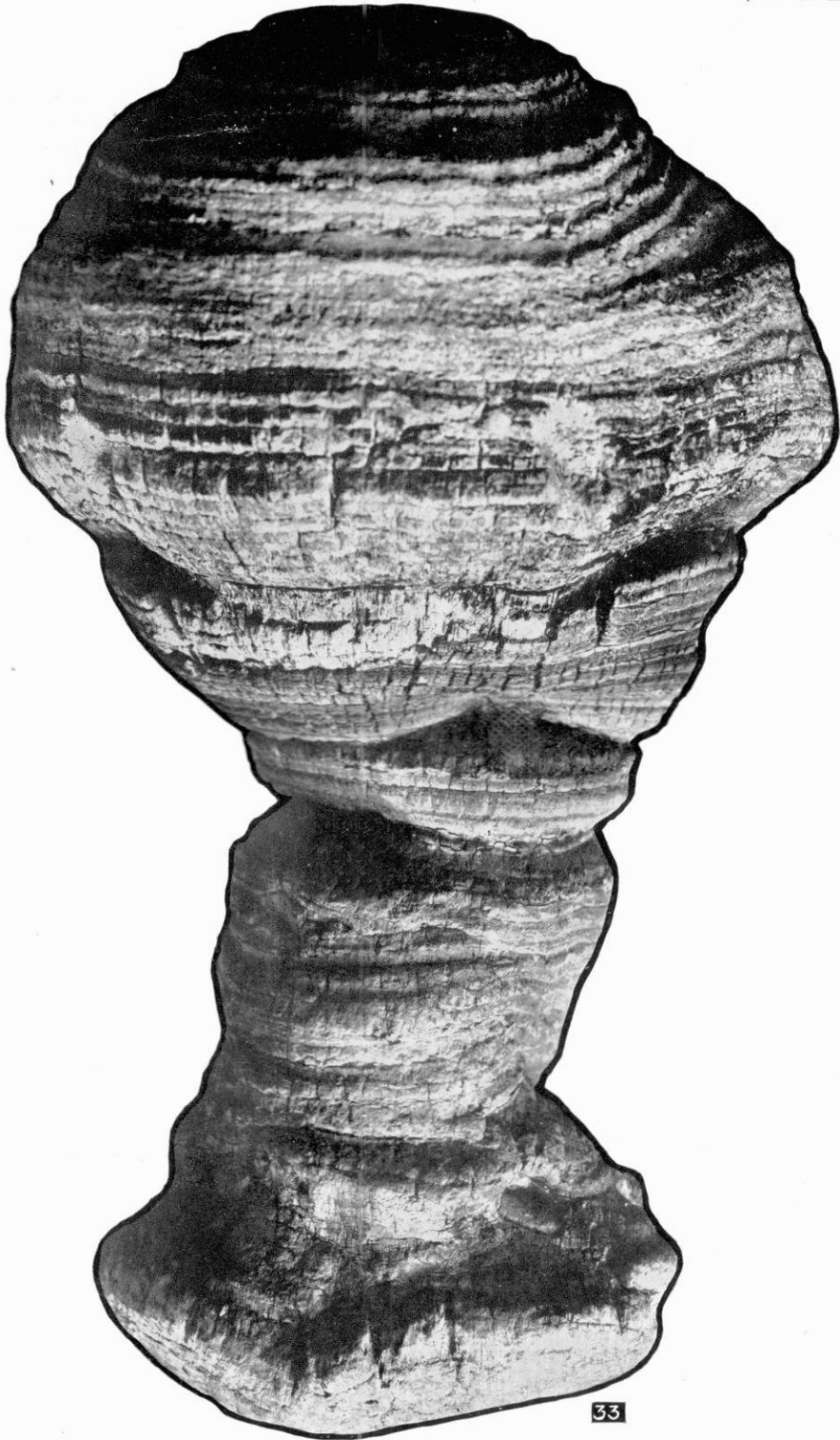


PLATE XI

PLATE XI.

Polyporus.

- Fig. 34.—*Polyporus nidulans* Fr. Pores. Devil's Lake, August.
- Fig. 35.—*Polyporus aurantiacus* Peck. *a*, surface of pileus. *b*, pores; *c*, section. Crandon, August.
- Fig. 36.—*Polyporus pubescens* (Schum.) Fr. *a*, surface of pileus; *b*, section; *c*, pores. Star Lake, August.
- Fig. 37.—*Polyporus resinus* (Schr.) Fr. Section. Bangor, September.
- Fig. 38.—*Polyporus guttulatus* Peck. Surface of pileus. Crandon, August.
- Fig. 39.—*Polyporus borealis* Fr. Pores and section. On poplar. Madison, summer.

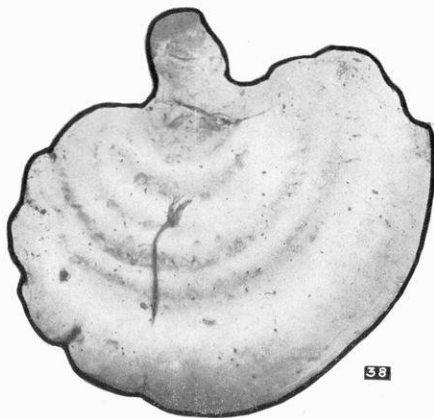
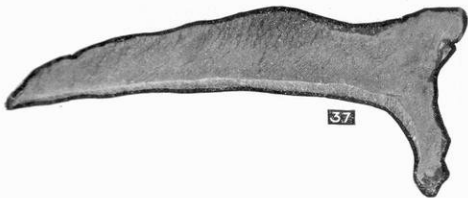
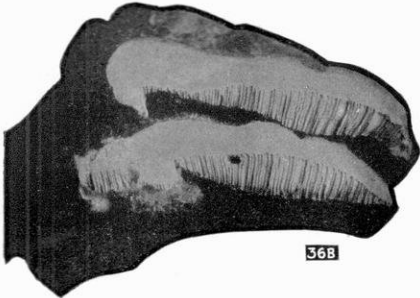
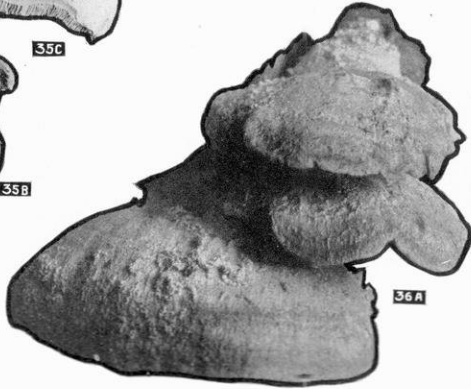
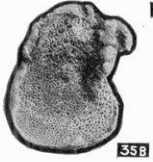
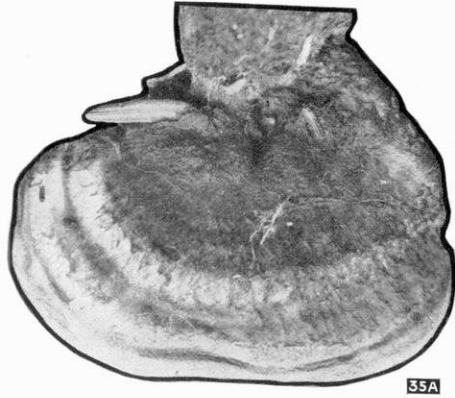
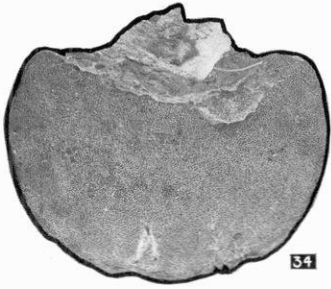
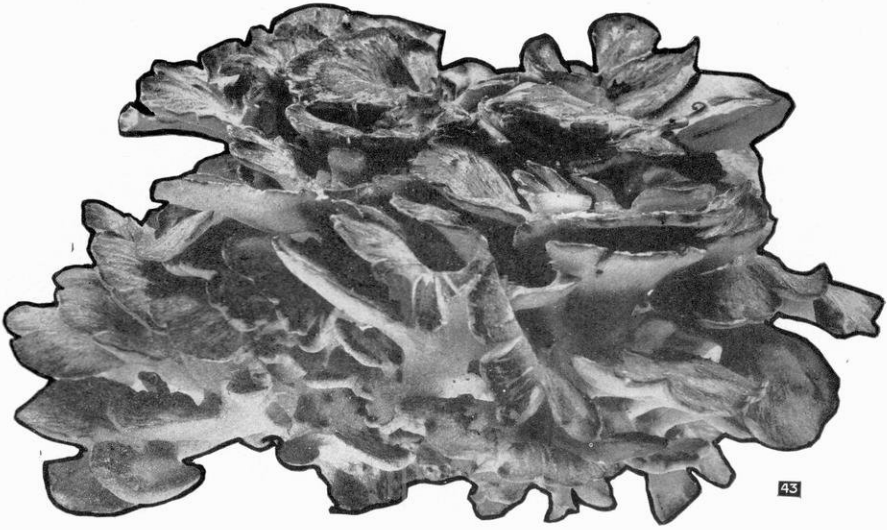


PLATE XII

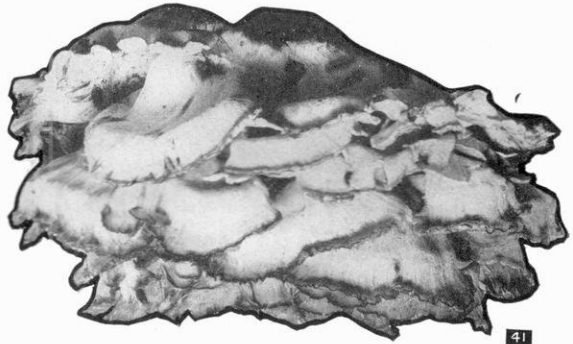
PLATE XII.

Polyporus.

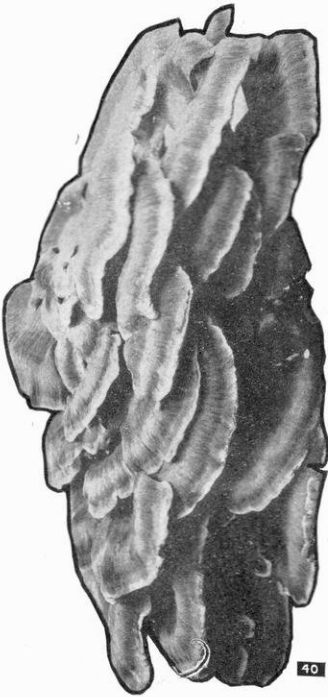
- Fig. 40.—*Polyporus sulphureus* (Bull.) Fr. Much reduced. On oak, Madison, August.
- Fig. 41.—*Polyporus anax* Berk. Much reduced. Madison, August.
- Fig. 42.—*Polyporus ovinus* (Fr.) Berk & Curt. On sandy ground among scrub pine. The Dells, September.
- Fig. 43.—*Polyporus frondosus* Fr. Crandon, August.



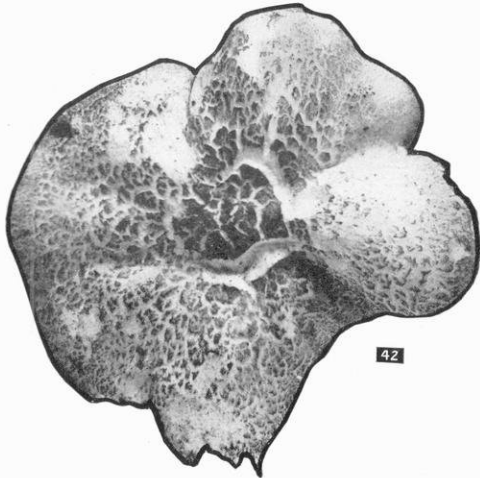
43



41



40



42

PLATE XIII

PLATE XIII.

Polyporus.

- Fig. 44.—*Polyporus graveolens* Schw. *a*, surface of pileoli; *b*, section. On oak. Mauston.
- Fig. 45.—*Polyporus volvatus* Peck. *a*, surface of pileus and mycelial plug from hole of bark borer; *b*, section; *c*, lower surface of "volva," showing opening; *d*, pores. Hazelhurst, August.
- Fig. 46.—*Polyporus betulinus* Fr. *a*, pores; *b*, section. On birch. Bangor, August.
- Fig. 47.—*Polyporus brumalis* Fr. *a*, pilei; *b*, pores. Bangor, October.
- Fig. 48.—*Polyporus lentus* Berk. Photograph from dried specimen. The stipe was straight when collected. Dodge. Blue Mounds, June.
- Fig. 49.—*Polyporus circinatus* Fr. *a*, section; *b*, pores. Dodge. Algoma.

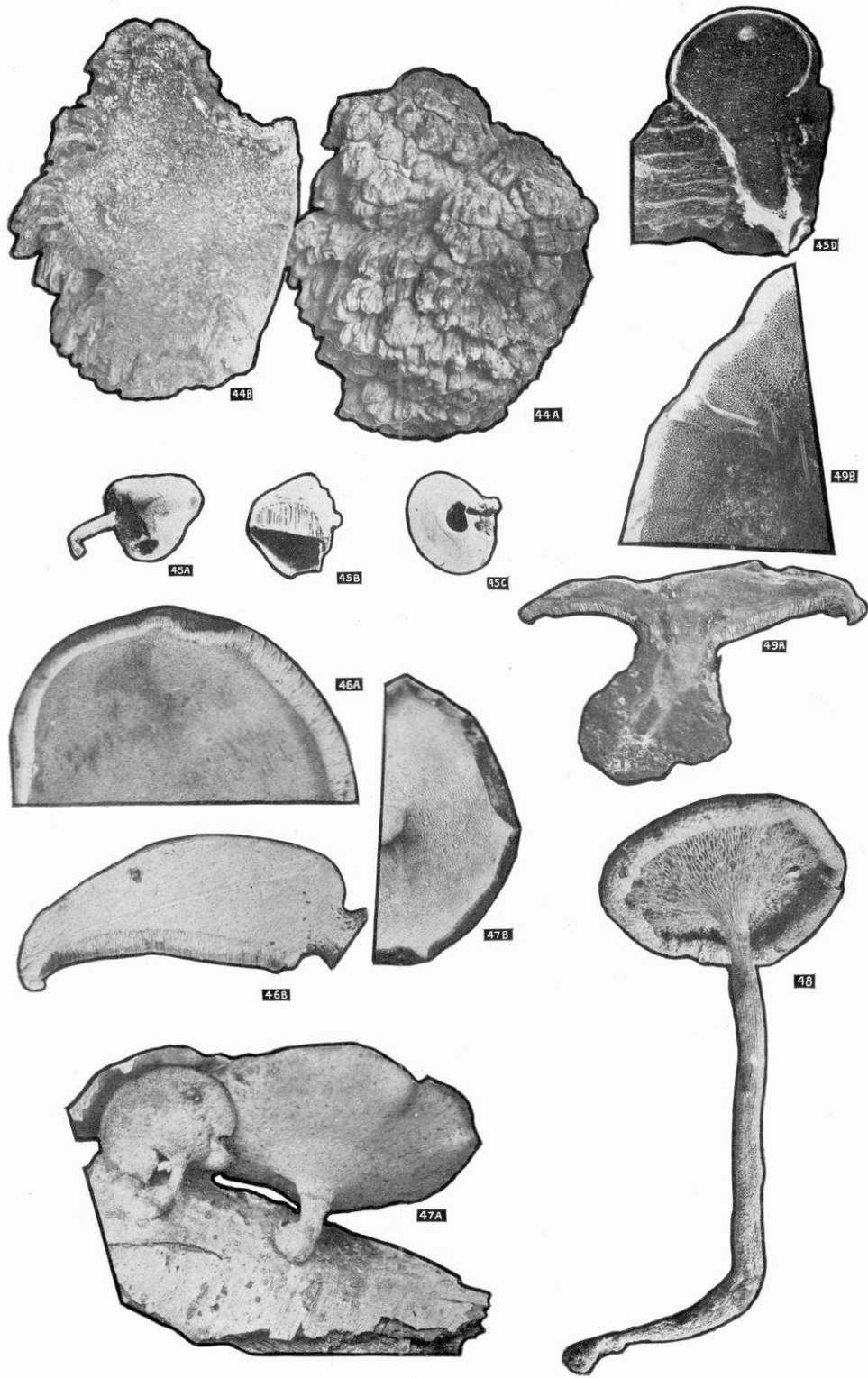


PLATE XIV

PLATE XIV.

Polyporus.

- Fig. 50.—*Polyporus Schweinitzii* Fr. Side view and pores. Bangor, September.
- Fig. 51.—*Polyporus squamosus* (Huds.) Fr. *b*, pores. Madison, May.
- Fig. 52.—*Polyporus picipes* Fr. *a*, pileus; *b*, side view. Crandon, September.
- Fig. 53.—*Polyporus subradicatus* Murr. Photograph from dried specimen. Algoma, September. B. O. Dodge.

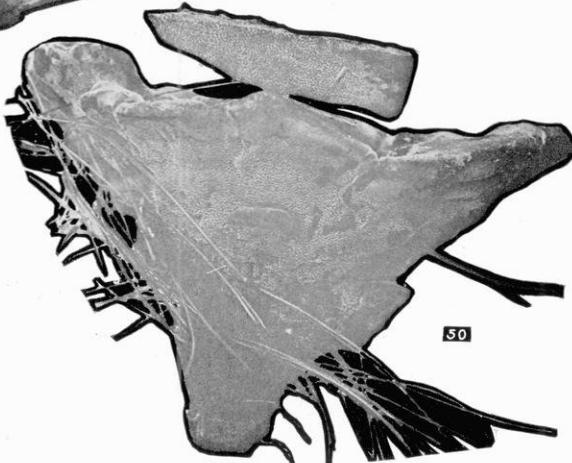
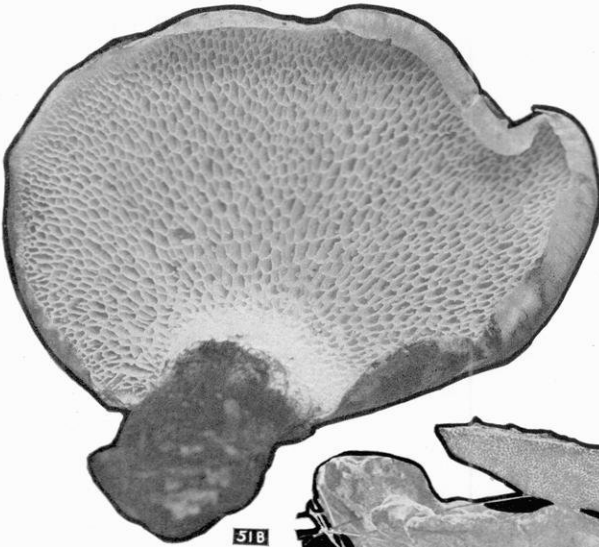
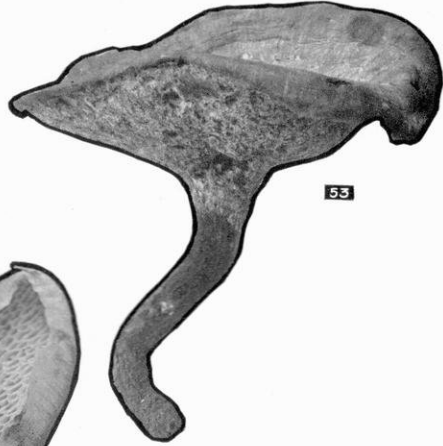
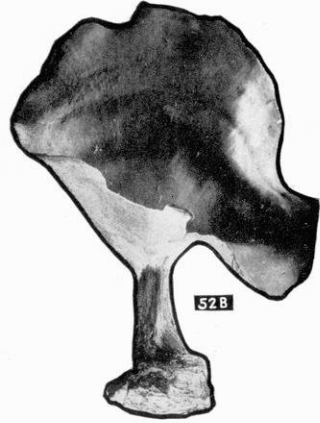
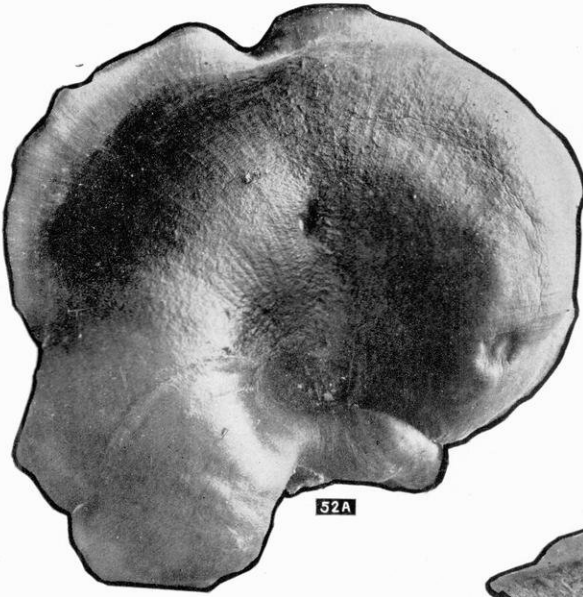


PLATE XV

PLATE XV.

Polyporus, Boletinus.

Fig. 51.—*Polyporus squamosus* (Huds.) Fr. *a*, pileus. Madison, May.

Fig. 54.—*Polyporus radicans*. Forest Hill Cemetery, Madison, September.
Much reduced.

Fig. 55.—*Boletinus paluster*. Dorward's Gorge, August.

Fig. 56.—*Boletinus pictus* Peck. *a*, entire, showing veil.

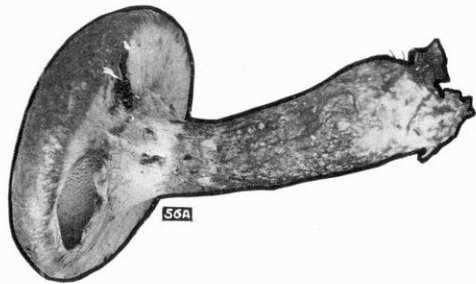
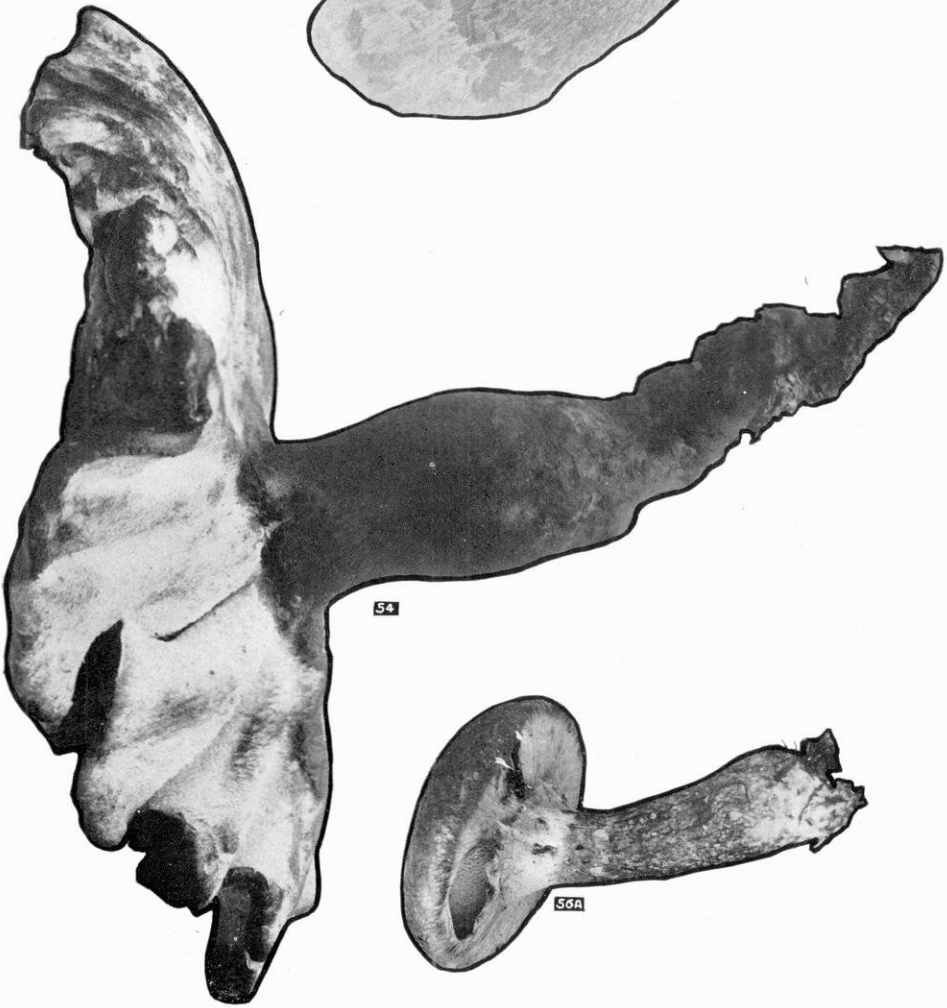
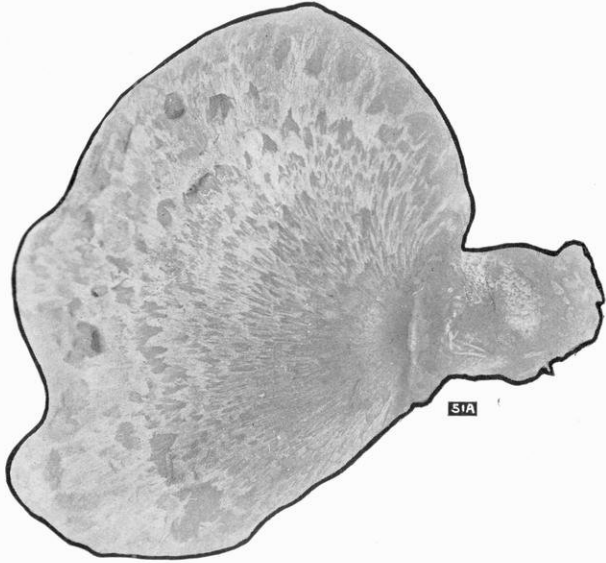


PLATE XVI

PLATE XVI.

Boletinus, Boletus.

- Fig. 56.—*Boletinus pictus* Peck. *b*, pileus; *c*, pores. *d* and *e*, young forms. *a*, Sand Lake, August. *b*, *c*, *d*, and *e*, Parfrey's Glen, August.
- Fig. 57.—*Boletus viscidus* Fr. *a*, Entire; *b*, pileus; *c*, young pores; *d*, older pores. Madison.
- Fig. 58.—*Boletus spectabilis*. *a*, entire; *b*, pileus; *c*, section.
- Fig. 59.—*Boletus Clintonianus* Peck. *a*, mature form entire; *b*, younger form, veil still attached to edge of pileus.

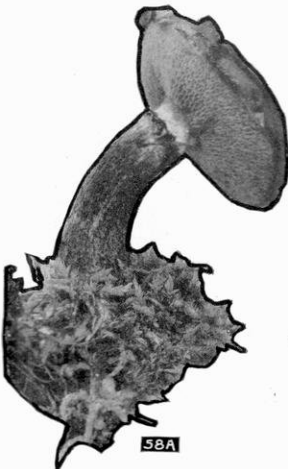
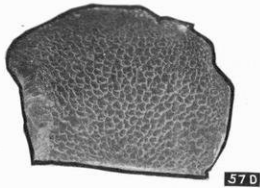
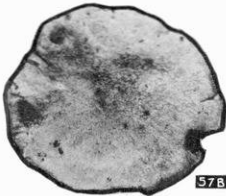
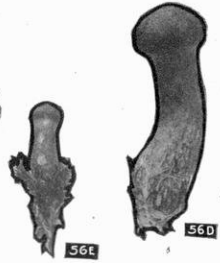
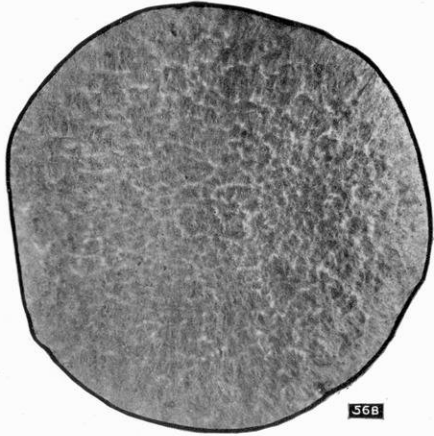
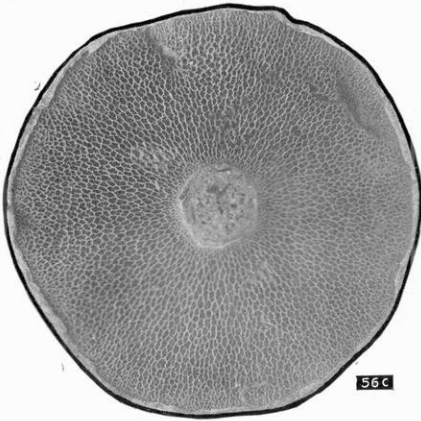


PLATE XVII

PLATE XVII.

Boletus.

- Fig. 59.—*Boletus Clintonianus* Peck. *c*, narrow form. Madison campus. *d*, pores. Crandon, August. *e*, section, old specimen; *f*, pores. The Dells, September.
- Fig. 60.—*Boletus Americanus* Peck. *a*, mature thinner type; *b*, thicker type, showing tufts of fibrils at margin of pileus; *c*, younger specimen, showing remnants of veil on margin of pileus and splotches of gluten on stipe; *d*, pores of mature specimen. Deward's Gorge, September. *e*, pores of younger specimen. Madison, August.

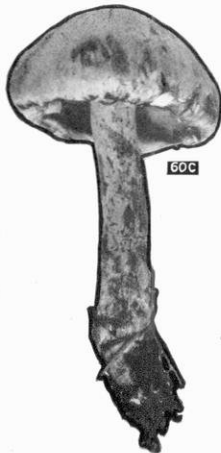
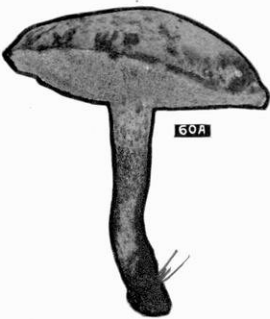
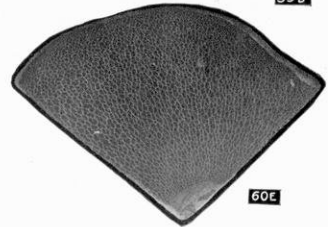
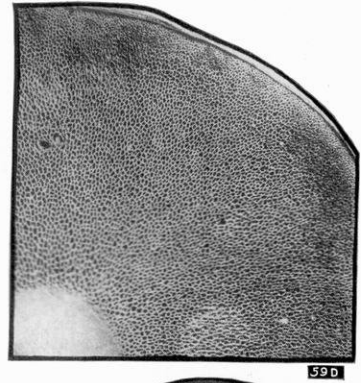
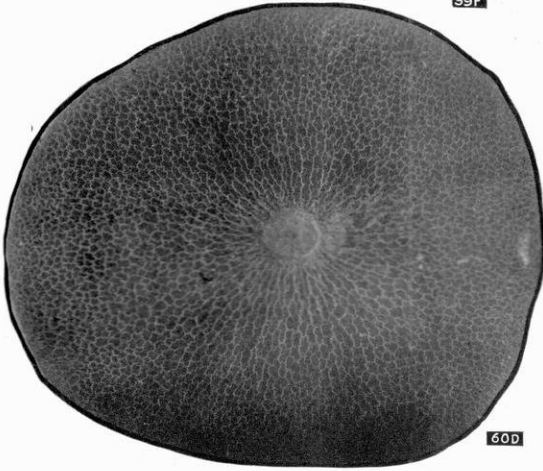
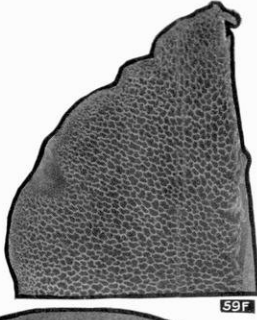
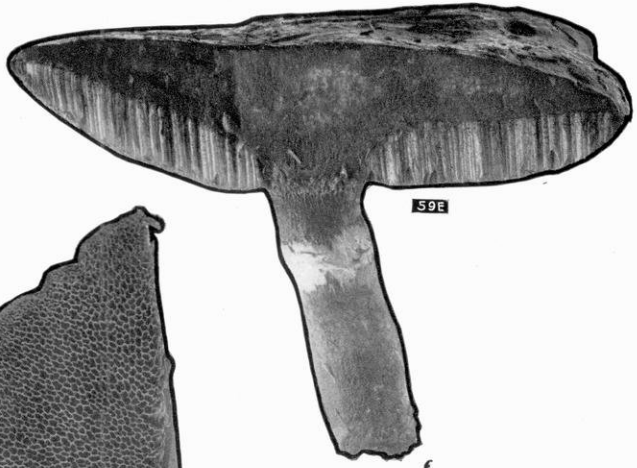
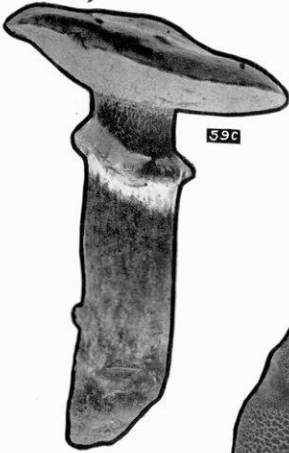


PLATE XVIII

PLATE XVIII.

Boletus.

Fig. 61.—*Boletus subaureus* Peck. *a*, pair of specimens; *b*, pores. Devil's Lake, August.

Fig. 62.—*Boletus sphaerosporus* Peck. *a*, entire; *b*, section. Devil's Lake, August.

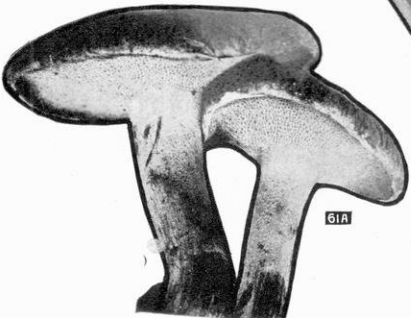
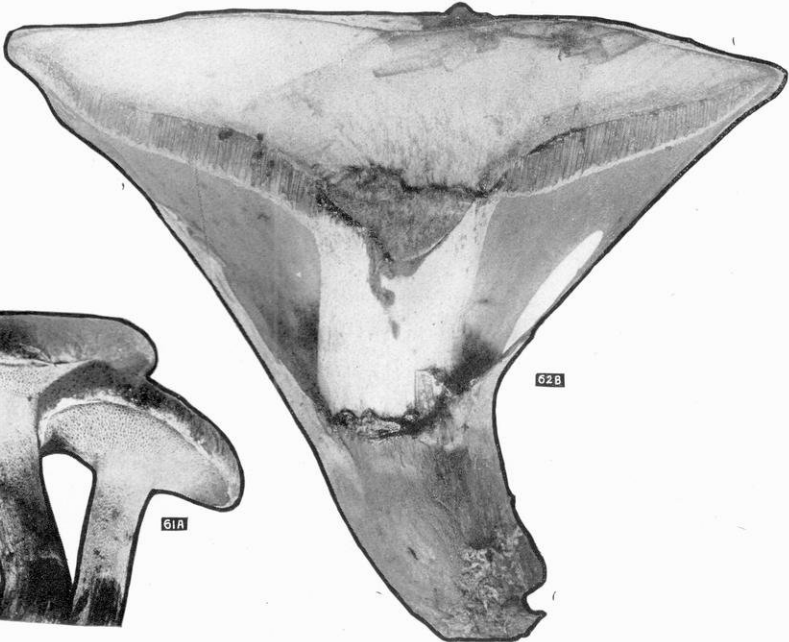
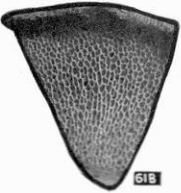


PLATE XIX

PLATE XIX.

Boletus.

- Fig. 63.—*Boletus hirtellus* Peck. Cap showing clearly the fine tufts of fibrils. The Dells, September.
- Fig. 64.—*Boletus punctipes* Peck. The Dells, September.
- Fig. 65.—*Boletus granulatus* Linn. *a*, entire young; *c*, entire form showing ring, *e*, pores. Dorward's Gorge, September.
- Fig. 66.—*Boletus brevipes* Peck. Typical section showing flesh, pores and stipe. The Dells, September.
- Fig. 67.—*Boletus Ravenelii* B and C. *a*, entire; *b*, section showing veil and pores. Ladysmith, August.

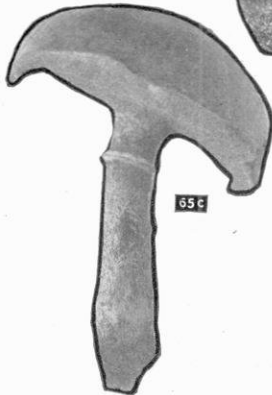
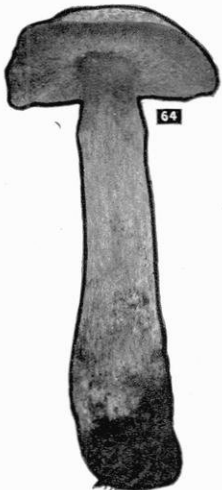
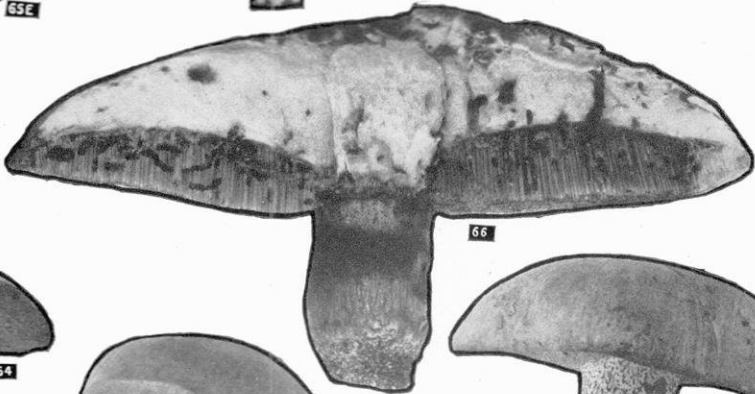
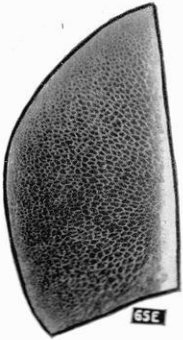
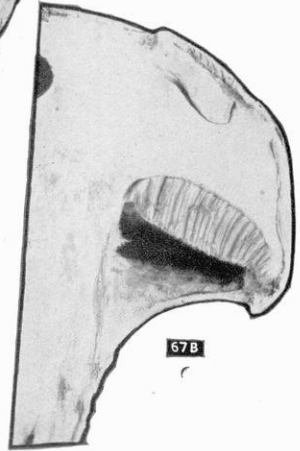
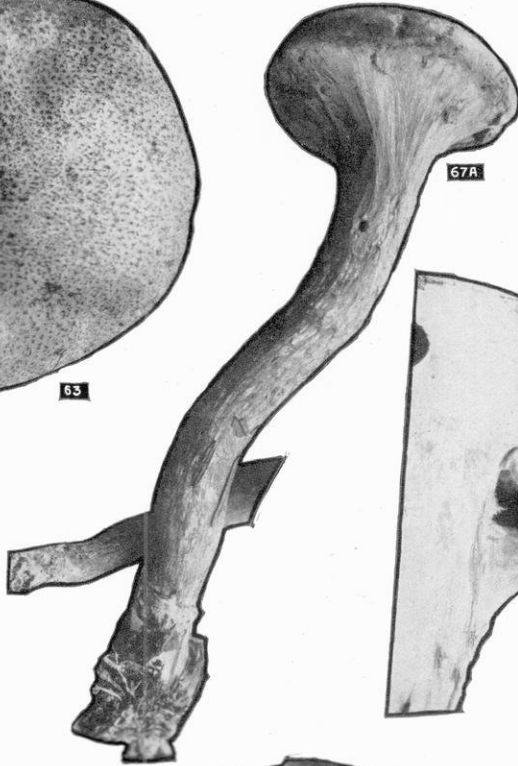
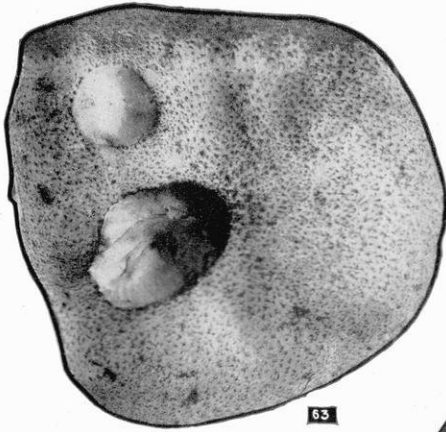
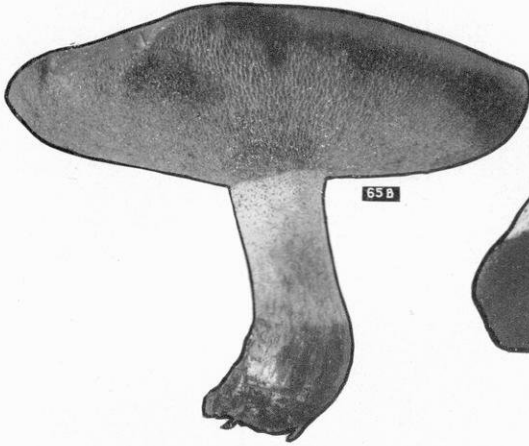


PLATE XX

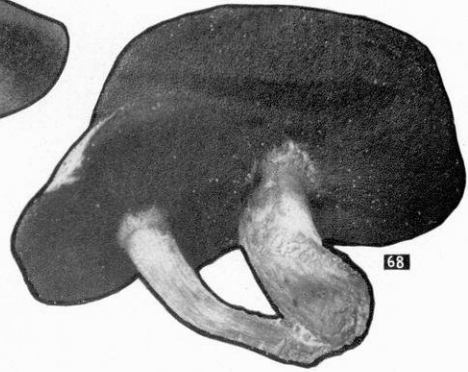
PLATE XX.

Boletus.

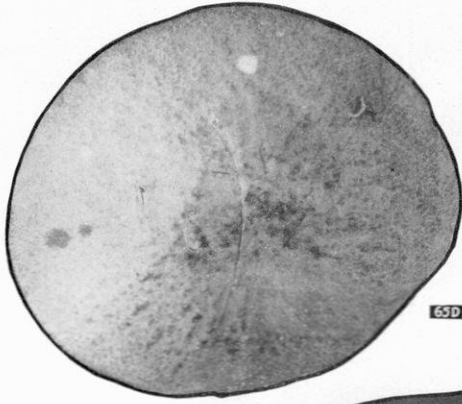
- Fig. 65.—*Boletus granulatus* Linn. *b*, entire, mature; *d*, pileus, showing glutinous scales.
- Fig. 68.—*Boletus collinitus* Fr. Pair of specimens. Stone Lake, August.
- Fig. 69.—*Boletus bicolor* Peck. *a*, entire, mature; *b*, pores; *c*, group of three young specimens. Devil's Lake, August.



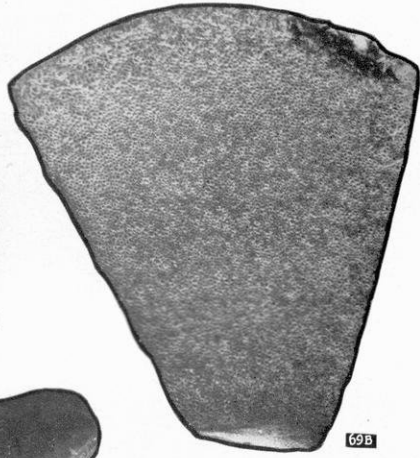
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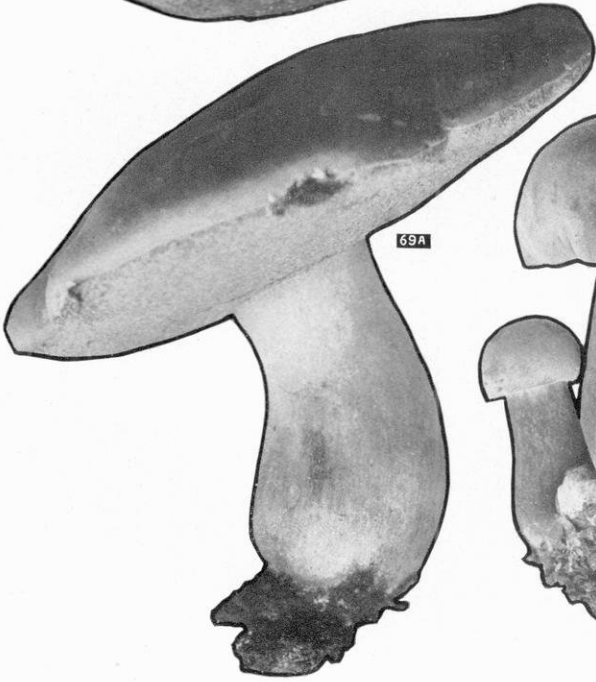
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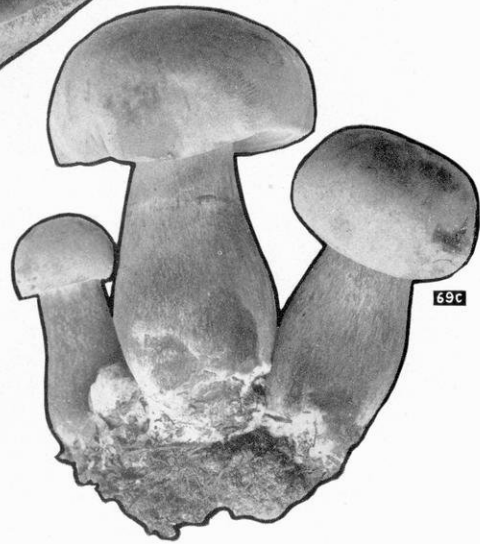
65D



69B



69A



69C

PLATE XXI

PLATE XXI.

Boletus.

- Fig. 70.—*Boletus alutaceus* Morg. *a*, section showing flesh and pores. The Dells, *b*, pores; *c*, pileus, younger specimen. Dorward's Gorge, September.
- Fig. 71.—*Boletus auriporus* Peck. Ladysmith, August.
- Fig. 72.—*Boletus pallidus* Frost. *a*, entire plant; *b*, pores.
- Fig. 73.—*Boletus chrysenteron*. *a*, pileus; *b*, pores. Ladysmith, August.

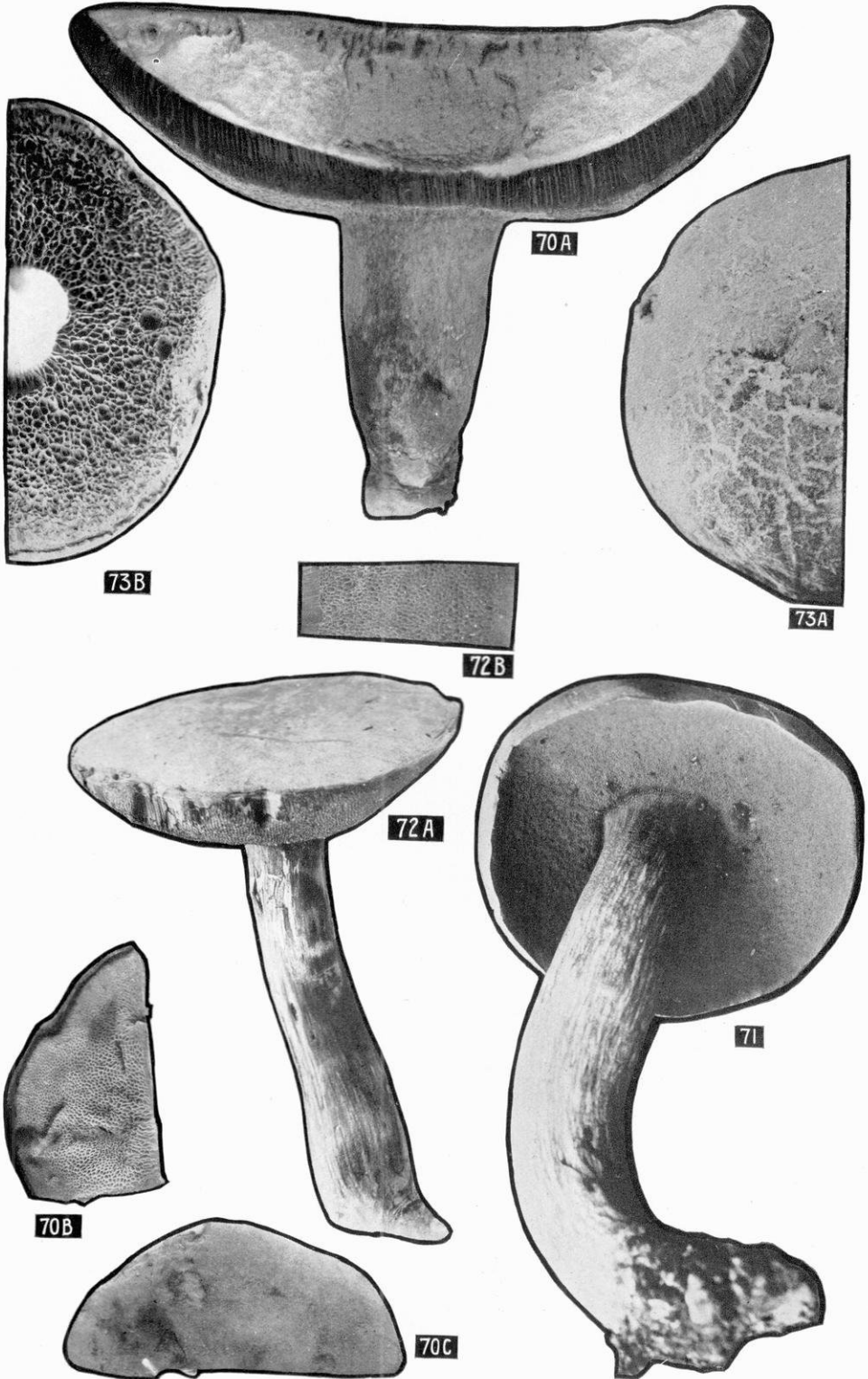


PLATE XXII

PLATE XXII.

Boletus.

- Fig. 74.—*Boletus subtomentosus* Linn. *a*, stipe and section of pileus; *b*, pores.
Fig. 75.—*Boletus radicans* Pers. *a*, entire plant; *b*, pores. Devil's Lake, August.
Fig. 76.—*Boletus Russellii* Frost. *a*, entire plant reduced; *b*, pores.
Fig. 77.—*Boletus separans*, Peck. Crandon, August.
Fig. 78.—*Boletus edulis* Bull., var. *clavipes*. Rather small specimen. Devil's Lake, August.

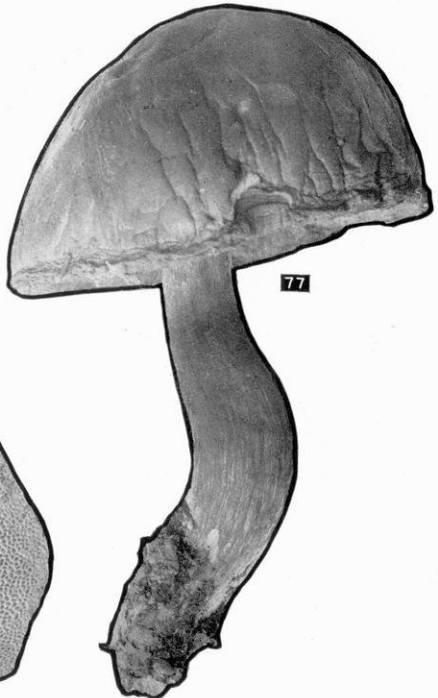
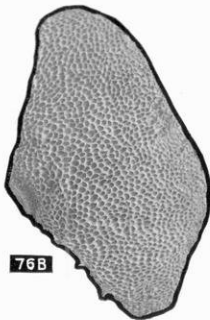
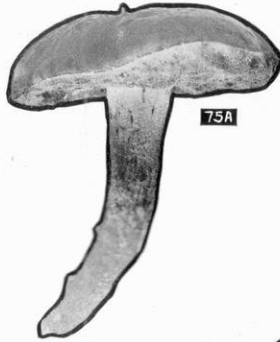
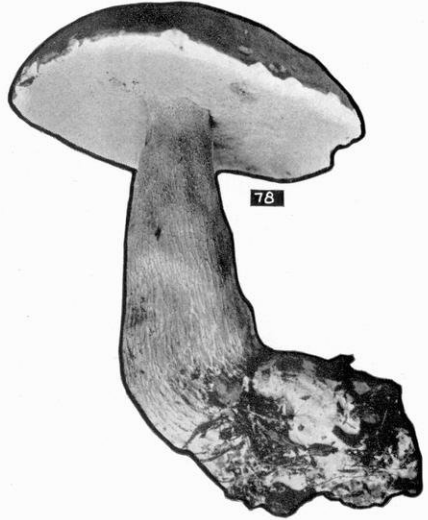
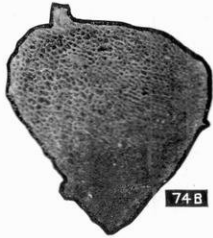


PLATE XXIII

PLATE XXIII.

Boletus.

Fig. 79.—*Boletus eximius* Peck. *a*, entire plant; *b*, pores. Devil's Lake, August.

Fig. 80.—*Boletus vermiculosus* Peck. Entire plant, young. Crandon, August.

Fig. 81.—*Boletus versipellis* Fr. *a*, form with narrow cap; *b*, mature plant, normal shape. Parfrey's Glen, August.

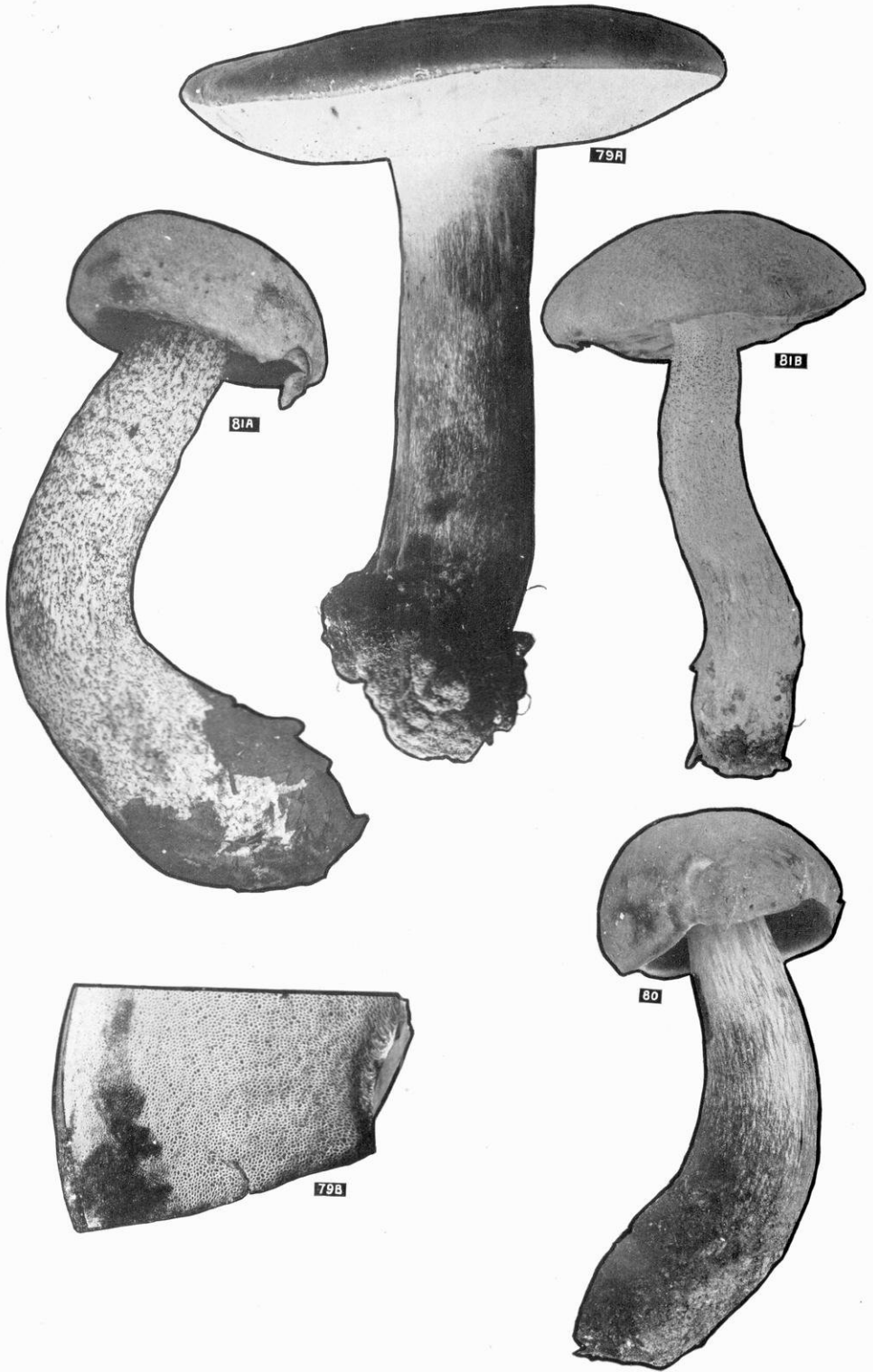


PLATE XXIV

PLATE XXIV.

Boletus.

Fig. 82.—*Boletus indecisus* Peck. *a*, entire plant; *b*, pores. Devil's Lake, August.

Fig. 83.—*Boletus felleus* Bull. *a*, entire, and *b*, section of half-grown form; hymenium connected to stipe by cords of hyphae; massive type; *d*, mature and far less massive type; surface dry and cuticle scaling off in spots in characteristic fashion. Parfrey's Glen. August.

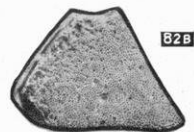
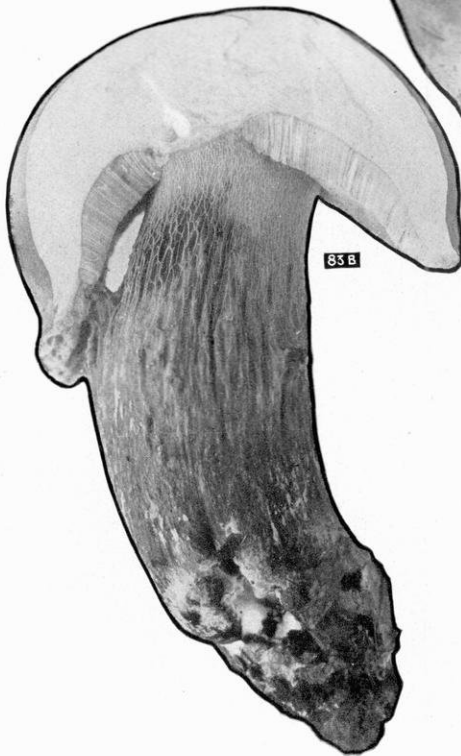
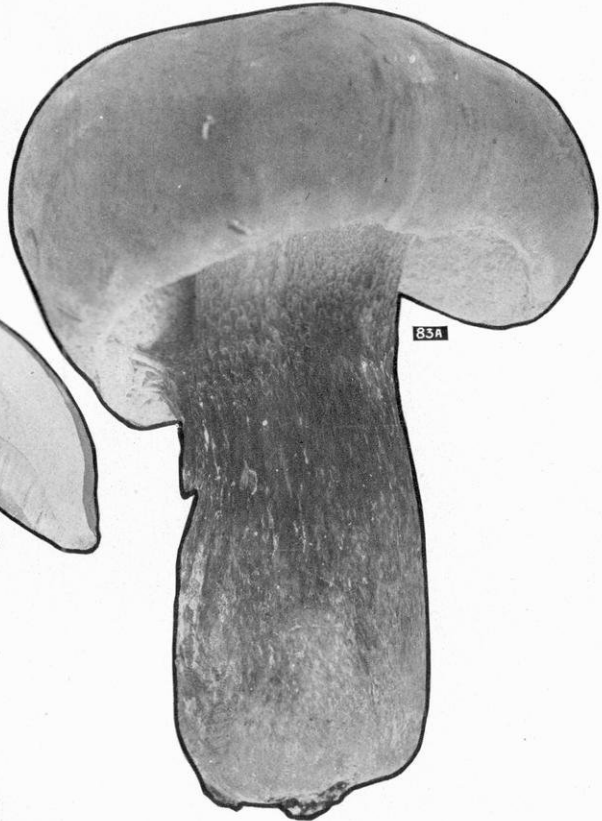
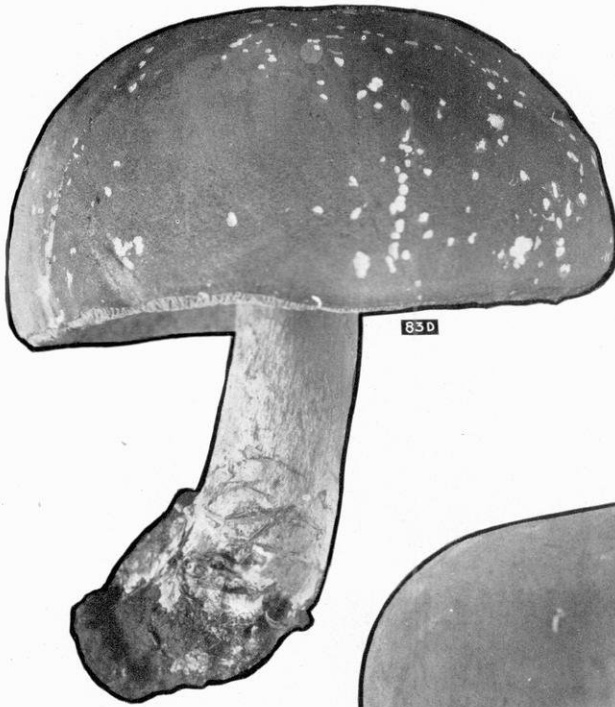
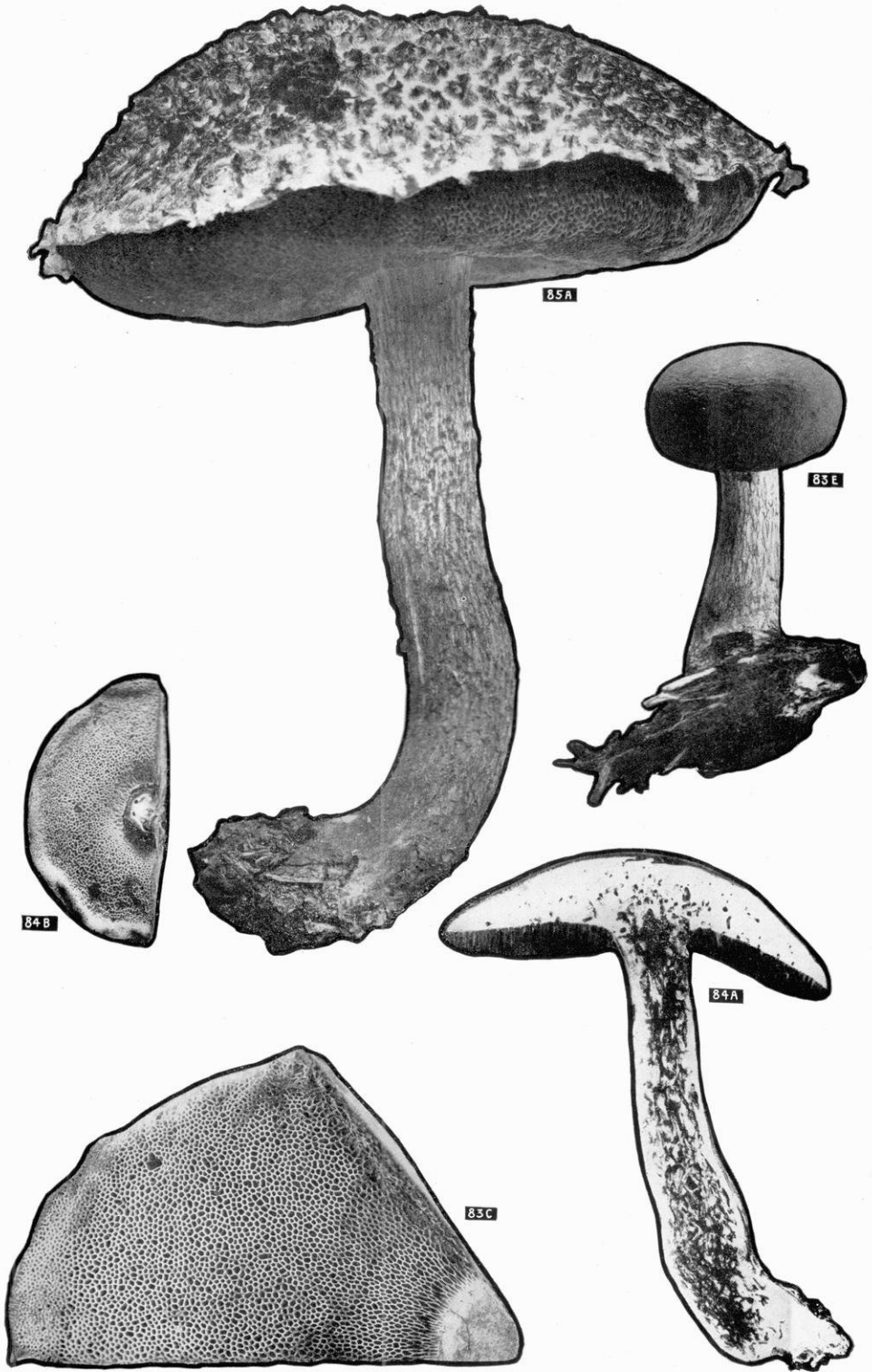


PLATE XXV

PLATE XXV.

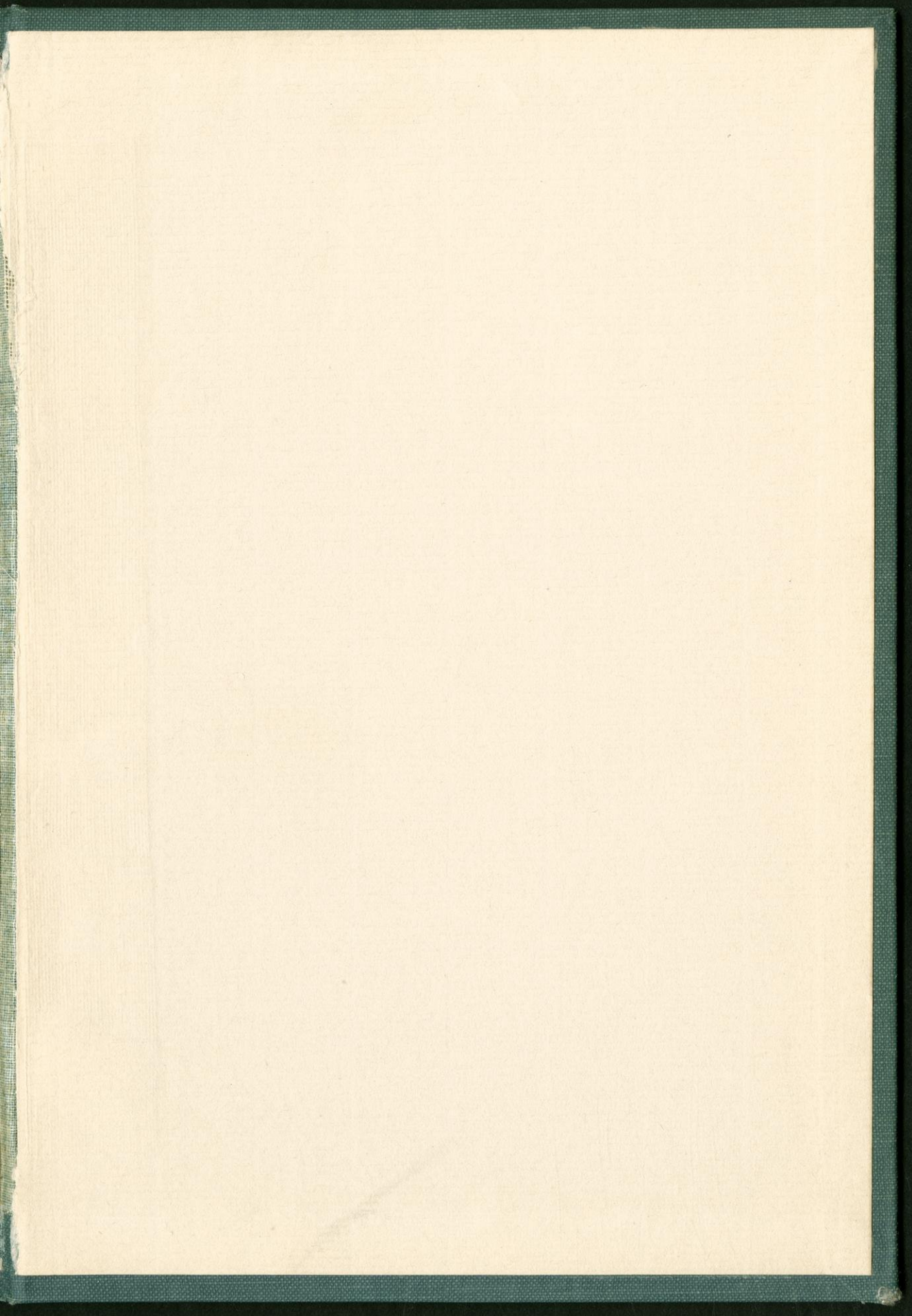
Boletus, Strobilomyces.

- Fig. 83.—*Boletus felleus* Bull. *c*, pores; *e*, smaller form growing on rotten wood. Hazelhurst, August.
- Fig. 84.—*Boletus castaneus*. *a*, median longitudinal section; *b*, pores. Madison, July.
- Fig. 85.—*Strobilomyces strobilaceus* Berk. *a*, entire. Madison, August.









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