# THE AGARICACEAE

OF

# MICHIGAN

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C. H. KAUFFMAN

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# THE AGARICACEAE OF MICHIGAN

BY

C. H. KAUFFMAN

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## LETTERS OF TRANSMITTAL.

*To the Honorable the Board of Geological and Biological Survey of the State of Michigan:*

Gov. Albert E. Sleeper.
Hon. Frank L. Cody.
Hon. Fred L. Keeler.

Gentlemen:—I have the honor to transmit herewith the manuscript and illustrations of a treatise on the Agaricaceae of Michigan by Dr. C. H. Kauffman with the recommendation that it be printed and bound as Publication 26, Biological Series 5, in two volumes.

Respectfully yours,
R. C. ALLEN,
*Director.*

Lansing, Michigan, February 10, 1918.

Ann Arbor, Michigan,

Sir:—I submit herewith a monographic report on the Agaricaceae of Michigan by Dr. C. H. Kauffman. This monograph is the result of field and laboratory studies made by Dr. Kauffman during the past ten years, and its object is to summarize what is known of the occurrence and characteristics of the species which have been found in the State. It should be of service to students and teachers of botany, to mycologists, and to persons interested in fungi as food. The report is to be considered as an addition to the series of monographs on Michigan plants and animals which the Survey is having prepared.

Very respectfully,
ALEXANDER G. RUTHVEN,
*Chief Naturalist.*

R. C. ALLEN, Director,
Michigan Geological and Biological Survey.

# PREFACE

This report is the result of a series of surveys initiated in the summer of 1906. During that season the shore of Lake Superior was visited at six points: Sault Ste. Marie, Munising, Marquette, Huron Mountain, Houghton and Isle Royale at Washington Island. In the summer of 1905 the region around Bay View in Emmet County was well covered in an independent study and these results are also incorporated. During 1907, 1908 and 1909, the flora of Ann Arbor, Jackson, Detroit and neighboring regions was studied. In 1910, 1911, 1912 and 1913, portions of the summers were spent at New Richmond, Allegan County. Brief trips were made to other points in the State; to Negaunee, Alpena, South Haven, etc, but due to dryness or to the time of year, comparatively little material was obtained. At all these places a considerable area was covered so as to include all possible habitats.

The purpose of the report is primarily to afford the people of Michigan a comprehensive account of the Agaric flora of the State. The extended study necessary to determine the material soon showed the need of critical notes for many species. Hence the report has developed into a manual of considerable size since it seemed worth while to include a large amount of general as well as scientific information, such as is widely scattered in books and journals and is not accessible to most readers. There resulted a two-fold arrangement of the commentary under the different species: first, an effort to simplify the identification of a species through suggestive comparisons and data of interest not given in the formal descriptions; second, critical discussions, from a more purely scientific standpoint, intended for advanced students and mycologists. Many species, especially those of small size and for which a microscope is essential for identification, have been discussed in the notes solely for the specialist. But every effort has been made to clarify the descriptions of the larger mushrooms to the advantage of the beginner.

All descriptions of species not in quotation marks were drawn from fresh plants collected in most cases by myself or sent to me immediately after picking. *The reported spore-measurements of all such,* except a few where noted, *have been made by me* and all

errors are therefore to be laid at my door; the same is true of the other microscopical details. Outside of the list of species reported by Longyear, nearly all of which I have collected also, few Michigan species which I have not seen in fresh condition have been included. It seemed safer not to rely on oral information as to the occurrence of a particular species. All available literature was used in the final determinations and the fresh specimens were compared carefully with the original descriptions of Peck and with those discussed in the works of Fries and many other mycologists. Most of the important works were taken along wherever collecting was done away from Ann Arbor, and besides this full descriptions and notes were written on the day on which the specimens were found. Usually sketches or colored drawings were also made of the fresh plants. In many cases photographs were obtained although this was not always feasible. The microscope was constantly at hand and spore-measurements were made on the day of collecting.

The descriptions of many authors are often very incomplete. Spore-size, presence or absence of cystidia, odor, taste, width or closeness of gills, and many other characters are often lacking. An attempt has been made to complete all descriptions so that the student may have a means to make full comparisons between species of a genus. I have found it very discouraging at times to find the one decisive character in a description lacking; in such cases it often becomes necessary to look through many books for the information wanted. No one can be more fully aware than I of the pitfalls lurking in such an attempt to emend the traditional descriptions. It seemed to me, however, that the errors which may have resulted from a wrong interpretation of some species were far outweighed by the information added to the many others. The principal claim for the descriptions is that they are relatively complete and accurate for the plants found in Michigan and that they were drawn from fresh material.

The work on the genus Coprinus has been done by Dr. L. H. Pennington for which I make grateful acknowledgment. That this difficult genus has been properly represented is entirely due to his efforts. Many of the species were cultivated by him in the laboratory and are strikingly shown in his photographs. The work was started while Dr. Pennington was still at the University of Michigan.

The genus Cortinarius has been included in the form of a preliminary monograph of the species of the eastern United States.



Experience has shown that it is scarcely wise at present to refer more than a few to synonomy because of the large number of species. Hence I have included the descriptions of those American species which I have not yet seen, placing them in quotations. The species found in the State can be easily separated by the locality given.

Throughout the work on this report I have been indebted to many individuals for help in identification, for specimens and for sympathy and encouragement. From Dr. Charles H. Peck who has so long held out a helping hand to beginner and specialist alike, I have received abundant and unstinted help. To Professor Geo. F. Atkinson I owe the foundation which has made the work possible. For their many favors I am deeply grateful. For material and suggestions I am also indebted to Dr. W. G. Farlow, Dr. R. A. Harper, Dr. C. E. Bessey, Dr. L. H. Pennington, Dr. L. L. Hubbard, Lars Romell and a number of others. To Dr. O. E. Fischer and Mrs. T. A. Cahn of the Detroit Institute of Science I am much indebted for abundant and excellent specimens, and especially to Dr. Fischer for the use of some photographs and for the chapter on Toxicology. Miss Rose Taylor made many collections at Negaunee.

I also wish to thank here those of my colleagues of the various departments of the University for their sympathy and interest and especially those officials who have so generously supplied the University library with the necessary books and plates for the special purpose of furthering this study; and also the staff of the Geological and Biological Survey, especially Dr. A. G. Ruthven, for their patience and encouragement during the long drawn out progress of the work. Grateful recognition is due to my wife for a helping hand in much of the detail work in caring for material, assistance in collecting and in the reading of the manuscript.

The photographs were taken and prepared throughout by myself except those obtained from Dr. Fischer. An effort was made to illustrate as many as possible of the plants not before illustrated. For all other plants full sets of references will provide the student with the means of comparison.

Cryptogamic Herbarium, University of Michigan, April 1, 1915.

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Plates I to CLXXII Vol. II

# THE AGARICACEAE OF MICHIGAN

C. H. KAUFFMAN

# GENERAL INTRODUCTION

## THE STRUCTURE OF AGARICS

An Agaric is a plant which, considered morphologically and physiologically, is composed of two portions: the vegetative, called the *mycelium*; the reproductive, called the *fruit-body* or *carpophore.*

### *The Mycelium*

When a spore, derived from the gills of a fruit-body, germinates it forms a protuberance on one or more sides; this elongates into the form of a filament, always growing at the apex and usually branching abundantly, so that finally a weft or mass of such becomes visible, even to the naked eye. The filaments thus formed are referred to as *hyphae,* or collectively as *mycelium.* In diameter they vary from 3 to 6 thousandths of a millimetre and singly can be seen only with the microscope. Cross-partitions are numerous and the separate divisions are the ultimate units of structure, i. e., the cells. Such mycelium is widely distributed in the soil, humus, decaying wood, etc., and once established is doubtless perennial, so that new supplies from spores are probably less common than ordinarily supposed. It absorbs its food directly through the delicate cell-walls and the interior of each cell is thoroughly saturated with water. It appears capable of withstanding considerable drying, perhaps for long periods, reviving and renewing its growth after receiving a new supply of moisture. In some cases the mycelium twines itself into strands which become dark colored and tough and which are spoken of as *rhizomorphs*; or minute tuber-like masses may be formed, termed *sclerotia.* These evidently also serve as a resting stage during dry weather. The mycelium is usually hyaline under the microscope, but massed together appears whitish to the eye; it may also have other colors, green, blue, red, yellow, etc., but these are not very common. When growing luxuriantly in artificial beds of manure it becomes the "spawn" of commercial mushroom growers. Methods are now in use in laboratories, by which many kinds of spores are germinated and the mycelium grown in pure cultures; the "spawn" obtained in this way is called "pure culture spawn."

The distribution of the mycelium in an undisturbed soil, as for

example, in a park, lawn, fallow field, roadside or in woods, may be considerable, extending underground for rods, so that the size of the plant in the vegetative stage, in a linear sense, is quite large. Under such permanent conditions, quite a number of species form "fairy rings" when they fruit. The mycelium is started at one point and if the soil is favorably homogeneous in every direction, growth continues radially from the original point and at the circumference of this patch of mycelium, where growth activity is greatest, the fruit-bodies appear each year. In one case a "ring" with a diameter of 65 feet was observed by MacQuan in Africa. (Grevillea, 1880-1881.) The appearance of the fruit-bodies of some species "in troops" is usually due to the fact that only one arc of the circle is left. In the forest, obstacles are too numerous so that the "ring" does not remain perfect and the fruit-bodies appear scattered promiscously. Observations made in a clean forest in Europe for a period of ten years showed that the "ring" of some forest species traveled radially for several rods but the periphery at length became obscure. The mycelium of many species doubtless is more affected by irregularities in the food supply and hence grows in an unequal manner, or produces such few fruit-bodies that the radial growth does not show. Doubtless also where there are scores of different kinds growing in a small area they intertwine or interfere with each other. During continued wet weather the compressed masses of fallen leaves in frondose woods are often found to harbor patches or sheets of mycelium of many species, which are easily observed by removing the top layers of leaves and which are a forerunner of a good crop of fruit-bodies if the humidity is maintained. Curious sheets of mycelium, of the appearance of sheets of paper, are sometimes found between planks or other piled up lumber, but these usually belong to the Polypore group of fungi.

### *The Fruit Body*

The fruit-body, or carpophore, is the portion popularly referred to as *the mushroom,* but it must be remembered that it is only a temporary product of the plant as a whole, just as is the apple of the tree which bears it. It is usually composed of the *pileus* or cap, *lamellae* or gills, and a *stipe* or stem; in the genera Amanita, Amanitopsis and Volvaria there is present in addition a *universal veil* which breaks away and forms a volva on the stem. In Amanita, Lepiota, Armillaria, Pholiota, Cortinarius, Stropharia, Chamaeota and slightly in a few other genera, there is found a *partial veil,*



which on breaking away may form an *annulus* in some of these. For details see the introduction to these genera. The essential parts are the *gills* and *pileus* and these are present in every species described in this book; the stem, however, is also usually present and such a fruit-body is a typical Agaric. The tissue of the fruit-body is primarily an aggregation of hyphae, and hence merely an extension of the mycelium, compacted to form a specialized structure. When a portion of the pileus is cut radially, or of the stem longitudinally, and magnified with the microscope, it is seen that these are merely masses of parallel or interwoven hyphae composed of cells, very similar to those of the mycelium. Some of it is specialized to be sure, as is the cuticle of the pileus or stem; sometimes portions are gelatinous, others hardened or encrusted, but this is more evident in the mature plant. The tiny beginnings of the mushroom are composed of much the same kind of hyphae throughout.

### *The Pileus*

The pileus is essential in that it bears the gills. There are only a few known species in which the gills radiate out from the top of the stem minus any cap, and these constitute the rare genus Montagnites, none of which are known in our state. The principal parts of the pileus are the surface layer, the margin, and the flesh or *trama.* For the many variations of the structure and form of these it is necessary to consult the glossary. (See also Fig. 1.) The trama may however, be briefly considered: in the young, fresh or actively developing fruit-body the hyphae of the trama are usually compact and appear like actual filaments, but as it approaches maturity the hyphae varies. In some, e. g., Coprini, the cells of the hyphae quickly loosen from each other and become rounded, and the whole pileus, if not quickly dried by the wind, collapses. Others are less evanescent and in these the tramal hyphae, although loosened considerably, support the pileus for some days. Many of the larger forms, e. g., Tricholomas, retain their compact form for a long time, and in tough species like Lentinus the hyphae of the trama appear to retain their close-lying position unchanged. The trama of the Lactariae is unique and is described under that group. Many of the smaller Agarics like Mycenas and Galeras have comparatively few layers of hyphae, often of very large cells.

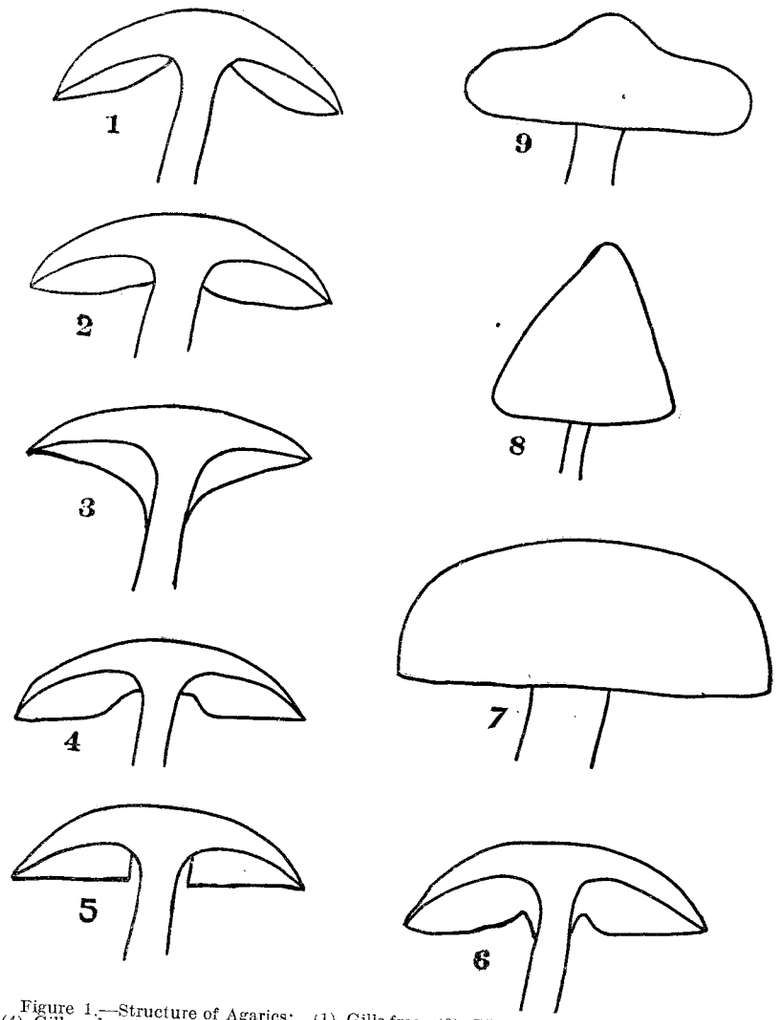


Figure 1.—Structure of Agarics: (1) Gills free; (2) Gills adnate; (3) Gills decurrent; (4) Gills adnexed; (5) Gills seceding; (6) Gills emarginate and uncinate; (7) Pileus convex; (8) Pileus conical; (9) Pileus campanulate.



### *The Gills*

Underneath the pileus the gills are attached in the form of knife-blades collectively called the *hymenophore*. Gravity appears to be responsible for their position on the lower side. Rarely one finds an outgrowth of an abnormal character on the top of the pileus, sometimes in the form of a second mushroom of the same kind with or without a stem, sometimes with the gills growing upward from a small area of the main cap. The latter case has never been satisfactorily explained. The gills are of course attached all along their thicker edge to the pileus. They may be attached to the stem at their inner end, also called the posterior end or base; or they may be free, i. e., not reaching the stem or at least not attached. The manner of attachment is shown in Fig. 1, 1-6, as adnexed, adnate or decurrent. These are important characters for the separation of genera. In some cases all the gills extend from the margin of the pileus to the stem, in many, however, they are dimidiate or with very short gills at the margin of the pileus. The spacing of the gills is quite important, but considerable variation occurs in the same species; only relative terms seem usable: crowded, close, subdistant and distant. The same may be said of their width.

It is very important to understand their structure. Here a microscope is necessary. A section cut tangentially across the pileus and gills will show a good view of the appearance of the trama, etc., of each lamella. The interior is again composed of hyphae and in such a section they lie either parallel, converging along the median axis, diverging, or interwoven irregularly. In all cases this is the gill-trama and is bordered by the hymenium.

### *The Hymenium* (See Fig. 2, 1.)

The border which extends over the whole surface on both sides of the gills is the hymenium. While the hyphae may lie in a general way parallel to the axis of our section, the large club-shaped cells which form the border extend outward at right angles to this axis and form a sort of nap like that of a Brussel's carpet. These large cells are the *basidia*, (singular, *basidium*), and at its apex, as seen in the figure, each basidium bears typically four *spores;* rarely it may develop only two spores or even three. Each spore is attached by a minute stalk called the *sterigma*, (plural, *sterigmata*). The basidia are in turn continuations of the hyphal filaments which compose the trama of the gills. Often there is a slight specialization

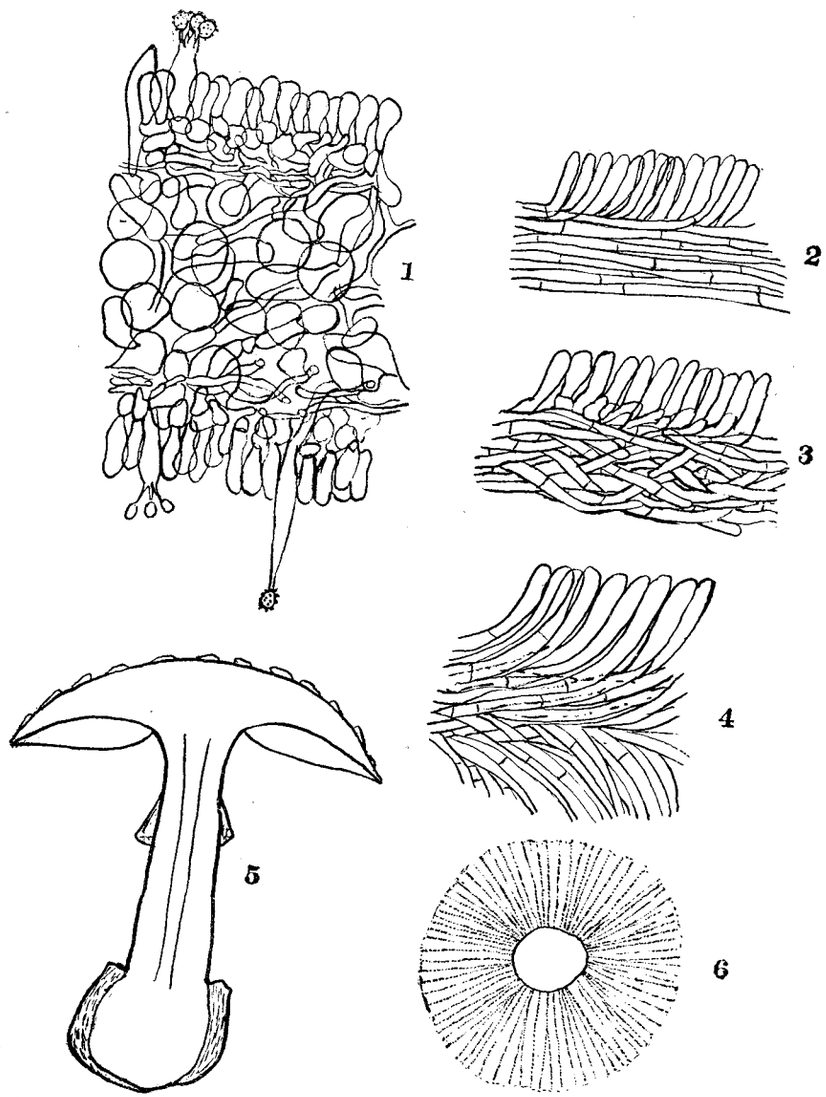


Figure 2.—Structure of Agarics: (1) Vesicular trama of a section through a gill of a Russula, showing also the hymenium, basidia, and a cystidium (adapted from Fayod); (2) Parallel gill-trama-diagramatic; (3) Interwoven gill-trama diagramatic; (4) Divergent gill-trama diagramatic; (5)Section of Amanita, showing volva, annullus and scales on the pileus.



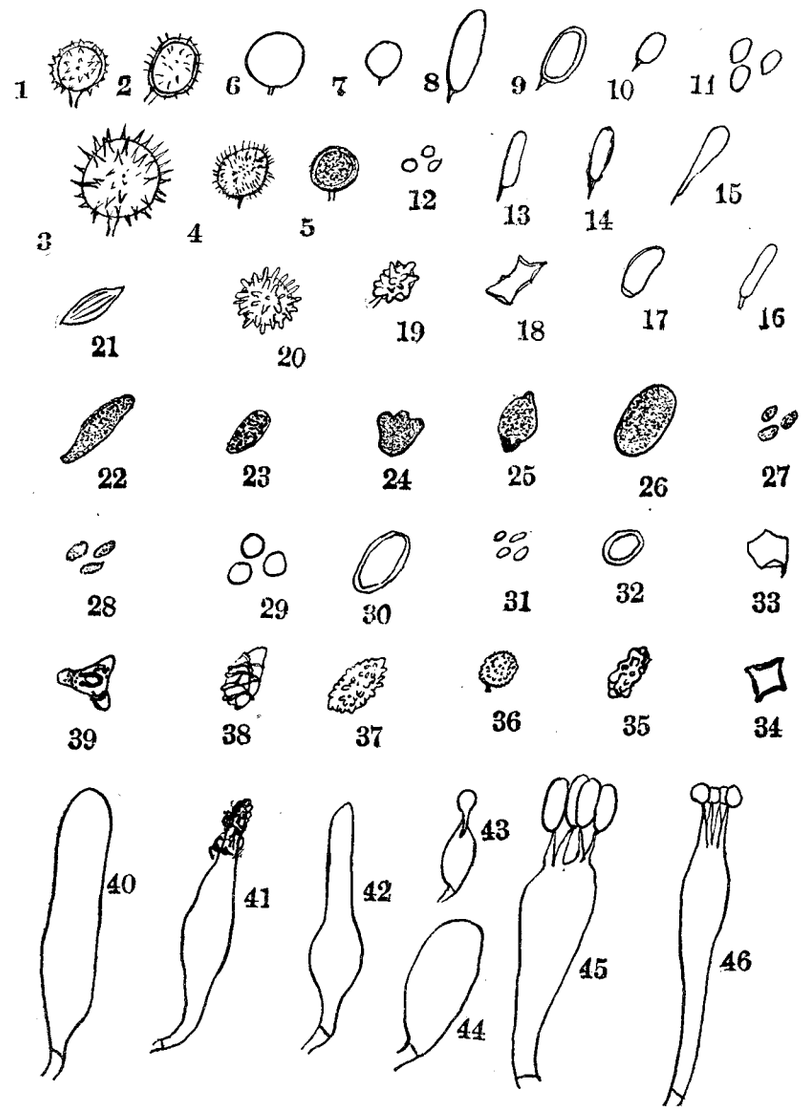


Figure 3.—Types of spores drawn to scale: (1) Russula decolorans; (2) Lactarius nigricans; (3) Lactarius tortilis; (4) Inocybe galliardi; (5) Coprinus sp.; (6) Amanita porphyria; (7) Trichloma laterarium; (8) Amanita peckianium; (9) Lepiota procera; (10) Lepiota naucina; (11) Tricholoma equestre; (12) Tricholoma nobile; (13) Cantherellus clavatus; (14) Hygrophorus subborealis; (15) Marasmius sicus; (16) Inocybe infelix; (17) Inocybe caesariata; (18) Inocybe decipientoides; (19) Inocybe leptophylla; (20) Inocybe calospora; (21) Clitopilus prunulus; (22) Gomphidius maculatus; (23) Coprinus atramentarius; (24) Coprinus boudieri; (25) Hypholoma rugocephalum; (26) Coprinus sterquillinus; (27) Hypholoma hydrophilum; (28) Psalliota arvensis; (29) Cropidotus putrigenus; (30) Pluteolus coprophilus; (31) Pholiota flammans; (32) Plueteus cervinus; (33) Entoloma clypeatum; (34) Entoloma cuspicatum; (35) Noleana dystales; (36) Cortinarius annulatus; (37) Cortinarius atkinsonianus; (38) type of reticulated spore; (39) Heliomyces nigripes; (40-44) Cystidia; (45-46) Basidia.

of the hyphae just inside the hymenial layer termed the *subhymenium*.

The hymenium may include, along with the basidia, cells of other shapes or functions; the *cystidia* (singular, *cystidium*), (see Fig. 3, 40-44) are elongated, cells fusiform, lanceolate or have various shapes according to the species, and project at maturity above the basidia. Their function apparently is to aid in the exudation of water from the plants. (F. Knoll, Jahrb. Vol. 50, p. 453.) The presence or absence of *cystidia* is much used to identify certain species. The observations must be carefully made, however, since they quickly collapse at maturity in some cases, and in others do not elongate until full maturity of the mushroom. They occur more or less scattered over the surface of the gills and are often tipped with oxalate of lime crystals. Also, they may occur on the edge of the gills and give this a minutely flocculose or fimbriate appearance. More frequently the edge is provided with elongated *sterile cells* of various shapes which produce the same effect as cystidia. In this work these are the only "sterile cells" referred to in the descriptions.

The spores vary in size, shape, color, structure of surface, etc., and are fully discussed under each group. (See Fig. 3, 1-34.)

The *stem, volva* and *annulus* are also described under each genus possessing them.

### HABITAT AND GROWTH CONDITIONS OF THE AGARICS

The Agarics, like all fungi, are either saprophytic or parasitic. They are dependent on organic matter for a large part of their food; this is due to the absence of chlorophyll which makes them incapable of manufacturing carbon-compounds from the air. As saprophytes they occur on a great variety of substrata; soil, humus, dung, wood, fallen leaves, bank, straw, dead animal remains, decaying fungi and forest debris of all sorts. They can even be cultivated in the laboratory on gelatine and agar with proper addition of sugars, etc. As parasites they are found on living trees or shrubs, rarely on herbs. They are often attached to the rootlets of trees and shrubs on which they cause formation of *mycrohiza*; some consider this relation a parasitic one.

The fleshy fungi are most abundant in woods and forests and hence are largely dependent upon the character of the forest. When the woods are cleaned or the forest cut down, there is often quite a change in the flora of such a place after a few years. In



addition to the proper food supply for their growth, moisture and temperature are the two most important factors for the rapid development of the fungi. The fruit-bodies of mushrooms contain a very high proportion of water, varying between 70 and 95 per cent according to species, weather conditions, age of plant, etc. The mycelium is also composed of much water which fills the vacuoles not occupied by the protoplasm. In spite of this fact, a far greater number of species occur in the upland forest than in wet swamps or marshes. It appears as if either some unfavorable soil content of a poisonous nature or too great an abundance of water prevents the mycelium of many species from growing in low wet places or at least prevents them from fruiting. Only certain kinds grow in marsh soil; although where there is an abundance of brush, logs or debris which can be used for support the moist surroundings are very favorable to forms which prefer such substrata. The largest number of species are found in forest hillsides, ravines, etc., where there is a clay sub-soil or where the forest floor is covered with sufficient humus, dead leaves, thick moss or other debris to hold the moisture. With the moisture content neither too large nor too small in such situations and where severe drying out is prevented, it would appear that the mycelium can vegetate luxuriantly, and after rains, especially long continued rains, the fruit-bodies or "mushrooms" form abundantly.

The temperature must also be favorable for each species. Warm or "muggy" weather, continued for several weeks with accompanying rains, usually causes the woods and fields to bring forth a good crop of mushrooms during July and August. Later, in September and October, an entirely different group of species appears, often in relatively cool weather; and some species often appear after the first frosts, always provided that the soil has been previously moist enough for the mycelium to vegetate sufficiently. Romell (Hymen of Lapland), reports that Agarics were abundant near the tree-line, and even in the region along the tree limit right up to the line of perpetual snow. This would indicate that for some species temperature is not so important as moisture, although growers of mushrooms in artificial beds in cellars, etc., find the temperature a very critical factor.

It must be remembered that time is also an element. After a drought it may take several weeks of steady rains before the fruit-bodies appear above ground. Rotten wood and logs retain the moisture and a single rain is often sufficient to induce growth. A single heavy rain or even a number of scattered showers, if too far

apart, are not sufficient to produce a crop outdoors. The exact combination of temperature, time and moisture necessary is hard to calculate with certainty even after much experience. The mycelium must be sufficiently well developed before it has enough energy to produce fruit-bodies and this development is often slow for reasons not clear to the collector. Every field student of mushrooms knows that there are "good" collecting grounds and poor collecting places. The conditions mentioned above are probably responsible in large part and yet very similar fields or woods may be exceedingly unlike in the number and abundance of forms which are found in them. Just why this is so is not understood.

The species which grow on living trees are many. The most prominent are here given:

*Armillaria mellea.* (On roots of living trees.)
*Armillaria corticatus.* (Hickory, maple.)
*Collybia velutipes.* (Willow, birch, oak, alder, elm, poplar, etc.)
*Pholiota adiposa.* (Maple, oak, ash, etc.)
*Pholiota albocrenulata.* (Maple, birch and hemlock.)
*Pholiota destruens.* (Yellow birch, willow.)
*Pholiota spectabilis.* (Birch, oak, etc.)
*Pholiota squarrusoides.* (Maple, birch, beech.)
*Pholiota squarrosa.* (Birch, beech, willow, poplar, alder, etc., in Europe.)
*Pleurotus applicatus.* (Maple, poplar, birch, etc.)
*Pleurotus atrocuerulius.* (Mountain ash, sorbus, etc.)
*Pleurotus ostreatus.* (Willow, birch, basswood, beech, oak, walnut, locust, etc.)
*Pleurotus sapidus.* (Similar to *ostreatus.*)
*Pleurotus subareolatus.* (Maple, basswood.)
*Pleurotus ulmarius.* (Maple, elm, basswood, hickory, etc.)
*Volvaria bombycina.* (Maple, beech, elm, horse-chestnut, etc.)

These species are probably all capable of some degree of parasitism, i. e., can affect living tissue. Direct evidence as to the extent of this power in each species is hard to get. The spores probably effect an entrance at a wound, the plant first growing on the dead tissue at the wound, then pushing through the heartwood which becomes rotten as a result and finally affecting the sapwood and cambium and so injuring the vitality of the tree. Even if not killed by the fungus, the decayed interior is a source of mechanical weakness and the tree is eventually blown down by storms.



The rotting of cut or structural timber by the mycelium of some Agarics is perhaps equally important. Bridge timbers, railroad ties and even house timbers may be attacked. *Pholiota aeruginosa* is perhaps a much greater enemy of railroad ties than the rare occurrence of its fruit-body would indicate. *Lentinus lepideus* has long been known as a destructive agent to all sorts of timber. Firewood left in the woods in moist situations, even if piled up, may be attacked by a great variety of the smaller Agarics. There can be no doubt that fungi of all sorts, including Agarics, are extensive agents of decay and are much more effective than bacteria in bringing about the disintegration of dead vegetable matter and thus returning it to the soil; it is only in the later stages of decay that the bacteria play the greater role.

Agarics may show a decided preference for a certain substratum, e. g., kind of wood, kind of dung, kind of leaves, etc., on which they grow. Some are sharply limited to coniferous wood and are never found on wood of broad-leaved trees. Others seem to thrive well on a great variety of substrata. A few are parasitic on other mushrooms. (See Nyctalis.) The field mushroom *Psalliota arvensis* and the common mushroom *Psalliota campestris* are scarcely ever found in the woods, just as *Cortinarius armillatus* is never found in the field. Some consider that the soil is here the controlling factor. It must be remembered, however, that it is decaying vegetable food, which is the foundation of the subsistance of the mushroom, and the presence of barnyard manure or the fact that sheep have pastured in a field is after all more effective than the mineral content. This question is not yet settled and French mycologists lay quite a little stress on the mineral content of the soil, insisting that calcareous soil and clay soil are the homes of different species. With regard to Michigan species, the data are not sufficiently clear.

### THE DISTRIBUTION OF AGARICS IN MICHIGAN

Any attempt to give a definite account at the present time of the distribution of species in the state is fraught with difficulties. Many localities have not been visited, and only a prolonged study of a locality reveals an approximation of the species occurring there. The very fascination of the search for fungi consists in their sporadic appearance. The species appearing one season may be absent the next. Some species fruit apparently only at long intervals; others only under special weather conditions.

The principal points in the state around which sufficient collect-

ing has been done to be of any use in such a summary are shown on the accompanying map. By far the largest part of the material of this report has been collected by myself, assisted at Ann Arbor by some of my students. Entire seasons have been spent at Ann

Figure 4.—Map of Michigan showing centers of principal collecting areas.

Arbor, New Richmond, Bay View and along the shore of Lake Superior and the flora of these regions is now partly known. The activity of members of the Detroit Mycological Club has resulted in a good survey of the region around Detroit. Between the years 1896-1903, Longyear and his co-workers studied the flora of East Lansing, and also obtained material from Greenville, Chatham



and other points. A few species have been received from isolated points but usually such are common and of wide distribution. The main central portion of the Southern Peninsula north of latitude 43° has not been touched; and from the iron-bearing regions of the northern Peninsula there are no records. Isle Royale was visited in a dry season and there were few important finds. Houghton, Marquette, Munising and Sault Ste. Marie were the centers of one season's extensive collecting and we have a fair idea of their summer flora; concerning the many autumn species which assuredly grow in the coniferous regions of the northern half of the state, we have little information, as most students and collectors must return to their school duties before October.

The principal species of field and lawn seem to be equally distributed throughout the state; here may be mentioned *Psalliota campestris* and *Psalliota arvensis, Marasmius oreades, Psilocybe foenesicii, Lepiota naucina* and the Coprini. It appears that *Lapiota Morgani* begins to disappear in the latitude of Lansing; that *Amanita caesarea* scarcely enters our southern border. The species which grow only on distinctly sandy soil are apparently distributed throughout the sandy regions of the state although in many cases the records are not complete; for example, *Amanita russuloides* and *Amanita spreta* have been found only at New Richmond whereas *Russula delica* is abundant in sand under copses and groves all along the Great Lakes, but less abundant in the interior of the state. Many species doubtless prefer a clay soil and are distributed accordingly. By far the larger number of species are, however, dependent for their distribution on the character of the forest. This is most sharply illustrated by the difference between the flora of the coniferous regions north of latitude 44° and along the eastern and western border of the state where conifers have existed in the past, and of the hardwood forests and woodlots of the southern portion. The genus Cortinarius is composed of seven large subgenera. Of these, the subgenera Bulbopodium and Phlegmacium have a large number of representatives in the hardwood region, but are poorly represented in the north; on the other hand, the subgenera Telamonia and Hydrocybe occur in large quantities in the coniferous regions. Whatever factors, therefore, influence distribution of conifers doubtless affect also the distribution of certain Agarics. It is much to be regretted that we have so little data concerning the original mushroom flora of the 15,000 square miles of the central-portion of the Southern Peninsula once covered by white pine forests. The nearest approach to original conditions, recorded in

this report, was found by the exploration of the white pine lands around New Richmond. None of the virgin pine forest is left at this place, but second growth groves still yield characteristic fungus forms. Many of the sand plains at New Richmond remain uncultivated and are covered with scrub oak; here, however, the pine flora is no longer in evidence except as isolated species. Alternating with the sand plains are clay lands originally covered by hemlock and hardwoods. In the ravines bordering the river bottoms, there are still remnants of these forests and these yield a flora which is comparable with that of Bay View, Marquette, and wherever such forests exist. The flora of the tamarack bogs seems to be very similar throughout the state. In the tamarack bogs around Ann Arbor, we find the same species which are found in the northern bogs.

It is still an open question to what extent the formation of mycohiza may influence the distribution. If certain species can thrive only within reach of the roots of the beech tree for example, then those species are to be looked for only in beech woods. Evidence, however, is at hand to show that some species can form mycorhiza on a number of hosts. Every collector has experienced the feeling that many species growing on the ground in the woods are always to be looked for in the neighborhood of certain tree species. Perhaps collectors exaggerate this impression but in any case the subject needs clearing up. With regard to species found regularly occurring on wood, there is no doubt that they follow more or less the distribution of their specific substrata. In some cases, to be sure, a species may have a wide selection of material on which it can grow, and hence its distribution is not limited in such a manner. The species which have a parasitic tendency, like *Pleurotus ulmarius,* must have their distribution controlled to a large extent by the presence of the foster plant, although no Agaric which requires a living host at all times seems to be known with certainty.

## COLLECTING AND PRESERVING AGARICS

### *For the Table*

A basket, clean white tissue paper cut a foot square, a large pocket knife, a knowledge of mushrooms, favorable weather and the right place—these are the essentials. Of these the possession of accurate information is most important, since ignorance may mean sickness or death. If inexperienced and dependent on others for guidance,



proceed cautiously and do not become over-confident. Collect first in meadows, pastures and open grounds away from thickets and woods. Always take every part of a mushroom of which you wish to make a study. As soon as you have advanced sufficiently to be able to recognize different kinds always wrap up the species separately. If you are learning how to identify by means of this book, it will be well to run down and compare the description after every collecting trip so as to become versed in the meaning of terms and also as a check on the correctness of your own or others' opinions.

Avoid the genus Amanita. Also at the first avoid anything that appears to belong to the genera Entoloma, Tricholoma, Hebeloma and Inocybe. Avoid all which are no longer fresh and firm, or which have small burrows due to grubs. Avoid the large, colored forms until you are well advanced in the subject. All except Amanitas may be tasted without swallowing with entire safety; avoid all that have a powerful peppery or nauseous taste. Dr. Peck states that he has always found those with a taste of fresh meal (farinaceus) to be edible. Avoid the green-gilled Lepiota. Avoid those with a milky juice until you know a great deal about them.

Try the large white forms which grow on tree-trunks, *Pleurotus ostreatus, sapidus* and *ulmarius.* Try the meadow, field and street mushrooms: *Psalliota campestris, arvensis* and *rodmani.* Try the inky caps, *Coprinus micaceus, atramentarius* and *comatus.* From the woods, always after a thorough study, try *Russula virescens, Hygrophorus russula, Tricholoma personatum* and *nudum. Hygrophorus sordidus* and *Tricholoma resplendens* are two white mushrooms of excellent flavor, but beware of mixing them with the white Amanita. If you live among evergreen woods try *Cortinarius violaceus,* if in southern Michigan *Cortinarius michiganensis.* After a start is made, others, one at a time, should be thoroughly studied until finally every trip will yield a meal.

My advice to all beginners and amateurs is: *Collect and study the deadly Amanitas first.* I have found many people who had known and eaten a few kinds for a long time, who were entirely ignorant of any Amanita; such people are always in danger in spite of and often because of their self-confidence. Fatal poisoning does not infrequently occur to just such people.

The specimens should in all cases be carefully gone over again before cooking. An excess supply can be kept on ice for a day only. Samples from the basket can be laid overnight with gills down on

white paper and covered, so that the spore print may be used next day to check any error before cooking.

*For the Herbarium*

The fleshy Agarics may be placed in alcohol but if the container is much handled the specimen soon becomes mushy or crushed; if, however, it is carefully mounted and fastened on a glass plate and immersed in a stationary glass jar it may retain its shape a long time. The alcohol will dissolve the color and extract it. The best way to make a herbarium of these plants is to dry them on a square piece of wire-netting suspended over a kerosene or other flame. In this way the mushroom gradually dries without cooking or scorching. The color may or may not change and this fact itself is useful to distinguish between species. The dried specimens are very fragile and should be transferred for a day to a moist atmosphere where they will absorb moisture enough to become pliant. They can then be straightened or gently flattened but should not be pressed. Placed in a box with a proper label and a handful of naphthalene or moth balls they will last indefinitely. If beetles attack them they must be fumigated in a closed box with carbon-bisulphide; but if the naphthalene is constantly kept with the specimen the beetles seldom find their way thither. The use of boxes of varying size is much to be preferred to the method of pressing and mounting on sheets practiced by the older herbarium men. In either case, if specimens are very valuable beetles can be kept away with greater certainty by Peck's method of the use of strychnine. This is dissolved in warm water and sufficient alcohol added to enable one to spread the mixture easily.

| | |
|---|---|
| Sulphate of strychnia | 1/8 oz. |
| Warm water | 5 oz. |
| Alcohol | about 2 oz. |

*Notes for the herbarium.* Specimens dried and prepared as above are of little value unless they were correctly identified when fresh by a mycologist, or, in case they remain unidentified, they be accompanied by full notes of the characters in the fresh condition. The taking of good notes is in itself a sign of a trained mycologist. But amateurs can, by care and patience, sufficiently describe a plant so that the specialist can identify it. It is advisable that they follow an outline, of which many have been published. The better way



is to write a formal description, but if this is too difficult for the amateur the following outline may be used:

(If you wish the best attention from the specialist, do this part well. See glossary.)

LOCALITY.

DATE.

FINDER.

WEATHER.

HABITAT: ground, leaves, humus, woods, open grove, field, lawn, wood (kind), tree (kind), moss, dung (kind), etc.

HABIT: solitary, gregarious, cæspitose, subcæspitose, scattered, etc.

ODOR: farinaceous, pungent, nauseous, amygdaline, nitrous, earthy, mild or slight, etc.

TASTE: bitter, acrid, peppery, farinaceous, agreeable, mild or slight, etc.

PILEUS: *size. Shape when young;* conical, campanulate, acorn-shaped, cylindrical, convex, etc.

*Shape when expanded:* plane, convex, obtuse, umbonate, umbilicate, depressed, etc.

*Surface:* viscid, dry, hygrophanous, moist, glabrous, silky, fibrillose, virgate, floccose, tomentose, scaly (kind of scales as: loose, innate, erect, squarrose, pointed, fibrillose, large, superficial, appressed, etc.), even, rough, wrinkled, rugose, striate, furrowed, etc.

*Margin:* (when young), incurved, straight, inrolled, glabrous (when older), regular, irregular, wavy, tomentose, hairy, striate, rimose, etc.

*Color:* (when fresh and moist) (after lying a while). *Important.*

GILLS: *attachment:* adnate, adnexed, decurrent, uncinate, free, remote.

*Width,* relative to thickness of pileus, relative to species you know, or in millimeters.

*Shape,* linear, equal width throughout, ventricose, attenuated in front or behind, broadest in front, etc.

*Spacing,* (relative) crowded, close, subdistant, distinct, few.
*Texture,* waxy, deliquescent, dissolving, dry, arid, fleshy.
*Variations,* forked, crisped, veined, intervenose, anastomosing, dimidiate.
*Edge,* acute, obtuse and thick, serrate, eroded, entire, fimbriate, flocculose, wavy, etc.

COLOR: very important to give the color of the gills in the young plant, (e. g., Cortinarius, etc.), also when mature, after bruising or touching.

STEM: *size,* length, thickness above and below.
*Shape,* cylindrical, tapering up or down, bulb (clavate, rounded, marginate, or abruptly depressed, large or small), flexuous, straight, equal, ventricose, rooting.
*Texture,* fleshy, cartilaginous, tough, flaccid, brittle, flexible, fragile, spongy, fibrous, rigid, etc.
*Interior,* hollow, tubular, cavernous, stuffed by pith, solid, spongy, etc.
*Surface,* (see *Pileus.*)
*Color,* difference at base and apex, within and without after handling, etc.

FLESH OF PILEUS: *consistency:* rigid, compact, spongy, soft, brittle, etc.
*Color:* when moist, under cuticle.
*Juice:* taste and color, abundance, changing after exposure to air.

MYCELIUM: color, abundance.

UNIVERSAL VEIL in young specimens, method of rupturing.

VOLVA: size, texture, color, present, absent.

PARTIAL VEIL: in young specimens.

ANNULUS: texture, color, present, absent, fugacious, persistent, ample, slight, etc.

SPORES: color of spore print, drawing of spores, size.

CYSTIDIA: shape, abundance, present, absent.

SKETCH: a good sketch or diagram of plant or its parts.

REMARKS.



### PHOTOGRAPHING AGARICS

Use a basket to collect for this purpose. It is well to have tin boxes, e. g., cocoa boxes, so that each specimen can be kept unharmed, wrapped separately in tissue paper and placed upright in the box. Amanitas especially become deformed or lose some of their surface tissue if not properly protected. The specimens can be set upright on decapitated pins in a row as in the photographs in this report. Natural size photographs are by far the best since comparisons are then easily made. For identification purposes such photographs are much more useful than those taken in the natural surroundings and reduced in size; the latter may be good pictures but are rarely helpful. Every part and every character used in a description that can be shown in a photograph ought to be brought out; to this end the specimens must be properly arranged and the details emphasized. Besides its value in this respect the photographing of Agarics yields much pleasure and entertainment.

### THE CULTIVATION OF MUSHROOMS

The history of this business and the methods in use, whether on a commercial scale or for home use, have been so often described that the reader is referred to those works. The best and most complete account is to be found in Bulletin No. 85, Bureau of Plant Industry, U. S. Dept. of Agriculture, entitled: *The Principles of Mushroom Growing and Mushroom Spawn Making,* by Dr. B. M. Duggar. For other papers see Bibliography, part (d), and the mushroom books of Atkinson, Hard, McIlvaine, etc.

## THE CLASSIFICATION OF AGARICS

The plant kingdom consists of two large groups; the seed-bearing plants or Phanerogams and the spore-forming plants or Cryptogams. The latter are sometimes referred to as "the lower plants" although they include also the large, tree-like ferns. The Cryptogams include the green plants like the Algae, Mosses and Ferns; they also include an enormous number of plants which do not possess the ordinary green color and these are the FUNGI. In the following outline of the fungi the grouping is given in a scientific manner, since this is the only arrangement sufficiently accurate. For the terms which are strange to the beginner, reference must be made to the glossary. Consistent perseverance and the use of elementary books on botany are the only self-helps that can be advised when one is first plunged into the subject. The best way to begin the study is by the help of a teacher or of a companion who is already somewhat informed and is enthusiastic enough to help others. Mycological clubs are of great value in this respect. This work treats only of a single one of the many families of Fungi, and for others the student is referred to the books dealing with the other groups.

### *The Keys*

The arrangement of the species of each genus in the form of keys or synopses is entirely artificial and arbitrary; hence these keys are merely guide-boards to point the student in the right direction by the use of selected characteristics of each species. A specimen is not to be considered identified when it is "run down" in the key, but the name so obtained should be referred to in the text and the description of the plant carefully applied to the specimen in hand. Such keys cannot be constructed so as to be perfect since plants of this class are quite variable and one often finds specimens not at all typical and hence they do not fit into the key at the right place. An amateur should use the glossary constantly at first until the meanings of the terms become fixed. Many of these keys were tried out for years on fresh plants and continually revised and it is hoped they will seldom mislead very far. The keys are mostly dichotomous; starting on the left, the plant must agree, for example

with either (a) or (aa). This leads to (b) and (bb) or to the name of the plant. Sometimes the letters are tripled, etc., as (aaa), (aaaa). In that case there are three or more possibilities to choose from.

### *Arrangement of Species in the Text*

The student will find, besides the keys, another means of identification. This is an arrangement in the text, by which the species which are the most closely related are grouped side by side. This is called a "natural classification" and is supposed to represent a relation according to the laws of evolution. Authorities differ on many points involved in such an arrangement, and hence it was necessary to follow, according to my best judgment, the order which appeared to be at the present time most acceptable. Our knowledge of many species is still too imperfect to expect any final arrangement. Furthermore, the number of species of such a small area of the world's surface as Michigan, is not representative of a like arrangement if applied to all the species of Agarics the world over. In view of this fact it seemed useless to try to be entirely consistent throughout the work. The genera are therefore subdivided in the way best adapted for each, although a general uniformity is approximated. The genera may be divided into subgenera and sections, and sometimes the sections are subdivided. In this way the most closely allied species are usually found together under the last subdivision.

### *Nomenclature*

The rules of the International Botanical Congress held at Brussels in 1910, have been used (see Authorities and Abbreviations). Synonyms have been purposely omitted except in so far as they are mentioned in the commentaries. The study of synonymies is apt to become a "wild goose chase" and often offers nothing of importance for those who wish to become acquainted with the living plants; it is well adapted for those who prefer to make their mycological studies in the herbarium and library. There is little doubt that in the course of time, some of our American plants which were supposed to be different and were given names, will be found to be synonyms of European species. But there is no need of passing judgment on such till the evidence is all in. Undue haste in considering species identical has often brought about more error than existed in the first place. The field mycologist is constantly finding species which he had given up as hopeless synonyms, and much collecting will make a mycologist cautious. A keen observer, like Dr. Peck, will often be quite certain of the distinctness of two species but fails in the description to make the distinction clear or strong enough to others. In such a case herbarium material may not show the facts and only the finding of fresh plants can settle the question.



The making of new species in haste is equally unfortunate. In the preparation of this work, scores of unidentified species accumulated, and many still remain unidentified. In many cases, however, the repeated finding of the same thing, often in better condition, perhaps with the necessary young stage, and further and better study on each occasion, resulted finally in its determination. Except in a few genera where I had made more extensive collections and a more exhaustive study, for example in Russula and Cortinarius, I felt it unwise to describe as new more than a few striking species. In spite of the accumulation of synonyms and the great possibility that more American species will end as synonyms, I believe that there are still quite a few Agarics in the United States which are unnamed. But it is hoped that such an expression of my view will not cause every amateur to give names to those he is unable to identify. In the recent German work of Ricken (Die Blätterpilze) over 1500 species of Agarics are given for Germany, Austria and Switzerland alone, and very few new species are included. This is a good example of conservatism with reference to the making of new species.

Credit has been given to Fries wherever possible in the use of names of European species, even where the species is reported under Agaricus in the Systema Mycologia. In certain genera only, where sufficient critical work has been done, e. g., Inocybe, has this procedure been varied. If inconsistencies occur it is because the methods of mycologists past and present have been inconsistent. Outside of possible errors each case has been treated with regard to the Brussels Rules on the one hand and the latest facts obtainable on the other. An attempt is made under many of the species to present as much material as possible for the further study of the species.

### AN OUTLINE OF THE FUNGI

I. Mycelium lacking. *Bacteria.* *Mycetozoa.* *Chytrids.*

I. Mycelium forming the vegetative part of the plant. II.

II. Mycelium non-septate, (i. e., without cross-walls). *Phycomycetes.*

II. Mycelium septate, (i. e., composed of many cells). III.

III. Spores not borne on a differentiated hymenium, not in asci nor on basidia. *Fungi Imperfecti.*

III. Spores usually borne on a differentiated hymenium. IV.

IV. Spores borne in asci, usually eight in an ascus. *Ascomycetes.*

IV. Spores borne on basidia, usually four on a basidium. *Basidiomycetes.*

### *The Basidiomycetes*

(1) Basidia not forming a hymenium; spores borne on a four-celled basidium arising from resting-spores; parasites. *Smuts and Rusts.*

(1) Basidia arranged so as to form a hymenium.....(2)

(2) Hymenium not in a special fruit-body but developed directly from the vegetative hyphae in the host. *Exobasidii.*

(2) Hymenium on or within a special fruit-body.....(3)

(3) Hymenium concealed within the fruit-body till spores are mature. (See 10th Rep. Mich. Acad. of Sci., p. 63.) *Gasteromycetes.*

(3) Hymenium exposed .....*(Hymenomycetes.)* (4)

(4) Basidia forked or divided into four cells; plants usually gelatinous, horny when dry. *Tremellales.*

(4) Basidia clavate or subcylindrical. *Agaricales.*

### *Key to the Families of Agaricales*

(1) Hymenophore* not differentiated; basidia scattered on a loose subiculum of hyphae. *Hypochnaceae.*

(1) Hymenophore even, not forming special branches, tubes, gills, etc. *Thelephoraceae.*

(1) Hymenophore in the form of wrinkles, warts, spines or tooth-like plates, usually on the under side of fruit-body. *Hydnaceae.*

*The term "hymenophore" is here used to designate that part of the fruit-body which bears the hymenium, e. g., gills, tubes, spines, etc.



(1) Hymenophore in the form of erect branches or an erect, simple, club. *Clavariaceae.*

(1) Hymenophore in the form of tubes or reticulations, usually on the lower side of the fruit-body. *Polyporaceae.*

(1) Hymenophore in the form of knife-blades (gills); mostly fleshy plants. *Agaricaceae.*

### KEY TO THE GENERA OF THE AGARICACEAE OF MICHIGAN

(a) Spores mostly white in mass (ochraceous-colored in some species of Russula and Lactarius)..... (1)

(a) Spores ochraceous, cinnamon or rusty-yellow in mass....(21)

(a) Spores flesh-color to roseate or salmon-color in mass....(32)

(a) Spores purple-brown in mass .....(39)

(a) Spores black in mass .....(43)

### *White-Spored Agarics*

1. Gills of waxy consistency: *Hygrophorus.*
1. Gills not truly waxy ..... (2)
2. Fruit-body, soft and fleshy, decaying..... (3)
2. Fruit-body toughish, corky or woody; thin plants shrivel on drying, revive when moistened .....(15)
3. Gills thick on edge ..... (4)
3. Gills thin ..... (5)
4. Gills decurrent and forked dichotomously: *Cantherellus.*
4. Gills not decurrent; plants parasitic on other mushrooms: *Nyctalis.*
5. Trama of fruit-body of two kinds of tissue, i. e., of globular and filamentous cells; spores globose, echinulate..... (6)
5. Trama filamentous throughout ..... (7)
6. With milky juice: *Lactarius.*
6. Not with milky juice: *Russula.*
7. Stem eccentric, lateral or wanting: *Pleurotus.*
7. Stem central ..... (8)
8. Gills free ..... (9)
8. Gills adnexed .....(10)
9. Volva and annulus present: *Amanita.*
9 Volva only present: *Amanitopsis.*
9. Annulus only present: *Lepiota.*
10. With annulus only: *Armillaria.*
10. Neither annulus nor volva present .....(11)

11. Stem fleshy or fibrous, sometimes outer rind subcartilaginous ..... (12)
11. Stem cartilaginous, mostly throughout ..... (13)
12. Gills decurrent or broadly adnate, not sinuate at stem: *Clitocybe.*
12. Gills at length sinuate or emarginate on stem; mostly large plants on the ground: *Tricholoma.*
13. Gills decurrent, pileus umbilicate: *Omphalia.*
13. Gills not decurrent ..... (14)
14. Fruit-body small; pileus thin, tending to remain unexpanded and bell-shaped: *Mycena.*
14. Fruit-body small, medium or large; pileus usually expanded when mature, somewhat fleshy: *Collybia.*
15. Fruit-body usually small, toughish, thin, not woody..... (16)
15. Fruit-body larger; stem central, eccentric lateral or wanting ..... (17)
16. Trama of pileus gelatinous: *Heliomyces.*
16. Trama fleshy-membranous; pileus usually small, not woody: *Marasmius.*
17. Plant woody or corky: (*Lenzites*).
17. Plant fleshy-leathery ..... (18)
18. Gills of the usual kind ..... (19)
18. Gills longitudinally grooved or split on edge ..... (20)
19. Edge of gills serrate-torn: *Lentinus.*
19. Edge of gills entire: *Panus.*
20. Edge of gills split lengthwise: *Schizophyllum.*
20. Edge of gills obtuse, crisped: *Trogia.*

*Ochre-Spored Agarics*

21. Gills easily separable from the trama of the pileus; margin of pileus involute: *Paxillus.*
21. Gills not separating easily from the pileus..... (22)
22. Trama of pileus vesiculose; spores globose and echinulate. (See *Russula* and *Lactarius.*)
22. Trama more or less filamentous ..... (23)
23. Inner veil cobweb-like (cortinate): gills at length dusted dark cinnamon or rusty; terrestrial: *Cortinarius.*
23. Inner veil membranous, fibrous or floccose ..... (24)
24. Annulus present: *Pholiota.*
24. Annulus lacking ..... (25)
25. Stem lateral or wanting: *Crepidotus.*



25. Stem central ..... (26)
26. Stem fleshy or fleshy-fibrous ..... (27)
26. Stem cartilaginous or fragile ..... (29)
27. Gills at length yellow, yellow-rusty, etc.; lignicolous: *Flammula.*
27. Gills alutaceus to sordid brown; terrestrial..... (28)
28. Pileus fibrillose, silky or innately scaly; spores often angular; cystidia often present: *Inocybe.*
28. Pileus more or less viscid when moist, smooth: *Hebeloma.*
29. Gills decurrent: *Tubaria.*
29. Gills not decurrent ..... (30)
30. Pileus convex or plane, margin at first incurved; stem rather short: *Naucoria.*
30. Pileus bell-shaped or conical; stem slender..... (31)
31. Pileus subviscid or viscid; plant very fragile: *Bolbitius* and *Pluteolus.*
31. Pileus not viscid: *Galera.*

*Pink-Spored Agarics*

32. Stem lateral or lacking; on wood: *Claudopus.*
32. Stem central ..... (33)
33. Volva present only: *Volvaria.*
33. Annulus present only: *Chamaeota.*
33. Volva and annulus lacking ..... (34)
34. Gills free: *Pluteus.*
34. Gills adnexed, adnate or decurrent ..... (35)
35. Stem fleshy or fleshy-fibrous ..... (36)
35. Stem cartilaginous, slender ..... (37)
36. Gills at length sinuate: *Entoloma.*
36. Gills decurrent or broadly adnate: *Clitopilus.*
37. Gills decurrent; pileus umbilicate: *Eccilia.*
37. Gills not decurrent ..... (38)
38. Pileus convex, margin at first incurved: *Leptonia.*
38. Pileus bell-shaped to conical, margin at first straight: *Nolanea.*

*Purple-Brown-Spored Agarics*

39. Annulus present; veil distinct ..... (40)
39. Annulus and volva lacking ..... (41)
40. Gills free: *Psalliota.*
40. Gills attached to stem: *Stropharia.*

41. Veil present, remaining attached to margin of pileus, rarely forming an annulus: *Hypholoma.*
41. Veil, if at first present, quickly evanescent or none at all; slender-stemmed ..... (42)
42. Margin of pileus at first straight; hygrophanous: *Psathyra.*
42. Margin of pileus at first incurved; gills adnexed to adnate-subdecurrent: *Psilocybe.*

*Black-Spored Agarics*

43. Gills delinquescing into a black mass when mature: *Coprinus.*
43. Gills not delinquescing ..... (44)
44. Spores elongate-fusiform; gills decurrent; soft-waxy; pileus viscid: *Gomphidius.*
44. Spores globose to elliptical ..... (45)
45. Pileus with striate or sulcate margin, fragile: *Psathyrella.*
45. Pileus not striate, rather fleshy, exceeding the gills; gills variegated-dotted by the spores: *Panoeolus.*

## CANTHERELLEAE

Fruit-body fleshy or submembranous. Stem central or lateral. Gills thick, obtuse on edge, fold-like or ridge-form, usually forked, narrow. Veil none.

By the inclusion of Trogia and several tropical or subtropical genera, the group is extended by some authors to include sessile and reviving or arid plants. As limited above the group approaches the Thelepharaceae on the one side, the genera Clitocybe and Hygrophorus on the other. The genus Dictyolus Quel. belongs here, but no species have been found within the state. It is characterized by plants having a lateral stem arising from the larger mosses, and by vein-like, forked gills. *D. retirugus* is probably a native of the state. The group includes Cantherellus, Dictyolus and Nyctalis.

### Nyctalis Fr.

(From the Greek, *nyx,* night, referring to the black color of the host-mushroom.)

White-spored; *chlamydo-spores abundant;* gills thick, distinct, obtuse on edge; stem central; *parasitic on other Agarics;* veil none.

Fleshy, putrescent, not large-sized mushrooms, developing on the pileus and stem of the fruit-bodies of Russula, Lactarius, Cantherellus, etc., after the latter have become well developed or are partially decayed. The gills and basidiospores in our species are often dwarfed or entirely undeveloped. The propagation of the plant is, instead, dependent on the presence of secondary spores which are formed in abundance over large parts of the surface of the plants. These spores are elliptical, brownish, long-spiny, 12-18 micr. in diameter. They are formed from the loosened hyphae of the surface of the pileus, etc., which break up into chains of spores, and because of this method of formation, are called *chlamydospores.*

### 1. Nyctalis asterophora Fr.

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1132, B.
Gillet, Champignons de France, No. 49.7.
Michael, Führer f. Pilzfreunde, Vol. II, No. 81 (as *N. lycoperdioides*).
Ricken, Blätterpilze, Pl. 2, Fig. 6.
Murrill, Mycologia, Vol. 6, Pl. 129.
Hard, Mushrooms, p. 204, Fig. 162.
Plate I of this Report.

PILEUS 1-2 cm. broad, at first subglobose then hemispherical, *whitish,* floccose, *at length dingy brownish and pulverulent.* FLESH pallid, moist, rather thick. GILLS adnate, distant, *rather narrow and thick,* obtuse, sometimes forked, whitish or dingy, *frequently not developed.* STEM 2-3 cm. long, 3-8 mm. thick, relatively stout, stuffed then hollow, pruinose or silky, whitish then brownish, often curved. SPORES often lacking by reason of the undeveloped hymenium, elliptical, smooth, 6 x 4 micr., white. CHLAMYDOSPORES on surface of pileus, etc., abundant, brownish, spiny, 12-18 micr., globose. ODOR and TASTE farinaceous.

Parasitic: on *Russula nigricans,* Bay View. August-September. Infrequent or local.

An interesting case of a parasitic mushroom; it has an entirely different structure from that of the host mushroom on which it grows. For other instances of parasitic mushrooms see *Stropharia epimyces, Volvaria Loveana, Boletus parasiticus,* etc.

## Cantherellus Fr.

(From the Greek *kántharos,* a vase or cup, referring to the shape of the mature pileus.)

Spore-mass white or yellowish-tinged; Gills *forked, fold-like* or *almost ridge-form* (except *C. aurantiacus*), obtuse on edge; stem central, confluent with the pileus; veil none.

Fleshy, putrescent, terrestrial mushrooms, with a more or less turbinate, or vase-shaped pileus, in some species almost membranous, on whose outer side the reduced gills run down the stem in the form of fold-like, thick ridges or elevations, sometimes markedly dichotomously forked, sometimes almost entire. They approach



Craterellus, a genus of the Thelephoraceae, whose hymenial surface is merely wrinkled and not gill-like. The fleshy species are much sought after for the table, and all of them are *edible.* Fries, in Epicrisis, included species whose stems are lateral or lacking; these have been segregated under other genera.

The PILEUS may be dull yellow, orange, red, cinereous or lilac-tinged. Sometimes it is deeply infundibuliform, as in the mature *C. floccosus,* or it may remain obtuse as in *C. cinnabarinus.* In the ashy or ashy-brown species the FLESH is thin and almost membranaceus and these approach species of Craterellus; in the others the flesh is thick. The GILLS afford the best means of recognizing the genus. In *C. aurantiacus,* however, the gills are thin, and, except for their marked dichotomous character, this species might be placed in the genus Clitocybe. The STEM is moderately stout in most species. In the fleshy forms it is solid, while in the cinereous-colored, thinner species it tends to become hollow, and in *C. infundibuliformis* the pileus is perforated so as to form an open tube down through the stem. The SPORES are usually elliptical or elongated, smooth, mostly white or whitish, but in some species tinged with yellow or ochraceous in mass. The BASIDIA are unusually elongated and approach those of Hygrophorus in this respect; they are said to be sometimes six or eight-spored. The ODOR and TASTE of our species is mild and agreeable.

### *Key to the Species*

(a) Plant cinnamon-red, fading, medium size. 5. *C. cinnabarinus* Schw.
(aa) Plant not red.
  (b) Pileus and gills some shade of yellow or orange.
    (c) Gills orange, thin, crowded. 9. *C. aurantiacus* Fr.
    (cc) Gills not crowded, ridge-form.
      (d) Stem solid, firm.
        (e) Plant markedly vase-shaped; pileus deeply funnel-form, firm, rufous-orange. 3. *floccosus* Schw.
        (ee) Plant somewhat top-shaped, entirely chrome-yellow or flavus. 4. *C. cibarius* Fr.
      (dd) Stem hollow, pileus thin, funnel-form. 6. *C. infundibuliformis* Fr. 7. *C. tubaeformis* Fr.
  (bb) Pileus and gills not both yellow.
    (c) Gills flesh-color to purplish-lilaceus, ridge-form; stem solid. 2. *C. clavatus* Fr.
    (cc) Gills not flesh-color.
      (d) Pileus infundibuliform, cinereous or brownish cinereous.
        (e) Pileus perforated in center, stem hollow. 6. *C. infundibuliformis* Fr.
        (ee) Pileus not perforated; stem stuffed or solid. 7. *C. tubaeformis* Fr.
      (dd) Pileus obtuse, or depressed; subumbonate, brownish-gray. 8. *C. umbonatus* Fr.

**Gills in form of thick ridges, rather distant.*

### 2. Cantherellus clavatus Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Fries, Sverig. Atl. Svamp, Pl. 91.
Michael, Führer f. Pilzfreunde, Vol. II, No. 19 (as Craterellus).
Bresadola, I, Fungh. Mang. e. vel., Pl. 82.
Ricken, Blätterpilze, Pl. 1, Fig. 1.
Patouillard, Tab. Analyt., No. 434 (as *C. neurophyllus*).
Plate II of this Report.

PILEUS 3-5 cm. broad, turbinate to truncate-obclavate, depressed to *concave-cyathiform,* often irregular and lobed, narrowed into the stem, at first purplish-flesh color, *soon* greenish-yellow, surface floccose or slightly scaly. FLESH *thick behind,* white, *compact at first,* at length toughish. GILLS in form of *thick, dichotomous, narrow but distinct ridges, connected by cross-ridges,* anastomosing below, long decurrent from the elevated margin of the pileus, rather distant, *flesh-color to pale purplish umber.* STEM expanding into the pileus, *solid, short,* rather firm, *fleshy,* at first incarnate-purplish, then pallid, below densely white-floccose, 4-8 mm. thick, usually tapering downward. Whole plant 4-9 cm. tall. SPORES subcylindrical or narrow elliptical, 10-12 x 4-5 micr., smooth, pale ochraceus in mass. ODOR and TASTE mild.

Gregarious, on the ground in hemlock forests of northern Michigan. Bay View, Marquette. July-August. Infrequent.

Well marked by its color and shape. In his later works Fries referred it to the Thelophoroceae under Craterellus. Its thick flesh and the well-marked ridges of the Cantherellus-type, seem to be sufficient reason to refer it back to Cantherellus.

### 3. Cantherellus floccosus Schw. (EDIBLE)

Trans. Amer. Phil. Soc. II, 4, 1832.

Illustrations: Peck, N. Y. State Mus. Mem. 4, Pl. 55, Fig. 9-13.
Peck, N. Y. State Mus. Rep. 33, Pl. 1, Fig. 18-20.
Hard, Mushrooms, Pl. 23, Fig. 160, p. 201, 1908.
White, Conn. State Geol. & Nat. Hist. Surv. Bull., No. 15, Pl. 19.



PILEUS 5-10 cm. broad (rarely broader), vase-shaped or trumpet-shaped, truncate when young, at length *deeply excavate-funnel-form,* firm, superficially floccose or subscaly, yellow at first, *at length rufescent to orange,* margin becoming undulate at times. FLESH rather thick, confluent with the stem, white. GILLS deeply decurrent, *ridge-form,* close to subdistant, *dichotomously forked, anastomosing throughout,* ochraceus to rufous-yellowish, sometimes darker. STEM short, whole plant 6-15 cm. high (rarely 20 cm.), 1-2.5 cm. thick, *solid,* glabrous, pallid-ochraceus, whitish at base, firm, sometimes abruptly short-attenuate at base, often deep in the ground. SPORES elliptical, "12-15 x 7-7.2 micr.", smooth, ochraceous in mass. ODOR and TASTE mild and pleasant.

On the ground in hemlock forests of northern Michigan, Marquette, Huron Mountains. July-August. Infrequent.

A most striking plant when in full luxuriance, forming a large vase with considerable capacity to its deep interior. It occurs gregariously but sometimes several arise at one place or apparently from the same stem. I have not seen it in the portion of the state where hemlock and pine are unknown. Like the preceding, it is scarcely possible to confuse it with any other species.

### 4. Cantherellus cibarius Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Fries, Sverig. ätl. Svamp., Pl. 7.
Cooke, Ill., Pl. 1103.
Gillet, Champignons de France, No. 88.
Ricken, Blätterpilze, Pl. 1, Fig. 2.
Michael, Führer f. Pilzfreunde, Vol. 1, No. 26.
Swanton, Fungi, Pl. 15, Fig. 3-5.
Atkinson, Mushrooms, Fig. 123, p. 128, 1900.
Hard, Mushrooms, Pl. 22, Fig. 128, p. 199.
Gibson, Edible Toadstools & Mushrooms, Pl. 19, p. 175, 1903.
Peck, N. Y. State Mus. Rep. 48, Pl. 32.
Plate III of this Report.

PILEUS 3-8 cm. broad, firm convex then expanded, soon depressed in center or margin elevated, often irregular, sometimes top-shaped, infundibuliform or one-sided, margin thick and at first involute, *chrome-yellow or pale egg yellow,* glabrous, not striate. FLESH compact, thick, white or yellowish toward surface. GILLS long, decurrent, thick, dichotomously forked or anastomosing, nar-

row, *rather distant, chrome-yellow,* edge blunt. STEM 3-6 cm. long, stout, 6-12 mm. thick, narrower downwards, solid, fleshy, glabrous, *chrome-yellow to pale yellow,* often tunneled by larvae. SPORES elliptical, 7-9 x 4-5 micr., smooth, faintly ochraceous-tinged. "BASIDIA 50-75x7-8 micr., 4-spored, sometimes 5-6 spored." ODOR and TASTE mild and pleasant.

Gregarious or subcaespitose, often scattered. On the ground in frondose or conifer forests . Throughout the state, from the southern border to Isle Royale. July-September (rarely earlier or later). Frequent only in certain seasons.

This is the famous "*Chantarelle*" of Europe, where it is highly prized, both on account of its flavor and from the fact that its flesh is free from larvae. In Michigan, and probably elsewhere in the eastern part of the United States, the fastidious lovers of mushroom meat are, alas, not so fortunate as their European brethren. During many years of collecting, I have rarely found this mushroom free from larvae and I have a large number of records. Occasionally, immediately after its rapid development due to favorable weather, I have found unattacked specimens. The color is often much paler yellow than that mentioned above and a white form is sometimes found. It is not easily confused with *C. aurantiacus,* which has thin and crowded gills and different shades of yellow.

### 5. **Cantherellus cinnabarinus** Schw. (Edible)

Trans. Amer. Phil. Soc. II, 4, 1832.

Illustrations: Peck, N. Y. State Mus. Mem. 4, Pl. 55, Fig. 1-8.
Murrill, Mycologia, Vol. 5, Pl. 92, Fig. 3.
Hard, Mushrooms, Fig. 161, p. 202, 1908.
Plate II of this Report.

PILEUS 1.5-3 cm. broad (rarely up to 7 cm.), firm, *convex and obtuse or expanded-depressed,* often *irregular, glabrous, cinnabar-red,* often faded, entirely faded in dried specimens. FLESH rather thin, whitish or tinged reddish toward surface. GILLS long-decurrent, dichotomously forked, *rather distant,* narrow and ridge-form, intervenose, *cinnabar-red,* yellowish or pinkish. STEM 2-4 cm. long, 4-6 mm. thick, *solid* or subcavernous, terete or compressed at apex, equal or tapering downward, tough-fleshy, glabrous, even, cinnabar-red or paler. SPORES oblong-elliptical, 8-10 x 4-5.5 micr., smooth, white or faintly pink in mass. BASIDIA long and narrow, 4-spored. ODOR and TASTE mild.



Gregarious, on the ground in open frondose woods or on bare soil along woodroads. Ann Arbor, Detroit, New Richmond, at least throughout the Southern Peninsula. July-October. Frequent.

Easily known by its color and size. When fresh the color is cinnabar-red but after exposure to wind and sun the color may be lost. Often the stem is diluted and compressed toward the apex, in which case it is found to be somewhat hollow. Typically the stem is solid. Some think *C. friesii* Quel. is the same, but that species is said to have a velvety-flocculose cap, different colors and probably smaller spores. Both fade, and the dried specimens probably look much alike. Our plant seems to be a distinct American form.

### 6. **Cantherellus infundibuliformis** Fr. (Edible)

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1109.
Ricken, Blätterpilze, Pl. 1, Fig. 4.
Michael, Führer f. Pilzfreunde, Vol. II, No. 41.
White, Conn. State Geol. & Nat. Hist. Surv. Bull. No. 3, Pl. 15, op. p. 35.
Peck, N. Y. State Mus. Mem. 4, Pl. 56, Fig. 9-16.

PILEUS 2-5 cm. broad, umbilicate to infundibuliform, *margin undulate or lobed,* pruinose-flocculose, glabrescent, cinereus-yellowish to watery-brown, paler when dry. FLESH *thin,* concolor. GILLS decurrent, narrow, ridge-form, dichotomously or irregularly forked, *pruinose, distant,* cinereous. STEM 3-9 cm. long, 3-7 mm. thick, *slender,* equal or subequal, glabrous, *hollow, terete or compressed, yellow.* SPORES globose- elliptical. 9-11x7-9 micr., smooth, pale yellowish in mass. ODOR and TASTE none.

Gregarious on the ground in wet swampy places, especially in conifer woods. Marquette, Houghton, New Richmond. August-October.

Distinguished from all the preceding by its thinner somewhat pliant pileus and darker colors; it often has a sooty or ashy shade. The center of the cap is usually perforated so as to expose the hollow cavity of the stem from above. Its spores are quite characteristic and set it off from its near relatives, which Murrill (N. A. Flora, Vol. 9, p. 168) has seen fit to include in this single species.

### 7. Cantherellus tubæformis Fr. (Edible)

Syst. Myc., 1821.

Illustrations: Michael, Führer f. Pilzfreunde, Vol. II, No. 41.
(?) Cooke, Ill., Pl. 1108.

PILEUS 2-5 cm. broad, convex and obtuse, at length depressed and margin irregular and recurved, sometimes subinfundibuliform, *not perforated in center,* brownish-yellow to yellowish ochraceus, *silky-tomentulose,* even, scarcely fading. FLESH *thin* at least toward margin, whitish-ochraceus. GILLS arcuate-decurrent, moderately thick, narrow and ridge-form, dichotomously forked, intervenose, *rather distant, not pruinose,* flesh-gray to yellowish-ochraceus, often slightly deeper in color than pileus and stem. STEM 3-6 cm. long, 3-6 mm. thick (sometimes thicker), fulvous-yellow to ochraceous, concolor within, *terete or canaliculate,* sometimes compressed, subequal, *solid or stuffed at first,* sometimes at length hollow, glabrous, often curved, white at the very base. SPORES broadly elliptical, 7-9.5x5-6 micr. punctate-granular, pale creamy-white in mass. BASIDIA 60-65x6-8 micr. long, slender, attenuate downward. ODOR and TASTE none.

On the ground or debris of frondose woods of southern Michigan. Ann Arbor and surrounding region. July-August. Infrequent.

Characterized primarily by its spores and its stuffed stem. It differs from the preceding also in its rather constant colors. Most of our plants were entirely yellowish-ochraceous when fresh and the stem was not hollow. The thin structure of the cap separates it from other yellowish species. Its name is misleading, since in its near relative, *C. infundibuliformis,* the tube is continuous from the stem to the surface of the pileus, while here the cap is not perforated, and the stem usually not hollow except in age. My observations agree with those of Ricken in these respects. *Cantherellus lutescens* is a related species, with an orange-yellow stem, blackish-brown, floccose-scaly cap and orange gills. Its spores are said to measure 10-12x7-8 micr.



***Gills approaching the form of those of true Agarics, close or crowded.*

### 8. Cantherellus umbonatus Fr. (Edible)

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1106.
Gillet, Champignons de France, No. 94.
Ricken, Blätterpilze, Pl. 2, Fig. 1.
Michael, Führer f. Pilzfreunde, Vol. III, No. 51.
Peck, N. Y. State Mus. Bull. 67, Pl. 84, Fig. 8-21 (as *C. dichotomous* Pk.).

PILEUS 2-4 cm. broad, top-shaped, convex to plane and depressed, *brownish-gray to blackish or smoky-gray, with or without a slight umbo,* pruinose or flocculose, dry, pliant, margin regular or wavy. FLESH *thin,* white, becoming reddish with age or some time after picking. GILLS decurrent, rather narrow, thick, dichotomously branched, *not ridge-form,* close, white, then *stained yellowish or reddish,* even on edge. STEM 3-8 cm. long, 4-7 mm. thick, equal or attenuated up or down, elastic, pallid or pale gray, sometimes smoky above, appressed-silky, stuffed, soft fleshy-fibrous within. SPORES narrow, subfusiform-elliptical, 9-11x3-4.5 micr., smooth, white in mass.

Gregarious, attached to moss, especially Polytrichum, around peat-bogs or in swampy woods.

Houghton, Ann Arbor, probably in lake districts throughout the state. July-October. Frequent in fall till frosts or later.

Distinguished from the preceding two by the more highly developed gills, the slight umbo and the tendency for the flesh and gills to assume reddish stains after being collected. In many cases it is attached directly by its mycelium to the stems and leaves of living mosses. There is no doubt that *C. dichotomous* Pk. is the same species, since the descriptions of *C. umbonatus* with which Peck compared his plant were incomplete, as Saccardo omitted the fact that the gills are dichotomously forked.

### 9. Cantherellus aurantiacus Fr. (Edible)

Syst. Myc., 1821.

Illustrations: Fries, Sverig. ätl. Svamp, Pl. 79.
Cooke, Ill., Pl. 1104.
Gillet, Champignons de France, No. 86.
Michael, Führer f. Pilzfreunde, Vol. 1, No. 27.
Ricken, Blätterpilze, Pl. 2, Fig. 2.
Atkinson, Mushrooms, Pl. 37, Fig. 124-125, p. 129, 1900.
Hard, Mushrooms, Fig. 159, p. 200, 1908.

PILEUS 2-6 cm. broad (rarely 7) pliant, convex-plane, depressed, at length often concave-subinfundibuliform with elevated margin, margin at first involute at length undulate, *orange-ochraceus to brownish-orange,* sometimes pale, *subtomentose* or subsquamulose on disk, even. FLESH *soft,* somewhat thick, thin on margin, pallid or tinged ochraceous. GILLS arcuate-decurrent, *thin,* edge blunt, dichotomously forked, *crowded,* rather narrow, *not ridge-form, bright orange* or tinged with salmon-color. STEM 3-5 cm. long, 4-10 mm. (or more) thick, *spongy,* thickened downwards, or subequal, *stuffed* sometimes hollow, minutely tomentose, *pale orange* varying brownish or pallid-yellowish. SPORES elliptical, 5-7 x 3-4 micr., smooth, whitish in mass. ODOR and TASTE mild.

Gregarious, on the ground, much decayed logs or wood, among debris, in conifer and frondose woods, more abundant northward. Throughout the state. July-October. Frequent.

Distinguished from *C. cibarius* by its thin, crowded gills and orange colors. A form occurs with pale yellowish-white cap and stem; this I have seen in Sweden where it is more common than with us. Fries says a white form also appears. It is marked poisonous or suspected by many European authors, although Peck, McIlvaine and others have eaten it without bad results, but the flavor is said to be poor. It occurs mainly in conifer woods but also in low frondose woods, perhaps where tamarack once grew.

## MARASMIEAE

Fruit-body reviving in moist weather, becoming shriveled when dry; fleshy-leathery, tough or toughish, persistent, normally not putrescent. Stem when present, confluent with the pileus. Partial veil or universal veil lacking.

The species of this subfamily are well-marked by their ability to cease growing and to shrivel up in dry weather, and by their rejuvenescence and further development when they become wet again. The gills are never corky or woody and only slightly fleshy, usually arid and toughish. It is possible, however, to find forms which approach Collybia, Mycena and Pleurotus and which represent connecting links between those genera and Marasmius. The following genera are included: Trogia, Schizophyllum, Panus, Lentinus, Marasmius, and Heliomyces.

### Trogia Fr.

(After *Trog,* a Swiss botanist.)

White-spored. Flesh toughish, arid, reviving in wet weather. Gills arid, fold-like, obtuse. Pileus sessile, or resupinate-reflexed.

Small, lignicolous, reviving plants, usually attached to dead branches of frondose trees. Related to Cantherellus by the plicate, i. e., fold-like gills, but tougher and reviving, as in Schizophyllum. The genus is placed under the Canthereleae by some authors but the persistent, reviving and arid characters ally it equally close to the Marasmieae. The pileus is either attached at a more or less eccentric point or resupinate for some distance and the gills are exposed in moist weather, but the dried pileus usually infolds on the margin so as to hide the gills which are mostly irregular or crisped.

### 10. Trogia crispa Fr.

Monographia, 1833.

Illustrations: Cooke, Ill., Pl. 1114.
Gillet, Champignons de France, No. 708.
Patouillard, Tab. Analyt., No. 14.
Ricken, Blätterpilze, Pl. 2, Fig. 5.
Atkinson, Mushrooms, Pl. 39, Fig. 131, op. p. 137, 1900.

PILEUS 1-2 cm. broad, tough, *sessile*, sometimes couchate or shelving, often resupinate when moist, sometimes subimbricate, persistent, *reviving* when moist, irregularly incurved when dry, surface tinged reddish-yellow with whitish hairs, *becoming tan or buff-brownish when dry, margin lobed.* FLESH thin, fleshy-membranaceous. GILLS very narrow, irregularly vein-like, interrupted or entire, often forked, crisped, white or bluish-grey. SPORES cylindrical, smooth, 3-4 x 1-1.5 micr., white.

Scattered, gregarious, often closely crowded on limbs or bark of frondose trees, especially beech, birch and cherry. Throughout the state. Frequent.

When dry the plants roll up irregularly and almost hide the gills, the white color of which when fresh is rather sharply contrasted in most cases with the color of the pileus. It has been placed in the genus Plicatura by some authors.

### 11. Trogia alni Pk.

N. Y. State Mus. Rep. 24, 1872 (as *Plicatura alni*).

"PILEUS 1.5-2.5 cm. broad, coriaceous, *resupinate-reflexed,* generally imbricated, silky-tomentulose, *brownish-tawny,* the margin sterile. GILLS narrow, irregular, interrupted wavy or crisped, angular, white, becoming inconspicuous on drying."

"On alder, etc."

This species has not been reported in the state, but is included for the sake of comparison. Some consider it identical with *Merulius niveus* Fr., but that species is said to be pure white.

## Schizophyllum Fr.

(From the Greek, *schizo*, to split and *phyllon*, a leaf, referring to the split edge of the gills.)

White-spored. Leathery-tough, arid, reviving in wet weather. Gills split halfway from the edge inwards. Trama of pileus thin. Veil none.

Only one species is known in our region, but this is very common. It grows on wood, on dead branches and trunks of standing trees or more rarely on fallen limbs. The gills are very characteristic, differing markedly from those of other genera by being split and the halves recurved, and the structure of the two layers is continued upwards almost through the pileus so that a thin pellicle covers the surface.



### 12. Schizophyllum commune Fr.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1114 B.
Gillet, Champignons de France, No. 641.
Atkinson, Mushrooms, Fig. 130, p. 136, 1900.
Hard, Mushrooms, Fig. 187, p. 233, 1908.

PILEUS 1-3 cm. broad, thin, tough, pliant, *sessile* by the narrowed base, from which it extends in a fan-shaped manner, often suborbicular and lobed on the incurved margin, tinged with brownish-gray when moist, *whitish when dry,* very hairy or tomentose, reviving. GILLS radiating from the point of attachment of the pileus, leathery-tough, split on edge, white or gray, sometimes with other tints, tomentose, on the inner side of the split. SPORES minute, cylindrical, 3-4 x 1-1.5 micr.

Scattered or gregarious on dead branches or trunks of frondose trees, especially of hickory; also on carpinus, walnut, elm, maple, sycamore, locust, apple and probably others. Throughout the state. Very common.

This is a pretty fungus when growing in luxuriance and can not be easily mistaken for anything else. Some species of Pleurotus have a similar habit, but are different in texture and especially in the structure of the gills.

## Panus Fr.

(From the Latin, *panus,* a tumor. Fries says the name was used by Pliny for a tree-inhabiting fungus.)

White-spored. *Fleshy leathery, reviving,* tough, persistent; the texture fibrous, radiating into the hymenium. Stem eccentric, lateral or lacking, confluent with the pileus. Gills at length coriaceous, *edge entire.*

Not putrescent, but arid and tough as in the genera Lentinus, Marasmius, etc. They approach Pleurotus and some species have been described under that genus. They are wood-inhabiting. *P. stipticus* has *poisonous* properties, the others are harmless.

The PILEUS is eccentric, lateral or at first resupinate; none of the last section has been distinguished in the state. The erect forms often have very irregular and crowded and depressed pilei which are somewhat thick. Their surface is usually strigose, villose

or slightly scaly. The color is various. The FLESH varies from quite tough in some species to somewhat fleshy in others; the latter may become more tough with age so that several species are easily confused with Pleurotus in the young stage. It is advisable to compare specimens with both genera where the texture is in doubt. The GILLS have an entire edge which distinguishes them from those of the genus Lentinus which have lacerate, serrate, thin edges. They become tough with age and are thickish. Intermediate forms occur, especially among typical species, so that some authors combine Panus with Lentinus. In our plants, however, the character of the edge of the gills is the best means of separation. The STEM is short, as a rule, sometimes continuous with the pileus, so that the pileus is not marginate behind. It is usually hairy or scaly. The SPORES vary in shape and size; they are smooth and white. CYSTIDIA are present in *P. rudis* and *P. angustatus*.

Several of the species are very common, growing on stumps, decayed branches, etc., in the cities, or on any sort of dead timber in the woods and fields. The harmless species are rather tough for the table, but can be used, according to McIlvaine, to flavor soups and gravies.

The genus is divided into three sections, of which the following include the species described below:

I. Conchati.
II. Stiptici.

*Key to the Species*

(A) Pileus sessile or prolonged laterally into a stem-like base.
  (a) Pileus with a gelatinous layer, whitish or yellowish, spathulate to fan-shaped. 16. *P. angustatus* Berk. (Syn. *Pleurotus stratosus* Atk.)
  (aa) Pileus without a gelatinous layer.
    (b) Gills when young covered by a fugaceous veil; pileus about 1 cm., cupulate, rufous. On alder bushes. *P. operculatus* B. & C.
  (bb) Without a cortina.
    (c) Pileus hygrophanous, small, pinkish-gray; gills dark ferruginous; on willows. 17. *P. salicinus* Pk.
    (cc) Pileus not hygrophanous, small, heaped in clusters, pale brownish; taste very disagreeable, astringent. 15. *P. stipticus* Fr.
(AA) Pileus with an eccentric stem; i. e. pileus marginate behind.
  (a) Pileus white or creamy-white when fresh, becoming yellowish when drying.
    (b) Pileus often very large, densely strigose-hairy; whole plant becomes dull yellow when dried. 12a. *P. strigosus* B. & C.
    (bb) Pileus up to 6 cm. broad, surface with long, delicate hairs, margin reticulated. *P. laevis* B. & C.
  (aa) Pileus reddish-brown to alutaceous-tan, medium size, margin at first inrolled.
    (b) Pileus rough with tufted hairs, tawny-alutaceous, etc., gills crowded and narrow. 13. *P. rudis* Fr. (Syn. *P. strigosus* Schw.)
    (bb) Pileus glabrous or obscurely fibrillose-scaly.
      (c) Gills crowded and narrow. 14. *P. torulosus* var. *conchatus* Fr.
      (cc) Gills close to subdistant. 14. *P. torulosus* Fr.



(Other species have been described by Peck, *P. betulinus* on birch, from Newfoundland, with a dimidiate, grayish-brown pileus; *P. nigrifolius* from Alabama, with distant, dark-brown gills. *P. dealbatus* Berk. was described from Ohio; it has an umber color throughout, with the shape of *P. angustatus*. *P. albotomentosus* Cke. & Massee, reported by McIlvaine, is probably the same as *Pleurotus albolanatus* Pk. of this report. *P. dorsalis* Bosc. is the same as *Claudopus nidulans*.)

*Section I. Conchati.* Stem eccentric; pileus irregular or conchate.

### 12a. Panus strigosus B. & C. (Edible)

North American Fungi, No. 99.

Illustration: Plate IV of this Report.

PILEUS *large,* varying from 10 to 40 cm. broad, *subcentral, strongly eccentric or lateral,* marginate behind, fleshy-fibrous to subcoriaceous, convex, subexpanded, *reniform, covered with a dense, thick, strigose-villose nap* composed of hairs up to 2 mm. long in large specimens, *creamy-white* when fresh, *becoming yellow on drying.* FLESH firm, somewhat tough, up to 2 cm. thick, tapering to the very thin margin, yellowish when fresh, white when dry. GILLS subdecurrent, *broad,* close to subdistant, heterophyllous, thick, white, changing to yellow on drying, *edge entire.* STEM short or long, *stout,* 2-15 cm. long, 2-4 cm. thick, *strigose-villose,* eccentric or almost lateral, whitish to yellowish, sometimes tinged cinereous. SPORES elongated-oblong, 11-13 x 3½-4½ micr., smooth white in mass. CYSTIDIA none. ODOR stronger in age, rather agreeable.

(Dried: Strigosity and cuticle are dull golden-yellow, flesh whitish, gills ferruginous.)

Solitary or caespitose, subimbricate, growing from the wounds of maple and yellow birch; also on apple trees and other deciduous trees. Probably throughout the state; Houghton, New Richmond. August-September. Infrequent or rare. Edible when young.

This is the largest Panus we have; the pileus is often a foot and

more in diameter and the stem very stout. The descriptions in the books are very meagre, and no mention is made of the change of color on drying. The dried specimens are elegant. Its flesh is not very tough and it is easily mistaken for a Pleurotus. The gills are very broad in large specimens, not truly distant, and are usually distinct on the stem or anastomose only in an obscure manner if at all. Some specimens are almost lateral, growing in a somewhat ascending-subhorizontal position, but with a marginate pileus; others have a subcentral stem. This is not *Lentinus strigosus* Schw., a species which seems to be synonymous with *Panus rudis*. Some consider *P. laevis* B. & C. to be the same as *P. strigosus*.

### 13. **Panus rudis** Fr. (Edible)

Epicrisis, 1836-38.

Illustrations: Hard, Mushrooms, Fig. 179, p. 224, 1908.
Ricken, Blätterpilze, Pl. 26, Fig. 4.
Patouillard, Tab. Analyt., No. 637.
Plate V of this Report.

PILEUS 2-7 cm. broad, irregular, eccentric or sublateral, ascending, depressed or vase shaped, sometimes infundibuliform, cuneate-rounded when young, *tough, villose-velvety or strigose,* alutaceous to reddish brown, *margin often lobed,* incurved. GILLS *narrow,* crowded, decurrent, pallid or tinged with the color of pileus, pubescent, *edge entire.* STEM *short,* eccentric, sometimes almost lacking, *villose, concolor.* SPORES elliptical-oval, 5-6 x 2-3 micr., smooth, white. TASTE slightly bitter at times. ODOR none.

Caespitose-crowded. Everywhere in town and country, on stumps, logs, dead branches, trunks, etc., of frondose trees. Throughout the state. May to November. *Very common.*

This is *Lentinus lecomtei* of many American notices, not the true *L. lecomtei* Schw. which has serrate gills. Our plant has entire gills. Schweinitz described the true *L. lecomtei* from a specimen sent from Georgia by Lecomte. (See Lloyd, Myc. Notes, Vol. I, p. 60.) It is also *Lentinus strigosus* Schw. to which Peck refers his specimens. Peck says it was found in one case on a balsam fir trunk, while ordinarily it is limited to deciduous trees. Patouillard says the gills of *P. rudis* are serrate, which is a rather remarkable statement. It can be used for flavoring gravies and dries well for winter use, but is readily attacked by beetles.



### 14. **Panus torulosus** Fr. (Edible)

Syst. Myc., 1821. (As *Pleurotus torulosus.*) Epicrisis, 1836-38.

Illustrations: Hard, Mushrooms, Fig. 180, p. 225, 1908.
Gillet, Champignons de France, No. 511.
Cooke, Ill., Plate 1149.

PILEUS 5-10 cm. broad, or broader, fleshy-pliant at first then tough, from plane to infundibuliform, eccentric or almost lateral, marginate behind, *livid flesh color or tinged violet or reddish,* surface when young and fresh with a delicate, detersile tomentum, soon *glabrous,* sometimes slightly scaly in the center of the cup, even on the margin, sometimes wavy. FLESH pallid, thickish, becoming thinner when full-grown. GILLS decurrent, *close to subdistant,* narrow, simple, occasionally forked, sometimes anastomosing on the stem, pallid to violet rufescent then alutaceous, *edge even.* STEM short, 2-3 cm. long, 1-3 cm. thick, stout, solid, tough, eccentric or lateral, *covered with a violaceous or gray tomentum.* SPORES elliptical, 6 x 3 micr., smooth, white.

Caespitose, on decaying stumps, logs, trunks, etc., of frondose trees. Ann Arbor. September. Infrequent.

Var. *conchatus* Fr. Pileus thinner, alutaceous and not with violet tints; gills closer. On beech log, Bay View. Infrequent. Becoming quite large, up to 15 cm. broad.

The species of Fries, *Panus conchatus,* does not seem to me specifically distinct, as the characters which he emphasizes occur also in *P. torulosus.* Specimens of the latter can be found whose pileus becomes minutely scaly at length, and whose gills vary forked and anastomosing, although never markedly so. The closeness of the gills depends somewhat on the expansion of the pileus and this varies not a little. Under certain weather conditions, the violet and reddish tints of *P. torulosus* are lacking, and then the plant could be referred to the other species. The spores of the two species, if I have interpreted correctly, are exactly alike, and unless structural differences can be shown it were better to make *P. conchatus* a synonym of *P. torulosus* as was done by Quelet. (Euchiridion Fungorum.) If collected in dry weather, they may be confused with infundibuliform species of Clitocybe.

*Section II. Stiptici.* Pileus sessile or prolonged behind into a stem-like base.

### 15. Panus stipticus Fr. (Poisonous)

Syst. Mycol., 1821. (As *Pleurotus stipticus.*) Epicrisis, 1836-38.

Illustrations: Hard, Mushrooms, Fig. 178, p. 222.
Ricken, Blätterpilze, Pl. 26, Fig. 3.
Michael, Führer f. Pilzfreunde, Vol. 3, No. 66.
Gillet, Champignons de France, No. 510.

PILEUS 1-3 cm. broad, *very tough,* pale cinnamon, fading to whitish, convex, subreniform, depressed and abruptly narrowed behind, surface breaking up into minute, furfuraceous scales, even. GILLS thin, *determinate,* i. e., abrupt behind, venose-connected, crowded, *cinnamon.* STEM lateral, short, distinct below, solid often compressed, pruinose, paler than gills. SPORES minute, narrowly oblong, 4-5 x 2 micr., smooth, white. TASTE *very astringent.* CYSTIDIA none on sides of gills.

Caespitose. On wood; stumps, logs, trunks, etc. Throughout the state. May to October. Common.

This little Panus is not edible, because of its toughness and its very disagreeable taste. It is said to be a violent purgative. When fresh it is slightly phosphorescent in a dark room. On the under side it appears to have a very definite stem, ending abruptly at the gills; above, the stem is not distinguishable. It revives when moistened, so that a cluster may be seen in place during the whole season.

### 16. Panus angustatus Berk.

Lea's Catalogue of Plants, 1849.
See also *Pleurotus stratosus* Atk.=syn, Jour. of Mycol., Vol. 8, 1902.

PILEUS 2-5 cm. broad, *obovate to broadly cuneate,* sessile or prolonged into a stem-like base, convex or depressed, sordid white to pale tawny, *trama composed, under the microscope, of four layers* (a) the surface layer of erect hyphae which form a minute tomentum; beneath this (b) a thin, compact layer; (c) a gelatinous layer of open, slender, distant, palisade threads; (d) a compact, floccose-interwoven layer, about half the thickness of the pileus; margin crenate-wavy. FLESH thin, tough, soft. GILLS converging, very narrow, crowded, white or yellowish. SPORES minute, spheroid-oval, 3 micr. diam., smooth, white in mass. CYSTIDIA numerous, fusoid or lanceolate, 45-60 x 10-14 micr. BASIDIA 4-spored.



Caespitose, often imbricate, sometimes solitary, on very rotten wood of birch, hemlock, etc., of northern Michigan. Bay View, Houghton, Negaunee. July-August. Infrequent. Probably edible.

This species has much the appearance of *Pleurotus petaloides* and *Pleurotus albolanatus.* When fresh it is hard to tell whether it ought to be referred to Panus or Pleurotus. I have found it only in the region of conifer or mixed woods.

### 17. Panus salicinus Pk.

N. Y. State Mus. Rep. 24, 1872.

"PILEUS 8-12 mm. broad, firm, thin, convex, deflexed or subpendant, *hygrophanous,* minutely farinaceus-tomentose, pinkish-gray. GILLS moderately broad and close, converging to an eccentric point, *dark ferruginous.* STEM very short below or obsolete, obliquely attached to the vertex of the pileus."

"Gregarious. Trunks of dead willows."

This was reported by Longyear in 4th Report Michigan Academy of Science. I have given Peck's description.

## Lentinus Fr.

(From the Latin, *lentus,* tough.)

White-spored. *Fleshy-leathery, tough,* reviving, persistent, *often becoming hard when old.* Stem eccentric, lateral or none, confluent with pileus. Gills concrete with pileus, *thin,* membranous, *edge becoming serrate or lacerate.*

Tough, even somewhat woody in age, lignicolous and polymorphous. They approach the fleshy Pleuroti on one side, and the woody Lenzites on the other. From Panus the thin, lacerate edge of the gills alone distinguishes them. They are very abundant in the tropics but there are relatively few species with us.

The PILEUS varies in size, being quite large in *L. lepideus* and *L. vulpinus,* or only about a centimeter broad in our small forms. It is often scaly spotted, by the breaking up of the cuticle. The GILLS are thin as compared with our species of Panus, and become lacerated-serrate on the edge. Their texture is homogeneous with the trama of the pileus and not at all separable from it, as is the case with the section Paxilloideae of the genus Clitocybe. They are white but often become dingy and arid with age, and are usually decurrent or become so at maturity. The STEM is tough, often

hard and woody at the base where it is inserted, i. e., instititious, on the ligneous substratum. Although normally eccentric or lateral in our species, it may become central, especially when growing on top of the substratum. Some species have adapted themselves to the debris or humus on the ground, so as to appear terrestrial. In one section there is often a definite *veil*, as in *L. lepideus* and *L. tigrinus* but it soon disappears or only rarely remains on the stem or on the margin of the young pileus as shreds or fibrils. The SPORES vary in shape, in our species mostly elongated-oblong or elliptical. Fries in characterizing the genus (Hymen. Europ.), as well as Quelet (Enchiridion) and Patouillard (Les Hymen. d'Europe), say the spores are subglobose. This is not at all the case with all of our species, although it may apply to the majority of tropical ones. Massee (Agaricaceae, Eur. Fung. Flora) records comparatively few spore-measurements, so that the statement of the above authors seems remarkable. The spores are white, smooth and often no longer present in old specimens. CYSTIDIA are lacking.

This is a troublesome genus because of the fact that the nature of the context, determines largely its place in the classification. Hence various species have been referred here by mycologists only to be later removed to genera with fleshy or fibrous context. Originally the genus Panus was included and some authors still include it. *Panus rudis* is commonly called *Lentinus Lecomtei,* the latter being a species we do not have with us. *Lentinus strigosus* Schw. is also *Panus rudis. Collybia lacunosa* Pk. is often mistaken for a Lentinus, and was erroneously referred to *L. chrysopeplos* B. & C. in the 8th Rep. Mich. Acad. Sci., p. 34. Others have referred *Omphalia umbellifera* var. *scabriuscula* Pk. to *L. chrysopeplos.* (See White's 2nd Rep. on Hymeniales of Conn., p. 22.) Certain species of Clitocybe, like *C. piceina* are often quite tough, but differ in the gills being discrete from pileus. Again, species of Paxillus might be confused with this genus. It is well for the amateur to compare the prominent characters of these different genera before deciding on a determination. None are reported poisonous; their toughness yields only to thorough cooking. They are hardly to be considered delicacies, but according to McIlvaine may be used to flavor soups. The large *L. lepideus* is often common on railroad ties and cut timber, and doubtless is an important agent in the decay of wood thus attacked.

The key will include also such species as may be looked for in the state. The genus is represented by two sections:



I. Mesopodes.
II. Pleuroti.

*Key to the Species*

(A) Pileus subentire; stem distinct.
  (a) Pileus more or less scaly.
    (b) Pileus umbilicate, with blackish-brown scales in the umbilicus; often deformed with aborted gills. 18. *L. tigrinus* Fr.
    (bb) Pileus convex, or plane and obtuse.
      (c) Pileus commonly rather large, 5-15 cm. broad.
        (d) Gills anastomosing on the stem; spores 12-15 x 5-6 micr.; pileus large, at first glabrous. *L. underwoodii* Pk.
        (dd) Gills not anastomosing.
          (e) Pileus with spot-like, brownish scales, gills sinuate; spores 11-13 x 4-6 micr. 19. *L. lepideus* Fr.
          (ee) Pileus rimose-scaly; gills not sinuate; spores 8-10 x 4-5 micr. *L. spretus* Pk.
      (cc) Pileus 5 cm. or less in width.
        (d) Pileus thin, rufous-tinged, sulcate on margin, 1-2 cm. broad. *L. sulcatus* Berk.
        (dd) Pileus thick, obconic, not sulcate; gills long-decurrent. *L. obconicus* Pk.
  (aa) Pileus glabrous, not large.
    (b) Caespitose, rarely solitary; pileus subinfundibuliform.
      (c) Stem furrowed, confluent-caespitose. 23. *L. cochleatus* Fr.
      (cc) Stem not furrowed; on the ground. *L. americana* Pk.
    (bb) Not caespitose or rarely so; pileus plane, or slightly depressed to umbilicate.
      (c) Pileus hygrophanous, umbilicate; stem central or eccentric. 20. *L. umbilicatus* Pk.
      (cc) Pileus not hygrophanous.
        (d) Pileus reddish-brown; stem whitish; spores minute, globose, 3-4 micr. 22. *L. microsperma* Pk.
        (dd) Pileus ochraceous to cream-color; stem short, blood-red to reddish; spores oblong. 21. *L. haematopus* Berk.
(AA) Pileus dimidiate, sessile.
  (a) Pileus large, 5-15 cm. broad, imbricate, coarsely hairy and rough-ribbed, flesh-color. 24. *L.vulpinus* Fr.
  (aa) Pileus less than 5 cm.
    (b) Taste peppery; pileus thick, whitish, becoming reddish-brown, hairy. 25. *L. ursinus* Fr.
    (bb) Taste pleasant; pileus thin, whitish or yellowish *L. suavissimus* Pk.

*Section I. Mesopodes:* Pileus subentire, stem distinct.

**Pileus scaly. Provided when young with a veil.*

### 18. Lentinus tigrinus Fr.

Syst. Myc., 1821. (As *Omphalia tigrina.*) Epicrisis, 1836-38.

Illustrations: Patouillard, Tab. Analyt., No. 406.
Ricken, Blätterpilze, Pl. 26, Fig. 2.
Gillet, Champignons de France, No. 406.
Cooke, Ill., Plate 1138 and 1139.
Lyman, G. R. Proc. Boston. Soc. Nat. Hist., Vol. 33, Plate

23 et al. (Illustrating the abnormal form, *Lentodium squamulosum.*)

PILEUS 2-5 cm. broad, fleshy-leathery, at first orbicular, convex then plane and *umbilicate,* white but covered, especially at the center, with *blackish-brown,* hairy scales, margin at length wavy and often split. FLESH white, *thin.* GILLS *decurrent,* somewhat narrow, close, white, edge eroded-serrate. STEM 1-3 cm. long, slender, tapering downward, *solid,* minutely scaly, whitish, white within, often darker at base. At first with a delicate *veil,* which may form an evanescent annulus. SPORES elliptical-oblong, 6-7 x 3-3½ micr., smooth, white in mass, often copious.

Gregarious. On dead wood, which is usually hard. Ann Arbor, New Richmond. September. Infrequent.

The umbilicate, thin, pileus, different scales, and much shorter spores, distinguish it from *L. lepideus.* It is at first soft, but becomes coriaceous in dry weather. Ricken gives the spore-length almost twice that of the American plants.

A monstrous form occurs, which is often more common than the normal form or may be the only one found. This was placed by Morgan in a new genus, *Lentodium squamulosum.* Prof. Lyman raised this form in the laboratory from spores and considered it definitely distinct from *L. tigrinus,* as indeed his results strongly indicate. (See reference above to Lyman's paper.) Peck, however (N. Y. State Mus. Bull. 131), points out that the monstrosity and *L. tigrinus* itself appear on the same log and considers this to show that they are one and the same. Lyman never obtained the normal form from his cultures of spores from basidia of Lentodium.

The collection which I made at New Richmond was observed for several weeks, and all stages were seen on the same pieces of wood lying on the ground, both the perfect form with regular gills, and the deformed form. The latter has the gills obliterated by an overgrowth of mycelium, so that the under side of the pileus presents an even surface, much as in one form of *Nyctalis asterophora.* In the light of Lyman's researches, this form must be considered as a regular variation of this mushroom, whose tramal hyphae may produce basidia and spores without the development of true gills. The monstrosity often becomes quite hard and woody in dry weather and is unique among our fungi.



### 19. Lentinus lepideus Fr. (Edible)

Syst. Myc., 1821. (As *Omphalia lepidea.*) Epicrisis, 1836-38.

Illustrations: Hard, Mushrooms, Fig. 182, p. 228, 1908.
Marshall, Mushroom Book, p. 56, 1905.
Freeman, Minn. Plant Diseases, Fig. 116, p. 237. 1905.
Cooke, Ill., Plate 1140.
Gillet, Champignons de France, No. 405.
Plate VI of this Report.

PILEUS 5-15 cm. or more broad, *compact and firm,* toughish, regular or irregular, *convex or obtuse,* at length plane, buff to pale ochraceous, variegated with subconcentric, brownish, adpressed, *spot-like scales,* even or sometimes areolate-cracked. FLESH white, pliant when fresh, hard when dry. GILLS decurrent, *sinuate behind,* broad, subdistant behind, close in front, white, often ferruginous-stained, transversely rivulose or striate, serrately-eroded, *covered when young by a membranous white* VEIL. STEM short, 2-5 cm. or longer, 1-2½ cm. thick, stout, solid, *hard,* pointed at base, *scaly,* irregular in cross-section, at first ringed at apex by the veil. SPORES elongated-oblong, 10-13 x 4-5½ micr., smooth, white. ODOR pleasant, rather faint.

Solitary or somewhat caespitose. On old timbers of bridges, side walks, railroad ties, fence posts, or on sun-exposed logs, stumps, etc., in woods, preferably on wood of conifers, hemlock, pine, tamarack, but also on oak, etc.

Throughout the state. May-October. Common. Edible when young.

A species has been segregated from this one by Peck, who has described a new form with gills which are decurrent but not sinuate and which has spores 7½-10 x 4-5 micr., under the name *Lentinus spretus.* It has a more slender habit, thinner pileus, and smaller scales. This doubtless occurs also with us. *Lentinus lepideus,* in the happy phrase of McIlvaine, "is a sort of commercial traveler." It is found everywhere on railway ties, whose decay it accelerates. Its ability to grow in rather dry situations makes it a dangerous enemy of exposed timbers, especially of coniferous wood. Specimens found on old tamarack logs measured 20 cm. across the pileus, and had a well developed veil which formed a membranous ring at the apex.

***Pileus glabrous; veil lacking.*

### 20. Lentinus umbilicatus Pk.

N. Y. State Mus. Rep. 28, 1876.

Illustration: Ibid, Plate I, Fig. 15-19.

PILEUS 1-2 cm. broad, tough, convex, *with a deep umbilicus, hygrophanous,* water-brown, (moist), fading, glabrous, even. FLESH thin. GILLS adnate or slightly decurrent, close, broadest behind, narrower in front, whitish, edge serrate. STEM 1-2½ cm. long, 2-3 mm. thick, equal or tapering upward, glabrous, *stuffed or hollow,* tough, *slightly wrinkled or lacunose,* central or eccentric, concolor or paler. SPORES broadly elliptical, 6 x 3.5-4 micr., smooth, white. ODOR none. TASTE tardily acrid.

Gregarious. On the ground, among leaves, in mixed woods of pine, beech, etc. New Richmond. September. Rare.

This little Lentinus has the habit of a Clitocybe. Our specimens had a central stem and grew from the ground. It is, however, said to grow on wood, where it has an eccentric stem. Its serrate gills and tough texture separate it from Clitocybe. It is close to *L. omphalodes* Fr. and may be its American form.

### 21. Lentinus haematopus Berk.

Grevillea, 1872.

PILEUS 2-5 cm. broad, orbicular or wider than long, sometimes lobed, *umbilicate or depressed,* pale or sordid yellow, glabrous, even. FLESH tough, whitish, tinged yellow, *thin.* GILLS decurrent, narrow, subdistant, white to dull yellowish, edge toothed to nearly entire. STEM short, 4-6 mm. long, 2-4 mm. thick, *eccentric to sublateral,* firm, glabrous *blood-red* or *reddish.* SPORES oblong-elliptical, inequilateral, 7-9 x 3 micr., smooth, white. CYSTIDIA none. ODOR aromatic-pleasant. TASTE bitterish.

Solitary. On wood. Ishpeming. August. Rare.

The specimen from which most of the above description was made, was sent to Peck who identified it as this species. It was first sent to Berkeley from an unknown locality in North America. Peck reports it twice from New York. In our plant the pileus is laterally extended on the short sublateral stem, and the gills and flesh have a distinct dull yellow tinge. It was found in mixed woods in the Northern Peninsula.



### 22. Lentinus microsperma Pk.

Torr. Bot. Club. Bull. 33, 1906.

PILEUS 3-5 cm. broad, thin, convex, *obtuse,* soft-pliant, glabrous, even, *brownish-tan,* darker on disk, margin spreading. FLESH white, thin. GILLS adnexed-emarginate, rather narrow, attenuate in front, close, white, becoming dingy creamy-yellowish, *edge lacerate-crenulate.* STEM 3-6 cm. long, 4-10 mm. thick, varying slender or rather stout, *hollow,* terete or compressed, eccentric, sometimes grooved, glabrous, equal, whitish. SPORES minute, globose, 3-4.5 micr., smooth, white. CYSTIDIA none. BASIDIA clavate, about 25 x 5 micr. TASTE bitterish.

Caespitose. On decayed wood. New Richmond. September. Rare.

This species was first sent to Peck from Missouri. It seems to be quite distinct although rare. I have collected it but once.

### 23. Lentinus cochleatus Fr. (Edible)

Syst. Myc., 1821. (As *Omphalia cochleata.*) Epicrisis, 1836-38.

Illustrations: Gillet, Champignons de France, No. 403.
Ricken, Blätterpilze, Pl. 26, Fig. 1.
Patouillard, Tab. Analyt., No. 126.
Cooke, Ill., Plate 1142.
Hard, Mushrooms, Fig. 183, p. 229, 1908.

PILEUS 2-5 cm. broad, tough, flaccid, *irregularly-compressed or lobed,* variable in shape, *depressed to infundibuliform,* glabrous, pale reddish ochraceous to brownish-isabelline. FLESH thin, whitish. GILLS decurrent, rather broad, close, whitish tinged flesh-color, edge serrate. STEM 3-7 cm. long, 3-7 mm. thick, glabrous, central, eccentric or sublateral, *confluent at base, deeply sulcate,* solid, variously and irregularly thickened, concolor. SPORES minute, subglobose, 4-5 micr. diam., smooth, white in mass. ODOR somewhat aromatic.

Confluent-caespitose, in dense tufts. On stumps, decaying wood of birch, ash, chestnut, etc., sometimes on wood buried in the ground, in mixed and frondose woods. Throughout the state. July to September. Common locally.

The densely tufted furrowed stems and irregular one-sided vase-shaped pilei distinguish this at once. Often there are many short undeveloped pilei around the base of large tufts. The plant is rare in some localities, and in others it may be very plentiful.

*Section II. Pleuroti.* Stem lateral or none. Pileus dimidiate.

### 24. Lentinus vulpinus Fr.

Epicrisis, 1836.

Illustrations: Atkinson, Mushrooms, Figs. 128, 129, p. 134-5, 1900.
Hard, Mushrooms, Plate 26, Fig. 181, p. 227, 1908.
Fries, Icones, Plate 176.

PILEUS 5-15 cm. broad, sessile, multiple-imbricated, conchate-reniform, joined at their bases, *coarsely hairy or scrupose, radiately rough ribbed,* flesh color to alutaceous, margin strongly incurved. FLESH rather thin, tough-fleshy, whitish. GILLS decurrent, broad toward front, *narrowed, to the base of the pileus,* crowded, simple, white or tinged flesh color, edge coarsely serrate. SPORES subglobose, 3-4 x 2-3 micr., very minute, smooth, white in mass, copiously shed on the pilei. ODOR and TASTE rather strong, pungent.

Densely connate-imbricate. On decaying logs, stumps and trunks of various deciduous trees. Ann Arbor, Detroit, New Richmond, Houghton, Marquette. Records from July 25-Oct. 19. Infrequent.

It reappears on the same log in successive years. The very rough and peculiarly colored pileus is not easily mistaken. It grows in shelving masses of many individuals, almost equalling *Pleurotus ostreatus* in this respect, and is by far the largest of the dimidiate species of the genus.

### 25. Lentinus ursinus Fr.—Bres.

Syst. Myc., 1821. (As Pleurotus.))

Illustration: Bresadola, Fung. Trid., Vol. 1, Pl. 66.

PILEUS 1-4 cm. broad, *sessile,* ascending, subimbricate, subreniform, convex, *pale reddish-brown,* varying glabrous to sub-tomentose, even, fading. FLESH thickish, very thin on margin, toughish. GILLS subdecurrent or radiating from the stem-like base, *rather broad,* close, dingy white to whitish-alutaceous, *edge lacerate-dentate.* SPORES *spheroid,* 5.5 x 4 micr., almost smooth, white.



CYSTIDIA none. ODOR mild. TASTE none or slightly disagreeable.

On prostrate trunks in woods of beech and hemlock. New Richmond. September. Infrequent.

Known by the sessile, rufous-brown pileus, which is somewhat tomentose or at least pruinose behind. Fries (Monographia) gives the size of the pileus as about 7 cm. broad; our plants agree better with Bresadola's description, averaging even smaller. Peck (N. Y. State Bull. 131) reports the larger-sized plant but says the taste is acrid and the margin of the pileus costate-corrugate.

## Marasmius Fr.

(From the Greek, *maraino,* to wither or shrivel.)

White-spored. Flesh tough, arid, shriveling in dry weather, *reviving again in wet weather.* Stem central, confluent with the pileus, but of different texture, often horny. Veil none. Gills arid.

Terrestrial or lignicolous, frequently on midribs or veins of fallen leaves, on grass, etc. Except in the texture of the pileus, it is similar and closely related to the genera Collybia and Mycena, and with the same habit. A few are highly prized for the table. *M. oreades,* is one of our best-flavored mushrooms, especially delicious when used in gravy or soups. *M. scorodonius,* because of its garlic flavor, is used to season various dishes, although *M. alliaceus* which has the same odor is mentioned as not edible. The latter has not been found with us so far. Several are reported as poisonous, e. g., *M. urens* and *M. peronatus.* It is worth while to become acquainted with *M. oreades,* even if one goes no further. The genus is a large one, comprising over four hundred and fifty species, of which the larger part occur in the tropics.

The PILEUS is not putrescent, as it is in Collybia and Mycena, but is composed of a toughish substance which revives in wet weather and this is a fundamental character by which this genus along with Panus, Lentinus and Schizophyllum is to be separated from the Agarics with a putrescent pileus. The size is similar to that of the species of Mycena. It is usually soon expanded as in Collybia and may be depressed or umbilicate. The two main groups correspond, with regard to the position of the margin in the young plant, to Collybia and Mycena respectively, and have the same name. The GILLS are arid, flexible, almost leathery at times, often crisped on drying, the edge entire. They are sometimes joined behind in

the form of a collar which loosens (secedes) from the stem. Often they are almost free, or, when adnate or adnexed they have a tendency to secede. It is often confusing to find that authors use the term "free" or "becoming free," when they mean that the gills become loosened from the stem after they have been attached. It is better to use the term "secede" and retain "free" for the usual purpose of indicating that they never were attached to the stem. In the smaller species the gills are often few and therefore very distant. The width is often quite reliable to separate species, although in some it varies. The STEM is cartilaginous or horny; in a few, e. g., *M. oreades* it is merely tough-fibrous or with a subcartilaginous cuticle. The nature and presence or absence of the villose, tomentose, etc., covering of the stem is used to distinguish some of the sections. The mode of attachment to the substratum, whether rooting or instititious, also helps to separate the subdivisions. Many of the smaller species have a black stem, and usually the color of the stem in most species is darker below and paler or white at the apex. With the exception of a small number of our species, like *C. oreades, C. urens, C. peronatus* and *C. subnudus,* the stem is hollow or slightly stuffed at first. In the small species the stem is almost bristleform and inserted by the attenuated base. The SPORES are white in mass, hyaline under the microscope, varying in shape from subspheriod to lanceolate. The majority have a similarity in form which is rather striking: round-enlarged at one end and tapering to a pointed apiculus at the attached end. The reviving ability of the gills explains the variability in size which is found at different times in separate plants of the same species. One must be cautious in taking the spore-measurements as in some cases it is clear that the spores continue to grow after the plant is revived by rains. CYSTIDIA are rarely present. In *M. cohoerens* they occur in great abundance in the form of relatively large brown spicules of the same kind as occur on the surface of the pileus and stem. In *M. delectans* they are colorless. The ODOR is strong and often like garlic as in *M. scorodonius, M. prasiosmus, M. polyphyllus* and *M. calopus.* In *M. foetidus* it is very disagreeable, but not of garlic. The TASTE is acrid or bitter in a few species, otherwise not important.

The arrangement of species is that of Fries. Until the development is carefully studied for each species, any new arrangement is likely to be unsatisfactory. The genus is divided into two subgenera: Collybia and Mycena with the following sections:



I. COLLYBIA
- (1) Scortei
- (2) Tergini
- (3) Calopodes

II. MYCENA
- (4) Chordales
- (5) Rotulae

*Key to the Species*

(A) Stem velvety, tomentose, floccose, pruinose or minutely pubescent, at least downwards. [See (AA).]
- (a) Gills arcuate-decurrent; plant glandular-pubescent, white. 41. *M. resinosus* Pk.
- (aa) Gills not decurrent, sometimes uncinate.
  - (b) Stem rooting or attached by a floccose or strigose base.
    - (c) Plants with a strong odor.
      - (d) Odor like garlic.
        - (e) Pileus 3-5 cm. broad; gills very crowded; spores 5-6 x 3-4 micr. 37. *M. polyphyllus* Pk.
        - (ee) Pileus 1-2.5 cm. broad; gills not crowded; spores 12-15 x 3-4 micr. 36. *M. prasiosmus* Fr.
      - (dd) Odor very disagreeable, not of garlic. Pileus umbilicate, plicate-striate. 43 *M. foetidus* Fr.
    - (cc) Plants not ill-smelling.
      - (d) Taste acrid or bitterish; pileus 2-5 cm. broad, brownish-red to alutaceus.
        - (e) Stem clothed everywhere by a whitish or grayish pubescence.
          - (f) Taste bitter; spores 10 x 4.5 micr. 29. *M. subnudus* (Ellis) Pk.
          - (ff) Taste acrid; spores 7-8.5 x 3.28. *M. urens* Fr.
        - (ee) Stem with yellow strigose hairs towards base; taste acrid. 27. *M. peronatus* Fr.
      - (dd) Taste not acrid nor bitter.
        - (e) Stem solid; plants growing in rings in grassy places, dull reddish-brown to dull yellowish. 26. *M. oreades* Fr.
        - (ee) Stem stuffed or hollow.
          - (f) Stem dark blood-red within; gills very crowded and narrow; pileus red-brown. 38. *M. varicosus* Fr.
          - (ff) Stem not with blood-red flesh.
            - (g) Gills soon reddish-brown from abundant dark-colored cystidia; stem horny, bay brown, subvelvety. 46. *M. cohaerens* Fr.
            - (gg) Gills without brown cystidia.
              - (h) Pubescence or tomentosity of stem dark-colored, brown, reddish, tawny or blackish, especially downward.
                - (i) Pileus subzonate, umbilicate, tawny-hairy like the stem. (828. *Collybia zonata.*)
                - (ii) Pileus not zonate, glabrous.
                - (k) Growing on bark of grape-vines; pileus 2-3 cm. broad, sulcate-striate. 30. *M. viticola* B. & C.
                - (kk) Growing among fallen leaves in woods.
                - (l) Stem spongy-thickened at base; gills broad; pileus fuscous-pallid. 32. *M. spongiosus* B. & C.
                - (ll) Stem equal.

(m) Stem minutely pruinose, horny, almost black below; pileus dark rose-madder. 39. *M. erythropus* Fr. var.
(mm) Stem densely tomentose.
(n) Stem dark reddish-brown throughout, 2-8 cm. long, 35. *M. semihirtipes* Pk.
(nn) Stem brown or fawn color, 5-12 cm. long. 47. *M. elongatipes* Pk.
(hh) Pubescence etc. of stem grayish or whitish, at least when dry.
(i) Growing on tree-trunks, bark, stumps, logs, etc.
(k) Slender; pileus 1-1.5 cm. broad, papillate, dull pinkish-white; on mossy logs. 48. *M. papillatus* Pk.
(kk) Short-stemmed; pileus 1-3 cm. broad, fulvous-alutaceus; caespitose-gregarious. 31. *M. fagineus* Morg.
(ii) Among fallen leaves, etc., in woods; stem 5-12 cm. long.
(k) Stem 2-5 mm. thick, reddish under the dense whitish pubescence; gills very narrow and crowded. (See 827 *Collybia confluens* Fr.)
(kk) Stem 1-2 mm. thick; covered with grayish pruinosity or tomentose.
(l) Gills very narrow and crowded, whitish or grayish. 40. *M. velutipes* B. & C.
(ll) Gills distant, at length reddish-spotted. 47. *M. chordalis* Fr.
(bb) Stem inserted at the base, instititious, short; plants small.
(c) Gills attached to a collar, distant; pileus rufescent; stem white. 44. *M. olneyi* B. & C.
(cc) Gills attached to stem.
(d) Pileus glabrous, rarely subpruinose.
(e) Pileus milk-white, not sulcate nor plicate; gills distant; stem reddish-brown. 54. *M. epiphyllus* Fr.
(ee) Pileus rufescent, striate when dry; stem brownish to blackish-brown. 50. *M. felix* Morg.
(dd) Pileus pruinose, chalk-white, stem black, white pruinose on surface; spores angular. (See 56. *Heliomyces nigripes* (Schw.) Morg.)
(ddd) Pileus hairy or strigose-hairy.
(e) On cedar twigs; pileus conic, papillate, dark tawny. (See 830 *Collybia campanella* Pk.)
(ee) On twigs, chips, acorns etc; pileus umbilicate; whitish to dark grayish. (See 829 *Collybia stipitaria* Fr.)
(AA) Stem glabrous (except sometimes at the very base).
(a) Stem villose-rooting or attached by a floccose tubercle.
(b) Gills soon reddish-brown from the dark-colored cystidia; stems usually coherent, bay-brown, densely white-hairy at base. 46 *M. cohaerens* (Fr.) Bres.
(bb) Gills white or slightly tinged.
(c) Stem 4-8 cm. long; pileus sulcate, ochraceus-red; spores large. 49. *M. siccus* Schw.=( *M. campanulatus* Pk.)
(cc) Stem 2-5 cm. long.
(d) Pileus, gills and apex of stem white, stem dark-brown below, attached by a spreading mycelium. 34. *M. delectans* Morg.
(dd) Pileus not white.
(e) Stem reddish-brown to chestnut downwards; pileus dingy ochraceus. 33. *M. glabellus* Pk.
(ee) Stem wine-purple or pink upwards; pileus tawny-brown to purplish or pink. 33. *M. bellipes* Morg.



(aa) Stem inserted at the naked base, very slender; on twigs, leaves etc.
(b) Odor more or less strong, of garlic; pileus rufous to whitish.
(c) Gills adnate, narrow; stem attenuated at the blackish base. Odor strong. 42. *M. scorodonius* Fr.
(cc) Gills adnexed, rather broad; odor faint; stronger as plant dries. 42. *M. calopus* Fr.
(bb) Odor not of garlic.
(c) Gills attached to a free collar.
(d) Pileus umbilicate, plicate on sticks, wood, etc., filiform.
(e) Umbilicus white, elsewhere cap is darker; stem black. 55. *M. capillaris* Morg.
(ee) Umbilicus darker, cap white; stem black. 51. *M. rotula* Fr.
(dd) Pileus umbonate, sulcate, pale rufous; stem black, on grass. 52. *M. graminum* Libert.
(cc) Gills adnate or adnexed.
(d) Plant entirely white; pileus obtuse, 4-8 mm. broad, stem very short. 45. *M. caricicola* Kauff.
(dd) Pileus reddish-brown-purplish, umbilicate; stem black. 53. *M. androsaceus* Fr.
(ddd) Pileus fuscous-cinereous; stem short; on bark of living tree-trunks. (See 845. *Mycena corticola.*)

*SUBGENUS COLLYBIA. Margin of pileus at first incurved;* stem somewhat cartilaginous; pileus fleshy-pliant, at length tough and sulcate or wrinkled.

*Section I. Scortei.* Stem *solid or fibrous stuffed,* externally covered by a *detersile villosity,* i. e., an easily removable villosity.

**Stem not strigose at the base.*

### 26. Marasmius oreades Fr. (Edible)

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1118.
Gillet, Champignons de France, No. 444.
Patouillard, Tab. Analyt., No. 328.
Hard, Mushrooms, Figs. 101 and 102; p. 136, 1908.
Gibson, Our Edible Toadstools and Mushrooms, Pl. 8, p. 105, 1903.
Swanton, Fungi, Pl. 9, Fig. 3.
Murrill, Mycologia, Vol. 2, Pl. 19, Fig. 3.
White, Conn. State Geol. & Nat. Hist. Bull. 15, Pl. 4, 1910.
Peck, N. Y. State Mus. Rep. 48, Pl. 33, Fig. 7-12, 1896.

PILEUS 2-5 cm. broad, *thickish,* pliant, campanulate-convex, obtuse or broadly umbonate, dull brick-red when young or moist, fading to yellowish-flesh-color, or yellowish-buff when dry, glabrous, even or substriate when moist. FLESH rather thick on disk, pallid.

GILLS rounded behind or almost free, *broad,* rather distant, whitish or tinged yellowish, interspaces often venose. STEM 3-7 cm. long, 3-5 mm. thick, equal, *solid,* even, tough, whitish, covered with a fine, interwoven, dense, detersile, villosity. SPORES ovate-fusiform, 7-9 x 4-5 micr., smooth, white. ODOR somewhat fragrant, agreeable. TASTE pleasant.

Gregarious, usually growing in rings or arcs, in grassy places, lawns, roadsides, pastures, etc., attached to grass, or roots of other plants. Throughout the state, more abundant in sandy regions. June-October. Common.

One of our best edible mushrooms, and very plentiful in some localities during a wet season. Its flavor is delicious and it can be used for this reason to add character to other dishes. Its toughness disappears by long cooking, a reversal of what happens in the case of many other species. When dry from sun or wind, its pale-honey-yellowish color and reviving ability are good marks of recognition; its tendency to form circles of close-growing individuals and its preference for grassy ground aid one to recognize it. Its gills are scarcely as arid as in other species of Marasmius, and this character, along with its fleshy cap indicate a close relationship with Collybia. The "fairy rings" caused by this and other mushrooms are due to the regularity of radial growth which the underground mycelium makes from year to year, starting from a central infection. It is believed by some that this mycelium excretes a substance which injures the grass so that the interior of the circle shows a poor growth of grass, but on the other hand some favorable influence from the actively growing portion along the "ring" causes the grass of this portion to grow better.

***Stem with a woolly or strigose base.*

### 27. Marasmius peronatus Fr. (Poisonous)

Syst. Myc., 1821.

Illustrations: Ricken, Blätterpilze, Pl. 25, Fig. 1.
Cooke, Ill., Pl. 1117 (var.).
Gillet, Champignons de France, No. 445.
Berkeley, Outlines, Pl. 14, Fig. 4.
Patouillard, Tab. Analyt., No. 411.
Gibson, Our Edible Toadstools and Mushrooms, Pl. 9, p. 111, 1903.
Hard, Mushrooms, Fig. 112, p. 149, 1908.



"PILEUS 2-6 cm. broad, convex-plane, obtuse. opaque, pliant, pale reddish-brick color fading to alutaceus, at length lacunose, *margin striate at first,* wrinkled when old. FLESH thin, leathery-membranaceus. GILLS adnexed-seceding, rather thin, at first whitish then rufescent, close to subdistant. STEM 5-8 cm. long, 2-4 mm. thick, fibrous-stuffed, subequal, sometimes compressed, with a villose covering, yellowish then rufescent, *toward base with yellow strigose hairs.* SPORES oval, 6-8 x 3-5 micr., smooth, white. ODOR none. TASTE *acrid.*"

Gregarious on the ground among leaves and sticks in frondose and coniferous woods. Probably throughout the state. July-October. Infrequent.

The description is adapted from Saccardo. This species seems less common with us than *M. urens.* Its acrid taste, habit, and the yellow hairs on the lower part or base of stem are good characters for its indentification. Its size corresponds to that of *Collybia dryophila.* The stem is said sometimes to become hollow. It is said to be poisonous.

### 28. Marasmius urens Fr. (Poisonous)

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1116.
Gillet, Champignons de France, No. 448.
Berkeley, Outlines, Pl. 14, Fig. 3.
Gibson, Pl. 9, p. 111.
Plate VII of this Report.

PILEUS 2-5 cm. broad, at first convex, then almost plane, obtuse or subumbonate, reddish-brown to alutaceus, darker on center, *at first even,* at length wrinkled, glabrous, opaque, pliant, margin at first incurved. FLESH thin, toughish-membranaceus. GILLS becoming free, at length remote, joined behind in places, thickish, subintervenose, *close,* at first crowded, narrow, whitish or pallid then tinged reddish. STEM 4-8 cm. long, 1-3 mm. thick, equal, *solid, terete,* pale reddish-brown, paler above, almost blackish at base, *covered throughout by a close, white pubescence,* composed of cohering minute hairs, whitish within, attached by an oblique substrigose base. SPORES oblong-lanceolate, slightly curved, 7-8.5 x 3 micr. CYSTIDIA none. ODOR none. TASTE *acrid; poisonous.*

Gregarious or scattered, on the ground in frondose woods, among leaves, debris and grass. Ann Arbor. July-October.

This species is considered identical with the preceding by Ricken, Massee and Romell. Even Fries was loath to separate it, and considered it a var. of *M. peronatus*. (See note under *M. urens*. Epicrisis, p. 373.) According to McIlvaine, *M. peronatus* is edible, while *M. urens* is marked poisonous. If the two are identical this can hardly be true. There is a remote possibility that *Collybia hariolorum* has been confused with *M. peronatus* while testing its edibility. In any case one needs to be careful. *M. urens* if distinct, seems more abundant locally than *M. peronatus*. The latter alone seems to have been differentiated by Peck, who does not report the first. Moffatt (Nat. Hist. Surv. Chicago) reports only *M. urens* and says it is frequent. Morgan (Myc. Flora. Miam.) reports both.

### 29. Marasmius subnudus (Ellis) Pk.

N .Y. State Mus. Rep. 51.

"PILEUS 2-5 cm. broad, convex or *nearly plane,* glabrous, tough, flexible, often somewhat irregularly uneven, *dull brownish red or dingy bay,* more or less striate on margin. FLESH thin. GILLS rounded behind, nearly free, narrow, *subdistant, whitish or creamy-yellow,* becoming darker on drying. STEM 4-8 cm. long, 2-4 mm. thick, slender, equal, tough, *inserted, solid,* reddish-brown above, blackish-brown below, everywhere clothed with a *grayish* down or tomentum, which is commonly a little more dense near the base. SPORES 10 x 4.5 micr. (Pennington.) TASTE of dry plant bitter."

On the ground in mixed woods. New Richmond, Ann Arbor. August-September.

This is apparently a variety of the preceding, if that species is distinct, and not of *M. peronatus* as Ellis considered it. It is probable that all three run into each other. The description is that of Peck. Our plants had a bitter taste when fresh, otherwise not very different from *M. urens* Fr. Glatfelter (Trans. Acad. Sci. St. Louis, Vol. 16) gives spores 6-8 x 4-5 micr. which agree with those of *M. urens.*

### 30. Marasmius viticola B. & C.

Ann. & Mag. N. H., 1859.

PILEUS 1-3 cm. broad, convex-expanded, at length depressed, *sulcate-striate,* pale rufous to alutaceus-brownish, glabrous. FLESH thin, subcoriaceus. GILLS slightly adnate, not broad, ventricose,



*subdistant,* pallid or tinged alutaceus. STEM 2-4 cm. long, 1-2 mm. thick, equal, tough, *pruinose-furfuraceus,* stuffed, *dark brown,* slightly enlarged and curved at very base. SPORES ovate-lanceolate, 8-9 x 3-4 micr., smooth, white. ODOR none. TASTE mild.

Gregarious or scattered, on rotten wood, debris, etc. Infrequent.

This is referred here with some hesitancy, although it is clearly distinct from the following, which differs in its subcaespitose habit, its short stem and long spores. It was named by Berkeley from material sent him by Curtis who collected it from grape-vines in Alabama.

### 31. Marasmius fagineus Morg.

Cinn. Soc. Nat. Hist. Jour., Vol. VI., 1883.

PILEUS 1-3 cm. broad, at first convex-campanulate, then plane, obtuse, pliant, striatulate when moist, radiately rugose when dry, *at length repand, pale fulvous-alutaceus,* appressed-silky, sometimes scaly-lacerate, margin at first incurved. FLESH thin, submembranaceus. GILLS narrowly adnate, seceding, rounded and subjoined behind, close, not broad, attenuate in front, crisped, whitish at first, *becoming brown—spotted or stained reddish,* edge subentire. STEM *short,* 1-2 cm. long, 1-2 mm. thick, *curved,* sometimes straight, subequal, *apex enlarged,* with a narrow stuffed axis, terete when fresh, compressed when dry, rufous or chestnut-alutaceus, fading to fuscous-alutaceus, apex paler, *covered by a whitish, villose tomentosity when dry,* strigose brownish-hairy where attached. SPORES subcylindrical, narrow, with curved apiculus, 9-12 (rarely 13) x 3.5-4 micr., with many immature of all sizes, smooth, white. CYSTIDIA none. ODOR and TASTE none.

Gregariously caespitose, usually abundant, on bark near base of living elm, beech and maple, or on stumps, etc., sometimes ascending the trunk five to six feet or more. Ann Arbor. July-August. Not infrequent.

Known by its caespitose, crowded habit, short stems, relatively broad pileus and spores. This may be the true *M. viticola,* but that species is poorly known.

### 32. Marasmius spongiosus B. & C.

Jour. Botany, 1849.

"PILEUS 1-2 cm. broad, plane, obtuse, *whitish-fuscous,* darker on center. GILLS slightly adnate, *broad,* close, whitish. STEM

3.5 cm. long, *thickened at the base* where it is spongy and fulvous-hairy, elsewhere furfuraceus-pulverulent." SPORES 7-9 x 3-4 micr. (Morgan); 4-5x3 micr. (Glatfelter).

Reported by Longyear, as under oak trees among grass. Also said to grow among fallen leaves, and around stumps in rich soil. I have not seen it.

*Section II. Tergini.* STEM tubular, rooting, cartilaginous. Pileus *hygrophanous.* Gills seceding.

**Stem glabrous except the mycelioid-hairy base.*

### 33. Marasmius glabellus Pk.

N. Y. State Mus. Rep. 26, 1874.

PILEUS 1-2 cm. broad, convex-expanded, obtuse, often distantly striate, *dingy ochraceous,* uneven on disk. FLESH membranaceus. GILLS adnate-seceding, *broad, distant,* ventricose, white or whitish, intervenose. STEM 2-5 cm. long, 0.6-1 mm. thick, slender, equal, horny, tubular, *glabrous,* shining, whitish at apex, *reddish-brown or chestnut* elsewhere, mycelioid-thickened at base. SPORES (10x4.5 micr., from one of Peck's collections).

Var. *bellipes*=(*M. bellipes* Morg.) Jour. of Myc., Vol. XI, 1905.

PILEUS *pale tawny-brown to pink-purplish,* distantly sulcate or plicate, subpapillate, glabrous or minutely velvety. STEM with dilated apex, *varying above from whitish to bright wine-purple or pink.* SPORES elliptical oval, curved-apiculate, 10-12x4-5.5 micr., smooth, white. BASIDIA 30-42 x 6 micr., slender. ODOR and TASTE none. (Otherwise like *M. glabellus.*)

Gregarious or scattered, among fallen leaves on the ground in frondose woods. Ann Arbor. August-September. Infrequent.

As no authentic spore-measurements are published, it is impossible to say whether *M. bellipes* is entirely distinct. The latter, however, seems to be the form that occurs in our region. Inasmuch as the plant, as it occurs here, varies considerably in color, it would not be surprising if Peck's species had the colors mentioned for both. The variety is a beautiful plant when in the fresh state, due to the highly colored stem. *M. pulcherripes* Pk. differs from the latter apparently only in its narrow gills and very filiform stem; the spore-size is not given.



### 34. Marasmius delectans Morg.

Jour. of Myc., Vol. XI, 1905.

Illustration: Hard, Mushrooms, Fig. 114, p. 151, 1908.

PILEUS 1-2 cm. broad, pliant, convex-expanded, depressed or subumbonate, glabrous, *white or whitish,* pale tan in age, rugulose-striate. FLESH subcoriaceous. GILLS adnexed, unequal, moderately broad, *subdistant, white,* intervenose. STEM, 3-5 cm. long, 1-1.5 mm. thick, *slender,* equal, even, hollow, cartilaginous-tough, *glabrous, shining, pure white above,* darker downwards, to dark brown below, *mycelioid at base,* mycelium forming wide, white mats over the fallen leaves where it grows. SPORES narrow elliptical, 7-9x3-4 micr., smooth, acuminate-apiculate, white. CYSTIDIA rather abundant on sides, especially on edge of gills, slender, spine-like, 36-45x3-5 micr. ODOR and TASTE mild.

Among fallen leaves in mixed and frondose woods. Ann Arbor, New Richmond. August-September.

Easily known by the white, mycelioid mats which it forms among the leafy covering of the ground in woods, by the white color of the cap and gills and apex of stem, and by its shining stem. It is quite frequent during continued rainy weather.

***Stem glabrous at apex only.*

### 35. Marasmius semihirtipes Pk.

N. Y. State Mus. Rep. 25, 1873.

Illustration: Conn. State Geol. & Nat. Hist. Surv., Bull. 15, Pl. 6.

PILEUS 2-3 cm. broad, pliant, tough, convex, soon plane, or depressed, glabrous, hygrophanous, even or rugulose, *reddish-brown when moist,* fading to pale alutaceus, disk darker. FLESH thin, submembranaceus. GILLS adnexed-seceding, rather narrow, close to subdistant, whitish, somewhat intervenose, edge subfimbriate. STEM 2-8 cm. long, 1-1.5 mm. thick, *tough,* subequal, *tubular,* sometimes compressed, substriate, *dark reddish-brown throughout,* glabrous at apex, *densely* velvety-tomentose nearly to apex, tomentum of same color. SPORES ovate, curved-apiculate, 8-9x4-5 micr., smooth, white. ODOR and TASTE mild.

On the ground in frondose or mixed woods among leaves and

debris. Ann Arbor, New Richmond, etc. Probably throughout the state. June-September. Frequent.

Known by the reddish covering of the stem. Hard says the plants are very small, which is scarcely correct. The name is deceptive, since the tomentose covering of the stem more often extends nearly or quite the whole length of the stem and the species could with equal propriety be referred to the next division.

### 36. Marasmius prasiosmus Fr.

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1120.
Gillet, Champignons de France, No. 447.

PILEUS 2-2.5 cm. broad, convex then expanded or depressed, obtuse, *pale brown with tinge of flesh color*, to pale isabelline, rugose-sulcate, glabrous. FLESH submembranaceus, toughish. GILLS adnate, seceding, sometimes with tooth, rather narrow, close to subdistant, *concolor* or paler than pileus, thick somewhat crisped. STEM 5-7 cm. long, 2-3 mm. thick, equal, *hollow*, horny-tough, dilated at apex, *dark rufous-brown downwards*, white and glabrous above, *clothed by a whitish or pallid villosity* which is denser below, attached by incurved or straight base to veins of oak leaves. SPORES narrowly lanceolate, curved, accuminate at one end, 12-15 x 3-4 micr., smooth, white. ODOR *strong, of garlic.*

On midribs of fallen oak leaves, in rich woods. Ann Arbor. September. Infrequent.

This differs from *M. scorodonius* in the villose coating of the stem, and from *M. alliaceus* by its habitat on leaves and by the spores; both of those have a garlic odor. Cooke (Ill.) gives the width of spores as 8 micr., and this appears to have been copied by most authors who give the spore size. Ricken departs from this in assigning to it minute spores, 7 x 4 micr. This last discrepancy points to a different species, and may represent *M. polyphyllus* Pk. in Europe.

### 37. Marasmius polyphyllus Pk.

N. Y. State Mus. Rep. 51, 1898.

"PILEUS 3-5 cm. broad, convex or nearly plane, even, *whitish to pale reddish*, often reddish brown on disk. FLESH thin. GILLS



adnexed or almost free, *very numerous, narrow, crowded*, pure white. STEM 3-7.5 cm. long, 2-6 mm. thick, equal, *hollow, reddish-brown* clothed below and upwards by *a whitish down or tomentum*, denser at base, sometimes absent at apex. SPORES minute, elliptical, 5-6x3-4 micr. ODOR and TASTE *of garlic*, persistent in the mouth.

"On damp shaded ground. July."

Reported by Longyear. It is evidently related to *M. prasiosmus*, from which it differs markedly in the size of the spores and the crowded, narrow, pure white gills. It approaches Richen's idea of *M. prasiosmus* more closely than the preceding. I have not seen it.

### 38. Marasmius varicosus Fr.

Epicrisis, 1836-38.

Illustration: Cooke, Ill., Pl. 1121.

PILEUS 1-2.5 cm. broad, pliant, campanulate then plane, obtuse, sometimes with shallow umbilicus, *at first dark reddish-brown, almost purplish*, opaque, somewhat paler in age, radiately rugulose-striatulate, innately silky. FLESH concolor, slightly fleshy. GILLS adnate-seceding, sometimes sinuate-subdecurrent, *very crowded, very narrow*, whitish at the very first, *soon stained dilute reddish*, finally darker, scarcely reaching margin of pileus. STEM 3-5 cm. long, 1-3 mm. thick, stuffed *soon tubular*, equal above, somewhat spongy-thickened at base, glabrous above or with slight grayish pubescence, *towards base covered by spreading or strigose rusty-fulvous hairs, dark blood-red within*, attached by rooting hairs. SPORES minute, narrowly ovate, 6-8x2.5-3 micr., smooth, white. ODOR none. TASTE slightly acrid or mild.

Gregarious or solitary among fallen leaves and debris in frondose woods. Ann Arbor. September. Infrequent.

Characterized by the dark reddish-umber to purplish pileus, the crowded and narrow gills and the ferruginous covering of the stem. When wet the hairs at the base of stem are almost black. By removing the tomentum of the stem the dark red flesh is revealed beneath. Ricken combines this species with *M. fuscopurpurea* Fr., but our plants certainly fit the old conception of *M. varicosus*. It must not be confused with the black species of Collybia: *C. atrata* has broad gills; *C. plexipes* var. lacks the hairy covering on the stem; *C. expallens* has a farinaceus taste. The interior of the stem

of *M. varicosus* seems to secrete a dark-red juice, but it is quite different from *Mycena haematopoda*.

***Stem, at least when dry, everywhere pruinose-velvety.*

### 39. Marasmius erythropus Fr. var.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1123.
Gillet, Champignons de France, No. 441.
Patouillard, Tab. Analyt., No. 577.
Patouillard, Tab. Analyt., No. 125 (as *M. calopus*).

PILEUS 1-2.5 cm. broad, hemispheric-campanulate, then plane, obtuse or subumbonate, pruinate, *dark rose-madder,* darker on disk, rugulose when dry, margin at first incurved. FLESH *white,* thin. GILLS narrowly adnate, seceding, *subdistant,* ventricose, *rather broad,* white or tinged ochraceus, scarcely intervenose, edge very entire. STEM 4-5 cm. long, 1-1.5 mm. thick, equal, horny, stuffed then hollow, *dark reddish-brown to blackish below,* tough, flexuous, pallid at apex, *minutely pruinose,* with an enlarged mycelioid base. SPORES elliptical-lanceolate, curved-apiculate, 7-9x3-3.5 micr. CYSTIDIA none. ODOR and TASTE mild.

On decaying leaves and twigs, on the ground in frondose woods, especially of beech. Ann Arbor. July-September. Rare.

This approaches *M. glabellus* and *M. calopus* Fr.; from the former it is separated by its different spores and gills, from the latter by its pruinose stem. Some specimens seem to have an entirely glabrous stem, thus being close to *M. calopus*. The color of pileus does not change. The pileus is not sulcate as in *M. siccus*. It departs from the descriptions of European authors in the spore-size and the less distant gills.

### 40. Marasmius velutipes B. & C.

Ann. & Mag. N. H., 1859 (N. Y. State Mus. Rep. 23, Peck).

Illustration: Hard, Mushrooms, Fig. 105, p. 140, 1908.

"PILEUS 1.5-3.5 cm. broad convex or expanded, glabrous, grayish-rufous when moist, cinereus when dry. FLESH thin, submembranaceus. GILLS *very narrow, crowded,* whitish or gray. STEM 7-12 cm. long, slender, equal, hollow, *clothed with a dense grayish, velvety tomentum throughout.*"



Peck's description, given above, differs from Berkley's in Saccardo, in that the cap does not have an umbilicus, and in the much longer and slender stem. No spore-measurements are published.

Among fallen leaves in woods, on the ground. Ann Arbor.

Our specimens were verified by Peck. The spores measure 6-7x4 micr., oval to ovate, smooth.

### 41. Marasmius resinosus (Pk.) Sacc.

N. Y. State Mus. Rep. 24, 1872 (as *M. decúrrens* Pk.).
N. Y. State Mus. Bull. 67, 1903 (as var. *niveus* Pk.).
Sylloge Fungorum, Sacc., Vol. V., p. 522.

PILEUS 5-12 mm. broad, convex, then expanded and depressed, pliant, tough, *dull white,* rarely grayish or tawny, sometimes umbilicate or subinfundibuliform, *even or subrugulose, glandular-pubescent.* FLESH thin, submembranaceus. GILLS *arcuate-decurrent,* close to subdistant, *narrow,* white or whitish, often veined or forked, edge flocculose. STEM 2-5 cm. long, 0.5-1 mm. thick, slender, equal, tough, cartilaginous, *glandular-pruinose,* tubular, not striate, white then pallid, *attached by floccose base,* rarely confluent. SPORES oval-lanceolate, 6-7x3-4 micr., smooth, white. STERILE CELLS on edge of gills numerous, narrowly clavate, obtuse, 30x6-7 micr. ODOR and TASTE mild.

Gregarious or subcaespitose, attached to grass, sticks, leaves, etc., in frondose woods. Ann Arbor. July-September. Frequent locally after heavy rains.

The pubescence of cap and stem is due to minute, short hairs which are often glandular-tipped as seen under the microscope. When rubbed between the fingers the fresh plant feels resinous. The decurrent gills suggest an Omphalia, but the reviving and tough substance of the plant are characteristics which place it here. It was first named *M. decurrens* by Peck, who happened on specimens which were not at all typical as to the color of the cap. Saccardo changed the specific name to *resinosus,* because *decurrens* was preoccupied. Later, Peck named the common form var. *niveus,* which still later he changed to var. *candidisimus.* All these names should be dropped, since the plant is practically always white.

*Section III. Calopodes.* Stem *instititious,* (i. e., inserted, the mycelium hidden), short, not rooting.

**Stem entirely glabrous.*

### 42. Marasmius scorodonius Fr.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1125.
Ricken, Blätterpilze, Pl. 24, Fig. 6.
Hard, Mushrooms, Fig. 109, p. 144.
Michael, Führer f. Pilzfreunde, Vol. II, No. 44 (as *M. alliatus*).

PILEUS 5-12 mm. broad, pliant, convex then plane, margin at length elevated, rufous-tinged at first, *then whitish, glabrous,* wrinkled in age, crisped on margin. FLESH thin, membranaceus. GILLS *adnate, narrow,* close to subdistant, whitish, crisped, edge minutely flocculose. STEM 2-3 cm. long, 1-2 mm. thick, tapering downward, horny, tubular, terete or compressed, reddish, apex whitish, glabrous, *inserted by the naked, blackish base, somewhat shining.* SPORES narrowly oval-lanceolate, pointed-apiculate, 6-8x3-4 micr., smooth, white. ODOR, when bruised, *strong of garlic.*

Attached to base of grass, herbs and rootlets in fields, roadsides, grassy places in or near woods. Ann Arbor, New Richmond, etc. Probably throughout the state. June-September. Infrequent, but abundant locally.

Var. *calopus* (*M. calopus* Fr.).

Syst. Myc., 1821.

Illustration: Plate VIII of this Report.

PILEUS 5-10 mm. GILLS *adnexed, rather broad,* emarginate, subdistant. STEM 2-3 cm. long, 1 mm. thick, reddish-bay color below, pallid-brownish above. ODOR *faint or none,* more noticeable when drying. (Spores, etc., same as *M. scorodonius.*)

Attached to grass stalks, etc., in woods. Ann Arbor.

*M. scorodonius* is known by its glabrous, tapering stem, narrow gills and strong odor when the plant is crushed. *M. calopus* is considered identical by some, but its slight odor, and different gills show it to be at least a variety. Hard's figure scarcely represents either plant as it occurs here. This species has long been used in



Europe as a seasoning for mutton-roasts, for other mushrooms and gravies.

***Stem minutely velvety or pruinose.*

### 43. Marasmius foetidus Fr.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1134.
Gillet, Champignons de France, No. 442.
Hard, Mushrooms, Fig. 104, p. 139, 1908.

"Pileus 1-3 cm. broad, pliant, convex then expanded and *umbilicate,* fulvous-bay color or rufescent, *plicate-striate,* pallid alutaceus when dry, margin incurved. FLESH submembranaceus. GILLS adnexed, joined in a collar behind, distant, rufescent or yellowish, somewhat subdecurrent. STEM 2-3 cm. long, 1-2 mm. thick, tubular, chestnut-brown or paler, *velvety-pruinose,* inserted by the floccose base on wood. ODOR *very disagreeable,* but not of garlic similar to *M. performs.*" Spores 7-8x3.5-4 micr. (Pennington).

I have not seen this species within the borders of the state, but do not doubt that it occurs. It is not *Heliomyces foetans* Pat., as some think. It occurs on wood, fallen branches, etc. The description is adapted from Ricken.

### 44. Marasmius olneyi B. & C.

Ann. & Mag. N. H., 1859.

PILEUS 1-1.5 cm. broad, pliant, convex, soon expanded-plane and depressed, glabrous, *rufescent,* striate when moist, at length radiately rugose, dull luster. FLESH membranous, concolor. GILLS *attached to a collar which secedes from stem,* subdistant, narrow, *white,* arid, edge somewhat crenulate. STEM 2-4 cm. long, 1 mm. thick, dilated at apex, tubular, even, *white to pallid,* minutely pubescent-floccose, *attenuated downward* and inserted at base. SPORES narrowly elliptic-lanceolate, pointed at one end, 9-11x4-5 micr., smooth, white. ODOR none.

On fallen leaves and twigs, in frondose woods of beech, maple, etc. New Richmond. September.

This and *M. leptopus* Pk. seem closely related, the latter differing,

according to the description, by its glabrous stem and the spores which measure 7-9x3-4 micr.

### 45. Marasmius caricicola Kauff.

N. A. F., Vol. IX, p. 277, 1915.

PILEUS 4-8 mm. broad, *convex-expanded, obtuse,* radiately and broadly sulcate or alveolate, *pure white,* toughish, pliant, reviving, *pruinose.* FLESH very thin, membranaceus. GILLS adnate, thick, *very distant,* rather broad, pure white. STEM *very short,* about 2 mm. long, 0-7 mm. thick, terete, equal, central, subglabrous, *pure white,* horizontal or ascending, *inserted by a naked base.* SPORES elliptical-ovate, narrowed toward apiculus, obtusely rounded at opposite end, 15-18x6-6.5 micr. when mature, smooth, white. BASIDIA 2 or 4-spored, about 45x7 micr., elongated-clavate. STERIGMATA stout, awl-shaped, 7-8 micr. long. ODOR none.

Gregarious, on lower portion of Carex stems, in marshes, willow swamps, etc. Ann Arbor. October-November. Common locally.

Differs from *M. candidus* Fr. in the sense of all authors, in that the pileus is not umbilicate nor hemispherical, in its naked, inserted base of the stem, and probably in the spores. Quelet (Jura et. Vosges) gives the spores of the same length for *M. candidus.* Cooke (Ill.) gives minute spores, and Patouillard (Tab. Analyt.) figures them fusiform for *M. candidus.* Hard's photograph (Mushrooms, Fig. 107, p. 142, 1908) can scarcely be considered as the *M. candidus* of Fries, whose plant is described as minute, but is apparently *M. magnisporus* Murr. Manifestly, *M. candidus* Fr. is not well understood.

The trama of the pileus is composed of compact long, thickish, hyaline hyphae, differentiated at the surface into globose, hyaline cells 6-7 micr. in diameter.

*SUBGENUS MYCENA: Margin of pileus at first straight and appressed.* Stem *horny,* tubular, sometimes stuffed, tough and dry. Pileus submembranaceus.

*Section IV. Chordales.* Stem radicating or attached by floccose-radiating hairs.



### 46. Marasmius cohoerens Fr.—Bres.

Epicrisis, 1836-38 (as Mycena).

Illustrations: Fries, Icones, Pl. 80, Fig. 1 (as *Mycena cohoerens*).
Ricken, Blätterpilze, Pl. 25, Fig. 4.
Atkinson, Mushrooms, Fig. 127, p. 133, 1900.
Hard, Mushrooms, Fig. 106, p. 141.

PILEUS 1-2.5 cm. broad, campanulate-expanded, obtuse, sometimes umbonate, even, or striatulate when moist, *soft-velvety,* vinaceus-cinnamon to chestnut color, fading to alutaceus, margin at length repand-wavy. FLESH thin, concolor. GILLS adnate, rounded behind or sinuate, seceding, moderately broad, ventricose, close to subdistant, pallid at first, soon colored, brown, brick red to reddish-brown from the dark-colored, spiculate cystidia, sometimes intervenose. STEM 5-15 cm. long, 4-6 mm. thick, elongated, subequal, *horny, tubular,* even, glabrous and shining, sometimes obscurely velvety from spicules, *bay-brown to chestnut,* pallid at dilated apex, base darker and densely floccose with interwoven hairs which join the stems and attach them to substratum. SPORES variable in size, 6-8.5x4-5 micr., oval-elliptical, smooth, white. CYSTIDIA numerous over entire surface of gills, *lanceolate-aciculate,* 65-95x8-10 micr., *reddish-brown.* ODOR "somewhat disagreeable." (Ricken.)

Caespitose and coherent, on the ground or much decayed wood, in frondose woods. Throughout the state. July-September. Not infrequent.

The rigid, horny, dark stems, joined at base by a mass of white mycelial threads, the numerous cystidia and the size, distinguish this well-marked plant. Sometimes they grow singly. *Collybia lachnophylla* Berk and *Collybia spinulifera* Pk. have been shown by Atkinson to be identical with it. It is often referred to as *Mycena cohoerens.* The surface of the pileus and of the stem are usually covered by dark spicules like those of the gills, and the color of any of these parts varies in proportion to their abundance. These spicules are microscopic in size.

### 47. Marasmius elongatipes Pk.

N. Y. State Mus. Rep. 26, 1874 (as *M. longipes* Pk.).

"PILEUS 8-12 mm. broad, convex, glabrous, finely striate on the

margin, *tawny-red.* FLESH membranaceus. GILLS adnate, close, white. STEM 5-12 cm. long, filiform, *tall, straight,* equal hollow, *pruinose-tomentose,* radicating, brown or fawn color, apex white." SPORES 7-8x3.5 micr. (Pennington.) Among fallen leaves in woods. Rare.

It has been suggested that this is identical with *M. chordalis* (Fr.) Bres. I will, therefore, append Bresadola's description of that species:

"Pileus 1-2.5 cm. broad, convex, soon umbilicate, then expanded, dry, *umber, then livid-whitish, marked with reddish spots,* pruinose under a lens, with an incurved, at first striate then sulcate margin. FLESH membranaceus. GILLS adnate to subdecurrent, distant, whitish, *at length straw yellow and reddish spotted.* STEM 7-10 (rarely 15) cm. long, 1-2 mm. thick, straight, stuffed by a pith, (then hollow), *date-brown,* apex whitish, densely gray pruinose, in wet weather the surface is shiny from yellowish watery drops. SPORES fusoid-ventricose, 8-10x6 micr., hyaline under microscope. CYSTIDIA fusoid. BASIDIA clavate, 40x4-6 micr. ODOR none."

It is evident that here are two forms of Marasmius, clearly distinguishable by the colors. Specimens have been sent from Europe, according to Pennington (information by letter) marked *M. chordalis,* which had the color of our *M. elongatipes.* It seems probable that there are two species in Europe which are confused under the one name. Bresadola's figure does not illustrate our plants and Peck's name should be retained. It was originally called *M. longipes,* a name which had been pre-empted.

### 48. Marasmius papillatus Pk.

N. Y. State Mus. Rep. 24, 1872.

PILEUS 5-15 mm. broad, convex-expanded, *markedly papillate,* striatulate on margin, *dingy whitish with pink tinge,* opaque, slightly subtomentose or glabrous. FLESH submembranaceus. GILLS broadest behind, decurrent by tooth, narrow in front, close to subdistant, whitish or tinged yellowish. STEM 2-5 cm. long, 1 mm. thick, equal, elastic, toughish, hollow, *pruinose,* pallid, tinged flesh color, slightly darker below, *distinctly rooting.* SPORES 10-11 x3-4 micr., subcylindrical, smooth, white. CYSTIDIA few, scattered, narrowly lanceolate, about 50x5-6 micr., acuminate.

Gregarious, on decayed, mossy logs in coniferous regions. Bay View, New Richmond. July-September. Infrequent.



Easily known by its habitat, the small rounded umbo on the cap and the incarnate tinge of cap and stem.

### 49. Marasmius siccus (Schw.) Fr.

Synop. Fung. Car., 1822 (as *Mycena siccus*).
N. Y. State Mus. Rep. 23, 1870 (as *M. campanulatus* Pk.).
N. Y. State Mus. Bull. 105, 1906.

Illustration: Hard, Mushrooms, Pl. 17, Fig. 110, p. 146, 1908.

PILEUS 1-2.5 cm. broad, or sometimes smaller, at first subconical, broadly campanulate, at length often depressed in center, dry, glabrous, *distantly radiately striate-sulcate to the disk,* ochraceus-reddish to bright rose-madder, darker on disk, in age sometimes ferruginous. FLESH membranaceus. GILLS free or slightly attached, *narrowed toward stem,* broad in front, *distant,* white or tinged by color of pileus, subvenose. STEM 4-8 cm. long, slender, horny, *glabrous and shining,* blackish-brown, often pallid to white at apex, tubular, attached to leaves, etc., by small mycelioid base. SPORES elongated oblong-lanceolate, narrowed to the pointed apiculus, variable in size, 13-18 (up to 24) x3-4.5 micr., smooth, white. ODOR mild.

Gregarious, on fallen leaves, twigs and debris in frondose woods. Throughout the State. July-September. Frequent.

One of our most beautiful species of Marasmius, due to its bright colors when in full luxuriance. The color varies considerably and in age is often rusty-reddish on the cap. The stem is paler at times when young. The spores are very variable, and either continue to mature, or in wet weather become elongated by the first stages of germination. Peck referred it to the species of Schweinitz, whose specimens of *M. siccus* are preserved in the herbarium of the Philadelphia Academy of Science. This species has been reported by De Seynes as occurring in the region of the Congo in Africa.

### 50. Marasmius felix Morg.

Jour. Mycol., Vol. 12, 1906.

PILEUS 3-8 mm. broad, convex-plane, dry, glabrous, striate-rugulose when dry, *rufescent.* FLESH membranaceus. GILLS adnate, not broad, *distant,* white, venose, sometimes forked. STEM 2-8 cm. long, filiform, brownish to blackish-brown, sometimes whit-

ish at apex, minutely brown-pubescent or velvety, instititious, slightly brown-hairy at insertion, base attached to veins of fallen oak leaves. SPORES elliptical, 7-9x4-5 micr., smooth, white.

In frondose woods. Ann Arbor.

*Section V. Rotulae.* Stem instititious, filiform, horny or rigid-setaceous. (Attached to leaves, twigs, etc.)

### 51. Marasmius rotula Fr.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1129.
Gillet, Champignons de France, No. 443.
Berkeley, Outlines, Pl. 14, Fig. 7.
Ricken, Blätterpilze, Pl. 25, Fig. 10.
Hard, Mushrooms, Fig. 108, p. 143.
Conn. State Geol. & Nat. Hist. Surv., Bull. 15, Pl. 5.

PILEUS 4-10 mm. broad (rarely broader), pliant, hemispherical-convex, subumbonate-*umbilicate, white* or whitish, umbilicus darker, *radiately plicate,* glabrous, margin crenate. FLESH membranaceus. GILLS *attached to a free collar behind,* distant, broad, whitish-pallid. Stem 2-5 cm. long, filiform, horny, tubular, black or brownish-black, whitish at apex, entirely naked, instititious. SPORES lanceolate-fusiform, 6-9x3-4 micr., smooth, white. ODOR none.

On fallen twigs, leaves and around base of living trunks, gregarious. Throughout the State. May-September. Very common.

Often in great abundance after rains in woods, around shade trees, thickets, etc., and is our commonest Marasmius. Its beautifully pleated white cap and black stem cause it to be a striking little plant when moist and fully expanded. Sometimes the plants arise in series along a prostrate black strand, and are then often sterile.



### 52. Marasmius graminum Libert.

Plant. Crypt., 1837.

Illustrations: Cooke, Ill., Pl. 1129.
Berkeley, Outlines, Pl. 14, Fig. 8.
Gillet, Champignons de France, No. 443.
Ricken, Blätterpilze, Pl. 25, Fig. 9.
Patouillard, Tab. Analyt., No. 325.

"PILEUS *minute,* 2-4 mm. broad, nearly plane, umbonate, *pale rufous, sulcate,* the furrows paler, umbo brown. GILLS few, subventricose, cream-colored, intervenose, *attached to a free collar.* STEM 2-4 cm. long, capillary, shining-black, apex white, entirely naked." SPORES obovate, 5-6 micr. long (Sacc.); lanceolate, 12-15 x3-4 micr. (Ricken) (Schroeter); globose, 3-4 micr. diam. (Massee) (Cooke).

Gregarious, attached to grass-leaves. Southern Michigan.

The description is adapted from Berkeley. Ricken and Schroeter describe it somewhat differently: "PILEUS bright reddish-yellow or brownish-orange, depressed and darker in center. GILLS very distant, all the same length, white or whitish. STEM entirely brownish-black or whitish at apex, hair-like in form, tough and hard." (Otherwise as above, but with long spores.) The very different sizes reported for the spores, show it to be as yet an uncertainly understood species. I have no record of the spores.

### 53. Marasmius androsaceus Fr.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1129.
Gillet, Champignons de France, No. 439.
Ricken, Blätterpilze, Pl. 25, Fig. 6.
Hard, Mushrooms, Fig. 103, p. 138, 1908.

PILEUS 6-12 mm. broad, at first subhemispherical, soon expanded and depressed-umbilicate, *reddish-brown or with purplish-tint,* sometimes whitish, distantly sulcate-striate or radiately wrinkled, glabrous. FLESH membranaceus. GILLS *adnate,* thickish, *distant,* moderately broad, sometimes forked, flesh-color or rufescent. STEM 3-6 cm. long, *capillary, tubular,* tough and hard, glabrous-shining, *black,* apex paler, equal or dilated at apex, insti-

titious. SPORES lanceolate, 6-8x2.5-3 micr., smooth, white. ODOR *none.*

Gregarious, attached to fallen leaves, twigs, pine needles, etc. Houghton, New Richmond and probably throughout the state. July-September.

Not to be confused with *M. perforans* Fr. which has a similar appearance, but differs in possessing a strong, specific odor (not of garlic), and in its minutely-velvety stem covering.

### 54. Marasmius epiphyllus Fr.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1137.
Patouillard, Tab. Analyt., No. 219.

PILEUS 2-8 mm. broad, convex, at length flattened and depressed or subumbilicate, subpruinose or glabrous, *milk-white* rugulose. FLESH membranaceus. GILLS adnate, few, *very distant,* white. STEM 1-4 cm. long, filiform, equal, *reddish-brown,* paler or whitish at apex, *pruinose, pubescent* toward base, instititious, tough. SPORES narrowly fusiform-lanceolate, 9-12x3-4 micr., smooth, white. CYSTIDIA moderately abundant, on sides and edge of gills, 40-50x7-8 micr., subacuminate, narrowly lanceolate. BASIDIA 30x7 micr., 4-spored. ODOR none.

Gregarious, on fallen leaves of oak, etc., attached to midrib and veins. Ann Arbor. October.

Distinguished from the preceding by the pruinose stem. *M. instititious* Fr. is said to differ by the sulcate-plicate pileus and the thicker stem which tapers downward. The spore-sizes given by various authors clash here as in many other cases. Massee and Cooke give them as 3x2 micr.; Morgan (ex Saccardo) as 6-7x2. Our plants appear to be those of Ricken.

### 55. Marasmius capillaris Morg.

Ann. Soc. of Nat. Hist. Jour., Vol. 6, 1883.

PILEUS 2-6 mm. broad, convex, umbilicate, plicate-sulcate, alutaceus sometimes darker, *with white umbilicus,* glabrous. FLESH membranaceus. GILLS *adnate to a free collar,* moderately broad, white, distant. STEM 3-5 cm. long, capillary, equal, long, black, scarcely whitish at very apex, glabrous-shining, tubular, tough,



instititious. SPORES oblong-lanceolate, 8-10x4-5 micr., smooth, white. ODOR none.

Gregarious on fallen leaves of oak, etc., twigs and sticks in woods. Ann Arbor. September.

Known by its long, filiform black stem and the white umbilicus which is in marked contrast to the color of the rest of pileus.

## Heliomyces Lev.

(From the Greek, *helios,* the sun, and *myphes,* a fungus.)

Flesh tremelloid, subcoreaceous, reviving in moist weather. Pileus rugose, sulcate or reticulate-ridged. Stem central, confluent with the pileus, tough. No veil. Gills with acute edge.

Marasmius-like plants with a gelatinous trama, usually lignicolous. The species are few and have been poorly studied; probably most of them occur in the tropical regions. It is highly desirable to know the microscopic structure of the species so far referred here. *Pleurotus subpalmatus* is closely related to this genus, and should perhaps be included. Only two species are represented in my collections.

### 56. Heliomyces nigripes (Schw.) Morg.

Epicrisis, 1836-38.

Illustrations: Hard, Mushrooms, Fig. 115, p. 152, 1908.
Lloyd, Myc. Notes, No. 5, Fig. 19 and 20, p. 46.

PILEUS 1-2 cm. broad, very thin, *pure chalk-white,* convex then expanded, pruinose, rugulose-subsulcate; *trama* composed of *subgelatinous hyphae* much interwoven. GILLS adnate or adnato-decurrent, subdistant, unequal, intervenose, some forked, *white,* rufescent. STEM 2-4 cm. long, 1-2 mm. thick, enlarged and usually compressed above, tapering downward, *instititious,* cartilaginous-tough, *black,* white-pruinose at first, minutely tubular, black within. SPORES coarsely stellate, 3-5 rayed, hyaline, 8-9 micr. diam. CYSTIDIA none.

On sticks, stems of Equisetum, fallen leaves, etc., in mixed woods. New Richmond. September.

In age the colors of the whole plant change to alutaceous. This species has usually been referred to Marasmius. It is an American plant and was placed in that genus by de Schweinitz. In his North

American Species of Marasmius (Jour. Mycol., Vol. 12, p. 98), Morgan included it under Heliomyces, where it probably belongs, although the gelatinous character of the trama is not very strongly developed. Its peculiar spores set it off from all others; Lloyd has given us a photograph showing their stellate character.

### 57. Heliomyces pruinosipes Pk. var.

N. Y. State Mus. Bull. 167, 1913.

PILEUS 1-2 cm. broad, *tremelloid,* convex then plane, minutely pubescent, hygrophanous, dark chestnut-brown, becoming paler, *surface marked by convolute, crowded, obtuse ridges,* not viscid. FLESH thick, becoming tough and slightly horny when dry, reddish-pallid. GILLS adnate running down the stem by short lines, medium broad, close, thin, pallid to dingy ochraceous, becoming brownish-yellow on drying, edge entire. STEM 3-4.5 cm. long, 3 mm. thick, equal, hollow, compressed, somewhat twisted and canaliculate on drying, fibrous, tough, *dark chestnut brown,* fading, clothed by a short tomentose pubescense. SPORES minute, oblong, 5x2.5 micr., smooth, white. TRAMA of cap of large, gelatinous, interwoven hyphae, which in cross-section have a very refractive center; that of gills of similar but more slender hyphae. ODOR and TASTE mild.

The specimen was sent by Mrs. Cahn, from Detroit, in July. The description applies only to our plant. It departs from the description of Peck in that the cap does not at first possess the bright orange-red colors and although our specimens were rather fresh such a loss of color by fading might be expected. A more important difference is the distinct cerebrose surface of the pileus in our plant, not mentioned at all by Peck; for the present it may be considered var. *cerebrosus,* until further data are at hand. It is evidently rare, but there is a curious coincidence in its discovery in the same year at three separate localities, viz., Vaughns and Ithaca, N. Y., and Detroit, Michigan.

## LACTARIEÆ

Context of fruit-body fleshy, putrescent, *vesiculose;* stem confluent with pileus and gills, central; gills brittle, attached, acute on edge, mostly with cystidia in the hymenium; spores sphoeroid, rough, white, yellowish or ochraceous.

This subfamily is sharply set off from the others by the vesiculose trama of the fruit-body and the echinulate or otherwise roughened, globose spores. With the exception of the Cortinarii, no other groups develop such a variety of bright-colored pilei. Many of them possess a strong acrid taste, and nearly all of them have specially differentiated hyphae scattered through the trama, which in the Lactarii secrete a milky or colored juice. The hymenium is composed of cylindric-clavate basidia intermingled with cystidia; the latter often extend into or below the subhymenium, and in the young plant project above the basidia; later they are often even with the rest of the hymenium. In a few cases the cystidia are scanty or lacking. The subhymenium is differentiated to a greater or less extent in the different species, consisting of a tissue of small roundish cells between basidia and trama.

The group is apparently derived from Hygrophorus, probably by several paths. The gills have a somewhat waxy consistency in some species, reminding one of the gills of that genus. There are two well-marked genera:

Lactarius, exuding a milky juice when wounded.

Russula, without this juice.

### Lactarius Fr.

(From the Latin, *lac,* milk.)

Veil none; the trama composed of *vesiculose* tissue, and *with a milky or colored juice* which exudes when plant is broken; gills rigid, fragile, acute on edge; stem central, confluent with the pileus; spores globose or subglobose, usually echinulate or verrucose, white or yellowish.

Fleshy and putrescent fungi, often of large size, mostly terrestrial, sometimes on much decayed wood. The genus is very distinct and

most closely related to Russula, from which it differs by the exudation of a milky or colored juice from the gills and elsewhere when wounded. The abundance and size of many species which are *edible* makes this an important genus economically; but a number of species are believed to be *poisonous* and must be carefully distinguished.

The PILEUS may be white, yellow, orange, green, blue, reddish, tan, gray, etc., often with the colors in variegated zones of related hues. It is either dry or viscid, glabrous, velvety or tomentose, and the margin which is at first involute is usually much more velvety or tomentose than the center of the pileus; in some species, however, the margin is naked. The GILLS are usually adnate at first or acuminate on the stem, becoming spuriously decurrent in many cases as the margin of the pileus is elevated at maturity or in age. They are usually rigid-brittle, and exude the milky juice to best advantage when quickly cut by a sharp-pointed instrument. They are usually of unequal length and often forked, sometimes dichotomously as in *L. piperatus*. The color of the gills varies from white to yellowish or grayish, and in many cases they become distinctly darker in age, a character on which the main division has been based. In one group they become dusted by the spores and are said to be pruinose in age. The STEM has a rigid cortex with a spongy-stuffed interior, and becomes rather brittle. It is never fibrous but may become hollow or cavernous with age. It is either white or has the color of the pileus, but often diluted. Its rigid, stiff-looking appearance, which is due to the vesiculose structure of the flesh, gives both the species of this genus as well as those of Russula a characteristic pose by which these two genera are soon easily recognized. The TRAMA has a structure which, along with that of the Russulas, is unique among the Agaricaceae. The hyphae of the usual slender, filamentous type of other genera are rather scanty, and interweave among clusters of thin-walled, parenchyma-like, isodiametric cells, forming the so-called vesiculose tissue. Mixed with the filamentous are the milk-bearing hyphae, called "latex-tubes" or "lactiferes." These extend longtitudinally up through the stem, spread out in the pileus and extend through the gills. The "MILK," as it is called, is usually white as it comes from a sudden wound, but in several species it is colored blue, orange or red. After the white milk is exposed to the air for a few minutes, it either remains unchanged or becomes yellow, lilac, pink, greenish or grayish. In many species this change is only noticeable where the milk touches the flesh, and the latter takes on the corresponding



color. In a few species the juice is watery or a diluted white; this was considered by Fries as a degenerate condition due to the habitat. During very dry weather or in old specimens the juice is dried up and does not respond to the wounding of the tissue. Some species of Mycena are also supplied with a colored juice, but these lack the vesiculose trama and are very slender-stemmed plants. The TASTE of the milk and flesh is often very acrid in fresh plants and continued sampling of many specimens the same day is apt to produce a sore tongue. It is, however, necessary to know whether a species is acrid or mild, hence cautious tasting of minute pieces of the gills is not objectionable and if kept in the mouth but a short time and not swallowed, no harm results. This character is of great importance in determining the species of this genus. Some species, usually called mild, have a woody or bitterish taste. The SPORES are globose to almost broadly elliptical in some species. The epispore is decorated with minute spines, reticulations, etc. The color varies from white to yellowish, not nearly as variable as in the genus Russula. The size of the spore is not sufficiently different to be of much use in ordinary diagnosis of species. CYSTIDIA are abundant in many of the species, and are apparently of the same nature as in Russula.

Many species, especially those with a mild taste, are EDIBLE, and are much prized by mycophagists; such are *L. deliciosus, L. volemus, L. hygrophoroides, L. indigo,* etc. The very acrid species should be tried cautiously. Some are considered poisonous and have been so marked. The poison is, however, not of the same order as in the Amanitas, and there is a growing belief that if properly prepared most, if not all of them, may be eaten with impunity. *L. piperatus,* whose milk has a most excruciatingly biting effect on the tongue when taken from a fresh plant, is known to be perfectly safe after it is cooked. All serious accidents which have come to my notice in the state, have been traced with fair certainty to the Amanitas. Any mushroom, however, especially if fried, may cause illness to people with poor digestion in the same way as many other delicious articles of food.

The Lactarii are most abundant during July and August, with a similar seasonal range as the Russulas. They often occur in large numbers in the open woods of higher ground, although some species are mostly limited to swamps, bogs and low rich woods. I have seen hundreds of individuals of several species, including *L. vellereus,* in an area several rods in extent. Others like *L. indigo* are mostly few in a place and occur in widely separated localities.

The Friesian arrangement into two main groups is here retained. Other groupings which have been attempted, seem to me to have brought out no clearer relationships and tend only to complicate matters. The main divisions are here considered as subgenera. These have been subdivided into sections, depending on the character of the surface of the pileus, and on the taste. The key includes only the species so far identified from plants gathered within the state.

### *Key to the Species*

(A) Milk brightly colored from the first. [See also (AA) and (AAA)].
  (a) Young gills and milk indigo-blue. 78. *L. indigo* Schw.
  (aa) Not indigo-blue.
    (b) Young gills and milk dark red. 76. *L. subpurpureus* Pk.
    (bb) Young gills and milk orange. 77. *L. deliciosus* Fr.
(AA) Milk at first white, changing color on exposure to the air, at least on the flesh.
  (a) Milk becoming lilac or violet-lilac, at least on the bruised flesh.
    (b) Pileus zonate, 8-12 cm. broad; stem spotted. 75. *L. maculatus* Pk.
    (bb) Pileus azonate, 3-7 cm. broad; stem not spotted. 74. *L. uvidus* Fr.
  (aa) Milk not changing to lilac.
    (b) Milk becoming pinkish-red, at least on the bruised flesh.
      (c) Pileus chocolate-brown to pale sooty-brown, usually rugose. 80. *L. lignyotus* Fr.
      (cc) Pileus grayish-brown to isabelline, even. 79. *L. fulginosus* Fr.
    (bb) Milk not changing to pinkish red.
      (c) Milk becoming yellow, at least on the bruised flesh.
        (d) Margin of pileus tomentose-hairy.
          (e) Stem spotted; pileus straw-color to ochraceous. 60. *L. scrobiculatus* Fr.
          (ee) Stem not spotted; pileus buff tinged with flesh color. 62. *L. cilicioides* Fr.
        (dd) Margin of pileus glabrous or nearly so.
          (e) Pileus azonate, dry or scarcely viscid, some shade of reddish-brown.
            (f) Odor strong, disagreeable. 69. *L. theiogalus* Fr.
            (ff) Not with marked odor.
              (g) Pileus substriate on margin, fading to isabelline. 88. *L. isabellinus* Burl.
              (gg) Pileus even on margin, color of *L. comphoratus*. 87. *L. colorascens* Pk.
          (ee) Pileus zonate, at least toward margin.
            (f) Pileus very viscid when moist, orange-yellow. 86. *L. croceus* Burl.
            (ff) Pileus subviscid.
              (g) Pileus distinctly spotted-zoned with dull-orange zones; milk very acrid. 68. *L. chrysorheus* Fr.
              (gg) Pileus faintly zonate; milk tardily acrid or bitterish. 69. *L. theiogalus* Fr.
      (cc) Milk not changing to yellow.
        (d) Milk becoming greenish on the bruised flesh.
          (e) Pileus dark olive-green, rather rigid, zonate. 59. *L. atro-virides* Pk.
          (ee) Pileus livid-smoky-gray, azonate. 73. *L. trivialis* var. *viridilactis*.
        (dd) Milk not changing to green or brownish on flesh.
          (e) Gills stained gray where bruised.



            (f) Pileus olive-brown to umber, rigid, 6-12 cm. broad. 58. *L. turpis* Fr.
            (ff) Pileus drab-colored to lilac-grayish, 3-6 cm. broad. 85. *L. vietus* Fr.
          (ee) Milk changing to brown on the flesh. 94. *L. luteolus* Pk.
(AAA) Milk white, unchanging.
  (a) Pileus viscid when moist.
    (b) Margin of pileus distinctly tomentose-hairy; pileus incarnate-tinged. 61. *L. torminosus* Fr.
    (bb) Margin of pileus glabrous or nearly so.
      (c) Pileus distinctly zonate, more or less copper-orange color. 70. *L. insulsus* Fr.
      (cc) Pileus not or obscurely zonate.
        (d) Pileus large, usually 8-15 cm. broad.
          (e) Pileus pale yellowish or subochraceous; gills broad. 71. *L. affinis* Pk.
          (ee) Pileus white soon spotted-stained; gills becoming flesh-colored. 65. *L. controversus* Fr.
          (eee) Pileus livid-smoky gray or tinged slightly with lilac-purplish. 73. *L. trivialis* Fr.
        (dd) Pileus medium to small, less than 8 cm. broad.
          (e) Pileus drab or lilac-gray; gills pruinose. 85. *L. vietus* Fr.
          (ee) Pileus some other color.
            (f) Pileus and stem cinereus, glabrous, small. 84. *L. cinereus* Pk.
            (ff) Pileus reddish.
              (g) Pileus unbonate-papillate, reddish-fulvous, 1-2 cm. broad. 96. *L. oculatus* (Pk.) Burl.
              (gg) Pileus umbilicate-depressed, reddish-brown, 5-7 cm. broad. 72. *L. hysginus* Fr.
  (aa) Pileus not viscid.
    (b) Pileus minutely tomentose, scaly, pubescent or with velvety-bloom.
      (c) Taste mild, never acrid; pileus reddish-brown to pale tawny.
        (d) Gills close; pileus rugose-reticulate, velvety-pubescent. 92. *L. corrugis* Pk.
        (dd) Gills distant; pileus even or slightly rugulose, almost glabrous. 93. *L. hygrophoroides* B. & C.
      (cc) Taste acrid or slowly acrid, if mild then pileus not reddish-brown.
        (d) Odor aromatic, rather strong.
          (e) Pileus ashy to smoky-brown. *L. glyciosmus* Fr.
          (ee) Pileus tawny to isabelline; in swamps and bogs. 81. *L. helvus* Fr.
        (dd) Odor none.
          (e) Pileus white or whitish.
            (f) Pileus persistently velvety-tomentose on entire surface. 63. *L. vellereus* Fr.
            (ff) Pileus glabrous on center, margin densely cottony-tomentose. 64. *L. deceptivus* Fr.
          (ee) Pileus not white.
            (f) Pileus 1-3 cm. broad, gray; often on much decayed wood. 83. *L. griseus* Pk.
            (ff) Pileus 2-7 cm. broad; flesh reddish or flesh-color where bruised.
              (g) Pileus chocolate-brown to pale sooty-brown, rugose on center. 80. *L. lignyotus* Fr.
              (gg) Pileus grayish-brown to isabelline. 79. *L. fuliginosus* Fr.
    (bb) Pileus glabrous.
      (c) Pileus etc. white; gills very crowded, dichotomously forked.

66. *L. piperatus* Fr.
(cc) Pileus not white.
(d) Pileus some shade of gray or brown.
(e) Gills becoming dingy greenish-brown where bruised.
(f) Pileus 1-3 cm. broad, pale lilaceous-umber. 89. *L. parvus* Pk.
(ff) Pileus 3-6 cm. broad, grayish-buff. 90. *L. varius* Pk.
(ee) Gills not changing to greenish-brown when wounded; pileus zoned, gray to brownish-gray. 67. *L. pyrogalus* Fr.
(dd) Pileus some shade of red or yellow.
(e) Gills distant; pileus pale brownish-orange. 93. *L. hygrophoroides* B. & C.
(ee) Gills close or subdistant.
(f) Taste acrid.
(g) Pileus bay-red to rufus. 82. *L. rufus* Fr.
(gg) Pileus pale yellowish to subochraceus. 71. *L. affinis* Pk.
(ff) Taste mild or nearly so.
(g) Odor aromatic, sometimes faint.
(h) Pileus even, brown-red; color persisting. 97. *L. camphoratus* Fr.
(hh) Pileus rimulose, areolate, brown-red, fading. 98. *L. rimosellus* Pk.
(gg) Odor none.
(h) Pileus 5-12 cm. broad, brownish-orange to fulvous; stem solid. 91. *L. volemus* Fr.
(hh) Pileus 2-5 cm. broad, brownish-red to isabelline; stem stuffed to hollow. 95. *L. subdulcis* Fr.

*PIPERITES:* Gills not becoming darker nor pruinose-sprinkled in age.

In this group the milk is either colored or white. In some species it changes on exposure to the air and stains the gills so that they assume a different color than at first; such species must not be referred to the second group, since there the gills assume a darker color without reference to the milk.

*Section I.* Pileus, especially on margin, shaggy, scabrous, tomentose or hairy-fringed; taste *acrid.*

### 58. Lactarius turpis Fr.

Epicrisis, 1836-38.

Illustrations: Fries, Sverig. Svamp., Pl. 60.
Cooke, Ill., Pl. 987.
Gillet, Champignons de France, No. 397.
Ricken, Blätterpilze, Pl. 9, Fig. 4.

PILEUS 6-12 cm. broad, *rigid,* convex-umbilicate, then expanded and depressed, *olive-brown to umber,* darker on disk, azonate, somewhat roughish-floccose, *fibrils glutinous when moist,* at length subglabrous, margin at first involute with an olivaceus-yellow villosity. FLESH whitish, compact, thick. GILLS adnate, decurrent, narrow, close to crowded, dingy cream-colored, *stained gray or nearly black where bruised.* STEM 3-4 cm. long, 1.5-2.5 cm. thick, stout, short, firm, scarcely viscid, glabrous, concolor or paler than pileus, *often spotted with darker spots,* even, stuffed, sometimes hollow. SPORES "globose, echinulate, 6.5-8 micr." (Burl.) MILK white, unchanging, causing gray stains on gills, *acrid.* ODOR slight. *Edible.*



Gregarious or solitary. On the ground in the north, in mixed woods of hemlock, balsam, poplar, maple, etc. Presque Isle, Marquette. August-September. Rare or frequent locally.

It is very distinct from *L. atroviridis* in its colors and in the character of the surface of the pileus, etc. Dried specimens are grayish-black. *Lactarius sordidus* Pk. is without doubt the same. It is said to be eaten in Europe, although as Fries remarks, it has a loathsome appearance. It has somewhat the habit of *Paxillus involutus* and like the latter, prefers coniferous woods.

### 59. Lactarius atroviridis Pk.

N. Y. State Mus. Rep. 42, 1889.

Illustration: Hard, Mushrooms, Fig. 139, p. 175, 1908 (not typical).

PILEUS 6-15 cm. broad, *subrigid,* convex-expanded, soon depressed, *dry,* rough-scabrous to scabrous-hairy, often rugose, *dark olive-green,* becoming blackish-green, sometimes obscurely mottled-zonate toward margin, which is at first involute then spreading and thin. FLESH whitish, thick and compact on disk. GILLS adnate or subdecurrent, close, distinct, rather narrow, whitish at first, *stained with dark green where bruised* or in age, intervenose, few forked. STEM *short,* 2-5 cm. long, 1-2.5 cm. thick, stout, subrigid, equal, dry, glabrous, *dark greenish,* soon hollow or cavernous. SPORES "subglobose, echinulate, 7-8 micr., white." (Burl.) MILK white, unchanging, causing dark green stains on gills, *acrid.*

Gregarious. On the ground in frondose woods. Ann Arbor, Detroit. August. Infrequent.

Blackish when dried. A very curious and repellent mushroom, concerning whose edibility nothing is known. It is quite distinct and easily recognized by its blackish-green colors, rigid flesh and