

tudinally. The SPORES vary from flesh color to bright rose and are often prominently angled, sometimes tuberculate. CYSTIDIA are usually lacking except in *L. seticeps*.

The species of this genus are rather difficult to diagnose. In some cases the color is rather striking, as for example, of *L. formosa* and *L. rosea*; in others the color varies considerably in different specimens of the same species, e. g., *L. asprella*, so that a microscopic study must be the final resort. Not much is known concerning their edibility, although several species appear quite frequently. Some of the species are rarely found and this accounts for the smaller number of species for the State. All species likely to occur in the State are included in the key.

#### Key to the Species

- (a) Stem and pileus rose-tinged; on sphagnum. 616. *L. rosea* Long-year.
- (aa) Stem and pileus white, becoming blackish on drying; pileus striate; gills adnexed; spores 10-12.5 x 7.9 micr. *L. transformata* Pk.
- (aaa) Stem and pileus waxy-yellowish; pileus scaly to fibrillose. 618. *L. formosa* Fr.
- (aaaa) Stem and pileus neither rosy, white nor yellowish.
- (b) Pileus, stem and gills green (aeruginous).
- (c) Odor strongly of mice. *L. incana* Fr.
- (cc) Odor not mentioned. *L. aeruginosa* Pk.
- (bb) Pileus and stem grayish-brown to fuscous, dark brown, or light-leather color.
- (c) Pileus hygrophanous, striatulate.
- (d) On rotten wood; gills rounded behind, nearly free, whitish; spores 10 x 7.5 micr. *L. undulatella* Pk.
- (dd) On the ground; gills adnate-seceding, tinged gray; spores elongate, 10 x 6-8 micr. 621. *L. asprella* Fr. var.
- (cc) Pileus not hygrophanous.
- (d) On rotten wood; pileus walnut-brown; gills slightly adnexed. Spores subglobose. 617. *L. seticeps* Atk.
- (dd) On the ground; pileus paler.
- (e) Pileus innately silky and substriatulate; gills whitish, broad, adnexed; stem glabrous; spores quadrate, 9-11 x 9-10 micr. *L. solsticiales* Fr. (Sense of Ricken.)
- (ee) Gills, stem and pileus gray, gills broad; spores spheroid, 8-10 micr. *L. grisea* Pk.
- (bbb) Pileus and stem violet, bluish-black, smoky or steel-blue.
- (c) Stem dotted with dark squamules, at least at apex.
- (d) Gills with a black serrulate edge; on the ground. 619. *L. serrulata* Fr.
- (dd) Gills with edge concolor; pileus fuscous, squamulose; stem tinged lavender, squamulose; on rotten wood. 614. *L. placida* Fr.
- (c) Stem glabrous or with few evanescent squamules.
- (d) Gills with a black serrulate edge; pileus grayish-white, umbilicus darker and scaly. *L. subserrulata* Pk.
- (dd) Gills unicolorous.
- (e) Pileus hygrophanous, striate (moist), squamulose to glabrous; gills grayish, adnate; spores 11-14 x 6-8 micr. 621. *L. asprella* Fr.

- (e) Pileus not hygrophanous, not striate.
- (f) Pileus at first bluish-black, then smoky-fuscous; gills adnate, ventricose, stem concolor; spores 9-12 x 6-7 micr.; on the ground. 615. *L. lampropoda* Fr.
- (ff) Pileus, gills and stem rather dark violet; squamulose-fibrillose on pileus; spores subspheroid, 8-10 x 7-8 micr.; on wood, sawdust, etc. 620. *L. euchroa* Fr.

*Section I. Nonhygrophanae.* The species of this section are not truly hygrophanous nor markedly striate on the pileus but in wet weather they may appear somewhat hygrophanous, and a few species are faintly or finely striate on the pileus.

\*Gills white or whitish at first.

#### 614. *Leptonia placida* Fr.

Syst. Mycol., 1821.

Illustrations: Fries, Icones, Pl. 97.

Cooke, Ill., Pl. 330.

Plate CXIV of this Report.

PILEUS 3-5 cm. broad, campanulate, then convex, obtuse, rarely depressed, ground color *pale fuscous, covered with brown to blackish silky scales which are denser and darker on disk*, often with an obscure tinge of violet, *not striate*. FLESH pallid, with a pinkish tinge, thin. GILLS *broad behind but abruptly narrowed and adnexed*, sometimes subarcuate and subdecurrent, narrowed in front, crowded, thickish, whitish then flesh color from spores, edge concolor, often eroded-crenate. STEM 2-5 cm. long, *rather thick, 3-8 mm.*, cartilaginous, stuffed then hollow, often compressed and grooved, sometimes twisted or variously curved, *loosely dotted by lavender or dark blue to blackish squamules above, squamules rosy or violet below, apex usually thickened, base white mycelioid, sometimes glabrous except at apex*. SPORES tuberculate-angular, oblong, 8-10.5 x 5-6 micr., apiculus oblique. CYSTIDIA none.

(Dried: Dark fuscous throughout.)

Gregarious. On rotten wood, stumps and logs, in low woods of elm, maple, etc. June to October. Ann Arbor, Detroit. Frequent at times.

A beautiful plant, with a stouter and more curved stem than the terrestrial Leptonias. The shades of lavender and blue vary considerably in different collections, but the peculiar dark scales on the pileus and stem are unmistakable. The gills of our plants always have a decurrent tooth.

615. *Leptonia lampropoda* Fr.

Syst. Mycol., 1821.

Illustrations: Cooke, Ill., Pl. 331.

Gillet, Champignons de France, No. 434.

Ricken, Blätterpilze, Pl. 73, Fig. 7.

Swanton, Pl. 42, Figs. 3-5, 1909.

PILEUS 1-3 cm. broad, convex then plane, umbilicate or depressed, *bluish-black to jet-black when young*, becoming smoky-fuscous when old, *becoming minutely squamulose* by the breaking up of the cuticle, innately-fibrillose at first, squamules dense in center, *never striate*, not papillate, sometimes rimose, margin decurved then raised. FLESH at first bluish-black, then gray to white, subhygrophanous, thin. GILLS adnate-seceding, moderately broad, subdistant, *ventricose*, white at first *then rose-colored*, edge entire and concolor. STEM 2.5-5 cm. long, 1-3 mm. thick, equal or tapering upward, stuffed then hollow, often compressed and grooved, straight or curved, *glabrous*, even, firm, elastic, *bluish-black at first, becoming fuscous*, white mycelioid at base, apex not punctate. SPORES variable in size, tuberculate, angular, 9-13 x 6-7 micr., *rosy in mass*. CYSTIDIA none. ODOR and TASTE none.

Gregarious. On the ground, wet places in mixed hemlock and maple woods. Bay View, New Richmond, Marquette. July-September. Frequent in conifer regions.

Easily known by its bluish-black color when young, the lack of striations on the pileus and the rather firm stem. It approaches *L. asprella*, and I at first referred it to that species, but the margin of the pileus is never striate and the gills are not gray. It has the colors of *L. serrulata* but the edge of the gills does not become black-dotted. The figures of European authors do not illustrate our plant well; this is not surprising, since it is always reported as growing "among grass." In fact, the majority of species in England are reported from grassy places, while with us the high winds and dryer conditions seldom favor their appearance in fields or meadows, and the forest forms are slightly different in appearance. It agrees well with the description of Fries given in his Monographia. Ricken gives broader spores; those of our plants agree with the size given by Saccardo.

616. *Leptonia rosea* Longyear

Mich. Acad. of Sci. Rep. 3, 1902.

Illustrations: Ibid, Plate I, Fig. 5.

Plate CXIV of this Report.

PILEUS 1.5-3.5 cm. broad, convex, then expanded, depressed or subumbilicate at center, *not striate, rose color when young*, fading to isabelline with reddish umbilicus, minutely fibrillose-scaly, especially at center. FLESH thin, white. GILLS adnate with slight tooth, close, moderately broad, ventricose, broadest behind, *white then flesh color*. STEM 5-8 cm. long, *slender*, scarcely 1.5 mm. thick, *equal*, cartilaginous, glabrous, *stuffed*, appearing solid, *pale roseate*, white-mycelioid at base, subpellucid-striatulate. SPORES angular, 10-12 x 7-8 micr., flesh color in mass.

Scattered. On sphagnum, in cedar and tamarack swamp (35 specimens). Bay View. "Burnt ground on a sandy hillside, Kent County. Longyear." July-September. Rarely seen.

The difference in habitat of the two localities where this has been found is remarkable. My own collection was made entirely on thick sphagnum, but Longyear found the two type specimens on burnt-over sandy soil. Its pretty colors are attractive and it is not easily mistaken. Gillet's figure of *Nolanea rufocarnea* Berk. reminds one somewhat of *L. rosea*, but our species is a true *Leptonia* with a non-striate pileus, without the bitter taste of *N. rufocarnea* and with a different color.

617. *Leptonia seticeps* Atk.

Jour. of Mycol., Vol. 8, 1902.

PILEUS 1-3 cm. broad, convex to expanded, umber to brownish-gray, darker on disk, *faintly and finely long-striate*, minutely granulate under a lens, margin somewhat incurved at first. FLESH whitish, very thin, composed of two layers, surface layer of oval or clavate long-pedicel cells mixed with longer, lanceolate to fusoid cells, all with smoky content. GILLS *slightly adnexed* or free, subdistant to close, broad, elliptical, white then flesh color, edge eroded; the trama composed of converging hyphae. STEM short, 1-2 cm. long, 2-3 mm. thick, glabrous or sometimes villose-dotted, whitish or brownish, subcartilaginous, solid, fibrous-striate, equal or bulbilose, straight or curved, sometimes slightly eccentric.

·SPORES broadly-elliptical to subglobose, *not angular*, minute, 6-7 x 5-6 micr. in diameter, pale flesh color in mass. CYSTIDIA more or less numerous on the edge of the gills, clavate to elliptical, sometimes hair-pointed, hyaline, 50-60 x 10-15 micr. ODOR and TASTE not marked.

Scattered. On rotten logs. Bay View, Houghton, Ann Arbor. July-September. Frequent in hemlock or tamarack woods; mixed with maple or birch.

This little *Leptonia* is partial to rotten wood. Its finely striate, granulose pileus reminds one of some of the small species of *Pluteus* and it approaches that genus also in its smooth spores and clavate cystidia. The gills are slightly adnexed or, in expanded specimens, they may be free, and the stem is subcartilaginous. It seems to form a connecting link between *Leptonia* and *Pluteus*.

\*\**Gills yellowish-tinged.*

618. *Leptonia formosa* Fr.

Syst. Mycol., 1821.

Illustration: Fries, Icones, Pl. 98.

PILEUS 1-3 cm. broad, convex then plane and umbilicate, *yellow-wax color*, covered with minute fuscous squamules, *margin striate*. FLESH thin, yellow, toughish, membranaceous. GILLS adnate, with a tooth, *rather broad*, subdistant, *tinged yellow* then flesh color, edge entire, concolor. STEM 4-5 cm. long, 1.5-2 mm. thick, strict, equal, cartilaginous, stuffed then hollow, *yellow*, glabrous, shining, *striatulate*. SPORES tuberculate-angular, rather rectangular in outline, 10-12 x 6-7 micr., apiculus oblique, flesh color. CYSTIDIA none. ODOR and TASTE mild.

Scattered. In low, swampy woods of hemlock, etc., in northern Michigan, in maple and elm woods in southern Michigan. July-September. Throughout the State. Frequent locally.

Easily recognized by the yellow cast to the whole plant and the striate and squamulose pileus. Fries says "scarcely different from *L. asprella* except in color." This is borne out by the fact that it is subhygrophanous, which makes it difficult to place not only this but other swamp species in the non-hygrophanous section.

\*\*\**Gills bluish or blackish at first.*

619. *Leptonia serrulata* Fr.

Syst. Mycol., 1821.

Illustrations: Hard, Mushrooms, Fig. 207, p. 254, 1908.

Gillet, Champignons de France, No. 437.

PILEUS 1-3 cm. broad, convex then plane, umbilicate-depressed, *not striate, at first bluish-black*, then smoky-umber or fuscous squamulose, especially in the umbilicus. FLESH thin, not hygrophanous, whitish. GILLS adnate, white, tinged bluish-gray, *edge black-serrulate*, ventricose. STEM 2-5 cm. long, 1-2 mm. thick, cartilaginous, *blackish to steel-blue*, stuffed then hollow, rigid, equal, *glabrous, except the black-dotted apex*, white-mycelioid at base. SPORES 11-4 x 7-8 micr., tuberculate-angular, elongated. *Sterile cells* on the edge of the gills, filled with blackish coloring matter.

Scattered or gregarious. In low wet places, of mixed hemlock woods in the north; ash, elm and maple woods of southern Michigan.

Throughout the State. July-September. Frequent locally.

This species and *Eccilia atrides* appear to run into each other. Both are characterized by the black-serrulate edge of the gills. In *Eccilia* they run down the stem by a broad tooth. The colors remind one much of *L. lampropoda*, which differs mainly in that it has not black-edged gills and is not black-dotted at the apex of the stem. Varieties and related species have been described, indicating that these two species run into each other. Var. *expallens* Fr. is *paler*; var. *laevipes* Maire has no black dots on the stem; var. *berkeleyi* Maire has entire gills.

620. *Leptonia euchroa* Fr.

Syst. Mycol., 1821.

Illustration: Cooke, Ill., Pl. 334.

PILEUS 1-2 cm. broad, convex then plane, not umbonate nor truly umbilicate, *covered with fibrillose squamules, violaceous to wine-color*, not striate, margin fibrillose-scaly. GILLS subdistant, *very ventricose*, narrowed at both ends, narrowly adnate, sometimes pseudo-decurrent when pileus is expanded, *violet at first then pallid*. STEM slender, equal, 2-3 cm. long, 2 mm. thick, stuffed then hollow,

toughish, *glabrous* or very delicately fibrillose with *purple fibrils* on a dark violet ground. SPORES tuberculate-angular, elongated, 10-12 x 6-7 micr. (occasionally wider), angles obtuse. CYSTIDIA none.

Subcaespitose. On sawdust, rotten wood, etc. Bay View. July-August. Rare.

This beautiful little plant is a wood-inhabiting species like *L. placida* but much more slender. The spores of our plants are longer than the measurements given by the English mycologists and their coarse obtuse angles make them somewhat unique. When old, the translucent margin of the pileus shows the lines of the gills so as to appear striate, a condition often found in other non-striate species when old.

*Section II. Hygrophanæ.* Pileus hygrophanous, margin striate when fresh and moist.

#### 621. *Leptonia asprella* Fr.

Syst. Mycol., 1821.

Illustration: Atkinson, Mushrooms, Fig. 139, p. 147, 1900.

PILEUS 2-4 cm. broad, convex, becoming somewhat expanded, umbilicate-depressed, *glabrous* or *fibrillose*, *striatulate* when moist, umbilicus villose or scaly, *hygrophanous*, silky-shining when dry, from pale umber to grayish-brown, variable in color, margin becoming split. FLESH watery to whitish, thin, rather fragile. GILLS adnexed to adnate seceding, *subdistant*, rather broad, narrowed in front, whitish to grayish, then rosy from the spores, edge concolor, entire. STEM 3-8 cm. long, 2-3 mm. thick, slender and usually straight, rigid and elastic but fragile, *glabrous*, livid-fuscous to pale, stuffed then hollow, sometimes twisted, white-mycelioid at base, apex pruinose. SPORES angular, angles sharp, 9-13 x 6-8 micr., broadly elliptic-elongate in outline. CYSTIDIA none. ODOR and TASTE mild.

Solitary or gregarious. On the ground in woods. Bay View, New Richmond, Ann Arbor. Infrequent. August-September.

This species varies considerably, and there seems to be no settled notion of its exact limitations. Cooke figures a plant quite different in color and size from that of the above description. The striations are not always definitely present, especially in the dry plant. The

spores are variable in size, even in the same plant. One variety occurs in low, mossy or sphagnum places. Its pileus is pale isabelline or pale brownish-gray when moist, slightly virgate with fibrils, scarcely or not at all striatulate. The gills are white at first. The stem is of the same color or is slightly paler than the pileus, so that the whole plant has a uniform color when fresh and mature. The cap is apt to be truncate at the apex and campanulate; in all other respects it agrees with the species. *L. asprella* is found in coniferous regions, e. g., Bay View, New Richmond. See Ricken's figure of *L. anatina*, Pl. 73, Fig. 9. That species, however, has markedly narrow gills.

#### *Nolanea* Fr.

(From Latin, *Nola*, a little bell.)

Pink-spored. Stem *hollow* and cartilaginous or tough, usually slender. Gills adnate, adnexed or almost free, seceding, not decurrent. Pileus thin, *campanulate*, usually *papillate*, margin at first straight and applied to the stem. Spores *angular*.

Terrestrial, small, slender plants, corresponding to *Mycena* of the white-spored group, approaching the smaller *Entolomas*, and separated from *Leptonia* by the unexpanded bell-shaped pileus. It is a small genus.

The PILEUS is *glabrous*, silky or scurfy, dry or *hygrophanous*; and its *campanulate* shape which is rather persistent and is due to the position of the straight margin on the stem when young, is quite characteristic. It is usually fragile. The color is some shade of brown in our species except in *N. caelestina*. The GILLS are often broad or ventricose, and generally secede (i. e. separate) from the attachment at the stem, in which respect they differ from those of *Clitopilus*. The STEM is central, tubular and elastic or fragile in most species; in some, however, it is toughish-cartilaginous like that of certain *Mycenas*. It has a tendency to become compressed or longitudinally furrowed because of its hollow interior. It is usually *glabrous* or minutely flocculose; in *N. dysthales* (Pk.) it is densely floccose-hairy. There is *no annulus*, *nor volva*, and the flesh is confluent with that of the pileus. The SPORES are angular, often irregularly tuberculate-angular. CYSTIDIA are usually absent; in *N. babingtonii* and *N. dysthales* they may be found on the edge of the gills. A few species have a slight ODOR; that of *N. mammosa* is similar to rancid meal. The *Nolaneas* are difficult

to identify to the species, and a microscope is essential to any final decision.

*Key to the Species*

- (a) Pileus and stem lavender to violaceous. 630. *N. caelestina* var. *violacea* Kauff.
- (aa) Pileus and stem some other color.
  - (b) Spores quadrate or cruciate-four-angled; pileus umber or smoky-umber. 623. *N. pascua* Fr.
  - (bb) Spores not distinctly four-angled.
  - (c) Pileus with greenish tint, fuscous-brownish, livid or smoky, very shining. 624. *N. versatilis* Fr.
  - (cc) Pileus without greenish or olivaceous tints.
  - (d) Stem and pileus hairy, fibrillose-scaly or flocculose; gills subdistant.
    - (e) Spores 14-20 x 8-9 micr.; whole plant smoky-brown. 622. *N. dysthales* (Pk.) Atk.
    - (ee) Spores subglobose, 8-9 micr.; pileus small, covered with loose brown fibrils. 625. *N. babingtonia* Berk.
  - (dd) Stem and pileus glabrous, silky and shining.
    - (e) Gills white or whitish at first; pileus hygrophanous.
    - (f) Pileus conical, cinnamon-brown then pale and shining; gills narrow. 628. *N. conica* Pk.
    - (ff) Pileus campanulate, grayish-brown; gills medium broad. 629. *N. fuscogrisella* Pk.
    - (ee) Gills grayish at first; odor somewhat rancid-farinaeous. 626. *N. mammosa* Fr. 627. *N. papillata* Bres.

\*Gills at first gray, brown or fuscous.

622. *Nolanea dysthales* (Pk.) Atk.

N. Y. State Mus. Report. 32, 1879 (as *Entoloma dysthales*).  
 Jour. of Mycol., Vol. 8, p. 114, 1902 (as *Nolanea nodospora* Atk.).

PILEUS 6-18 mm. broad, rarely larger, thin, campanulate-convex, obtuse, densely floccose-hairy, sometimes furfuraceous and striate, more often even, the hairy tufts sometimes squarrose, *smoky-umber* or *dark fuscous*, margin at first straight. FLESH submembranous. GILLS adnate, ascending, *broad*, ventricose, subdistant to distant, thickish, dark fuscous-gray or smoky, tinged flesh color at maturity, edge flocculose. STEM 1-4 cm. long, 1.5-4 mm. thick, equal, more or less densely *floccose-tomentose*, *dark fuscous* or seal-brown, becoming smoky, toughish-cartilaginous, stuffed then hollow, concolor within. SPORES large, variable, *elongated tuberculate-angular*, 14-20 x 8-9 micr., deep flesh color in mass, faintly colored under the microscope. CYSTIDIA only on edge of gills, *variable*, sometimes elliptical to ventricose and obtuse, sometimes ventricose-lanceolate and pointed, 60-70 x 20-25 micr. ODOR and TASTE mild.

Solitary or scattered. On low, wet, mossy or swampy ground, on leaf mold, etc., in hemlock regions. Bay View, South Haven, New Richmond. July-September. Infrequent.

This species is known by the covering of the cap and stem, its color and the very large tuberculate spores. It is very variable and was considered an *Entoloma* by Peck, who first described the form with the thin, striate pileus whose surface is only granular-furfuraceous or mixed with the characteristic hairs. Later Atkinson described the form in which the hairy covering is more highly developed, often as if matted, as *Nolanea nodospora*. I have found the two forms in different parts of the state and consider them variations of the same plant. The trama of the pileus is two-layered, the layers being separated by a dark line of narrow hyphae. A form occurs in frondose woods, of which the hair-like fibrils of the stem are almost ferruginous. The gills of *N. dysthales* remain dark grayish-brown a long time and hence it is easily mistaken for an *Inocybe*; at length, however, they are somewhat colored by the rather bright spores. It seems that in very moist situations the cap is less hairy-scaly and then striate, especially when more fully expanded. The size of the basidia varies as the plant slowly matures and the cystidia seem to take on a different shape in age.

623. *Nolanea pascua* Fr.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 376.  
 Gillet, Champignons de France, No. 493.  
 Ricken, Blätterpilze, Pl. 74, Fig. 3.  
 Swanton, Fungi, Pl. 42, Fig. 10-12.

PILEUS 2-4 cm. broad, *fragile*, *conico-campanulate*, obtuse or umbonate, hygrophanous, umber-brown and striatulate (moist), fading and even (dry), glabrous, silky-shining. FLESH thin, concolor. GILLS rounded behind, adnexed, rather broad, *ventricose*, grayish, then gray-flesh color, seceding, close. STEM 4-10 cm. long, 2-4 mm. thick, pallid grayish-brown, cartilaginous, hollow, equal, often twisted, *fragile*, splitting longitudinally, fibrillose-striate. SPORES *subquadrate* or *almost cruciform*, 8-11 micr. diam., deep flesh color in mass. CYSTIDIA none; sterile cells absent on edge of gills.

Gregarious. On low mossy ground in open woods by lakes. Ann Arbor. September. Infrequent.

This species is said to be very common in Europe. I have only one record and the specimens are lost. It was most sharply marked by the quadrate, 4-angled spores. This is a character given by nearly all authors and by the figures. Our plants approached closely *N. staurospora* Bres. (Fung. Trid., Vol. I, p. 18), and this species and *N. pascua* (sense of Ricken) seem to be very similar. It certainly is not a common species with us and I did not observe any olive tints, such as occur in our *N. versatilis*.

624. *Nolanea versatilis* Fr.

Monographia, 1863.

Illustrations: Fries, Icones, Pl. 98, Fig. 5.

Ricken, Blätterpilze, Pl. 74, Fig. 7.

Plate CXV of this Report.

PILEUS 1-3 cm. broad, at first conic or elongated-oval, then campanulate, fragile, obtuse, at length expanded and subumbonate, silky-shining, sometimes *silky-fibrillose*, almost *glittering*, color variable, livid-fuscous, olivaceous-brown, smoky-tinged, subhygrophanous. FLESH thin, submembranous, grayish. GILLS narrowly adnexed, almost free, ventricose and *broad in front*, subdistant, *gray*, becoming smoky-flesh color, edge minutely fimbriate. STEM 3-6 cm. long, 1-4 mm. thick, equal, hollow, *often twisted or compressed*, splitting longitudinally, fibrillose-striate, *shining*, glabrous or flocculose, pallid then pale fuliginous or fuscous. SPORES tuberculate-angular, longer than wide, 9-11 x 6-7.5 micr. (few longer), flesh color in mass. CYSTIDIA numerous on edge of gills, few elsewhere, ventricose, often acuminate-pointed, 45-65 x 12-16 micr. ODOR and TASTE slight or none.

Gregarious. Among grass in low moist woods. Ann Arbor, New Richmond. July-August. Infrequent.

This species was abundant in a single wood-lot during one season; elsewhere it occurred as few individuals. It varies in size and shape (within limits); often it has the shape and size of Cooke's figures of *N. pascua*, at other times the caps may be narrow and stem slender and longer, all in the same patch. The cap is beautifully silky and shining and usually has a somewhat olive or greenish hue which suggests the glitter of metal. The shape of the young plant is often like that of *Hygrophorus conicus* or of an *Inocybe*. In our specimens the stem was frequently somewhat flocculose.

Except for the spores it approaches *N. pascua* quite closely in color and shape. It is here conceived in the sense of Ricken.

625. *Nolanea babingtonii* Berk.

Outlines of British Fungology, 1860.

Illustrations: Patouillard, Tab. Analyt., No. 429.

Cooke, Ill., Pl. 377.

"Pileus 6-12 mm. broad, conico-campanulate, pale gray, *covered with dark brown fasciculate fibrils free at one end*, silky-shining, disk subsquamulose. FLESH very thin. GILLS adnate, *distant*, gray, ventricose, edge minutely flocculose. STEM 2-3 cm. long, 2 mm. thick, equal, *covered with dark-brown down*, hollow, slightly undulate. SPORES angular-nodulose, subglobose or slightly oblong, 7-8 micr., apiculate."

Lewiston. On moss, in wet places. Rare. Reported by Longyear.

The description is taken from Masee's British Fungus Flora, and the spore-measurements were doubtless made from the type specimen. Patouillard gives spore size as 9-10 x 5-6 micr. It is a delicate little plant, characterized by the loose fibrils which stand out from its pileus and stem. There is some doubt of this determination.

626. *Nolanea mammosa* Fr. (Sense of Bresadola.)

Epicrisis, 1836.

Illustrations: Bresadola, Fung. Trid., Vol. I, Tab. 82, 1881.

Gillet, Champignons de France, No. 491.

PILEUS 2-4 cm. broad, conic to broadly campanulate, margin decurved, *mammilately umbonate*, faintly striate, umber (moist), soon grayish-brown or fuscous, innately fibrillose and shining when dry. FLESH dingy, brownish near surface, thin, subscissile. GILLS rather broad, rounded behind, usually narrowly adnate but seceding, *subdistant*, thickish, *pale gray at first* then tinged flesh color by spores, edge often uneven. STEM 5-9 cm. long, elongated, 2-5 mm. thick, tubular, terete or compressed, *tinged fuscous*, not white, cartilaginous, slightly fibrillose-striate, *white-pruinose at apex*, otherwise glabrous. SPORES tuberculate-angular, elongate, distinctly longer than broad, 9-11 x 6-7 micr., deep flesh color, nucleate. CYSTIDIA none. ODOR and TASTE of rancid meal.

(Dried: Gills pale brown.)

Gregarious. On the ground in woods, copses, etc., sometimes in grassy places. Throughout the State. July-October. Frequent.

This is our commonest *Nolanea*. It may be known by its elongated stem which is often furrowed longitudinally, by its gray gills and by the spores; the latter are distinctly longer than broad, and the angles are not as clearly and sharply marked as in other species. It is somewhat hygrophanous. The gills are often broadly adnate. There are short sterile cells on the edge of the gills.

627. *Nolanea papillata* Bres.

Fungi Tridentini, Vol. I, 1881.

Illustrations: Ibid, Pl. 82.

Fries, Icones, Pl. 98, Fig. 4 (as *Nolanea mammosa* var. *minor* Fr.).

PILEUS 2-3 cm. broad, campanulate, then expanded, papillate, umber to watery-brown and striate (moist), paler when dry, glabrous. FLESH thin, scissile, subhygrophanous, fragile. GILLS sinuate-adnate, seceding, broader toward front, subdistant to close, subventricose, livid-whitish then somewhat salmon-colored from spores. STEM slender, 3-5 cm. long, 1-2 mm. thick, tubular, pale grayish-brown, glabrous, slightly pruinose at apex, white-mycelioid at base, straight or curved, cartilaginous, sometimes striatulate. SPORES angular, 9-11 x 6-7 micr., nucleate, salmon-colored in mass. ODOR none or slightly of rancid meal. CYSTIDIA none.

Scattered. Low places in moist frondose woods. Ann Arbor, Bay View, New Richmond. September. Infrequent.

Differs mainly from *N. mammosa* in its more slender habit, smaller size and closer gills.

\*\*Gills white at first.

628. *Nolanea conica* Pk.

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

PILEUS 5-15 mm. broad, conical, then expanded and papillate, hygrophanous, watery-cinnamon and striatulate (moist), paler, silky-shining and subzonate (dry). FLESH thin. GILLS nearly free, close, moderately broad, narrowed behind, white at first, bright flesh color from spores. STEM slender, 2-5 cm. long, 1-2 mm. thick,

equal, straight, tubular, cartilaginous, elastic, white-mycelioid at base, tinged ashy-brown. SPORES tuberculate-angular, 7-9 (including apiculus) x 5-6 micr., longer than broad, apiculus prominent. CYSTIDIA none.

Solitary or scattered. On moss or low places in swamps or wet conifer or mixed woods. Northern Michigan. July-September. Infrequent.

The conical, shining, hygrophanous pileus and small spores distinguish it. The length of spores rarely passes 8 microns unless apiculus is included.

629. *Nolanea fuscogrisella* Pk.

N. Y. State Mus. Rep. 39, 1886.

PILEUS 1-2.5 cm. broad, campanulate, more or less papillate, hygrophanous, glabrous, grayish-brown and striatulate (moist), paler and silky-shining (dry), papilla darker. GILLS rather broad, narrowed behind, adnexed, almost subdistant, whitish then bright flesh-colored. STEM 5-7 cm. long, 2-4 mm. thick, glabrous, white-mycelioid toward base, apex pruinose, brownish, often darker than pileus, tubular, cartilaginous. SPORES 7-9 x 5-6 micr. (incl. apiculus), angular, apiculus prominent.

Gregarious. On moss, etc., of low mixed woods. Sault Ste. Marie. July. Infrequent.

This differs from the preceding in its stouter stem, and less conic pileus. The spores are very similar. The gills are broader. In our specimens the stem was invariably darker than the pileus, and hoary at base and above by the white mycelium. The spores are slightly shorter than the measurements given by Peck.

630. *Nolanea caelestina* var. *violacea* Kauff.

Mich. Acad. Sci. Rep. 10, 1908.

PILEUS 8-10 mm. broad, conico-campanulate, lavender, acutely papillate, innately silky-fibrillose, margin even. GILLS adnexed, rather narrow, subdistant, white then flesh color, not reaching to the margin of pileus. STEM slender, 5 cm. long, 1 mm. thick, even, glabrous, pruinose at apex, equal, lavender, darker than cap. SPORES tuberculate-elliptical, 9-11 x 6-7 micr. CYSTIDIA none. ODOR none.

Solitary. In low elm swamp. Ann Arbor. Rare.

A beautiful little plant, usually hidden among the debris of the woods. The stem is flexible, subcartilaginous and does not turn reddish when bruised. It differs from the descriptions of the type in the narrow gills. It appears close also to *N. cruenta* Quel. except in color.

#### *Eccilia* Fr.

(From the Greek, *ekkoilo*, I hollow out.)

Pink-spored. Stem *cartilaginous*, hollow or stuffed, slender. Gills *decurrent*, either attenuated behind or broadly adnato-decurrent. Pileus *umbilicate* or depressed, its margin at first incurved. Spores *angular*.

Terrestrial or lignicolous. Small, slender plants, corresponding to *Omphalia* of the white-spored group; differing from the small *Clitopilus* in the cartilaginous stem. A very small genus composed of rather rare species.

The PILEUS is glabrous, silky, or somewhat squamulose in the umbilicus; dry or hygrophanous. It is usually expanded and then the center is depressed to strongly umbilicate. Its margin is at first incurved and this character may persist until maturity. The color varies from white to grayish and brown. The GILLS are attached in two ways, either attenuate-long-decurrent or broadly adnate and then slightly decurrent, remaining attached, i. e., not seceding as a rule. They are often quite distant as in *E. rhodocyliæ* Fr. or crowded as in *E. atrides* Fr. and *E. polita* Fr. They vary from narrow in some species to broadly triangular in others. In *E. apiculata* Fr., *E. vilis* Fr. and *E. rhodocylicioides* Atk. they are distinctly gray; in others, white or dingy white, finally colored by the spores. Some species possess cystidia, giving the edge a minutely fimbriate appearance. The STEM is usually enlarged somewhat at the apex where it expands into the membranaceous pileus. It is truly cartilaginous, slender, and soon hollow or tubular within. Some species have been described as solid, but it remains to be seen whether these are not really only stuffed at first by a differentiated pith. The color is often that of the pileus or paler. The angular SPORES correspond to those of *Leptonia*, *Nolanea*, *Pluteus* and one of the sections of *Clitopilus*. CYSTIDIA usually absent; in *E. pirinoides*, *E. rhodocylicioides* Atk. and *E. roseoalbocitrina* Atk. cystidia-like cells are present on the edge of gills.

The group is difficult, and the rarity of specimens makes it hard to learn much concerning their variability. A microscopic study is essential to determine the species with any satisfaction, as the size of spores and basidia, the structure of the trama, and the presence or absence of cystidia must often determine the final judgment.

Because of their rare occurrence, it seems best to include in the key all forms which may possibly be found in the State. *E. polita* and *E. carneo-grisea* have been reported from the neighboring States.

#### Key to the Species

- (a) Gills crowded or close.
  - (b) Edge of gills black-dotted. 631. *E. atrides* Fr.
  - (bb) Edge of gills concolor, not black dotted.
  - (c) Pileus 2-4 cm. broad, hygrophanous, livid (moist); gills very crowded, broad. *E. polita* Fr.
  - (cc) Pileus 5-20 mm. broad, not hygrophanous, mouse-gray; gills close, broad; spores 5-angled, 8-10 micr. 634. *E. pentagonospora* Atk. var.
- (aa) Gills subdistant to distant.
  - (b) Pileus 2-5 cm. broad, hygrophanous, tough, sordid-brown; stem tough, concolor; taste tardily pungent; gills close to subdistant; on the ground. 635. *E. mordax* Atk.
  - (bb) Pileus smaller (rarely as large in *E. carneo-grisea*).
  - (c) On wood; pileus deeply umbilicate, 1-1.5 cm., hygrophanous; gills very distant, broad, long-decurrent. *E. rhodocyliæ* Fr.
  - (cc) Not on logs, stumps or wood.
  - (d) On sphagnum; pileus umbonate, small, dark-brown; gills long-decurrent, distant, broad. Spores 10-12.5 x 6-7.5 micr. *E. sphagnicola* Pk.
  - (dd) On lawns, fields, or in woods on humus, etc.
  - (e) Pileus white, 1-2.5 cm., silky; gills adnato-decurrent, subdistant; stem long, white. Spores elongate, 9-11 x 6-9 micr. *E. roseoalbocitrina* Atk.
  - (ee) Pileus grayish-brown to fuscous.
    - (f) Pileus hygrophanous; gills without cystidia.
      - (g) Edge of gills darker, crisped; pileus gray flesh color, margin micaceous; gills distant, spores 6-7 x 4-5 micr. *E. carneo-grisea* B. & Br.
      - (gg) Edge of gills concolor; pileus brownish-gray (moist); gills subdistant, broad. 632. *E. grisco-rubella* Fr.
    - (ff) Pileus not hygrophanous; gills with cystidia.
      - (g) Gills adnato-decurrent, broad behind, distant; spores spheroid, angles not sharply marked. 633. *E. pirinoides* sp. nov.
      - (gg) Gills arcuate, distant, decurrent; spores prominently angled, quadrate. *E. rhodocylicioides* Atk.

#### Illustrations:

*E. vilis* Fr.: Ricken, Blätterpilze, Pl. 73, Fig. 10.

*E. carneo-grisea* Fr.: Hard, Mushrooms, Fig. 205, 1908.

*E. parkensis* Fr.: Icones, Pl. 100, Fig. 5.

*E. polita* Fr.: Atkinson, Mushrooms, Fig. 140, 1900.

Fries, Icones, Pl. 100, Fig. 3. Hard, Mushrooms, Fig. 206, 1908.

- E. rusticoïdes* Gill.: Ricken, Blätterpilze, Pl. 73, Fig. 11.  
*E. rhodocaylix* Fr.: Swanton, Fungi, Pl. 42, 1909. Fries,  
 Icones, Pl. 100, Fig. 6.  
*E. sphagnicola* Pk.: N. Y. Mus. Rep. 54, Pl. 1, 1900.

631. *Eccilia atrides* Fr.

Epicrisis, 1836.

PILEUS 1-2 cm. broad, deeply umbilicate, dark *umber*, umbilicus darker, striate to umbilicus, somewhat virgate, pruinose. FLESH thin. GILLS decurrent, narrowed behind, close, pallid, *edge black*. STEM 2-3 cm. long, 1-2 mm. thick, brownish, apex paler and floccose-dotted, dots sometimes black, sometimes pallid, hollow, glabrous below, equal and slender. SPORES tuberculate-angular, elongated, 11-13 x 6-7 micr. (incl. apiculus), bright flesh color in mass.

Solitary or gregarious. On very rotten wood. Houghton, Bay View. July-August. Infrequent in maple and hemlock woods of northern Michigan.

This species approaches *Leptonia serrulata* Fr. which also has black-edged gills. At times this character is almost or entirely absent except in old plants. Our plants had truly decurrent gills, but not extending far down the stem. It is usually found on debris or on very rotten logs in forests. Ricken considers it identical with *L. serrulata*.

632. *Eccilia griseo-rubella* Fr.

Epicrisis, 1836.

Illustrations: Fries, Icones, Pl. 100, Fig. 4.  
 Gillet, Champignons de France, No. 568.  
 Cooke, Ill., Pl. 613.

PILEUS 1-2.5 cm. broad, campanulate, umbilicate, hygrophanous, striate and brownish-ashy (moist), umbilicus darker, minutely squamulose, *elsewhere with innate white fibrils*. FLESH concolor, thin. GILLS *broadly adnate*, slightly decurrent, broad, subdistant, pallid then flesh color, edge even. STEM 2-4 cm. long, 1-2 mm. thick, pallid to buff, *glabrous*, equal, even, cartilaginous, hollow. SPORES tuberculate-angular, elongated, 8-9 x 5-6 micr.

Solitary or scattered. On the ground in cedar swamps. Bay View. September. Infrequent.

Our plant has rather broad gills as is shown in Fries' Icones. The other authors figure narrower gills. The pileus becomes hygrophanous-streaked on drying.

633. *Eccilia pirinoides* sp. nov.

PILEUS 1-2 cm. broad, campanulate, then subexpanded, margin decurved, depressed-umbilicate, grayish-brown to fuscous, moist, silky shining when dry, *with dense appressed small squamules on disk*, appressed-fibrillose elsewhere. GILLS adnate-decurrent, *broad behind, subdistant*, thin, whitish then rosy-tinged to bright flesh color. STEM 4-6 cm. long, 1-2.5 mm. thick, distinctly cartilaginous, white, slightly fuscous, pruinose, equal, even, stuffed with a white pith, finally hollow. SPORES spheroid-subangular, angles not prominent, 8-10 micr. diam. (without apiculus), *abruptly narrowed to an apiculus which is 2-3 micr. long*, obscurely 5-6 sided. CYSTIDIA not numerous, slender, acuminate, about 75 micr. long. BASIDIA 4-spored, clavate, 45-50 micr. long. ODOR none.

Gregarious. On the ground, among forest debris, hemlock, oak and maple woods; clay ravine. September. New Richmond.

Except for its lack of a strong malic odor, it agrees with all the descriptions which we have of *E. pirina* B. & C. It also approaches *E. rhodocylicioïdes* Atk.; but it differs from the latter in its bright colored spores, even pileus and broadly adnate, white gills; the shape of the spores is also different. It has so far been found only in one locality.

634. *Eccilia pentagonospora* Atk. var.

Jour. of Mycol., Vol. 8, p. 113, 1902.

PILEUS 5-20 mm. broad, fragile, convex-plane, umbilicate, hygrophanous, *at first blackish-gray, fading to steel-gray and shining*, even, at first minutely tomentose-flocculose over the entire surface, later appressed scurfy. FLESH thin, membranous. GILLS broad behind and *adnate-subdecurrent*, at first grayish then dark-flesh color, close to subdistant, thickish, somewhat crisped, edge concolor. STEM 1-2.5 cm. long, 1-1.5 mm. thick, equal, hollow, entirely *glabrous*, cartilaginous, *metallic gray*, whitish-mycelioid at base. SPORES tuberculate-angular, mostly 5-angled, angles obtuse, 7-9.5 micr. (incl. apiculus), deep flesh color in mass. CYSTIDIA none. BASIDIA about 30 x 9-10 micr.

Gregarious. On moist soil in frondose woods. Ann Arbor. August.

This collection departs from Atkinson's description in the more flocculose, hygrophaneous pileus and the hollow stem. The microscopic characters seem to be the same.

635. *Eccilia mordax* Atk.

Jour. of Mycol., Vol. 8, p. 113, 1902.

PILEUS 2.5 cm. broad, convex, *tough*, umbilicate, hygrophaneous, glabrous, *dull-reddish-brown to pale chestnut or cinnamon (moist)*, sordid isabelline (dry), even, margin inrolled. FLESH dirty white, thin. GILLS adnate to subdecurrent, close, *dingy brown at first* then tinged flesh color, narrow. STEM 3-6 cm. long, 3-5 mm. thick, *tough*, equal, fibrous-cartilaginous, fistulose, often compressed, *concolor*, glabrous or pruinose, white mycelioid at base. SPORES oval, 6-7 x 4-5 micr., smooth, pale flesh color. CYSTIDIA none. BASIDIA clavate, 25-30 x 6-8 micr., 4-spored. TASTE at first mild, after 15-20 minutes pungent in the throat and causes nausea.

Gregarious. On the ground, springy sides of ravines. Ann Arbor. August. Infrequent.

This species approaches *Clitocybe cyathiforme* in external appearance, but differs by its flesh-colored spores, its umbilicate pileus and the habitat on the ground. It seems to be our largest *Eccilia* and is probably somewhat poisonous.

*Claudopus* Smith.

(From the Latin, *claudus*, defective, and *pes*, foot.)

Pink-spored. Stem *eccentric, lateral or wanting*. Pileus dimidiate or resupinate, irregular. Gills not seceding nor anastomosing, radiating from an eccentric or lateral point. Spores angular or rounded.

On rotten wood or humus. Corresponding to the genus *Pleurotus* of the white-spored group. With the exception of *C. nidulans*, they are small, insignificant, soft plants, often growing in small hollows of decayed wood or on humus at the base of stumps, etc. The small forms are white, grayish or brown; *C. nidulans* is *yellow to buff*. All except one of the small species are at first resupinate, i. e., applied to the substratum with gills uppermost, but finally

becoming reflexed with gills in the usual position. The stem is entirely lacking or is small and inconspicuous, usually tomentose or villose at the point of attachment of the stem or pileus. Only a few species are known in our flora.

*Key to the Species*

- (a) Pileus medium to large, yellowish; gills orange yellow. 636. *C. nidulans* Fr.
- (aa) Pileus small, 3 cm. or less in diam.; not yellow.
- (b) Pileus white or whitish, at first resupinate.
- (c) Spores angular; pileus silky to villose-floccose. 637. *C. depuens* Fr.
- (cc) Spores not angular; pileus tomentose. *C. variabilis* Fr.
- (bb) Pileus gray to brown.
- (c) Pileus hygrophaneous, striatulate (moist); gills scarcely reaching stem. *C. griegensis* Pk.
- (cc) Pileus not hygrophaneous, subdecurrent. 638. *C. byssisedus* Fr.

636. *Claudopus nidulans* Fr.

Syst. Mycol., 1821. (As *Pleurotus*.)

Illustrations: Atkinson, Mushrooms, Pl. 41, Fig. 141, p. 149, 1900.

Hard, Mushrooms, Fig. 208, p. 256, 1908.

Clements, Minn. Mushrooms, Fig. 35, p. 59, 1910.

Plate CXV of this Report.

PILEUS 1-7 cm. broad, shelving, sessile or narrowed behind into a short stem-like base, nearly orbicular, dimidiate or reniform, *coarsely hairy or tomentose on the surface*, rich yellow or buff, margin at first involute, even. FLESH soft, rather tough. GILLS *orange-yellow*, medium broad, close to subdistant, adnate, rarely subdecurrent. STEM or attached base tomentose next to the gills beneath. SPORES elongated, slightly curved, 6-8 x 3-4 micr., smooth, *pink in mass*. ODOR *very disagreeable* when fresh. TASTE becomes rather mild at length; not desirable for the table.

Gregarious or imbricately caespitose. On decaying logs, etc., of frondose trees. Throughout the State; Marquette, Houghton, Ann Arbor, etc. July-October. Infrequent.

*Panus dorsalis* Bosc. is now agreed to be the same. The toughish consistency of *C. nidulans* approaches that of the genus *Panus*. In general appearance it looks like a *Pleurotus* and was so called by Fries, and as its spore-color is not a very bright pink it would seem to fit that genus as well as *Pleurotus subpalmatus* does. The latter, in my opinion, might equally well be made a species of the pink-

spored group. The beginner will be apt to refer *C. nidulans* to the ochre-spored group in *Crepidotus* if he neglects to make a spore-print. This all emphasizes the fact that nature takes no account of the convenience of the student and probably no system can ever be devised in which some plants will not be found half-way between the groups. This is the largest of the genus, and is not easily confused with other mushrooms except *Crepidotus dorsalis* which resembles it in colors but is smaller and has globose, ochre-brown spores. The pileus is more often dimidiate or kidney-shaped rather than the shape given in Atkinson's illustration.

637. *Claudopus depluens* Fr.

Syst. Mycol., 1821.

Illustrations: Patouillard, Tab. Analyt., No. 431.

Cooke, Ill., Pl. 344.

PILEUS 1-5 mm. broad, *white*, resupinate at first then reflexed, suborbicular, subreniform, conchate, etc., *variable in form, floccose*, almost sessile or attached by a *short*, white, villose STEM. FLESH membranous, very thin. GILLS radiating from the stem, *broad*, subdistant to distant, rose-colored at maturity. SPORES *angular*, somewhat longer than broad, spheroid-angular from the end-view, 7-10 x 6-7.5 micr., distinctly rose-colored in mass, nucleate.

On very decaying wood or black humus, in hemlock and birch mixed woods, in springy places. New Richmond. September. Rarely found.

Massee gives the spores as spheroid; Patouillard and Peck give them slightly longer. It may be that varieties occur which might explain the difference. There was no tinge of red or gray present in our plants, as described by Fries. They are small and insignificant plants. *C. variabilis* is similar, but has non-angular spores. Ricken reports the above species under *Crepidotus* and with smooth spores.

638. *Claudopus byssisedus* Fr.

Syst. Mycol., 1821.

Illustrations: Patouillard, Tab. Analyt., No. 432.

Cooke, Ill., Pl. 344.

"PILEUS 5-20 cm. broad, at first resupinate, then reflexed, near-

ly plane, reniform, covered with a fine pruinosity, gray tinged with pink, or grayish-brown, *striate on the margin*. FLESH thin, membranous. GILLS subdecurrent, grayish, rosy from the spores. STEM short, eccentric, or lateral, incurved, villose, *white fibrils radiating from the base* forming an interlaced membrane." SPORES elongate-angular, 9-11 x 6-7 micr., rosy in mass.

On very rotten wood. Swamps of frondose or conifer trees. Throughout the State. Summer. Infrequently found.

The description is taken from Fries and Patouillard. As in the preceding species, there is a difference in the spore-measurements given. Our plants have spores agreeing with those of Peck, while in Europe they seem to be smaller. Patouillard and Massee, give them 7-8 x 6 micr. The American form must, therefore, be considered as a variety. It is scarcely distinct from *C. griegensis* Pk.

LEUCOSPORA

*Amanita* Fr.

(From the Greek *Amanos*, the name of a mountain in Asia Minor, which doubtless abounded in edible fungi, for the Roman physician Galen used the term Amanites to refer to *Agaricus campestris*. Persoon first applied it to this genus, using *Amanita caesarea* as the type.)

White-spored; stem provided with an *annulus* and a *volva*, and separable from the pileus. The gills are *free* or attached by a line, *white*, cut off squarely at anterior extremity. The volva is formed from a *universal veil* which covers the whole plant in the egg-stage and is *discrete* from the cuticle of the pileus. The hyphae of the trama of the gills are *divergent*.

Soft-fleshy, terrestrial, mostly *poisonous* mushrooms, usually of rather large size, never truly caespitose; mostly in forests or on the border of woods and thickets; sometimes, however, in fields or lawns.

The PILEUS is soft, entirely enveloped at the beginning, along with the stem, by a differentiated layer of tissue called the universal veil. When this splits above the pileus during the enlargement of the plant, it is pulled off from the pileus and leaves the surface of the pileus glabrous; when it splits circularly around the edge of the pileus (circumscissile) the loose layer left on top ceases to grow and as the pileus expands and enlarges, this covering is broken into patches or warts, sometimes called scales; if

the universal veil is of a powdery or loose consistency, it tends to disappear on the surface, or remains as floccose or mealy granules either irregularly disposed over the pileus or only on the margin; all intermediate arrangements occur when affected by the weather, as when rains wash off the scales, etc., or dry weather causes slow expansion and corresponding irregularities. The margin is markedly striate in some species like *A. caesarea* and *A. russuloides*, or striations may be entirely lacking as in *A. phalloides*. The shape of the pileus varies in the young stage, usually ovoid or spherical, sometimes campanulate or somewhat conical. Many species have the surface of the pileus, under the scales, provided with a delicate viscid pellicle, which causes fresh specimens when wrapped in tissue paper to adhere to the paper, and indicates one of the ways of recognition. The color of different species varies from pure snowy white to smoky brown, yellow, orange or bright red; bright green or blue colors do not occur in our species of this genus, olive, ashy to lead-color or livid-purplish being the only shades in this connection.

The GILLS are white or whitish, in some species tinged yellow. They are free from the stem, sometimes remote leaving an open space around its apex, sometimes reaching it by the narrowed point which may run down the stem as a line. Their shape varies, sometimes ventricose, often broader in front, sometimes almost equal in width except at stem; the anterior end is more or less sharply truncate, and this can be used to distinguish this genus and Amanitopsis from other Agarics even after cooking. Shorter gills alternate with those of full length. The trama of the gills is composed of hyphae which in this genus diverge toward the hymenium, instead of being noticeably parallel; in this respect it agrees with the genera *Armillaria* and *Hygrophorus*.

The STEM is usually soft; the interior is stuffed by a pith which is sometimes weblike and evanescent, sometimes forming a spongy column in the stem, and only disappearing at full maturity; in both cases the stem may become hollow. In *A. strobiliformis*, *A. solitaria* and *A. chlorinosma* the pith approaches the condition of solid stems, but all Amanitas have practically a form of stuffed stem. The texture of the stem is not homogeneous with that of the pileus and the apex separates rather easily from the pileus leaving a socket. It is cylindrical or tapers upward, the base enlarged in most cases into a bulb, but occasionally cylindrical throughout as in *A. spreata*. The base is enveloped in the volva which is found in various degrees of development or persistency and which can be

grouped under three heads: (1) The VOLVA is the remains of the whole universal veil which has split above the pileus and has formed a true cup or sheath at the base of the stem, the margin usually extends above the bulb or base. (2) The VOLVA in this case is only the lower half of the universal veil and adheres closely around the bulb, sometimes forming circular rolls or scaly rings on the lower part of the stem. (3) The VOLVA is very incomplete and fragmentary, floccose, mealy or minutely warty; this is due to the loose, friable texture of the universal veil, the remnants of which disappear easily when the stem is pulled from the soil. Thus the presence of a volva is not a safe or positive characteristic in case persons depend on the "death-cup" for their identification of the poisonous Amanitas. Besides the volva, the stem is provided with an ANNULUS. The annulus is sometimes formed from an outer layer of the stem. In the young, "button" stage the gills lie with their edges closely against and adnate to the stem, and during elongation of stem and expansion of pileus, this thin outer layer is pulled loose from the stem by the fact that it adheres more closely to the gills than to the stem. If it begins to tear off from the stem in the early stage of elongation, it peels the entire stem upwards and after loosening from margin of pileus it drops down on the lower part and forms an "inferior" annulus. When it is not loosened from the gills or margin of pileus until the stem is nearly elongated, it peels off only from the apex of the stem and later from the gills and margin of pileus and forms a "superior" annulus. The latter is much the commonest method, and the layer of tissue which in this case holds on to the gills for a time and conceals them is called the "inner veil." Sometimes this inner veil separates at the stem instead of at the margin of the pileus and so hangs in shreds or in pieces from the margin of the pileus. In fact conditions of weather, etc., may cause all sorts of variations from the above two most common methods. The surface of the stem where the outer layer has been peeled off to form the annulus, usually becomes roughly floccose. Sometimes also the outer rind is split and broken in various ways by drying, as shown in our figures of *A. rubescens*; at other times the stem is glabrous.

*Properties.* This is usually called the "poisonous genus," as some of the species are sure to cause death. Poisonous species occur also in many other genera, but the poisons are not as deadly. Some Amanitas are known to be edible, as for example, *A. caesarea* and *A. rubescens*. But one who has not a thorough knowledge of most of

the mushrooms, including their microscopic characters, would be unwise to eat any of the species of *Amanita*, since the poisonous species sometimes approach the edible ones quite closely in general appearance. And to serve them to others under ordinary circumstances is worse than criminal. For further discussion see "Chapter on Mushroom Poisons," and remarks on individual species.

*Identification of Amanitas* is not always easy. Even those who know all the genera and their characters will proceed cautiously. The stems with their volvas are often deep in the ground and one must get the whole plant if amateurs are to be asked to pass upon them, else they may not take account of this danger-signal—the presence of a volva "death cup". The species with a powdery volva often lose the remnants by the time they are fully expanded, and might be referred to *Lepiota* by mistake. *When both volva and annulus are present on a plant with white gills or white spores, an Amanita is certain.* Young undeveloped "buttons" are the more dangerous, since they then imitate to an extent the common widely used, edible mushroom *Agaricus campestris* in its button stage. Of course, an experienced mycologist would "feel" the difference when picking it up, but amateurs and those who collect only the "pink gilled" mushroom, may in this way easily make a sad mistake. The prudent collector of mushrooms for the table, no matter where they grow, or how many he has examined, will always look on the under side of the cap for the white gills, and at the bottom of the stem for the remains of the volva.

The SPORES vary from spherical to elliptical. They are rather large, smooth, granular or nucleate, and white, and their size and shape are most important in diagnosing closely related species.

The TASTE of fresh *Amanitas* varies. The deadly *A. phalloides* has a bitter taste due to its poisonous content. The edible *A. caesarea* is considered in Europe one of the finest flavored mushrooms, and is highly prized. The ODOR is sometimes strong, as in *A. chlorinosma* Pk. In this species it resembles chloride of lime. In many species the odor is not marked, and cannot be used to recognize species.

*HABITAT.* *Amanitas* prefer the woods or borders of woods and thickets. Rarely, however, they are found on lawns, or in fields, especially in towns which have groves or whose outlying residences are situated among the original forest trees. Some species prefer conifer forests, others hardwoods, while others are partial to particular soils. *A. spruta*, *A. russuloides* and *A. peckiana* have been found in Michigan only in the sandy regions. *A. phalloides*

prefers the deep moist forest humus. *A. verna* is partial to the edge of groves, although widely found elsewhere. I have occasionally found it growing from the very rotten cavities of stumps or logs. There is no rule which we can be sure that they may not break in their selection of a place to grow.

The genus is with difficulty divided into natural sections. Those mycologists who laid the foundations of classification, like Fries and Quelet, divided the genus by the different ways in which the universal veil forms a volva. Prof. Atkinson has shown that a single species, *A. phalloides*, may act, under different weather and growth conditions, so that some specimens can be placed under one section, other specimens under another section. Monsieur Bondier (Bull. Soc. Myc. France, 18, 1902) has pointed out that although this is true, we can still tell them apart if we take account of the differences in the structure of the universal veil. For example, in the "Phalloides" section the universal veil is membranous and composed of narrow-celled hyphae, and the veil when it does tear in a circumscissile manner, leaves thin shreds on the cap, never in the form of elevated warty-scales; while in the "Muscaria" section the universal veil is composed of large, rounded cells which do not cohere well, and hence the veil breaks in a circumscissile manner, and leaves thick floccose warts on the cap. We will therefore follow the old divisions and group them in sections with reference to the texture and dehiscence of the universal veil. Twenty-two species have been so far found in the State. Since the genus *Amanita*, by virtue of its species with poisonous properties, is of great interest, and its species need to be known as widely as possible, it has seemed best to include in the following synoptical key all of the species of the northeastern part of the United States that one might be likely to find in Michigan.

#### Key to the Species

- (A) Base of stem, or bulb, provided with a distinct, membranous, loose cup-like sheath, or rarely with a shallow cup.
  - (a) Pileus orange-red, yellow or straw-colored.
    - (b) Volva entire, large; pileus deep yellow to orange, striate on margin, glabrous. 639. *A. caesarea* Fr.
    - (bb) Volva saucer-shaped; pileus straw-yellow, usually with floccose warts, margin even. 649. *A. mappa* Fr. (form B).
  - (aa) Pileus white with delicate pinkish or cream-colored appressed, fibrillose scales; inner veil evanescent; volva large; stem faintly rubescent. 645. *A. peckiana* Kauff.
  - (aaa) Pileus pure white; bulb rounded below.
    - (b) Pileus conical at first; inner veil adhering to gills or edge of pileus. 643. *A. virosa* Fr.
    - (bb) Pileus convex to subcampanulate; stem with a well-formed annulus.

- (c) Plant rather stout; basidia 4-spored; volva large. 641. *A. verna* Fr.
- (cc) Plant slender; basidia 2-spored; otherwise like preceding. 642. *A. bisporigera* Atk.
- (aaaa) Pileus brown, umber, gray, drab or shades of these.
- (b) Base of stem cylindrical, not bulbous; pileus pale brown to umber. 646. *A. spreta* Pk.
- (bb) Base of stem bulbous, bulb rounded.
- (c) Pileus viscid, pale smoky olive, umber, or smoky white, often with shreds of veil on top; annulus apical, white. 640. *A. phalloides* Fr.
- (cc) Pileus scarcely viscid or dry; stem slender.
- (d) Spores elliptical, 11-13 x 7-9 micr.; pileus brown or grayish-brown; disk with white patch-like scales. 648. *A. recutita* Fr.
- (dd) Spores globose.
- (e) Pileus scarcely viscid, fuscous to pale brown, glabrous; annulus distant, brownish; bulb rather small. 644. *A. porphyria* Fr.
- (ee) Pileus with numerous ash-colored appressed scales; ash-colored pulverulence on stem. 647. *A. tomentella* Kromb.
- (AA) Base of stem or bulb without a cup-like, free-margined volva.
  - (a) Pileus orange, yellow or straw colored.
  - (b) Margin of pileus markedly tubercular-striate, yellowish to straw color; annulus evanescent; volva usually evanescent or a few scales on bulb. 656. *A. russuloides* Pk.
  - (bb) Margin even or only slightly striate; pileus orange to bright yellow; annulus persistent.
  - (c) Flesh of stem changing to reddish when bruised or in age. 658. *A. flavorubescens* Atk.
  - (cc) Flesh not reddish.
  - (d) Pileus large, more than 7 cm. broad; stem stout, provided with prominent, concentric scales or rings on or above bulb. 650. *A. muscaria* Fr.
  - (dd) Pileus less than 7 cm. broad.
  - (e) Bulb with an adherent, inrolled, collar-like ring on its upper margin; spores spherical. 651. *A. frostiana* Pk.
  - (ee) Bulb and pileus with a few, flocculent masses of the friable, yellow volva; spores oval; common. 659. *A. flavoconia* Atk.
- (aa) Pileus not yellow nor yellowish.
- (b) Odor strong of chlorine or chloride of lime; stem bulbous-napiform, more or less deeply rooting; plant entirely white and very densely floccose-scaly. 655. *A. chlorinosma* Pk.
- (bb) Odor not penetrating like chlorine.
- (c) Base of stem more or less deeply rooting below an enlarged or concentrically furrowed bulb.
- (d) Pileus white to grayish; plants large and stout, densely floccose scaly. 654. *A. solitaria* Fr. *A. strobiliformis* Fr.
- (dd) Pileus or its scales grayish-brown to umber-brown; plants slender, covered with a loose pulverulence; spores 8-12 x 4-6 micr. *A. cinereoconia* Atk.
- (cc) Base of stem rounded, or at most short conical below.
- (d) Flesh of stem or of whole plant turning to reddish where bruised or in age.
- (e) Pileus decorated with yellow powdery masses; flesh changing to red only toward base of stem. 658. *A. flavorubescens* Atk.
- (ee) Pileus decorated with grayish or reddish-stained, floccose warts; whole plant becoming reddish, never yellow. 657. *A. rubescens* Fr.

- (dd) Flesh not turning red when bruised.
- (e) Pileus, etc. white or whitish.
- (f) Bulb at base of stem provided with a concentrically grooved close-fitting inrolled sheath; annulus superior. 652. *A. cothurnata* Atk.
- (ff) Bulb with remnants of volva variously disposed.
- (g) Stem floccose-scaly or torn, below with an ovate bulb, which is concentrically scaly.
- (h) Annulus adorned with yellow floccules, ample, distant; stem stuffed by pith, soon hollow; pileus covered with dense, white, floccose patches. 653. *A. chrysoblema* Atk. sp. nov.
- (hh) Annulus white, ample, apical; stem solid-stuffed; pileus with angular or pyramidal warts. *A. caudida* Pk.
- (gg) Stem slender, glabrous or pulverulent, bulb naked or with remains of friable volva.
- (h) Entirely white; pileus 5-10 cm. broad, with angular, erect warts; bulb subglobose, abrupt; annulus persistent. *A. abrupta* Pk.
- (hh) Pileus grayish-white or yellow-tinged, 2-5 cm. broad, adorned with flocculent scales; annulus evanescent, slight; edge of gills crenulate-floccose. *A. crenulata* Pk.
- (ee) Pileus brown-gray, smoky brown to umber.
- (f) Annulus inferior, broadly pendant; pileus rich hair-brown to umber-brown; bulb ring-margined above. *A. velatipes* Atk.
- (ff) Annulus superior.
- (g) Margin striate; upper margin of bulb with appressed ochreate volva, sometimes with rings above it. *A. pantherina* Fr.
- (gg) Margin not striate; pileus with grayish scales.
- (h) Volva friable; pileus with mealy scales; gills adnexed by decurrent lines; bulb oval or globose. Spores 8-9 x 5-6 micr. 660. *A. spissa* Fr.
- (hh) Volva friable-floccose; gills free; bulb marginate-rounded, concentrically grooved. Spores 11-13 x 6-8 micr. (Boudier). *A. excelsa* Fr.

*Section I.* Universal veil splitting at apex; volva *persistent* on bulb or base of stem, usually *forming a true cup*, its upper part free from stem or merely collapsing on it, *membranous*; surface of pileus bare (except occasionally in *A. phalloides* and *A. spreta* in which thin membranous shreds or patches remain on pileus).

639. *Amanita cæsarea* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Michael, Vol. II, No. 97.

Bresadola, Fungh. mang. e. vel., Pl. 1.

Atkinson, Mushrooms, Plate 18 and 19, 1900.

Hard, Mushrooms, Fig. 28 and 29, 1908.

Marshall, Mushroom Book, Pl. 4. op. p. 50, 1905.

Peck, N. Y. State Mus. Rep. 48, Pl. 15, 1897.

Not yet reported in Michigan. It is occasionally found farther south. The present known range seems to be as far north as latitude 43°. This would bring it into southern Michigan where no doubt it will yet be found. Its name indicates that it is the emperor of its genus, and its large, showy, orange to red cap and perfect volva fully justify the name. *The pileus is striate and glabrous; gills and stem are yellow.* "The thick volva, before splitting is about the size of a hen's egg and of like shape and color." It is edible, and was served to the Caesars of Rome as a delicacy long ago. It approaches the deadly *A. muscaria* in color, except that the gills of the latter are white. Avoid eating it unless intimately acquainted with both species. It often forms large fairy rings.

640. *Amanita phalloides* Fr. (DEADLY POISONOUS)

Syst. Myc., 1821.

Illustrations: Gillet, Champignons de France, No. 3 (as *A. bulbosa*, the green variety).

Bresadola, Fungh. mang. e. vel., Pl. 2, (green variety).

Cooke, Illustrations, Plate 2, (yellow variety).

Ricken, Blätterpilze, Pl. 75, Fig. 2.

Fries, Sverig. ätl. u. gift. Svamp., Pl. 2.

Farlow, Bull. No. 15, U. S. Dept. Agr., Plate XXIII, 1898.

(See also Hard, Mushrooms, Fig. 11, p. 21, 1908, for same figure.)

Atkinson, Mushrooms, Plate 14, Fig. 56, 57 (umber to olive variety).

Marshall, Mushroom Book, p. 48, 1905.

PILEUS 5-12 cm. broad, at first ovate or rounded, then subcam-

panulate to expanded, quite *viscid* when moist, *umber-brown* to *smoky olive*, sometimes virgate, often paler or whitish on margin, glabrous or with few remnants of the universal veil in the form of thin shreds or patches, *margin even*. GILLS free or adnexed by a line, medium broad, close, white. STEM 8-20 cm. long, 6-12 mm. thick, cylindrical above bulb, varying stout to slender, *glabrous* to subsquamulose, stuffed by fibrils then hollow, white or tinged by color of pileus. ANNULUS superior, *white*, ample, pendant, membranous. VOLVA mostly buried in the ground, forming a loose or appressed cup, sometimes entire and lobed, often irregularly torn, formed by the *universal veil dehiscant or tearing in shreds at the apex*, not truly circumscissile, *its texture membranous*, not floccose. SPORES spherical-ovate, the ovate-pointed side ending in a rather stout apiculus, 9-12 (with apiculus) to 8-9 micr., granular within, white, smooth. ODOR rather nauseous.

Scattered or gregarious. In conifer or frondose woods, borders of woods, thickets, rarely on lawns, etc. Common throughout the State. July to September (earliest record July 9, latest September 24).

The form with circumscissile universal veil belongs under *A. mappa*. The typical form with dark cap described above is rather common and recognizable by the umber to olive-brown colors or paler shades of these colors, the even margin, the rather ample volva which may be reduced in size by the shreds it sometimes leaves on the cap, by the subglabrous stem and spherical-ovate spores. It is distinguished from *A. mappa*, form (A) by the membranous texture of its universal veil which does not split in a truly circumscissile manner, by the more ample volva, and by the shreds which when present on the cap are membranous, not floccose-warty. In this separation, I have followed Boudier, the eminent French mycologist. This is one of our most deadly mushrooms, no antidote having yet been discovered for its poison. The amateur need not attempt to keep *A. phalloides* and *A. mappa*, form (A) apart, as they are equally poisonous. The autumnal yellow form is more easily distinguished but is also a deadly species. See Chapter on Poisons. In Europe, the green variety is very common; their yellow variety (*A. bulbosa*) is referred by Ricken to *A. mappa*. We do not seem to have these color forms here.

641. *Amanita verna* Fr. (DEADLY POISONOUS)

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Plate 3 (bulb imitates that of *A. mappa*).

Gillet, Champignons de France, (as *A. bulbosa* var. *alba*).

Bresadola, Fungh. mang. e. vel., Pl. 4.

Atkinson, Mushrooms, Fig. 59 and 60; also Fig. 55 (as *A. phalloides* var. *alba*), 1900.

Marshall, Mushroom Book, p. 48 (probably *A. verna*, given as *A. phalloides*), 1905.

Murrill, Mycologia, Vol. 5, Pl. 87, Fig. 1. (As *A. phalloides*.)

Hard, Mushrooms, Fig. 16, p. 27, 1908.

Plate CXVI of this Report.

PILEUS 5-12 cm. broad, elongated ovate then *convex* to subcampanulate, finally expanded, *pure white*, viscid when moist, *glabrous*, without patches from the veil, *even* on margin. GILLS free or adnexed by a line, not broad, subventricose, crowded, *white*, edge floccose or pulverulent. STEM pure white, 8-20 cm. long, *rather stout*, 8-15 mm. thick, cylindrical above bulb, or tapering upward, *stuffed*, then somewhat hollow, glabrous or floccose-scaly, bulb oval or orbicular, not as wide as in *A. mappa*, *sunk in the ground*. ANNULUS ample, superior, pendant, white, membranous, not disappearing normally. VOLVA firm, thick below, thinning out toward lobed margin, derived from the entire universal veil, which dehisces at its apex, membranous, white, forming a genuine cup the ample free margin of which is at first rigid then appressed to stem. SPORES spherical-ovate, the ovate-pointed end terminating in a rather stout apiculus, granular within, white, 9-12 (with apiculus) x 8-9 micr., immature spores smaller. BASIDIA 4-spored. ODOR nauseous or slightly so.

Solitary or scattered gregarious. In conifer, mixed or frondose woods or thickets, rarely on lawns, often in clearings. Very common throughout the State. July-October (latest record October 11.)

This beautiful, pure white, stately and deadly poisonous *Amanita* is called the "destroying angel." In the egg-stage it is easily confused by the inexperienced with *Agaricus campestris*. *The hidden volva must be looked for in every white mushroom gathered for the table so as to avoid it.* *A. verna* has spores like *A. phalloides*; and

spores which are larger and less truly spherical than in *A. mappa*. From the next species it is separated by its four spores to each basidium and by its stouter habit. But to the amateur, *A. verna*, *A. bisporigera* and *A. virosa* will look alike, and as they are equally poisonous, he need not separate them. They are only kept distinct for scientific reasons. The bulb, as well as the adjustment of the volva on it varies considerably so that unless it can be shown that the microscopic characters differ, the so-called "*alba*" var. of *A. phalloides* and *A. verna* proper are here combined into one. It seems to have no soil preference with us, although Boudier says it is partial to limestone land. I have found it on clay and sandy soil in southern Michigan, and on the rocky foundations of the Lake Superior region. See Chapter on Poisons.

642. *Amanita bisporiger* Atk. (DEADLY POISONOUS)

Botanical Gazette, Vol. 41, 1906.

Illustration: Atkinson, Mushrooms, Fig. 61, 1900 (as *A. verna*).

Like *A. verna*, except in its more slender habit, and the *2-spored basidia*. Pileus 4-7 cm. broad. Stem 8-12 cm. long, 5-8 cm. thick above the bulb which varies from 2-4 cm. in thickness. Whole plant is pure white, and only separable from *A. verna* in the field after some experience. I have examined the *2-spored* character frequently and it seems to be constant.

Usually solitary. Throughout the State, in hemlock or frondose woods. One specimen was found growing from a rotten hemlock trunk near its base, in the Huron Mountains. July to September. Frequent. Poisonous.

643. *Amanita virosa* Fr. (DEADLY POISONOUS)

Hymen. Europ., 1874.

Illustrations: Fries, Sverig. ätlig. u. gift. Svamp., Pl. 84.

Cooke, Ill., Pl. 1.

Gillet, Champignons de France, No. 6.

Atkinson, Mushrooms, Fig. 62, p. 62, 1900.

Like *A. verna*, except that it has a conical pileus when young; the annulus is rarely formed, because the inner veil remains

attached to gills and edge of pileus and becomes torn into parts or shreds; the stem has a tendency to be eccentric, and is usually floccose or squamulose, and the spores are slightly smaller, spherical-ovate, 8-9 (with apiculus) x 7-8 micr., white. It seems to be partial to sandy soil in this State. Ann Arbor, New Richmond. September. Infrequent. Poisonous.

644. *Amanita porphyria* Fr. (SUSPECTED)

Syst. Myc., 1821.

Illustrations: Gillet, Champignons de France, No. 5.  
Plate CXVII of this Report.

PILEUS 3-6 cm. broad, at first campanulate then expanded, *glabrous, pale brown*, disk smoky-brown, moist or subviscid, silky and obscurely virgate when dry, *margin even*. Flesh thin, white. GILLS white, slightly *adnexed*, close, medium in width, subventricose, thin. STEM rather slender, 7-12 cm. long, 4-6 mm. thick, subequal, soft, even, *glabrous*, stuffed then hollow, whitish to pale brown, *with a small bulb*. ANNULUS superior but distant, thin, membranous, white *becoming brown-tinged, pendant*. VOLVA white, thin, flaccid, membranous, forming a thin cup, imbedded with the bulb in the soil, somewhat evanescent. SPORES spherical, 7-9 micr. diameter, granular within, smooth, white. BASIDIA 4-spored.

In low, swampy ground, among poplars and willows. July. Ann Arbor. Rare.

Distinguished from *A. tomentella*, by its sheathing cup and glabrous pileus. Our plants did not have the purplish tinge reported as frequent in European plants. Gillet gives a good figure. The annulus becomes brownish and is thin and drapes the stem at some distance from the apex. In this and other respects it differs from small forms of *A. phalloides*. This appears to correspond with Ricken's "*forma volvata*." (Blätterpilze, Pl. 75, Fig. 3.)

645. *Amanita peckiana* Kauff. (SUSPECTED)

Mycologia, Vol. V, p. 67, 1913.

PILEUS 5-9 cm. broad, at first ovate, becoming broadly convex or nearly plane, white, *glabrous* at first, *then fibrillose or somewhat scurfy with numerous minute pinkish or cream-colored squam-*

*ules, not striate*, margin at first incurved and bordered by the thickish union of the universal and partial veil, at length crenate-fringed or lacerate-appendiculate. FLESH firm, thickish, white. GILLS free or attached by a line, reaching the stem, moderately broad, much broader in front, subellipsoid, pure white, flocculose on edge, trama divergent. STEM 5-9 cm. long (rarely up to 13 cm., 1-2 cm. thick, stout, tapering slightly upward, stuffed by loose pith, then hollow, white, *at first bulbous*, the bulb covered by a thick, firm, loose VOLVA which is margined with ovate lobes, the flesh often pinkish or salmon-colored, especially toward base. ANNULUS evanescent, but in the young plants the gills are concealed by the very thin inner veil. SPORES elongate-oblong or subcylindrical, obtuse, 13-16 x 5-7 micr., sometimes slightly narrower toward one end, white in mass. BASIDIA 46-50 x 9 micr., elongate-clavate, 4-spored. STERILE CELLS on edge of gills, inflated, pyriform, variable in size. ODOR none or very slightly of radish.

Gregarious. On sandy ground under white pine in open groves. New Richmond. September. Infrequent.

Known by the fringed margin of the pileus, the large, two-layered volva, the thin, evanescent inner veil, the peculiar delicate innate, fibrillose scales on the cap and stem and the large subcylindric spores. The volva is entirely immersed in the sand; it splits usually at the top of the young cap into ovate lobes and at length seems spuriously two-layered below by the separation of a thick layer of the bulb so that finally the stem is removable and appears subcylindrical at base. Rarely the volva breaks so as to leave a large thick piece on top of the cap as in *A. coccola* Scop. In some respects it approaches *A. spreata* Pk., but differs distinctly in color and spores. Sometimes the surface of the cap is beautifully dotted by the pale salmon-colored, delicate scales. The volva may reach a large size, 4 to 5 cm. high and 3 to 4 cm. across. The inner veil is very thin and often remains adnate to the stem at first, and appears to be absent; in the mature plant it is rarely to be made out. This species is close to if not identical with *A. coccola* Scop. (sense of Boudier, Soc. Myc. d. France, Bull. 18, p. 253 and Pl. 13). The shape and size of the spores are figured and described like those of our species. The margin of the pileus, however, is said to be always striate, Saccardo says "sulcate." On the other hand, the inner veil of *A. coccola* is said to be very thin and evanescent, and the figures, showing the volva, are very suggestive of our plant. Furthermore, Ricken (Blätterpilze, under *A. ovoidea*) quotes Quelet as authority for the statement that the flesh of *A.*

*coccota* assumes a reddish hue. Some consider the latter species a form of *A. ovoidea* Fr. to which our plant cannot be referred, but to which it may be related.

646. *Amanita spreata* Pk. (DEADLY POISONOUS)

N. Y. State Mus., Rep. 32, 1879.

Illustrations: Atkinson, Mushrooms, Fig. 71, p. 69, 1900.

Plate CXVIII of this Report.

PILEUS 7-12 cm. broad, ovate at first, then broadly convex-expanded, *pale brown to umber-colored*, often unicolorous, *glabrous* or with a few large patches of the white universal veil, slightly viscid, *margin even* or obscurely striatulate. FLESH white, soft, thick, abruptly thin at margin. GILLS crowded, *reaching the stem* and adnexed by a decurrent line, rather broad, narrowed behind, subventricose, pure white, edge fimbriate-serrulate, its trama with diverging hyphae. STEM 10-15 cm. long, *stout*, 10-20 mm. thick, equal or tapering slightly upward, stuffed then hollow, striate and mealy above the annulus, subglabrous or subfibrillose below, *whitish, not bulbous*, inserted at base into the *rather large, thickish, persistent, membranous, sheathing, white* VOLVA. ANNULUS white above, tinged umber beneath, thin, membranous, superior. SPORES elliptical, 11-12 x 6-7 micr., *nucleate* at maturity, smooth, white. No cystidia. Basidia 4-spored.

Solitary or gregarious. On *sandy soil*, in the pine plains of western Michigan now covered with scrub-oak, etc., where it is frequent. September. New Richmond, along the Kalamazoo River.

Known by the sheathing volva and the bulbless stem, which are both deeply immersed in the sandy soil and imitate *Amanitopsis vaginata* in this respect. The color of the pileus is uniformly darker than it is given by Peck. It prefers sandy soil. Its stout habit and its spores, as well as the base of the stem, are strikingly different from *A. porphyria*. *A. cinerea* Bres. of Europe also lacks the bulb but is a much smaller plant.

*Section II.* Universal veil splitting in a circular line between bulb and pileus (*circumscissile*), the upper half adhering *on the pileus* in the form of *floccose scales, warts or pyramids*, the lower half adhering to the bulb or the base of the stem and forming abrupt inrolled sheaths, or several imperfect rings. The universal veil is composed of globose, inflated cells, at least in the upper part.

\**Annulus median or inferior.*

647. *Amanita tomentella* Kromb. (SUSPECTED)

Naturgetreue Abbildungen, 1831.

Illustrations: Krombholtz, *ibid.*

Ricken, Blätterpilze, Pl. 76, Fig. 1. (As *A. porphyria*.)

PILEUS 4-9 cm. broad, convex then expanded, umber-brown or paler, with a tinge of violaceous (ecru-drab, Ridg.), almost dry, *radiately-silky*, shining, covered by numerous, delicate, pulverulent-floccose, appressed, ash-colored scales, *margin even* and decurved. FLESH white or tinged ashy under the separable pellicle. GILLS white, rather narrow, of equal width, close, free or decurrent by a line, *edge minutely fimbriate and sometimes ashy-tinged*. STEM 7-9 cm. long, tapering upward from the thick, ovoid bulb, stuffed then hollow, often *with an ashy pulverulence both above and below the distant annulus*, innately scaly below, whitish. VOLVA thick, circumscissile, covered with tomentose pulverulence, its margin thick, short and somewhat angled. ANNULUS median, usually ample, membranous, thin, persistent, ashy-colored on under side, somewhat striate above. SPORES *spherical*, 8-9.5 micr. in diam., smooth, white with minute apiculus.

(Dried: Cap shining, chestnut, scales paler; gills pale alutaceous.)

Solitary. In conifer and mixed woods of northern Michigan. Isle Royale, Houghton, Munising. August-October. Infrequent.

I have restored Krombholtz's name in order properly to limit our plant. According to Boudier *A. recutita* has oval spores, 11-12 x 7-9 micr. in size. Except for this discrepancy, this form would be referred to that species. It differs from *A. porphyria* in belonging to this section, by reason of its circumscissile universal veil and the floccose structure of the scales on the cap, which are numerous; the spores, however, are the same. No doubt our plant is one of three different species, which are closely related. It is easily known

by the ashy-colored pulverulence on cap and stem, and the median, pendant annulus. The main color of the pileus varies from umber-brown to drab, with an obscure tinge of lilac or purplish. It is an autumnal Amanita of the conifer forests.

648. *Amanita recutita* Fr. var. (SUSPECTED)

Epicrisis, 1836-38.

Illustration: Michael, Führer f. Pilzfreunde, Vol. 3, No. 124.

PILEUS 5-8 cm. broad, convex-plane, dry, grayish, *brown on disk*, disk dotted with patch-like whitish scales, striate on margin. FLESH rather thin, white. GILLS free but with decurrent line, *rather narrow*, close, white or whitish, trama divergent. STEM 8-9 cm. long, *slender*, 7-10 mm. thick, *silky*, white, equal above the small rounded bulb. ANNULUS membranous, thin, subpersistent, distant, narrow, whitish. VOLVA sheathing but short, truncate, thickish, extending above bulb, whitish. SPORES broadly elliptical, oval to subpyriform, 11-13 x 7-9 micr., variable in shape, smooth, white. BASIDIA 40-45 x 10 micr., attenuated downward, 4-spored. ODOR none.

On sandy soil, coniferous region, under thickets. New Richmond. September. Rare.

This species is distinct from *A. porphyria* and *A. tomentella*, which it imitates in size and coloring, and by its large spores. It differs also from *A. porphyria* in the mode of breaking of the universal veil, the greater part of which remains at the base of the stem in the form of a thimble. The spores agree with the species as known to Boudier. (Soc. Myc. d. France, Bull. 18, p. 259.) The striations of our plants extend halfway to the center of the cap and this seems to be an aberrant feature, although the descriptions by European authors are not very full.

\**Annulus superior*.

649. *Amanita mappa* Fr. (DEADLY POISONOUS)

Hymen. Europ., 1874.

Illustrations: Cooke, Ill., Pl. 4 (shape, etc., but not with the colors of the American plant).

Bresadola, Fungh. mang. e. vel., Pl. 5.

Rolland, Bull. de la soc. Myc. de France, Pl. IV, Fig. 1.

Ricken, Blätterpilze, Pl. 77, Fig. 2.

Atkinson, Mushrooms, Fig. 58, p. 58 (as *A. phalloides*), 1900.

Hard, Mushrooms, Fig. 24, p. 35, 1908.

PILEUS 4-8 cm. broad, convex then expanded, usually very regular, *margin even*. FLESH white, not very thick. GILLS free or adnexed by a line, close, medium broad, *white*. STEM subcylindrical above the *very broad, abrupt, subdepressed bulb*, stuffed then hollow.

There are two forms with us: (A) PILEUS *smoky-umber varying to dark olive*, sometimes almost white, often paler in color or umber color only present on disk, the rest being whitish covered with floccose soft scales, the upper part of the universal veil. STEM with a very abrupt, depressed, margined bulb above the edge of which the margin of the circumscissile volva may project slightly, bulb rounded below, surface of stem glabrous or nearly so, white or tinged smoky brown. SPORES globular, 8-9 micr., apiculate. ANNULUS superior, white, membranous. VOLVA evanescent on bulb, but remaining on cap. This form is usually confused with *A. phalloides*.

(B) PILEUS *yellowish-white to straw-color*, rarely approaching sulphur-yellow, covered with more or less persistent, *floccose*, sordid-white or pale brownish scales. GILLS with edge floccose-crenulate, due to globose-pyriform sterile cells, its trama with divergent hyphae. STEM with *depressed saucer-shaped* wide bulb, up to 3 cm. diameter, cylindrical above, 10-15 mm. thick, pallid, or tinged very slightly with drab, almost glabrous, 6-9 cm. long. ANNULUS superior, *straw-colored* as a rule, membranous, rather ample. VOLVA appressed on the bulb, its short, thick, cup-margin free from stem and leaving a space between it and the stem, rarely obtusely short-lobed. SPORES *perfectly globular*, with an abrupt apiculus, 7-9 micr. diameter, or smaller when immature, granular within, white.

Form (B) is autumnal, rarely appearing before September, when it is common throughout the State. September to November (earliest record August 25th, latest November 2). It seems to prefer sandy soil, but also occurs in sandy-clay soil. Boudier says it seems to be lacking in clay soil in France; he also gives spores slightly larger. Found in white pine or hemlock forests, as well as in oak, maple, etc. Both forms have a circumscissile volva, the upper part of which is floccose in structure, the lower membranous. It is therefore intermediate between the first and second sections. The European form is said to have a nauseous odor. It is *poisonous* like *A. phalloides*. The spores of the yellow form are entirely spherical and the apiculus is abrupt and very slender and short; in this it differs from *A. phalloides*, which has spores with the spherical shape but on the side of the apiculus becomes somewhat ovate-pointed, the point ending in a rather stout apiculus; this diameter is therefore a few microns longer, sometimes 10-12 micr. long to 9 broad.

650. *Amanita muscaria* Fr. (DEADLY POISONOUS)

Syst. Myc., 1821.

Illustrations: Gibson, Our Edible Toadstools and Mushrooms, Pl. IV (colored), 1895.

Farlow, Bull. No. 16, U. S. Dept. Agr., Pl. 22, copied by Hard, Mushrooms, Fig. 13, 1908.

Atkinson, Mushrooms, Frontispiece (colored), also Pl. 12-13, Figs. 52, 53 and 54, 1900.

Marshall, Mushroom Book, Pl. III (colored), 1905.

Murrill, Mycologia, Vol. 5, Pl. 85 and Pl. 87, Fig. 3.

McIlvaine, Amer. Mushrooms, Pl. IX, 1900.

PILEUS 8-20 cm. broad, at first ovate or hemispherical, then broadly convex to plane, viscid when young and moist, *yellow*, sometimes orange or orange-red, rarely whitish, *covered with numerous, whitish or pale yellowish warts*, margin at maturity *slightly striate*. FLESH white, or yellowish under the separable pellicle. GILLS reaching the stem, but free or decurrent by a line, crowded, broadest toward front, *white*. STEM 10-20 cm. high, equal or tapering upward, loosely stuffed then hollow, ovate-bulbous below, *white* or tinged yellow, with a white annulus above, the lower half floccose-scaly or somewhat lacerate, and near the bulb *provided with prominent concentric scales or rings*, which are the remains of the broken

*veil*. ANNULUS large, thick, superior, white. VOLVA is much torn and surrounds the bulb and the stem just above the bulb in the form of scales or rings. SPORES broadly oval, 9-10.5 x 6-7.5 micr., smooth, usually with a large oil-globule nearly filling the spore, obliquely apiculate, white. ODOR and TASTE usually insipid in the fresh condition of the mushroom; its poison when extracted is, however, extremely bitter.

(Dried: More or less ochraceous to alutaceous throughout, the scales on pileus always paler.)

Gregarious or closely massed, often in large fairy rings. In thickets of poplar, wood-lots of oak and maple, forests of pine or hemlock, cemeteries, roadsides, etc., widely distributed *throughout the State*. Sometimes on poor, gravelly soil, sometimes in swampy poplar woods, usually on denuded or pastured ground if found under conifers. July-October. Frequent.

One of the most showy and attractive mushrooms of the State. Known by its size, its yellow caps ornamented with whitish patches, its white gills and scaly bulb. *A. frostiana* and *A. flavoconia* have similar colors, but are much smaller. In Europe, the colors are bright scarlet and very striking. With us this form does not occur. Our species is really a color-variety of the European plant, much like that which European mycologists name var. *formoso*, except that our plant has white scales on its pileus. *A. flavorubescens* has soft yellow scales but is otherwise much different from var. *formosa* as described, with which it must not be confused. I have no record of the European var. *formosa*, and am not sure that it exists in this country. The color of *A. muscaria* varies somewhat, and in deep shaded places may be white; this is var. *alba*. The stately var. *regalis* with a pale liver colored cap has not been found in the State, although I have seen it in Sweden; it is very large. In wet situations the veil may split as in the preceding section and leave the cap bare; this is var. *puellaris* and is usually smaller.

The deadly *A. muscaria* has few uses. Its poison may yet be found to be of medicinal value, and the early settlers used an infusion of it to make "fly paper," which was an effective remedy for the troublesome house-fly—sometimes, but which caused disaster if small children partook of it. It is a delightful object for the artistic eye of the nature lover but in all other respects a menace.

651. *Amanita frostiana* Pk. (NOT POISONOUS)

N. Y. State Mus. Rep. 33, 1880.

Illustration: Atkinson, Mushrooms, Frontispiece, Fig. 2 (colored), 1900.

PILEUS 3-6 cm. broad, convex or expanded, bright orange or yellow, only slightly viscid, decorated with yellowish scales or warty patches, which are sometimes lacking, striate on margin. GILLS free, white or slightly tinged with yellow, close, broadest toward front. STEM 5-8 cm. long, 4-5 mm. thick, white or yellowish, stuffed, bearing a slight, sometimes evanescent annulus, with a distinct bulb which is margined above with a collar-like ring. ANNULUS superior, thin, fragile. VOLVA floccose-membranous, adhering on bulb in concentric scales or prominent rings as in *A. muscaria*, but less marked. SPORES globose, 7.5-10 micr., smooth, white, granular within.

Solitary or few. On very rotten hemlock logs and debris, in hemlock and mixed woods of the northern part of the State. Huron Mountains, Marquette. August-September. Infrequent.

This species is doubtless most often confused with *A. flavoconia* which is sometimes of similar size but has a universal veil composed of a powdery yellow substance, and whose bulb has therefore a different appearance. *A. frostiana* appears more like a small form of *A. muscaria* and prefers shady conifer woods, while *A. flavoconia* is more common in the southern part of the State in frondose woods, even in the open. McIlvaine says it becomes reddish-orange to scarlet farther south and imitates *A. caesarea* in color; but no confusion should be possible between the two since they have different volvas. *A. frostiana* has globose spores; *A. muscaria* has oval spores; besides the spores, the size seems the only important difference. Ford and Sherrick found it contained no deadly poison.

652. *Amanita cothurnata* Atk. (SUSPECTED)

Studies of Amer. Fungi, Mushrooms, etc., 1900.

Illustrations, Ibid, Figs. 68, 69, 70, pp. 67-68.

Hard, Mushrooms, Fig. 26, p. 37.

Pl. CXIX of this Report.

PILEUS 3-8 cm. broad, at first globose to hemispherical, then

convex-expanded, viscid, especially when moist, white, sometimes slightly tinged on centre with yellow or tawny-olive, covered with numerous, white floccose scales, margin finely striate when mature. GILLS free, remote, rounded behind, crowded, white, broader in front, edge floccose. STEM 6-12 cm., cylindrical, even, white, hollow, minutely floccose-scaly, with a large oval bulb below. ANNULUS superior, white, rather persistent. VOLVA forming a close-fitting covering for bulb and ending above the bulb by a circular roll which is often abrupt. SPORES globose, 8-9 micr., smooth, white, almost filled by a large oil globule.

Gregarious. In oak and maple woods. Ann Arbor, Detroit. July-August. Infrequent.

Have seen only the pure white form in Michigan. This species approaches *A. pantherina*, common in Europe. The latter has a brown to fawn-colored pileus which is long-striate and has whitish warts; its annulus is median, and there are usually several oblique rings of the volva a little above the bulb. Murrill's figure in Mycologia, Vol. 5, Pl. 87, is not of a typical plant. *A. cothurnata* has the bulb abruptly terminated by a close-fitting roll; its cap may have a slight tinge of umber or yellow on the disk. Quelet and Battaille give the spores of *A. pantherina* as oval-elongate, 10-12 micr. long; Karsten and Smith give them 8-9 x 4-5 micr.

653. *Amanita chrysoblema* Atk. sp. nov. (PROBABLY DEADLY POISONOUS)

Illustration: Plate CXX of this Report.

PILEUS 8-10 cm. broad, convex-expanded, pure white, densely covered with white floccose patches or scales, viscid, margin finely striate. GILLS free, somewhat remote, narrow, close, white, plane, heterophyllous. STEM stout, 10-14 cm. long, 1 cm. thick above, tapering from the clavate-bulbous base, 2 cm. thick, stuffed by a pith then hollow, very torn-scaly below annulus, floccose above, white, bulb and lower part of stem somewhat adorned by narrow thick rings, the remains of the volva. ANNULUS superior, rather ample, thin, pendant, somewhat distant, white except a sprinkling of yellow floccules on upper side. VOLVA floccose, rather fragile, white, in broken rings on bulb and lower stem. SPORES broadly-elliptical, 9-10 x 6-7 micr., smooth, white, granular within.

Solitary. On the ground, in the edge of a sphagnum swamp. September-October. Ann Arbor. Rare.

Differs from *A. cothurnata* in its bulb and annulus characters, and in its elliptical spores. The scales of the stem are due to its torn surface and point upward. The floccose structure of the universal veil and its manner of breaking separates it from *A. verna*, *A. phalloides* and *A. virosa*. The yellow floccules on the annulus are a character peculiar to this species. *A. crenulata* differs from *A. chrysoblema* in its very evanescent volva, in its gills which reach the stem and have a strongly floccose edge, the floccules of which are sometimes yellow, and in its nucleate spores.

**654. *Amanita solitaria* Fr. (EDIBLE, BUT USE CAUTION)**

Syst. Myc., 1821.

Illustrations: Atkinson, Mushrooms, Pl. 21 and 22, 1900.

Gillet, Champignons de France, No. 16 (as *A. pellita*), No. 8 (as *A. echinocephala*).

Cooke, Ill., Pl. 939.

Var. (A) (*A. strobiliformis*)?

**PILEUS** 10-15 cm. broad, globose-hemispherical at first, finally expanded-plane, at an early stage covered by large, firmly adhering, pyramidal warts, when expanded dotted with floccose, rather soft, brownish warts, not striate, whitish. **FLESH** white. **GILLS** free or almost so, crowded, narrow, white or tinged cream-color, edge entire. **STEM** 10-15 cm. or more in length, solid, rooting napiform-bulbous at first, then elongated and 1-2 cm. thick, the thick bulb at the first concentrically corrugated by thick, pointed warts, when full grown oval ending below in a large, tapering "root" which penetrates the soil deeply, the bulb then covered with smaller, scattered warts, becoming almost glabrous upward to the ring, whitish. **ANNULUS** pendant, apical, white then dingy yellowish and disappearing. **SPORES** variable in shape, 9-12 x 6-7.5 micr., elliptical, smooth, white. **ODOR** none at any stage.

Solitary on the ground in low woods of maple, oak, etc. Ann Arbor. August. Infrequent.

The spore-measurements agree with the spore-measurements by Bresadola, but not at all with his figure (Fungh. Mang. et. vel., Pl. 8), which shows the surface of the stem torn-scaly like the surface of an open pine cone. It is more like the forms photographed by Atkinson (Mushrooms, Pl. 21, 1900), except for the more napiform bulb and larger spores. Authors disagree widely

as to the characters of *A. solitaria* and *A. strobiliformis*. Boudier (Soc. Myc. de France, Bull. 18, 1902) differentiates *A. solitaria* by its larger spores, 13-15 x 8-10 micr., by its floccose, thinner warts, by the thin, fragile and the cream-colored annulus; and his *A. strobiliformis* has spores 10-13 x 6-8 micr., a turbinate, napiform bulb, and grayish cap covered with very large, thick, adnate angular scales. Ricken (Blätterpilze) reverses the spore size and also considers them smaller: 9-10 x 5-6 micr. for *A. solitaria*; 12-14 x 8-9 for *A. strobiliformis*; at the same time his other characters agree pretty well with those of Boudier's description of the two species. Both Bresadola and Atkinson consider the two species identical under *A. solitaria*, assuming that great variations occur in the nature of the scales on the cap and stem, and in the shape of bulb and stem. That weather conditions cause great variation in these plants, whether a single or composite species, is quite certain. But with such data as those given above, as to size of spores, it becomes necessary to explain by further studies the discrepancies reported by these eminent mycologists.

All European mycologists agree in omitting any mention of an odor of chloride of lime. Hard and McIlvaine report both *A. solitaria* and *A. strobiliformis* with such an odor. I infer from this that American plants which have often been referred here, belong to *A. chlorinosma* Pk. or one of its varieties.

**655. *Amanita chlorinosma* Pk. (EDIBLE, BUT USE CAUTION)**

Torr. Bot. Club. Bull., Vol. 6, 1878.

Bot. Gazette, Vol. IV, 1879.

Illustration: Hard, Mushrooms, Pl. 3, Fig. 22, 1908. (As *A. strobiliformis*.)

**PILEUS** 8-15 cm. or more broad, subglobose at first then convex to expanded, white or tinged dingy cream-color, surface with a very variable covering of dense white floccose scales or warts, sometimes mealy-floccose, sometimes as rounded masses, sometimes pyramidal pointed warts, always floccose in structure, except in age they may become hard and adherent, sometimes few and large then again smaller and numerous, margin appendiculate with shreds of veil. **FLESH** thick, compact, pure white, thinner on margin. **GILLS** free or adnexed by a point, relatively narrow, sub-ventricose, broader in front, white tinged cream-color, edge minutely

*flocculose*. STEM 6-15 cm. long, rooting, root up to 10 cm. long, ventricose varying to napiform and then very thick, up to 3 cm. at bulb, equal upwards, firm and hard, solid below; spongy-stuffed within the hard outer rind, sometimes becoming cavernous, *floccose-torn* from bulb to annulus, often concentrically floccose near bulb, white. ANNULUS fragile, lacerated, sometimes remaining as a ring with margin quite torn, sometimes adhering to gills or margin of pileus. VOLVA densely floccose, white, mostly left on pileus, sometimes attached to bulb or stem as floccose, irregular concentric, soft scales. SPORES *not large*, 8-12 x 5-7 micr., varying in both dimensions. Young immature spores are spherical then ovate, *elliptical at maturity*, granular within. ODOR *strong of chlorine or chloride of lime, disagreeable*.

(Dried: Dingy-white.)

Solitary or gregarious. In woods on the ground, often on hard, gravelly soil. Lansing, Detroit. Infrequent.

The original description, copied by McIlvaine, was made by Peck from a single specimen. Austin the finder, also published a description at the same time. Since the plant is very variable, in the manner so fully described for *A. solitaria* by Atkinson in his mushroom book, the original description must naturally have many short-comings. Hence I will assume, until we have further data, that all our plants with the strong chlorine odor belong under this species.

Like *A. solitaria*, *A. chlorinosma* is a large and striking species, usually pure white, becoming dingy cream color; the surface of the whole plant is sometimes thick with a mass of cottony scales. The spores have been found variable and add to the confusion of species. Under the microscope the young and matured spores are shown detached. The young spores naturally measure much less than the mature spores. *A. radicata* Pk. (Bull. Torr. Bot. Club, Vol. 27, p. 609) is described as having large and firm scales; the odor, the spores and the rooting stem are the same as in *A. chlorinosma*. It seems to bear the same relation to *A. chlorinosma* as *A. strobiliformis* bears to *A. solitaria*.

656. *Amanita russuloides* Pk. (SUSPECTED)

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

PILEUS 5-12 cm. or more broad, ovate at first, then convex-expanded, *pale yellow or straw-color*, paler on margin, surface viscid,

covered with whitish, floccose warts which are often lacking entirely or in part, *margin* markedly *tuberculate-striate*, *striae* 1 to 3 cm. long. GILLS *white*, free or at first reaching the stem, crowded, rather narrow, broadest in front and tapering to stem. STEM 8-15 cm. long, *tapering upward* from bulb, varying in thickness 5-10 mm. at apex to 8-20 mm. above bulb, bulb 1.5 to 2.5 cm. thick, stuffed by webby pith then hollow or cavernous, *white*, glabrous or fibrillose-floccose, the cortex sometimes squarrose-torn. ANNULUS superior, thin, *mostly evanescent*, sometimes loosened and near the bulb, edge sometimes floccose. VOLVA *circumscissile, thin, fragile, often disappearing* or forming at first a few subconcentric delicate rings on bulb. SPORES 9-10 x 5-6 micr., elliptical, *nucleate* when mature, smooth, white, apiculate.

Gregarious, rarely subcaespitose, often in large circular patches. *On the sand plains* along the Kalamazoo River, originally white pine forest, now scrub oak, etc. New Richmond. Abundant locally. September.

Known by its peculiar long tuberculate-striae on the margin of the pileus and its thin evanescent volva. The annulus separates and breaks early, and often clings to the apex of the bulb, simulating the species with close-fitting inrolled volva. It was found in great abundance all over the oak-barrens about New Richmond during September, 1910, and is partial to sandy soil which clings to its caps.

This species cannot be *A. junquillea* Quel., as some authors intimate. The spores are larger, the colors paler and the long striations are markedly tuberculate.

*Section III.* Universal veil *friable* and pulverulent-floccose, *circumscissile, fugacious*. Pileus with soft floccose masses or warts, rarely bare. Bulb of stem bare or with flocculent masses which soon vanish.

657. *Amanita rubescens* Fr. (EDIBLE, BUT USE CAUTION)

Syst. Myc., 1821.

Illustrations: Fries, *Sverig. ätlig. u. gift. Svamp.*, Pl. 74.

Cooke, Ill., Plate 1163.

Bresadola, *Fungh. mang. e vel.*, Pl. 9.

Gillet, *Champignons de France*, No. 16.

Patouillard, *Tab. Analyt.*, No. 303.

Ricken, Blätterpilze, Pl. 80, Fig. 1.

Atkinson, Mushrooms, Plates 19, 20, and Fig. 73, 1900.

Hard, Mushrooms, Fig. 27, 1908.

Plate CXXI of this Report.

PILEUS 5-12 cm. broad, oval at first, then broadly convex or campanulate, sometimes expanded, *obtuse*, subviscid when moist, *pale brownish-buff to sordid reddish-brown*, covered with floccose masses or soft warts which are whitish, grayish or reddish-stained, margin even or obscurely striatulate. FLESH soft, thin, whitish, *becoming reddish-stained* when bruised or in age. GILLS narrowed toward stem and free, moderately broad in front, close, *white or whitish*, edge pulverulent under lens. STEM 10-20 cm. long, 8-15 mm. thick, subcylindrical above, clavate-bulbous to rounded-bulbous below, *stuffed*, subglabrous, even or the apex slightly striate and mealy, pink-tinged within and without, dull red where bruised. ANNULUS *broad*, superior, membranous, fragile, often striate on the upper side. VOLVA mostly lacking, *evanescent*, grayish. SPORES elliptical, 7-9 x 6 micr., when mature (immature plants shedding smaller spores), smooth, white.

Solitary or scattered. In oak and maple woods of southern Michigan, mixed woods of conifer regions; it seems to prefer clay soil. Especially common in open or pastured woods. Throughout the State. July to September, far more common in July. Edible.

The color is quite variable, soon tinged with the reddish stains which separate this species from all others except *A. flavorubescens*. When fresh the flesh turns red rapidly where bruised. The stem has a rather hard cortex in dry weather which cracks across and peels in part. Sometimes there are minute, reddish or tawny scales on the stem. The spores are 1 to 2 micr. shorter than in the European plant as shown in specimens I have from Sweden, and by the measurements given by Boudier. Cooke in the Illustrations refers to shorter spores, so that they were probably immature. It is easy to find expanded specimens whose spores are not fully developed. The annulus is usually large and pendant. It is edible, but one must be extremely careful.

658. *Amanita flavorubescens* Atk. (SUSPECTED)

Jour. of Mycology, Vol. 8, 1902.

Illustrations: Murrill, Mycologia, Vol. 5, Pl. 87, Figs. 4 and 7.  
Plate CXXII of this Report.

PILEUS 10 cm. broad, convex to expanded, *covered with floccose or powdery chrome-yellow patches or masses*, which are easily rubbed off, beneath which the surface is lemon-yellow to brownish on disk, margin even or faintly striatulate. FLESH thin, *yellowish*. GILLS *white*, long-elliptical, rather narrow, free or adnexed by a line, close. STEM 8-13 cm. long, 6-12 mm. thick, white, covered above with fine floccose yellow scales, below with reddish scales, its base ending in an oval bulb, stuffed then hollow; its flesh turning slowly reddish when bruised. ANNULUS superior, distant, thin, membranous, fragile, yellow below, white above. VOLVA yellow, powdery, evanescent. SPORES oboval, 8-10 x 6-8 micr., smooth, granular within; basidia 4-spored.

Solitary or gregarious. In frondose woods mixed with Larix. Ann Arbor. Rare. July.

The bright yellow volva, annulus and margin of pileus, and the reddening of the flesh of the stem are its chief distinguishing characters. The pileus may be entirely yellow at first, becoming reddish or sordid brown in age.

659. *Amanita flavoconia* Atk. (PROBABLY POISONOUS)

Jour. of Mycology, Vol. 8, 1902.

Illustrations: Hard, Mushrooms, Fig. 15 (as *A. frostiana*).  
Plate CXXIII of this Report.

PILEUS 3-8 cm. broad, convex then expanded, *obtuse*, viscid, chrome yellow to orange yellow, *covered with numerous, yellow, flocculent masses of the universal veil*, which are easily rubbed off, sometimes bare, margin even. FLESH thin, white. GILLS free, close, medium broad to narrow, *white*, edge minutely fimbriate, trama with divergent hyphae. STEM 6-10 cm. long, 5-10 mm. thick, stuffed then hollow, straight or flexuous, subequal, covered with flocculent scales which are sometimes tinged sulphur-yellow, yellow-pulverulent above annulus, bulbous. ANNULUS superior, membranous, sulphur-yellow to chrome-yellow. VOLVA evanescent,

yellow-pulverulent at first adhering to bulb as small, chrome-yellow, pulverulent masses. SPORES oval, 6.9 x 4.5 micr., white, smooth.

Solitary or scattered. In low, conifer or frondose woods, among decayed debris, on mosses, etc. Throughout the State: Ann Arbor, Detroit, Palmyra, New Richmond, Bay View, Munising, Marquette, Houghton. July-September. Common.

In the even margin of the pileus and the powdery volva it differs from *A. frostiana* which it resembles most, and from small forms of *A. muscaria*. It is about the same size as *A. frostiana*, sometimes larger, and is often erroneously referred to it. With us, *A. frostiana* occurs only in the conifer regions of the State. *A. flavoconia* occurs annually on a bed of *Polytrichum commune* bordering a small lake north of Ann Arbor. It is our commonest, small yellow Amanita and like *A. muscaria*, is widely distributed. The bulb does not become reddish when bruised as in *A. flavorubescens*.

660. *Amanita spissa* Fr. (DEADLY POISONOUS)

Epicrisis, 2836-38.

Illustrations: Cooke, Ill., Pl. 69.

Gillet, Champignons de France, No. 3 (as *A. ampla*) and No. 19.

Bresadola, Fungh. mang. e. vel., Pl. 7.

Ricken, Blätterpilze, Pl. 80, Fig. 2.

Plate CXXIV of this Report.

PILEUS 6-10 cm. broad, convex then campanulate-expanded, obtuse, subviscid when moist, shining when dry, gray with brown or sooty-brown disk, covered by small, angular, floccose or pulverulent, soft grayish scales or warts, glabrescent, margin not striate. FLESH rather thin, white. GILLS free but reaching the stem and decurrent by a line, medium broad, crowded, shining white, obscurely flocculose on edge. STEM 8-12 cm. long, 1 cm. or more thick, stuffed by a pith, firm, tapering upward, white or grayish, pruinose above, the ring, the clavate or globose bulb, and sometimes the stem above the bulb, covered at first by loose, gray floccose masses. ANNULUS membranous, apical, pendant, entire, white or tinged gray below. VOLVA pulverulent, floccose, evanescent, gray. SPORES broadly elliptical, obtuse, 7.9 x 6 micr., smooth, white. STERILE CELLS on edge of gills inflated-pyriform or globose on a slender stalk. ODOR mild.

Gregarious or scattered. On the ground in frondose woods of oak, maple, etc. Ann Arbor. July. Infrequent.

This species has usually been considered of doubtful occurrence in this country. It has been one of the last of the Amanitas mentioned in this report that I have collected. It is certainly distinct and usually agrees thoroughly with the descriptions, but seems to be rare. Its gray to smoky-brown cap, the pulverulent-floccose, friable, gray universal veil, the non-striate pileus and spores characterize it well. Only the little gray masses on the lower part of the stem and on the surface of the cap, indicate the presence of an outer veil. The annulus is distinct, far up on the stem and sometimes with gray particles on the lower side. After rains there may be no remnants of the veil either on the cap or stem.

*Amanitopsis* Roze

(From the Greek, *opsis*, appearance of, and *Amanita*.)

White-spored. Stem inserted at base into a volva formed as in Amanita; partial veil and annulus are lacking; otherwise like Amanita.

Soft, fleshy, terrestrial, long or slender-stemmed, non-caespitose mushrooms, growing mostly in forest humus, rarely in fields or lawns.

The characters, except the absence of an annulus, imitate so closely the species of Amanita, that the reader is referred to the discussion of that genus. None are definitely known to be poisonous, but the ease with which they can be confused with Amanitas should make everybody extremely cautious. The poisonous *Amanita spreata* Pk. imitates some of the species of *Amanitopsis* closely, because of its thin, close-appressed annulus. Other Amanitas sometimes lose their annulus, and might be taken for *Amanitopsis*. Only three species have been collected in the State; about twelve species have been reported from the United States. The following species, not yet found, but included in the key, may be looked for: *A. albocreata* Atk. (this is considered the same as the one described by Peck in the 33d N. Y. State Rep. under *A. nivalis*); *A. farinosa* (Schw.) Atk. which has, however, a somewhat southern and eastern distribution and is one of the smallest Amanitopsis; *A. adnata* (Smith) Sacc. reported from the Chicago region, departs from the demands of the genus in having adnate gills. *A. pusilla* Pk. is another small species, its pileus hardly 3 cm. broad. *A. par-*

*civolvata* Pk. has a brilliant orange pileus shading to whitish on the margin; it has been found from New Jersey to North Carolina. (See colored plate, Marshall, Mushroom Book, Frontispiece, 1905.)

*Key to the Species*

- (A) Volva membranous, cup-shaped or sheathing the base of the stem.
- (a) Pileus small, 2-3 cm. broad, pale brown; stem bulbous, slender; spores elliptical, 5-6 x 4 micr. *A. pusilla* Pk.
- (aa) Pileus larger; spores 8 micr. or more in the longest diameter.
- (b) Gills adnate; pileus even on the margin, yellowish-buff; volva close-fitting, white. *A. adnata* Smith.
- (bb) Gills free; pileus more or less striate on margin.
- (c) Pileus hairy-squammulose; volva large, firm, cup-shaped. 661. *A. volvata* Pk.
- (cc) Pileus glabrous except for occasional patches of the universal veil; volva sheathing, flabby.
- (d) White. 662. *A. vaginata* Fr. var. *alba* Sacc.
- (dd) Tawny-yellowish. 662. *A. vaginata* Fr. var. *fulva* Sacc.
- (ddd) Gray to mouse-colored. 662. *A. vaginata* Fr. var. *livida* Pk.
- (AA) Volva friable, floccose, etc., not membranous.
- (a) Pileus orange to yellow, plicate-striate on margin; stem and gills pale yellow; volva thin and evanescent. *A. parvicolvata* Pk.
- (aa) Pileus some other color.
- (b) Pileus small, 2-3 cm. broad, pulverulent, striate, grayish to mouse-colored. *A. farinosa* Schw.
- (bb) Pileus larger, with floccose patches or warts on its surface.
- (c) Pileus white to pale yellowish, finely striate on the margin; volva ocreate, as in *Amanita pantherina*. *A. albocreata* Atk.
- (cc) Pileus grayish-brown, sulcate striate, covered with mouse-colored warts; volva breaking up into sub-annular fragments on stem. 663. *A. strangulata* Fr.

*Section I.* Universal veil membranous, splitting at the apex; the volva vaginate or cup-shaped at the base of the stem, entire.

661. *Amanitopsis volvata* Pk. (POISONOUS)

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

Illustrations: *Murrill, Mycologia, Vol. 5, Pls. 86 and 87, Fig. 2.*

PILEUS 5-7 cm. broad, convex then plane, even or slightly striate on margin, covered with fibrillose or floccose scales, whitish to brownish. GILLS free, close, white. STEM 5-10 cm. long, 5-10 mm. thick, white to brownish-gray, equal or tapering slightly upward, stuffed, densely pulverulent-floccose or shaggy above the volva, with a very large, persistent, membranous, firm, brown volva sheathing the base. SPORES elliptic-oblong, 9-11 x 6-7 micr., smooth, white, granular within.

In open frondose woods, solitary. August-September. Detroit. Rare.

This is easily separated from *A. vaginata* by its oblong spores and floccose-scaly pileus. The volva is also more firm and ample. It is said to be identical with *A. agglutinata* B. & C. Our specimens were brownish throughout on cap and stem. The gills become dull-brown on drying. According to Peck the volva sometimes leaves patches on the pileus.

662. *Amanitopsis vaginata* Fr. (EDIBLE)

Var. *alba* Sacc.

Var. *fulva* Sacc.

Var. *livida* Pk.

Syst. Myc., 1821. (As *Amanita*.)

Illustrations: N. Y. State Mus. Rep. 48, 1896, Bot. ed.

Atkinson, Mushrooms, Plate 23, p. 75, 1900.

Marshall, Mushroom Book, op. p. 54, 1905.

Hard, Mushrooms, Figs. 30 and 31, p. 44, 1908.

Bresadola, *Fungh. mang. e. vel.*, Pl. 12.

Ricken, *Blätterpilze*, Pl. 75, Fig. 1.

Minn. Mushrooms, Fig. 5, p. 11, 1910.

Plates CXXV, CXXVI of this Report.

A composite species; according to the present custom including a number of *color forms*, here called varieties. The constancy of these varieties indicates that they could, with entire propriety, be referred to under species names, e. g., *Amanitopsis alba*, *Amanitopsis fulva*, and *Amanitopsis livida*. The description, however, applies equally well to all forms except as to color.

PILEUS 5-10 cm. broad, ovate to campanulate at first, then convex to plane, glabrous or rarely with fragments of the universal veil, slightly viscid when young or moist, sulcate-striate on the thin margin, white, fulvous, or grayish-mouse color in the corresponding varieties. FLESH white. GILLS free, white or whitish, close, broad, broadest in front, narrowed behind. STEM 8-18 cm. long, 4-8 mm. thick, rather slender, fragile, glabrous or mealy-squammulose, stuffed then hollow, subcylindrical, base without a bulb and inserted deep into the ground with the elongated, sheathing, flabby,

white VOLVA. SPORES spherical, 8-10 micr. diam., nucleate by a large oil-globule, smooth, white.

Solitary or scattered. In conifer or frondose forests; in open, low woods; in copses, sometimes on much decayed wood. July, August and September, rarely earlier or later. Throughout the State. Very common. *Edible*.

In some localities the white and tawny forms prevail, as at Ann Arbor; in others, especially in conifer regions, the tawny and livid forms are found more commonly. The pileus and stem are rather fragile, and the volva is apt to break and adhere to the soil so that the extracted stem appears to be without a volva. The variation in size and color seems to be greater in Europe than with us; Secretan differentiated ten forms and raised them to the rank of species. The spores of our plants, at least of the fulvous form, are always spherical, with an obscure angle on the apiculus side. Saccardo gives them ovate and 10-15 micr. long, and Patouillard figures them ovoid. Quelet and Battaile agree with us, calling them spherical and 10 micr. diam. The gray form must not be confused with *Amanita spreata* Pk. which is also without a bulbous stem. The beauty and symmetry of the different forms are a constant delight to the field botanist.

*Section II.* Universal veil breaking into floccose or powdery scales or fragments, which cover the pileus and base of stem.

663. *Amanitopsis strangulata* Fr. (EDIBLE)

Epicrisis, 1836-38.

Illustrations: Marshall, Mushroom Book, p. 53, 1905.

N. Y. State Mus. Rep. 51, Plate 50, 1898.

N. Y. State Mus. Mem. 4, Plate 44, 1900.

Fries, Icones, Pl. II.

Gillet, Champignons de France, No. 11. (As *A. inaurata*.)

Patouillard, Tab. Analyt., No. 401.

Cooke's Ill., Plate 13.

PILEUS 5-10 cm. broad, ovate to campanulate at first, then convex to plane, slightly viscid when young or moist, *sulcate-striate* on margin, pale umber colored, *decorated with floccose, cinereous to mouse-gray scales or warts*, the remnants of the veil. GILLS free, close, white or ashy-tinged, broader in front. STEM 8-15 cm.

long, 5-12 mm. thick, equal or tapering upward, stuffed then hollow, subglabrous, or furfuraceous, white above, darker to pale umber *below where it is somewhat decorated by the fragments of the mouse-gray volva*. SPORES spherical, 9-12.5 micr., granular within.

Solitary or scattered. In mixed forests of hemlock, maple and yellow birch, of the northern part of the State. Bay View, Marquette, Houghton. July-September. Not infrequent at times. *Edible*.

It is remarkable that this species does not occur in the southern part of the State; at least I have never seen it there. Peck and McIlvaine say it occurs "in open grassy places, in wheat-stubble, etc." as well as in the woods, in Pennsylvania, New Jersey and West Virginia. So far I have seen it three different summers in the Northern Peninsula, always in hemlock woods.

The SPORES are not in entire agreement with the European measurements. With us they are spherical or nearly so. Saccardo is evidently in error when he says they measure 9-15 micr. and are ovate; Stevenson quotes Smith's measurements as 16 x 8 micr., and Boudier gives them as 12-13 micr. Peck considers it clearly distinct from *A. vaginata* and in the 51st Report has given an excellent account of the plant.

*Lepiota* Fr.

(From the Greek *lepis*, a scale.)

White-spored (except *L. morgani*); stem *fleshy, separable* from the pileus, provided with a persistent or evanescent *annulus*; gills *free* (except in some of the "granulosi" section).

Fleshy, firm or soft mushrooms, growing on the ground, on debris, or on more or less rotten wood in forests; large and small.

The PILEUS is scaly from the breaking up of the cuticle, rarely smooth, most often white, but also tinged yellow, brown or red; there are a few species with a viscid pileus. The STEM is stuffed or hollow, firm or soft, fleshy and different in texture from the trama of the pileus, and easily separable from it. The GILLS are white, but may change color in age or when bruised; (in *L. morgani* they become sordid-green from the greenish spores). They are usually free, but a small group has adnate or adnexed gills, although otherwise like the genus; e. g., *L. granosa*, *L. amianthina*, etc.

The VEIL is theoretically double, as in *Amanita*, but the outer

or "universal veil" is concrete with the pileus and does not split or break to form a volva on the stem or to form superficial patches on the cap. Sometimes it breaks away early at the base of the stem and is pulled up on the stem as the latter elongates, like a movable ring, as in *L. procera*; then again it breaks away only from the margin of the pileus, leaving a sheath on the stem terminated above by a flaring margin, as in *L. rugosa*. The inner veil is quite variable in texture, membranous to fibrillose, floccose or granulose; sometimes the delicate structure soon disappears or is washed away by the rain. The TASTE is mild, and all the large species except the green-spored *L. morgani* can be eaten with safety. Some of the smaller species, like *L. clypeolaria* Fr., *L. helvola* Bres. and *L. charcarias* are suspected. The SPORES are white in mass (except one species) and varying in shape, usually longish, sometimes subfusiform, often minute and then elliptical or ovate, in a few cases somewhat angled; they often mature slowly, so that measurements must be made with care.

The genus can be divided into three natural groups with reference to the character of the cuticle of the pileus or of the veil; these groups can be further subdivided into sections, as follows:

A. Cuticle of pileus glutinous or viscid; trama of gills divergent (= *Limacella* Earle):

I. Lubricae

II. Viscidae

B. Cuticle dry; annulus terminating a sheath or such other remnants of the veil as remain on the stem:

III. Clypeolariae

IV. Asperae

V. Granulosae

C. Cuticle dry; annulus independent, often movable; stem without any other remains of the veil:

VI. Subclypeolariae

VII. Procerae

#### Key to the Species

- (A) Pileus viscid.  
 (a) Pileus small, 2-5 cm. broad, stem slender.  
 (b) Stem and pileus both very viscid or glutinous, white. 664. *L. illinita* Fr.  
 (bb) Stem not viscid; pileus with a subviscid, thin separable pellicle, tinged pink. 667. *L. delicata* Fr. var.  
 (aa) Pileus larger, 5-10 cm., and stem stout.  
 (b) Pileus whitish to pinkish-tan, slightly viscid; stem fibrillose-glabrescent. 666. *L. fischeri* sp. nov.  
 (bb) Pileus reddish-bay, viscid; stem scaly. 665. *L. glioderma* Fr.

- (AA) Pileus not viscid.  
 (a) Growing in fields, pastures, gardens, lawns, and on decomposing vegetable matter (rarely in open woods); large to medium-sized.  
 (b) Annulus movable; plant very large.  
 (c) Plant taller than broad; spores white, 14-18 x 9-11 micr. 686. *L. procera* Fr.  
 (cc) Plant as broad or broader than tall; spores greenish, 10-13 x 7-8 micr. 687. *L. morgani* Pk.  
 (bb) Annulus not freely movable (except sometimes in *L. americana*).  
 (c) Plant assumes a dull reddish color when bruised or on drying; annulus rather large; spores 8-10 x 5-8 micr. 688. *L. americana* Pk.  
 (cc) Plant not changing as above.  
 (d) Stem thickened toward base like the seed-stalks of onions, densely caespitose. 680. *L. cepaestipes* Fr.  
 (dd) Stem not of the above shape.  
 (e) Gills becoming pink in age; pileus firm, medium large, white; stem with persistent annulus. 689. *L. naucina* Fr. (syn. *L. naucinoides* Pk.).  
 (ee) Gills remaining whitish; pileus small, rugulose, widely striate, whitish. *L. rugulosa* Pk.  
 (aa) Growing in forests, open woods, under copses, bushes, etc. (rarely on lawns); medium to small.  
 (b) With some shade of blue or purple, either when fresh or on drying; small.  
 (c) Gills, stem, flesh etc. changing to blue when drying; annulus membranous, persistent; pileus brownish-scaly. *L. caerule-scens* Pk.  
 (cc) Gills, etc., not changing to blue when drying; annulus powdery, evanescent.  
 (d) Odor foetid; pileus lavender; stem dark brown to blackish below. *L. ecitodora* Atk.  
 (dd) Odor not foetid; plants small.  
 (e) Pileus whitish, covered with a heliotrope-purple, powdery substance; flesh tinged yellow. *L. purpureoconia* Atk.  
 (ee) Pileus whitish, tinged with blue around margin; flesh turning brownish where bruised. *L. cyanozonata* Long-year.  
 (bb) Without shades of blue or purple.  
 (c) Stem clothed with a floccose, squamose or filamentous sheath; pileus not granular nor mealy.  
 (d) Spores 12 micr. or more in length.  
 (e) Pileus and lower stem brown; spores truncate at base, with oblique apiculus. *L. geniculospora* Atk.  
 (ee) Pileus ochraceous or yellowish-white, sometimes reddish-tinged; spores subfusiform, 13-18 x 4-6 micr. 668. *L. clypeolaria* Fr. (*L. metulaespora* B. & Br.)  
 (dd) Spores less than 12 micr. long.  
 (e) Growing on rotten wood, small; pileus pale tawny to subalutaceous, floccose-scaly; spores 8-11 micr. long. 673. *L. acerina* Pk.  
 (ee) Growing on the ground, or among debris; spores usually smaller.  
 (f) Pileus medium size, with erect, tomentose or floccose wart-like scales; veil copious.  
 (g) Spores 7-9 micr. long.  
 (h) Gills crowded, much forked. 671. *L. friesii* Lasch.  
 (hh) Gills crowded, not forked. 670. *L. acutae-squamosa* Wein.  
 (gg) Spores 4-5 micr. long. 672. *L. asperula* Atk.  
 (ff) Pileus with appressed, tomentose, spot-like or patch-like scales.

- (g) Annulus persistent; stem slender, about 1 mm. thick, blackish-brown. *L. gracilis* Pk.
- (gg) Annulus evanescent or obscure.
- (h) Pileus 4-8 cm. broad, patches tawny-olive; stem stout; spores attached at basal angle. *L. calocephus* Atk.
- (hh) Pileus dark-brown, usually less than 4 cm. broad.
- (i) Spores minute, 4 x 2 micr.; veil forming a dense, brown tomentum on stem. *L. eriophora* Pk.
- (ii) Spores larger, 6-8 x 4-5 micr.; veil of more delicate and loose floccose filaments. 669. *L. felina* Fr.
- (cc) Stem without evident sheath, but provided either with an evanescent or a persistent annulus. (See ecc.)
- (d) Spores 9 micr. or more in length.
- (e) Pileus moderately large, with red appressed scales; annulus persistent. 681. *L. rubrotincta* Pk.
- (ee) Pileus small, minutely squamulose; annulus evanescent; base of stem mycelioid, forming a "sand-bulb." *L. arenicola* Pk.
- (dd) Spores less than 9 micr. long.
- (e) Pileus rather small, 1.5-4 cm. broad, with reddish-brown scales on a white surface; spores attached at basal angle; with a marked odor. 682. *L. cristata* Fr.
- (ee) Pileus white, small, minutely fibrillose-squamulose; spores minute; annulus thin and fragile. 684. *L. miamensis* Morg.
- (eee) Pileus with minute pale-yellow hairy scales. 683. *L. alluvinus* Pk.
- (ccc) Stem clothed or peronate with squamulose, granular, furfuraceous, or minutely warty scales; pileus granular, warty or furfuraceous.
- (d) Gills adnate.
- (e) Pileus distinctly rugose on disk.
- (f) Plant growing on rotten logs, stumps, etc., large; the sheath membranous-margined above. 674. *L. granosa* Morg.
- (ff) Plant growing on the ground or on leaf-mould, small; the floccose-scaly sheath not margined above. 675. *L. rugoso-reticulata* Lorin.
- (ee) Pileus not rugose.
- (f) Stem long, slender; pileus often umbonate. *L. amianthina* Fr.
- (ff) Stem short, stouter; pileus not umbonate. 676. *L. adnatifolia* Pk.
- (dd) Gills adnexed or emarginate.
- (e) Growing on rotten wood; color whitish to pale tawny. 678. *L. pulveracea* Pk.
- (ee) "On the ground; color rusty-yellowish. 677. *L. granulosa* Fr.
- (eee) Like preceding but whitish throughout. 677. *L. granulosa* var. *albida*.
- (ddd) Gills free; plants quite small; soft, fragile.
- (e) Pileus dingy-white, or brownish. 679. *L. pusillomyces* Pk.
- (ee) Pileus white, disk pinkish. 685. *L. cristatellus* Pk.

*Section I. Lubricae.* The young plant enclosed in a universal glutinous veil. The trama of the gills divergent.

664. *Lepiota illinita* Fr.

Syst. Myc., 1821.

Illustrations: Fries, Icones, Pl. 16, Fig. 1.

Patouillard Tab. Analyt., fasc. VII, No. 609.

Gillet, Champignons de France, No. 425.

PILEUS 2-6 cm. broad, thin, soft, ovate then campanulate-expanded, subumbonate, *glutinous* (moist), *glabrous*, *white*, or whitish, even or substriate on margin. GILLS free, close, moderately broad, white, soft, trama divergent. STEM 5-8 cm. x 3-6 mm., white, glutinous, equal, stuffed to hollow, not scaly. FLESH white, soft, thin. SPORES 4-6 x 3-4 micr., subglobose to ovoid, smooth, white. TASTE and ODOR none. ANNULUS obsolete, glutinous.

Singly or gregarious. Ground, white birch woods near Marquette. Elm and maple woods, southern Michigan. September.

Known by its glutinous and slimy cap and stem. The European plants are a little larger.

*Section II. Viscidae.* Surface of pileus provided with a continuous gelatinous, separable pellicle; stem dry. Trama of gills divergent (except in *L. delicata*).

665. *Lepiota glioderma* Fr.

Monographia, 1857.

Illustration: Cooke, Ill., Pl. 118 A.

PILEUS 2-5 cm. broad, obtusely convex, *viscid*, *reddish-bay* fading to dull ferruginous, glabrous, even, cuticle separable. FLESH thin, white or tinged rufous. GILLS close, *broad*, subventricose, white, free but reaching apex of stem by a point, edge very even, trama divergent. STEM 5-7 cm. long, 4-6 mm. thick, *dry*, covered with *reddish-floccose scales* up to the slight ANNULUS, equal or attenuated downwards, solid, fibrous. SPORES globose, 4-5 micr.

diam., smooth; basidia 4-spored; no cystidia. TASTE farinaceous. ODOR none.

(Dried: Cap and gills brownish-tan to fuscous.)

Singly or few. Debris on ground, in hemlock, maple or birch woods. Marquette, Houghton, Bay View and New Richmond, apparently limited to conifer territory. August and September. Infrequent.

This *Lepiota* approaches the genus *Armillaria* in appearance, but the gills are not attached to the stem. The annulus is sometimes well-developed and flaring.

666. *Lepiota fischeri* sp. nov.

Illustration: Plate CXXVII in this Report.

PILEUS 4-9 cm. broad, convex-campanulate, obtuse, even, *subviscid*, cuticle separable and continuous, fleshy, rather soft, *white to pale alutaceous*. FLESH white, thick, rather soft. GILLS crowded, rather narrow, free and somewhat remote, plane, white, edge entire. STEM 4-10 cm. long, 4-10 mm. thick, subbulbous, somewhat curved, *striate*, fibrillose, *solid, firm*, fibrous-fleshy, separable from pileus. ANNULUS superior, large, membranous, at length pendulous, white, subpersistent, fragile. SPORES minute, 3-4 x 2-3 micr., smooth, oval; *basidia* small, with 1 to 2 long sterigmata, (5-7 micr. long), rarely 3 or 4, rarely also a forked sterigma, tramal hyphae of gills divergent. TASTE slight; odor becoming strong on drying, like that of *Tricholoma sulfureum*.

(Dried plants: Pale alutaceous, gills brownish.)

Gregarious. On ground in low frondose woods. Near Detroit. September and October. Infrequent.

Related to *L. lenticularis* (*Amanita lenticularis* Fr.), and is perhaps its American counterpart. Our plants differ in lacking the dark green drops oozing from apex of stem and annulus, (see Quelet and Battaile, Flora Monographic des Amanites et des Lepiotes, 1902), and in character of stem which is said to be stuffed or hollow and floccose-scaly in the European plant. Quelet, Ricken and Battaile give the spores 6 to 8 micr. It also differs from *L. persoonii* Fr. in stem and gill characters. I have dedicated it to the energetic student of mushrooms, Dr. O. E. Fischer of Detroit, who found it.

667. *Lepiota delicata* Fr. var.

Syst. Myc., 1821.

Illustration: Fries, Icones, Pl. 15, Fig. 2.

PILEUS 2-4 cm. broad, thin, subumbonate, campanulate-expanded, with a continuous, separable, *subviscid cuticle*, delicately *pink-colored*, sometimes shading to white on margin, even, radiately innately silky. FLESH pure white, *unchanged* when bruised, thin, fragile. GILLS narrow, close, free, somewhat remote, pure white. STEM 5-9 cm. long, 3-5 mm. thick, tapering upwards from a subclavate bulb, dry, *glabrous*, curved or straight, soft, stuffed. ANNULUS membranous, thin, subpersistent, white, median, at length pendant. SPORES 5-6.5 x 3-4 micr., elliptical, subacute at ends, white, smooth. CYSTIDIA on edge of gills subcylindrical, clustered, numerous, 7 x 4.5 micr., none on sides of gills; basidia 4-spored. ODOR and TASTE none.

(Dried: Annulus *snow-white*, stem and gills pale alutaceous, cap pink with brownish umbo.)

Gregarious. On the ground in swampy woods of elm, etc., also under hemlock in ravines. New Richmond. September. Infrequent.

*L. oblita* Pk. differs in its viscid stem and more tawny pileus; the spores are similar. It is apparently much like *L. incarnata* Clem. and *L. rufescens* Morg. The presence of a separable gelatinous cuticle, the unchangeable flesh, and the cystidia distinguish it from these. A hot-house variety is said to occur in Europe.

*Section III. Clypeolariae.* Stem clothed at first by a floccose or filamentous sheath. Pileus pruinose, floccose or appressed scaly, the cuticle at first continuous.

668. *Lepiota clypeolaria* Fr. (SUSPECTED)

Sys. Mycol., 1821.

Illustrations: Fries, Icones, Pl. 14, Fig. 2.

N. Y. State Mus. Rep't. 54, Pl. 76, 1901.

Gillet, Champignons de France, No. 416.

Ricken, Blätterpilze, Pl. 85, Fig. 2.

Plate CXXVIII of this Report.

PILEUS 2-5 cm. broad, campanulate-convex to expanded, obtuse

or umbonate, floccose-scaly, even or striate beneath the scales on margin when old, color of scales variable: white, yellowish, rufous-ochraceous or ochre, the disk often darker, brown or reddish-brown, white beneath scales, margin often appendiculate from remnants of the veil. FLESH white, thin, *flaccid*. GILLS free, close, white, narrower in front, edge minutely flocculose. STEM slender, 3-10 cm. long, 3-5 mm. thick, equal or tapering upward, sheathed up to the evanescent, floccose annulus, by soft, loose, floccose, white or yellowish scales or tomentum, hollow, fragile, whitish under scales and at apex. SPORES very variable in size, even in the same specimen, 10-16 x 4-6 micr., subfusiform, elongated-elliptical, broader at the distal end or symmetrical, etc., smooth, white.

(Dried: Pileus pale ochraceous or rufous-tan; stem covered by a *white* floccose sheath.)

Scattered. Ground or debris in woods. Marquette, Bay View, Ann Arbor, New Richmond; throughout the State. July to October. Frequent.

There is much uncertainty among all mycologists concerning the limits of this species. *L. metulaespora* is said to be a very similar plant. Studies so far made, both of the European and American plant, seem to have increased the confusion. Some (Morgan, Mycol., Vol. 12) give the spores of *L. clypeolaria* 15-20 x 5-6 micr., and *L. metulaespora* 9-12 x 4-4 micr. Others (Beardslee, Jour. Mycol., Vol 13, p. 26, 1907) reverse this. The spore-sizes of the Michigan specimens overlap both. I have so far found none with spores 18-20 micr. long, but, of course, shorter, immature spores are always present. Most European authors omit the spore-size of *L. clypeolaria* Masee (Masee, European Fungus Flora Agaricaceae, 1902) gives 15-16 micr. for *L. metulaespora*, which is close to ours; for *L. clypeolaria*, he gives 6 micr. Peck (Peck, N. Y. State Mus. Rep. 54, 1901, p. 173) has come to the conclusion that there is no essential difference except the striations on the cap of *L. metulaespora*; this is hardly a specific distinction. A number of varieties have been split from these species, (Quelet & Battaille, Flore des Amanites et des Lepiotes, 1902, p. 66) and they are evidently very variable in color, and this may be true of the spores within certain limits. For the present we will use one name for all the forms.

### 669. *Lepiota felina* Fr.

Hym. Europ., 1874.

Illustrations: Pat., Tab. Analyt., No. 505.

Ricken, Blätterpilze, Pl. 86, Fig. 3.

PILEUS 3-5 cm. broad, campanulate-convex, subumbonate, whitish under the numerous subtomentose or floccose *blackish* scales. FLESH white, thin. GILLS free, close, rather narrow, white. STEM slender, equal or tapering upward, base with slight bulb, hollow, whitish, clothed below by floccose, brown or blackish scales. ANNULUS slight, evanescent, inferior or median, sometimes tinged black on edge. SPORES 6-8.5 x 4-5 micr., elliptic-ovoid, white; basidia 4-spored.

On the ground, hemlock woods. Bay View. August-September. Infrequent or rare.

Distinguished from *L. clypeolaria* by its spores, from *L. cristata* by the blackish scales and floccose stem. SPORES 8-10 x 3-4 micr., as given by Ricken. The Michigan plant may be *L. fuscocosquamea* Pk.

*Section IV. Asperae.* Pileus fibrillose-scaly at first, then with pointed, or pyramidal or fasciculate, erect or squarrose scales or warts; stem variously sheathed or glabrescent.

### 670. *Lepiota acutæsquamosa* Fr.

Epicrisis, 1836-38.

Illustrations: Hard's Mushrooms, Fig. 38, p. 55 (from Michigan plants).

Gillet, Champignons de France, No. 409.

Michael, Führer f. Pilzfreunde, III, No. 122.

Ricken, Blätterpilze, Pl. 86, Fig. 1 (as *L. friesii*).

PILEUS 5-15 cm. broad, soft, at first subhemispherical then convex-expanded, obtuse, even, at first covered by a soft tawny or pale umber tomentum which usually breaks up into brown or rufous-brown, *pointed, pyramidal, erect scales or warts*, the tips of which become blackish, are crowded and darker on disk, the cracks showing the white flesh beneath, margin extending beyond gills. FLESH white, moderately thick. GILLS *crowded*, free, rather

narrow, thin, not forked, white becoming dingy, edge serratulate. STEM 6-12 cm. long, 6-12 mm. thick above, tapering upward from a bulbous base, sometimes equal and subbulbous, stuffed to hollow, soft, whitish, at first covered by the fibrils of the veil, with scattered brown squamules, terminating in a floccose-fibrillose, often oblique and broken, rather evanescent ANNULUS. SPORES elongated oblong, smooth, white, 7.9 x 2.5-3 micr. ODOR and TASTE not marked.

(Dried: Cap, gills and stem alutaceous to wood-brown.)

Gregarious. On the ground or on very rotten wood in forests, on flowerbeds, conservatories, etc. Ann Arbor, Bay View, New Richmond. September. Frequent.

Much the appearance of the next two species; separable with certainty from *L. friesii* by its entire gills, from *L. asperula* by the spores. The veil is composed of silky filaments woven into a membrane which is at length lacerated vertically so as to appear like a "cortina" of the genus *Cortinarius*.

#### 671. *Lepiota friesii* Lasch.

Epicrisis, 1836-1838.

Illustrations: See Hard's Fig. of *L. acutaesquamosa*, which it imitates in appearance.

Marshall, Mushroom Book, 1902, op. p. 65.

The description of the preceding species is sufficient for all the characters except the following: GILLS very narrow, *abundantly forked*, very crowded. SPORES 6.9 x 2 micr., narrowed at one end, smooth, white, elongated-oblong to subfusiform. Sterile cells on edge of gills as in the preceding species. Habitat, etc., same as in *L. acutaesquamosa*.

Ann Arbor, Houghton, Munising, New Richmond.

The spores in our plants are narrower than in *L. acutaesquamosa*, which may be a constant character. The forking of the crowded gills is very marked. The pointed warts are crowded on the disk, or may be scattered over the entire surface of the pileus, and easily rubbed off.

#### 672. *Lepiota asperula* Atk.

Atkinson, Mushrooms, p. 82, 1900.

Illustration: Ibid, Pl. 26, Fig. 84, p. 82.

PILEUS 1-4.5 cm. broad, campanulate-convex to expanded, obtuse, "hair-brown to olive-brown" or ochraceous-brown, cuticle breaking up into erect, rather pointed, blackish-brown warts, more numerous on disk, sometimes *subconcentrically rimose*, not striate. FLESH white, thickish, scissile, rather fragile. GILLS free, rather narrow to medium width, crowded, white becoming dingy, not forked, edge minutely eroded. STEM 2-6 cm. long, 4-6 mm. thick, *cylindrical* above the bulbous base, stuffed by fibrils, then hollow, covered at first by the loose, silky or fibrillose veil which collapses at the pileus and terminates on the stem by an evanescent ANNULUS, glabrous or fibrillose above annulus, below annulus sometimes minutely brown-squamulose. SPORES *minute*, 4.5 x 2-3.5 micr., oblong, smooth, white. Basidia 4-spored; sterigmata slender. No cystidia. ODOR and TASTE not marked.

(Dried: Like *L. acutaesquamosa* and *L. friesii*.)

Gregarious. Hemlock or mixed woods, on the ground among debris. Bay View, New Richmond. August-September. Infrequent.

Differs from *L. acutaesquamosa* in minute spores, and smaller size. Probably often confused with that species and difficult of separation from it. The veil is sometimes quite copious and cobwebby.

#### 673. *Lepiota acerina* Pk.

N. Y. Mus. Rep. 51, p. 283, 1898.

PILEUS 1-2.5 cm. broad, convex then expanded, covered with tawny or pale rufous-brown, appressed, fibrillose or floccose scales, darker and erect and pointed on the disk, margin even. FLESH thin, white. GILLS free, close, thin, rather broad, white or whitish, edge minutely fimbriate. STEM 2-4 cm. long, 1.5-4 mm. thick, stuffed to hollow, equal or slightly bulbous, covered up to the obsolete ANNULUS by small, dark, fibrillose scales colored like those of pileus. SPORES 8-11 micr. long, 3-4 micr. wide, obliquely apiculate and truncate at one end, narrowed toward other end, smooth, white; sterile cells on edge of gills clavate.

(Dried: Pileus and gills umber or fuscous-brown.)

Gregarious. On very decayed wood, in woods of maple, birch, hemlock, etc. Houghton, Munising, Bay View, New Richmond. July, August and September. Infrequent.

Shape of spores like those of *L. boudieri* Bres. (see Tab. XLVI, Fungi Trid.), but different in other respects. *L. cristata* has similar spores.

*Section V. Granulosae.* Pileus and stem granular, furfuraceous, pulverulent or minutely warty.

674. *Lepiota granosa* Morg.

Jour. Cincinnati Soc. Nat. Hist., 1883.

Illustrations: Marshall, Mushroom Book, Pl. 12, op. p. 63, 1905.

Hards, Mushrooms, Pl. VIII, Fig. 36, p. 52.

Plate CXXIX of this Report.

PILEUS 5-9 cm. diam., ovate then convex-expanded, umbonate or obtuse, ochraceous to fulvous, *furfuraceous-granulose*, *rugose-wrinkled* to almost even, margin regular or undulate. FLESH thick, whitish or tinged ochraceous. GILLS narrow, *crowded*, *adnate*, sometimes subarcuate, whitish to ochraceous. STEM 5-10 cm. long, 8-15 mm. thick, equal or tapering upward from the clavate base, straight or curved, fibrous-stuffed to hollow, *peronate* by furfuraceous or floccose scales, colored like the pileus and terminating above in a *rather large, flaring or reflexed, membranous, persistent* ANNULUS, yellowish within, pallid or brownish above the annulus. SPORES smooth, white, 4.5 x 3 micr.

Gregarious or subcaespitose. On rotten wood; maple, birch and beech woods. Marquette, Bay View. September. Infrequent.

In size, it stands at the head of this group. It is easily known by its large, persistent annulus. It differs from *L. amianthina* in size and the character of sheath and annulus.

675. *Lepiota rugoso-reticulata* Lorin.

Oest. Bot. Zeitschrift, 1879.

PILEUS 1-4 cm. broad, convex, *rugose-reticulate*, covered with dense, glistening granules, pale cinnamon-brown, *tinged reddish*,

mostly unicolorous, margin appendiculate. FLESH thick, *white*. GILLS adnate, sometimes subdecurrent, crowded, rather narrow, whitish, edge entire. STEM 4-7 cm. long, 3-4 mm. thick, equal or tapering upward, *solid*, peronate with cinnamon- or reddish-brown floccose scales, terminating in an *incomplete or obsolete* ANNULUS, pallid above, white-mycelioid at base. SPORES 4.5.5 x 3 micr., smooth, ovoid, apiculate. ODOR not noticed.

(Dried: Pileus pale brick-red, gills alutaceous, stem white-mycelioid at base.)

Gregarious. On mosses, low woods of white birch in northern Michigan, elm, etc., in south. Ann Arbor, Marquette. August-September. Infrequent.

This species resembles *L. granulosa* in color, etc., but differs in its slender stem and rugose pileus; it approaches *L. granosa* in pileus characters but is small and the annulus is rarely persistent. It differs from *L. amianthina* in its lack of an umbo, and its small spores.

676. *Lepiota adnatifolia* Pk.

N. Y. State Mus. Bull. 54, p. 947, 1902.

PILEUS 2.5 cm. broad, broadly convex, granulose to warty or scaly on disk, dark *ferruginous-red*, not umbonate, even, margin appendiculate. FLESH white. GILLS *adnate*, close, narrow, thin, whitish, edge entire. STEM 2-4 cm. long, 4-6 mm. thick above, tapering upward from a clavate base, solid, peronate by reddish or whitish squamules, and terminating in an evanescent *annulus*, apex white or tinged pink. SPORES minute, 5-5.5 x 2.5-3 micr., oval-oblong, slightly curved in one view. CYSTIDIA very slender, hyaline, about 50 micr. long, 3 micr. thick, subcylindrical, apex capped by conical covering, sometimes infrequent or entirely lacking, on edge and sides of gills. ODOR slight.

On debris or decayed logs in woods of hemlock, maple, etc. New Richmond, Ann Arbor. September-October. Rare.

Differs from *L. amianthina* and *L. granulosa* in the presence of cystidia and lack of an umbo, and by its color. The spores are smaller than given by Peck. The main part of the cap is covered closely with appressed, flat, tomentose warts.

677. *Lepiota granulosa* Fr.

Syst. Myc., 1821.

Illustrations: Patouillard, Tab. Analyt., No. 611.

Ricken, Blätterpilze, Pl. 81, Fig. 3.

Cooke, Ill., Pl. 18, Vol. I.

PILEUS 3-6 cm. broad, ovate then convex-expanded, obtuse or subumbonate, *furfuraceous-granular*, often radiately wrinkled, ochraceous *tinged brick-red*, but varying to buff or dark-rufous with a hoary lustre. FLESH thin, white, rufescent. GILLS *adnexed, rounded behind*, close, medium width, white. STEM short, 2-5 cm. long, 4-8 mm. thick, stuffed to hollow, equal or tapering upward, granulose to floccose-scaly and pale reddish up to the *slight* evanescent annulus, whitish at apex. SPORES minute, 4-5 x 3-3.5 micr., ovate, smooth; cystidia none.

(Dried: Cap and scales of stem rufous-ochraceous, gills ochraceous-alutaceous.)

Gregarious to subcaespitose. On leaf-mould, mosses, etc., in open woods of maple, oak, hemlock, etc. Ann Arbor, Marquette, New Richmond. August-October. Local but frequent.

The spores are smaller than given by Patouillard (Tab. Analyt.) and Quelet and Battaille (Flore des Am. et des. Lep.). Hennings in Engler & Prantl, however, gives the size as found in American plants. Also our plants are usually shorter and thicker stemmed than the figures of Patouillard and Cooke would indicate, i. e., the plant is more squat, except possibly when it grows in low, wet situations. It approaches other species, like *L. charcharias* and *L. amianthina*, which were formerly called varieties of it. There is a hoary sheen to the granularity on the cap, by which one may know it. The way the gills are attached distinguishes it from the three preceding species.

678. *Lepiota pulveracea* Pk.

N. Y. Mus. Rep. 54, p. 144, 1900.

"PILEUS 1-2.5 cm. broad, hemispheric then convex-expanded, *pulverulent* or minutely granulose and squamulose, even, tawny or paler. GILLS *adnexed*, close, thin, narrow, yellowish-white. STEM equal, hollow, sheathed with *delicate* brownish, small granulose

scales terminating in the obsolete ANNULUS, pruinose and whitish at apex." SPORES minute, oblong-elliptical, obscurely curved, smooth, white, 4-5.5 x 3 micr.

(Dried: Cap pale fulvous, stem paler with scattered floccose-squamules.)

Gregarious. On *moss* growing over an old hemlock log. Marquette. September. Rare.

The spores are not ovate as in *L. granulosa*, and the adnexed gills and color, etc., separate it from *L. rugoso-reticulata*. The dried specimens lack the rich tints of the others of this group.

679. *Lepiota pusillomyces* Pk.

N. Y. Mus. Rep. 28, p. 48, 1876.

Illustration: Ibid, Plate I, Figs. 1-3.

PILEUS 4-8 mm. broad, thin, convex, obtuse, *furfuraceous* or *covered with minute granular floccules*, white or nearly so, remains of veil clinging in granular flocs to edge of pileus. TRAMA of pileus composed of vesicular cells, pulverulence on surface also of thin-walled globular cells. GILLS *broad*, free, ventricose, moderately close, white. STEM 1-3 cm. long, 1-2 mm. thick, slender, equal, stuffed with fibrils, rufescent beneath the *white mealiness* which terminates at the obsolete ANNULUS. SPORES elliptic-oblong, 4-5 x 2.5-3 micr., smooth, white.

Single and scattered. On rich soil in woods. Ann Arbor, Bay View. August. Infrequent.

This is close to *L. seminuda* of Europe, and may be the same, unless the microscopic characters are shown to be different. Patouillard figures the spores of *L. seminuda* more ovate than elliptical, but other authors give the latter shape. This is a delicate *Lepiota* and approaches *L. cristatellus* Pk. which is distinguished by the pinkish tinge usually present on the pileus, and the glabrous stem.

*Section VI. Subclypeolariae.* Pileus thin, minutely scaly, pruinose or pulverulent. Annulus membranous, persistent or evanescent. STEM for the most part glabrous or denuded.

680. *Lepiota cepæstipes* Fr. (EDIBLE)

Epicrisis, 1836-38.

Illustrations: N. Y. State Mus. Bull. 94, Pl. 87, 1905.

Hard's Mushrooms, Fig. 37, p. 54.

Gillet, Champignons de France, No. 414.

Michael. Führer f. Pilzfrennde, Vol. III, No. 94.

Plate CXXX of this Report.

PILEUS 2-8 cm. broad, thin, oval then campanulate-expanded, obtuse, soft, at length umbonate, *striate-plicate* and splitting on the margin, covered with minute, numerous, *mealy* or wart-like scales, which are often brown, elsewhere white. FLESH white. GILLS narrow, free, close, white then dingy, thin, edge pruinose. STEM 4-12 cm. long, 4-6 mm. thick at apex, tapering upward or often *somewhat ventricose*, flexuous, glabrous or occasionally with floccose particles, hollow, white. ANNULUS thin, membranaceous, subsistent, white. SPORES oval-elliptical, smooth, white, 9-10 x 5-7 micr., nucleate. ODOR and TASTE mild.

Caespitose. On rich soil of gardens, conservatories, etc., decaying straw-piles, sawdust, stumps, or decomposing vegetable matter of any kind. Ann Arbor, Bay View, New Richmond. June-September. Not common. Edible.

Often in dense clusters. Sometimes the pileus is yellow-tinged. The name refers to the shape of the stem which often resembles the enlargement on the seed-stalk of the onion. The plants soon droop and collapse in the wind. Hennings (in Engler and Prantl) says this mushroom was introduced into Europe from Brazil and also states that at first there is a small *sclerotium*.

681. *Lepiota rubrotincta* Pk.

N. Y. State Mus. Rep. 35, p. 155.

PILEUS 2-6 cm. broad, ovoid then convex-expanded, obtuse or subumbonate, the unbroken cuticle at first even, and innately fibrillose and *uniform reddish-pink*, darker or reddish-brown on disk, at

*length breaking up into appressed red scales* and rimose. FLESH white, thin. GILLS free, narrow, tapering toward stem, crowded at first, less so after expansion, white, edge minutely flocculose. STEM 4-9 cm. long, 3-8 mm. thick, tapering slightly upward or clavate at base, stuffed then hollow, even, *easily splitting lengthwise*, silky-fibrillose or glabrous. ANNULUS *well-developed*, membranous, persistent, edge thickish and often tinged red. SPORES 9 x 5 micr., but variable, often larger, narrow-elliptical, apiculate; CYSTIDIA on edge of gills about 36 x 6 micr.

(Dried: Color of cap red, gills dingy white, stem pale fuscous.)

Scattered or singly. On the ground among decaying leaves, mixed or hardwood forests. Ann Arbor, Detroit, New Richmond. August-September. Infrequent.

682. *Lepiota cristata* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Atkinson, Mushrooms, Fig. 83, p. 81, 1900.

Gillet, Champignons de France, No. 417.

Patouillard, Tab. Analyt., No. 504.

Ricken, Blätterpilze, Pl. 84, Fig. 3.

Cooke, Ill., 29.

Plate CXXXI of this Report.

PILEUS 1.5-4 cm. broad, thin, ovate then campanulate-convex or expanded, obtuse or umbonate, cuticle at first continuous, and entirely dull reddish or reddish-brown, then *broken into small concentric reddish-brown scales* except the darker umbo, the cracks white, margin often denuded of cuticle. FLESH white, thin. GILLS free, rather close, narrow to subventricose, white, edge minutely crenulate. STEM 3-5 cm. long, 2-5 mm. thick, slender, equal, hollow or stuffed with loose pith, glabrous or silky-fibrillose below ring, whitish or tinged dingy lavender, pinkish within. ANNULUS white, small, soon broken and deciduous. SPORES somewhat wedge-shaped, or angular, sometimes irregularly fusiform to oblong, depending on the view, white, 6-7 x 3-4 micr. ODOR rather disagreeable.

(Dried: Stem rufescent, pileus brownish to alutaceous.)

Gregarious. In grassy places or on the ground in low woods, etc., often on lawns. Marquette, Ann Arbor, Detroit, Houghton, New Richmond, etc. July-October. Common.

An effort was made by Morgan (Jour. of Mycol., Vol. 12, p. 244, 1906), to separate this into two species, *C. cristata* Fr. and *C. angustana* Britz. The separation was based on the spores and odor. Our plants sometimes have angular spores and no odor, and the spores vary, even in the same plant. Atkinson (Mushrooms, 1900, p. 92) has already pointed out that they are identical. The odor seems to be strong, weak or absent under different conditions. The pileus may be as much as 5 cm. across.

683. *Lepiota alluvius* Pk.

N. Y. State Mus. Rep. 35, p. 157, 1884.

"PILEUS 1-3 cm. broad, thin, convex or plane, sometimes reflexed on margin, *white, adorned with minute pale-yellow hairy or fibrillose scales*. GILLS free, thin, close, white or yellowish. STEM 2-4 cm. long, 2-3 mm. thick, slender, fibrillose, whitish or pallid, slightly thickened at the base. ANNULUS slight, subpersistent, often near the middle of the stem. SPORES elliptical, 6-7.5 x 4-5 micr."

Alluvial soil among weeds and shrubs. East Lansing. August. Reported by Longyear.

"In drying the whole plant assumes a rich yellow hue."

684. *Lepiota miamensis* Morg.

Jour. Cincinnati Soc. Nat. Hist., 1883.

PILEUS 2-4 cm. broad, soft, convex-expanded, subumbonate, even, *fibrillose-scaly* except disk, *white*, disk sometimes brownish. FLESH white, very thin, fragile. GILLS free, *rather broad*, rounded behind, *ventricose, white*. STEM 3-5 cm. long, 2-4 mm. thick, slender, hollow, subequal, glabrous or pruinose at apex, often compressed, *white*. ANNULUS thin, fragile, subpersistent, *median*. SPORES oblong-oval, 5-6 x 3-3.5 micr., white.

(Dried: Pileus whitish, with brownish center, gills dingy-white, stem pallid.)

Singly or few. On the ground in rich woods among leaves. Ann Arbor. September. Rarely found.

Apparently similar to *L. alluvius*, differing in lack of yellow color, especially on drying, and rather broad gills.

685. *Lepiota cristatellus* Pk.

N. Y. State Mus. Rep. 31, p. 31, 1879.

PILEUS 5-8 mm. broad, soft, oval then convex, covered by minute granular-mealiness, *at first tinged pink all over*, then white with pinkish disk, margin mealy. GILLS free, white, medium broad, rounded behind, subventricose, *subdistant*. STEM 2-3 cm. long, 1 mm. thick, slender, equal, hollow or stuffed with fibrils, whitish, subglabrous below the *evanescent* ANNULUS, pruinose above. SPORES minute, subelliptical, 4-5 x 3 micr., smooth, white.

Scattered. In low, moist woods, on mosses, etc. Ann Arbor, Bay View, New Richmond. September. Frequent.

A small *Lepiota*, near *L. pusillomyces*, from which the pink of the cap and the white stem seem to distinguish it so that the two are quite easily recognized in the field. *L. cristatellus* is also said to have narrower gills, and its stem is usually glabrous, while *L. pusillomyces* has broad gills and a mealy stem below the annulus.

*Section VII. Procerae.* Pileus thick and fleshy, the cuticle commonly broken into large scales (continuous in *L. naucina* in most cases); annulus thick, mostly movable.

686. *Lepiota procera* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Atkinson, Mushrooms, Pl. 25, Fig. 81, p. 79.

Peck, N. Y. State Mus. Rep. 48, Pl. 18, 1896.

Hard, Mushrooms, Pl. VI, Fig. 32, p. 46.

Freeman, Minn. Plant Diseases, Fig. 18, p. 39, 1905.

McIlvaine, Amer. Fungi, Pl. XIII, p. 34.

Fries, Sverig. ätl. u. gift. Svamp., Pl. 3.

Michael, Führer f. Pilzfreunde, No. 53.

Gillet, Champignons de France, No. 429.

Ricken, Blätterpilze, Pl. 83, Fig. 1.

Plate CXXXII of this Report.

PILEUS 8-15 cm. broad, elliptic-ovate before opening, then campanulate-convex to subexpanded, *umbonate*, at first covered with a reddish-brown or umber-brown *cuticle, which breaks up into large brown scales or patches* during expansion of pileus, with smaller floccose scales between and exposing the white flesh beneath, cuticle

on umbo often continuous. FLESH thick, white. GILLS free, remote from stem, *broad anteriorly*, narrowed behind, thin, close, white or tinged pink, brownish in age, edge flocculose. STEM 15-30 cm. long, cylindrical or tapering upward from a bulb, 6-12 mm. thick above, apex sunk deep into the flesh of the pileus as into a socket, hollow or stuffed with delicate long fibrils, *surface layer breaking up into small brownish scales*, or furfuraceous so as to appear variegated, white beneath and within. ANNULUS *movable*, thick, formed of the firm, membranous veil which breaks away early, its outer and lower surface covered with small brown scales, representing a continuation of the cuticle of the pileus at a very early state. SPORES 14-18 x 9-12 micr., elliptical, smooth, white; no cystidia found. Sterile cells on edge of gills, numerous, 35-45 x 10-15 micr., subcylindrical.

(Dried: Pileus buff with fuscous scales, stem pale fuscous, gills dingy-buff.)

Solitary or gregarious. On the ground, in meadows, pastures, open woods, or preferably in pastured clearings. August, September, October. Throughout the State. Edible.

*Its long stem, movable annulus and shaggy, spotted cap*, distinguish it from all others. Its height is often surprising, sometimes reaching a foot and a half, with a cap six to ten inches broad. Its cap is delicious, when after removing the scales, it is fried in butter. Its distribution is world-wide.

687. *Lepiota morgani* Pk. (POISONOUS)

Botanical Gazette, Vol. 4, 1879.

Illustrations: Hard, Mushrooms, 1908, Pl. VII, Fig. 35, p. 50.

McIlvaine, Amer. Mushrooms, 1900, Pl. XIV, p. 36.

Plates CXXXIII and CXXXIV of this Report.

PILEUS 10-20 cm. broad, at first globose then convex and expanded, cuticle at first continuous, buff to pale umber, soon *broken up* except on disk, *into irregular scales or patches*, which are drawn apart and disappear in part. FLESH thick, firm, white. GILLS free, remote (4-5 mm.) from stem, close, rather broad, ventricose, *at first white then changing to dull green*. STEM stout, 10-20 cm. long, 1-2 cm. thick above, 2-4 cm. at base, tapering upward from a clavate base, stuffed with fibrils, *hard and firm*, glabrous, whitish or grayish-white to pale umber. ANNULUS thick, *mov-*

*able*, superior, toughish but soft. SPORES bright to dull green in mass, subelliptical, obliquely apiculate, 9-12 x 6-8 micr., nucleate.

*Gregarious*, often in large fairy rings. In meadows, pastures and open woods. In southern Michigan, Ann Arbor. Frequent but local.

*Unsafe*. Eaten with impunity by some persons, but others suffer vomiting, etc. This is our largest-capped meadow mushroom known; it attains a diameter of 14 inches. Its *large size, movable ring and greenish spores and gills* distinguish it. The underside of the ring next to the stem is at first covered by the remains of the cuticle which was continuous with the pileus. All the cuticle of the pileus except the center may disappear. The young margin of the cap is beautifully torn-serrate and floccose at first. Reports have come in that the whole plant is sometimes green or greenish.

688. *Lepiota americana* Pk. (EDIBLE)

N. Y. State Cab. Rep. 23, p. 71, 1872.

Illustrations: N. Y. State Rep. 49, Pl. 44, 1896.

Atkinson, Mushrooms, Fig. 82, p. 80, 1900.

Hard, Mushrooms, Fig. 34, p. 49, 1908.

Murrill, Mycologia, Vol. 3, Pl. 49, Fig. 6.

McIlvaine, Amer. Mushrooms, Pl. XV, p. 48, 1900.

PILEUS 3-10 cm. broad, ovate then convex-expanded, umbonate or subumbonate, cuticle at first reddish-brown and continuous, *then broken up* except on umbo into large, scattered, *reddish or bay-brown scales*, elsewhere white when young and fresh but *becoming dingy-red in age*, more or less striate on margin. FLESH thin, white, *reddening when bruised or in age*. GILLS free, close, rather broad in front, narrowed behind, white. STEM 7-12 cm. long, 4-6 mm. thick at apex, *tapering upward from a clavate base*, sometimes fusiform, stuffed then hollow, glabrous, white becoming reddish where handled. ANNULUS rather large, membranous, flaccid, sometimes movable, sometimes evanescent. SPORES elliptic-ovate, 8-10 x 5-7 micr., nucleate, white. ODOR and TASTE mild.

(Dried: Whole plant tinged dull red or smoky-red.)

Solitary to caespitose. On rich soil in grassy places, in fields or around old stumps. Ann Arbor and Ludington. August. Apparently rare in Michigan. Edible.

Bresadola (Tab. Analyt., Vol. 2, p. 83) suggests that our plant is

the same as the European *L. haematosperma* (*Agaricus haematosperma* of Hymen. Europ.), as well as *L. badhami* Berk. In these also the flesh changes to reddish in age or on drying. The French mycologists (Quel. and Battaile, Aman. et Lep., 1902, p. 73) have taken exception to this view, claiming that *L. haematosperma* actually has reddish or purplish spores when mature; while *L. badhami* has white spores. Hence the American name must be retained. Our plants can be distinguished from our other Lepiotas by this character of the flesh. The shape of the stem imitates at times that of *L. cepaestipes*, being enlarged just above the base, sometimes, however, it merely tapers from the very bottom; in the former case the base is sometimes short-pointed. The pileus is sometimes almost entirely white when fresh. The gills and flesh may assume a yellow tinge at first.

689. *Lepiota naucina* Fr. (EDIBLE)

Epierisis, 1836-38.

Illustrations: N. Y. State Mus. Rep. 48, Plate 19, 1896.

Gillet, Champignons de France, No. 428.

Atkinson, Mushrooms, Figs. 79-80, p. 76-78.

Bresadola, Fungh. mang. e. vel., Pl. 15.

McIlvaine, Amer. Mushrooms, Plate XV, p. 44.

Ricken, Blätterpilze, Pl. 84, Fig. 2.

Plates CXXXV, CXXXVI of this Report.

PILEUS 4-8 cm. broad, at first subglobose to ovoid, then convex to subexpanded, obtuse, soft, *glabrous*, rarely broken into scales on the surface, white or smoky-white. FLESH white, thick, rather firm, abruptly thin on margin. GILLS free, not remote, close, moderately broad, narrowed behind, white at first, *slowly changing to pinkish then dingy-brown*, edge minutely flocculose. STEM 5-10 cm. long, 6-12 mm. thick above, tapering upward from a thickened base, sometimes subequal, stuffed then hollow, *glabrous* or silky below the ring, pruinose above, *white within and without*. ANNULUS formed from the membranous veil and outer layer of stem; the latter is shown peeled off up to the ring in the section of the young plant in our illustration. It is white, rolled together in the form of a collar, persistent and superior, in age it often becomes movable. SPORES elliptic-oval, 7-9 x 5-6 micr., but variable, some longer, occasionally abnormal and then spherical, nucleate, smooth, white. ODOR and TASTE mild.

Gregarious. Grassy ground, in pastures, fields, roadsides, and parks. Ann Arbor, Marquette, New Richmond, etc. September-November. Common throughout the State. *Edible*.

(Dried: Gills pale cinnamon-brown to umber, pileus smoky-buff, stem buff tinged umber or fuscous-brown.)

It seems to be agreed that there is an European plant like ours with elliptical spores. (Beardslee, Jour. Mycs., Vol. 13, p. 27, 1907.) Whether there is also one in Europe with uniformly globular spores is as yet uncertain. (Morgan, Jour. Mycs., Vol. 13, p. 10.) Our species will probably be known henceforth as *L. naucina* instead of *L. naucinoides* Pk., a name it has held so long. The spores vary remarkably in some individuals, while in others they are quite constant. All our specimens had mostly elliptical-oval spores; in some cases a few spheroid spores were present, but such occur in other mushrooms, and must be considered abnormal. This is one of the best mushrooms for the table. Its white gills and veil when young might lead the novice to think it to be an Amanita. The stem is firmer and lacks remnants of a volva, and the gills turn brown when heated or toasted, while in Amanita they remain white" (McIlvaine). It is not infested by larvae, and some method of cultivation is awaited eagerly by mushroom gardeners. *Lepiota excoriata* Fr., as figured by Bresadola, has the same general appearance, but differs in the torn surface of the cap near its margin, in the bulblet at the base of the stem and in the much larger spores, which measure 15-17 x 9 micr.

*Armillaria* Fr.

(From the Latin, *armilla*, a ring.)

White-spored. Stem continuous with the hymenophore, provided with an *annulus*. Volva none. Gills adnexed, adnate or decurrent, partly with a diverging trama.

Fleshy, often compact, firm mushrooms; either terrestrial or on wood; mostly autumnal.

The PILEUS is either viscid or dry, *glabrous* or scaly, often provided with a separable pellicle; the surface sometimes cracked in dry weather. Most of the rarer species are large and stout, the pileus of dull shades of color: whitish, yellowish, brownish or reddish. The margin is often incurved. The scales on the pilei of some species represent the broken cuticle which is continuous with the veil but concrete. The GILLS are variously attached, and

Fries used this character to subdivide the genus into three groups, e. g., Tricholomata, with sinuate-adnexed gills; Clitocybae, with gills attenuated behind and subdecurrent; Collybiae, with gills equal. No examples of the Collybiae are known from the State. The stems of these three groups are normally central. With Patouillard (Les. Hymen. Eur., p. 95) it seems to me desirable to include here a fourth group: the Pleurotoidea, with eccentric or lateral stem, to include the species *Armillaria dryina* and *Armillaria corticata*. The gills are usually white but may turn yellowish or become stained in age, depending on the species. Some species possess a gill-trama with diverging hyphae, but in other species the hyphae are parallel. The relationships shown by this character in this genus are not yet very clear. The STEM is usually stout; in *A. bulbigera* it is marginate-bulbous as in some *Cartinarii*. Usually it is solid, and often peronate by a more or less persistent sheath when young, later scaly-spotted by the breaking up of this sheath. The VEIL is probably double in such species as *A. caligata* and *A. aurantia*, the outer veil being continuous with the cuticle of the pileus, the inner veil closely adherent to it between the margin of the pileus and the underside of the young gills. It is mostly membranous, but inclines to a cobwebby or fibrillose texture in *A. bulbigera* and when it sheathes the stem it breaks away from the margin of the pileus to form the spreading annulus. Sometimes it is lacerated at the junction of cap and stem and parts of it may remain on the margin of the pileus so that the pileus becomes appendiculate. In *A. mellea* the veil is extremely variable; it is usually membranous, but sometimes floccose-fibrillose or very thin and webby so that no annulus is formed on the stem. In other characters also *A. mellea* is quite variable. The SPORES are white, varying much in shape and size; in most species they are small and almost spherical; in some, as in *A. macrospora* Pk. from Colorado, they are elliptical and measure 10-15 x 6-8 micr. Several species have a distinct ODOR; that of *A. nardosmia* Ell. is said to resemble oil of almonds; that of *A. viscidipes* Pk. is strong and penetrating, somewhat alkaline. Nearly all the species are said to have a slight odor of some kind by which they can be distinguished. *A. mellea* Fr. is very common and plentiful in its season; the other species of *Armillaria* are infrequent and can be considered rare during any series of years. So far only five of the latter class have been found in the State, although doubtless our northern hemlock and pine forests hide others. It has seemed best, therefore, to include in the key such species as may occur within our

area. About 18 species of *Armillaria* have been mentioned in the literature as having been observed in the United States; only about half of these were reported east of the Mississippi River. Ricken, (Blätterpilze), refers all *Armillarias* to the genus *Tricholoma*. Some species of *Clitocybe*, *Tricholoma*, and *Pleurotus* will be looked for here.

*Key to the Species*

- (A) Stem lateral or eccentric; pileus white. 694. *A. dryina* Fr. 695. (*A. corticata* Fr.)
- (AA) Stem usually central.
  - (a) Pileus or stem viscid.
    - (b) Lignicolous, growing on tree-trunks, etc., pileus glutinous. *A. mucida* Fr.
    - (bb) Terrestrial.
      - (c) Only the stem viscid; pileus large, whitish, or yellow-tinged; odor penetrating, alkaline. *A. viscidipes* Pk.
      - (cc) Stem not viscid; pileus with a slightly viscid pellicle.
        - (d) Pileus and stem covered with tawny-orange to ochraceous-rufous scales. 691. *A. aurantia* Fr.
        - (dd) Pileus glabrous, pale-brick red; stem covered with pink-red floccose scales. 692. *A. focalis* Fr. var.
  - (aa) Pileus and stem not viscid.
    - (b) In caespitose clusters about stumps, trunks, etc., honey-yellow, becoming rusty-stained; gills adnate to subdecurrent. 693. *A. mellea* Fr.
    - (bb) Not caespitose; gills emarginate or rounded behind, not decurrent.
      - (c) Veil cortina-like, white, fugaceous; stem marginate-bulbous; pileus glabrous, gray, brownish or rufescent; spores 7-10 x 5 micr. *A. bulbigera* Fr.
      - (cc) Veil membranous; stem not marginate-bulbous.
        - (d) Pileus white or whitish.
          - (e) Stem sheathed by the subviscid, persistent veil; pileus large, 10-15 cm. broad, white or yellowish, glabrous. Spores globose, 4 micr. diameter. *A. magnivelaris* Pk. *A. ponderosa* Pk.
          - (ee) Stem not sheathed; veil fibrillose—membranous, not viscid; pileus 5-10 cm. broad, whitish to rusty-tinged; spores subelliptical, 7.5 x 5 micr. *A. appendiculata* Pk.
    - (dd) Pileus or scales dark brown, reddish-brown or grayish brown.
      - (e) Pileus glabrous, hard and compact; veil ample, gills broad; spores 7 micr., ovoid-globose. *A. robusta* Fr.
  - (ee) Pileus with brown or reddish-brown scales; gills narrow.
    - (f) Odor strong, of spikenard or oil of almonds; pileus whitish, except the brown scales; spores 6 micr., globose. *A. nardosmia* Ell. (See *A. caligata*.)
    - (ff) Odor none, scales reddish-brown to chestnut-brown; spores globose-ovate, nucleate, 6-7.5 x 5 micr. 690. *A. caligata* Fr.

*A. TRICHOLOMATA*. Gills sinuate-adnexed; stem fleshy, similar in substance to the pileus.

690. *Armillaria caligata* Vitt.-Bres.

Hymen. Europ., 1874.

Illustrations: Bresadola, *Fungh. mang. e. vel.*, Pl. 17.

Gillet, *Champignons de France*, No. 33.

Barla, *Champignons de Nice*, Pl. 10, Fig. 4-7.

Patouillard, *Tab. Analyt.*, No. 306.

Hard, *Mushrooms*, Fig. 42, p. 59 (as *A. nardosmia* Ell).

Van Hook, *Ind. Acad. Sci. Proc.*, 1911, Fig. 1, p. 348 (as *A. nardosmia*).

Plate CXXXVII of this Report.

PILEUS 6-10 cm. broad, firm, convex then expanded and depressed, *spotted by appressed, rufous-brown or dark brown, elongated fibrillose scales*, elsewhere silky, white between scales or brunescent, margin at first incurved and margined by remnants of the veil. FLESH white, thick, compact. GILLS sinuate-adnate, at length with decurrent tooth, medium *broad* (5-8 mm.), heterophyllous, white, crowded, edge entire, trama of parallel hyphae. STEM *stout*, 4-7 cm. long, 2-3 cm. thick, subequal or tapering down, solid, sheathed at first to the middle or above it by *the veil which terminates above by an ample, flaring, thickish, membranous ANNULUS*, later breaking below into subconcentric, *rufous-brown* scales, white and rough-scurfy above the ring, then glabrous and shining, white within. SPORES spherical-ovoid to short elliptical, 6-7.5 x 5 micr., smooth, white in mass. BASIDIA 38-40 x 7-8 micr., 4-spored. ODOR none. TASTE of nuts or slightly bitterish-acrid.

Solitary or in caespitose pairs. On the ground, oak hillside bordering a tamarack bog. Ann Arbor. October. Rare.

Our plants agree so well with Bresadola's description and figure of *A. caligata* that I have no hesitancy in referring them there. There is a slight discrepancy as to odor. Bresadola describes the European plant with an agreeable, fruit-like odor. On this point our specimens also differ from the description of *A. nardosmia* Ell. Several correspondents from the eastern part of the United States inform me that their specimens of *A. nardosmia* often or always lack the odor of almonds attributed to it. Peck (Rep. 33) first referred the New York species to *A. rhagadisma* Fr., but in the

43d Report assigned it to *A. nardosmia*. I am inclined to think the New York species all belong to *A. caligata*. I have collected the same but smaller plant in New York, and it seems usually to be smaller farther south and east. Whether any microscopic characters accompany the almond odor remains to be seen. As in *A. aurantia*, the parallel hyphae of the gill-trama are an exception for this genus.

691. *Armillaria aurantia* Fr.

Syst. Myc., 1821. (As *Tricholoma aurantia*.)

Illustrations: Fries, *Icones*, Pl. 27.

Gillet, *Champignons de France*, No. 31 (too pale).

Bresadola, *Fungh. mang. c. vel.*, Pl. 18.

Michael, *Führer f. Pilzfreunde*, Vol. III, No. 121.

Atkinson, *Mushrooms*, Fig. 86, p. 85, 1900.

Ricken, *Blätterpilze*, Pl. 87, Fig. 2. (As *Tricholoma*.)

PILEUS 5-7 cm. broad, convex then expanded, subumbonate, viscid in wet weather, *ochraceous-fulvous to tawny-orange-red*, with a pellicle which soon breaks up into numerous, crowded, appressed, concolorous scales, *margin at first inrolled and glutinous floccose*. FLESH white, thick, abruptly thin on margin. GILLS rounded behind, slightly adnexed, rather narrow, close, *white*, rusty-brown-spotted in age, a few forked, edge entire, trama of parallel hyphae. STEM 4-7 cm. long, 8-15 mm. thick, equal or narrowed downwards, *covered by concolorous subconcentric scales* up to the obscure annulus, white at apex and between scales, solid. SPORES minute, globose-oval, variable, 4-5 x 3-4 micr., smooth, nucleate, white. CYSTIDIA and sterile cells none. BASIDIA 25-28 x 4-5 micr., 4-spored. ODOR strongly farinaceous, somewhat disagreeable.

Scattered. On sandy ground under hemlock trees. New Richmond. September. Infrequent.

This is *Tricholoma peckii* Howe. The quite young plant has an ovate obtuse pileus with an inrolled margin, and an external, colored layer which breaks up into appressed floccose patches or scales, but scarcely ever leaves an annulus. That it is a better *Tricholoma*, where Fries at first placed it, is shown by the structure of the gill-trama whose hyphae lie in a parallel position. The tawny-orange red color of the scales is a distinguishing character. Cooke's figure (Ill., Pl. 33) evidently illustrates a different species. Bresadola

says it has the odor of stale olives, while Maire (Soc. Myc. France, Bull. 27, p. 404) reports a slight dextrine odor.

692. *Armillaria focalis* Fr. var.

Epicrisis, 1836-38.

Illustration: Cooke, Ill., Pl. 245.

PILEUS 3-6 cm. broad, campanulate-convex, *soft-fleshy*, obtuse, even, *glabrous*, provided with a thin, separable, *viscid* cuticle, *bright brick-red*. FLESH thin, tinged pink. GILLS *sinuate-adenexed*, rather broad, about 5 mm., *ventricose*, soft, close, white or tinged brick-red, edge thin. STEM 4-11 cm. long, 5-8 mm. thick, rather slender, subequal, attenuated below, soft, solid, fragile, *covered by brick-red, floccose scales up to the evanescent, median annulus*, whitish and silky-shining above. SPORES globose, 3-4.5 micr., white, smooth; basidia 4-spored, slender, about 24 micr. long. CELLS of the gill-trama large, 75-125 micr. long, about 12 micr. wide, *divergent*. Cells of the cuticle of pileus long, narrow, 5-6 micr. wide, gelatinous. ODOR and TASTE farinaceous.

Gregarious or solitary, on the ground, in mixed hemlock and maple woods, clay ravines. New Richmond. September. Rare.

This plant seems to be intermediate between *A. focalis* and *A. aurantia*. Its pileus is somewhat viscid and in this respect differs from *A. focalis* and is related to *A. aurantia*. Its spores also approach those of *A. aurantia*. In stature, texture of the flesh, character of pileus, etc., it is, however, quite different from *A. focalis*. The soft texture is given as an important character of *A. focalis*, and Cooke's illustration gives a good idea of the coloring and the appearance of the stem of our plants, except that the stem is much more elongated and attenuated downward. No critical studies of *A. focalis* Fr. could be found, and it is possible that its cap may be provided with a viscid pellicle in wet weather.

*B. CLITOCYBAE*. Gills attenuated behind, more or less decurrent; stem solid.

693. *Armillaria mellea* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 32.

Atkinson, Mushrooms, 1900, Pl. 27, p. 84.

Hard, Mushrooms, 1908, Figs. 39, 40, p. 56, 57.

Marshall, Mushroom Book, p. 61.

Murrill, Mycologia, Vol. 1, Pl. 1, Fig. 2.

Conn. Nat. Hist. Survey, Bull. No. 3, Pl. IV.

Plates CXXXVIII, CXXXIX, CXL of this Report.

PILEUS 3-10 cm. and more broad, oval to subhemispherical at first, then convex to almost plane, obtuse, normally honey-colored, varying to yellowish-brown, rusty-brown, or quite pale, adorned with dark-brown or blackish pointed tufts or scales, sometimes glabrescent, striate on margin in age. FLESH whitish. GILLS *adnate* or decurrent, subdistant, whitish or dingy yellowish, becoming rusty-stained in age, not broad, at length powdered by the white spores. STEM variable in length, 5-15 cm. long, 6-20 mm. thick, *equal*, stuffed then hollow, often spongy within, fibrous without, elastic, floccose-scaly, glabrescent, glabrous or striate and mealy at apex, whitish above, dingy yellowish, brownish or rusty-stained below. The VEIL is usually well-developed, membranous, and at first conceals the gills, at length collapsing to form a superior *annulus*; sometimes both veil and annulus are almost or entirely lacking; they are white or whitish, sometimes stained like cap and stem. SPORES elliptical-ovate, 8-9.5 x 5-6.5 micr., white, smooth, nucleate; basidia 4-spored; trama of gills composed of divergent hyphae. TASTE somewhat disagreeable or acid.

*Caespitose*. At base of living tree-trunks, around stumps, decaying roots, etc., of all sorts of trees, both conifer and broad-leaved. Throughout the State. July-November (earliest record July 13, latest November 2). Very common. Parasitic and saprophytic.

In an abundant species like this, the variations are much more easily observed than in a rare plant, so that about ten varieties have been named and described. The most important of these is var. *exannulata* Pk. This is an ecological form, doubtless, whose dense, caespitose clusters, stem attenuated below, undeveloped an-

nulus and small glabrous pilei, are the result of unfavorable conditions. Other varieties, like *obscura*, *flava*, *glabra*, *radicata*, *bulbosa*, etc., differ from the normal condition in the characters indicated by their respective names. An abortive form occurs, doubtless parasitized like *Clitopilus abortivus*, by some other fungus whose identity is unknown. This form consists of irregular roundish white masses composed of fungus mycelium. For a fuller account see N. Y. State Mus. Rep. 48, page 262.

*Armillaria mellea* is of considerable economic importance. At times it grows from living roots to which it is connected by black, twine-like strands called Rhizomorphs. These are often found even where no fruit-bodies are present, and before their connection with this species was known, the strands were referred to an independent fungus and called *Rhizomorpha subcorticalis*. These strands extend under the bark of living roots and eventually injure or kill the trees. The American *A. mellea* is safely edible. Large quantities are collected by the foreign-born population of some localities—Detroit and the mining regions of the Northern Peninsula; they are dried, and used for the table during the winter. The taste is somewhat disagreeable, and many people do not think them particularly palatable.

*Clitocybe monodelpha* Morg. has been considered by some as a variety of this species. It is, however, clearly separated by the character of the hyphae in the gills, which do not diverge as in the genus *Armillaria*, but lie parallel between the subhymenial layers.

*C. PLEUROTOIDAE.* Stem eccentric or lateral; gills decurrent.

694. *Armillaria dryina* Fr.-Pat.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 226. (As *Pleurotus*.)

Patouillard, Tab. Analyt., No. 517.

Atkinson, Mushrooms, Pl. 32, Fig. 106, 1900. (As *Pleurotus*.)

PILEUS 4-8 cm. broad, firm, convex-plane, *floccose-tomentose at first*, in dry situations *becoming scaly* from the breaking up of the floccose covering, *white*, scales darker in age, margin at first involute. GILLS decurrent, subdistant, attenuated at ends, broadish in the middle, white, not anastomosing behind. STEM eccentric or lateral, 2-4 cm. long, 1-1.5 cm. thick, subequal, sometimes stouter

at first, covered by a more or less dense tomentum, especially toward base, above with a somewhat temporary *annulus* from the thin, membranous veil, which is quickly lacerated and disappears as pileus expands. SPORES oblong, 9-10 x 4-4.5 micr., smooth, white. ODOR very strongly of oil of bitter almonds (benzaldehyde).

From base of stumps, on trunks, etc. Marquette. August. Infrequent.

The plants described above were growing near the ground and in a moist situation and this may account for the unusual tomentosity on the stem. The size of the spores, which appeared to be mature, would seem to be one basis of separation from the next species. When the stem is lateral or nearly so, the pileus is usually subreniform.

695. *Armillaria corticata* Fr.-Pat.

Syst. Myc., 1821.

Illustration: Atkinson, Mushrooms, Pl. 33, Fig. 107. (Small forms as *Pleurotus*.)

PILEUS 6-15 cm. or more broad, convex-expanded, obtuse or depressed, *firm, dull white or becoming brownish* tinged, finely floccose at first, then the *cuticle breaks up into scale-like areas*, margin at first involute and appendiculate. FLESH thick, white. GILLS decurrent, moderately close, *rather broad*, narrowed behind, white becoming yellowish, *anastomosing on the stem*, edge entire. STEM 4-10 cm. long, eccentric or almost lateral, sometimes stout and short, solid, firm to rigid, subtomentose or floccose, reticulate in large specimens, equal or tapering down. VEIL attached near apex, leaving a thin, white floccose-membranous evanescent ring, or sometimes remnants on the margin of the pileus. SPORES *cylindrical-elongated, large*, 13-17 x 4-5 micr., smooth, white. BASIDIA 4-spored. ODOR slightly acid-aromatic to foetid.

Solitary or caespitose, on wood, especially on living trunks of hickory, maple, etc. Ann Arbor, Marquette. September-November. Infrequent.

This is considered by Atkinson (Mushrooms, p. 106, 1900) as merely a form of *A. dryina*, and as far as the variation of stem-length and size of plant are concerned, such a conclusion is well supported. The difference in the size of the spores in our collections has, however, opened up the question again, and further study

seems necessary. Schroeter gives 13-15 x 4-5 micr. as the size of the spores of *A. corticata*, a measurement nearly equal to the spore length of our form. The size of the spores of *A. dryina* is not mentioned by most authors; Masee says they are 10 x 4 micr. Large specimens of this species when the veil has disappeared, might be mistaken for *Pleurotus ulmarius* or *Panus strigosus*; but *P. ulmarius* has sinuate-adnexed gills and *P. strigosus* has a nap of strigose-villose hairs on cap and stem and is much larger.

### Pleurotus Fr.

(From the Greek, *pleuron*, a side, and *ous*, an ear.)

White-spored, (except *P. sapidus* and *P. subpalmatus*). Stem fleshy, *eccentric, lateral or lacking*, continuous with the pileus. Gills adnate, adnexed or decurrent. Veil *none*.

Putrescent, (except *P. atrocaeruleus*, *P. atropellitus*, *P. niger*, and *P. striatulus*), *lignicolous*, medium to large, or often small and then resupinate. Intergrading with the genera *Clitocybe* and *Armillaria*. They correspond to the genera *Claudopus* and *Crepidotus* of the pink-spored and ochre-brown-spored groups respectively. All are believed to be *edible*, and are considered by many people the most delicious of our mushrooms when properly prepared.

The PILEUS varies from quite large in those attached laterally or with a stem, to quite small when it is resupinate. *P. ulmarius* and *P. ostreatus* and their near relatives have a thick, fleshy pileus and ample gills, thus providing a large amount of food for the mushroom enthusiast. The small species are rather thin, often membranous; four of the species revive on moistening. Our large species are nearly all white when fresh, becoming tan-colored or darker when old, and are always firm and even tough in age. The medium-sized species are ashy, greenish, yellowish or reddish in color. The small forms are white, gray or blackish. Several are hygrophaneous. Several have a gelatinous or viscid upper layer, of which the thick-fleshed *P. serotinus* is the most note-worthy. The GILLS are fastened to the stem, but their mode of attachment is so different in the various species as to have given some authors ground for making distinct genera out of the sections. In some they are deeply decurrent as in *Clitocybe*, in others, sinuate-adnexed as in *Tricoloma*, and in the resupinate and lateral species they radiate from the point of attachment of the pileus as in *Crepidotus* of the ochre-brown-spored group. In the large species

they are usually very broad. Among the medium-sized forms there are cases where the gills are very narrow and very crowded, reaching the base almost as lines; examples of this class are *P. petaloides*, *P. borealis*, and *P. porrigens*. The small, resupinate forms expose the gills on the upper side while the pileus is closely applied to the substratum; later the pileus becomes reflexed so that the gills project downward, giving the older a different appearance than the younger plant. This genus is often separated from *Clitocybe* with difficulty, especially in the cases where the stems are only slightly eccentric, so that different authors have placed the same plant under the two genera. The STEM is occasionally almost central in the large-stemmed species, which may then be mistaken for *Tricholomas*; the latter, however, grow practically always on the ground. Otherwise, the stem is lateral, eccentric or entirely wanting. The interior of the stem is fleshy-fibrous in most species, but several have a stuffed to hollow axis, with a tough exterior, as in *P. lignatilis*.

The SPORES are white except in the aberrant species *P. sapidus*, *P. euosmus* and *P. subpalmatus* in which the spores have a slight flesh color or lilac tint. *P. sapidus* and *P. euosmus* resemble *P. ostreatus* so closely in other respects, that placing them among the pink-spored agarics would not improve matters. *P. subpalmatus* seems to me nearer *Entoloma* as its stem is sometimes central; its reticulate, toughish, gelatinous pileus is rather unique, and reminds one of the genus *Heliumyces*. The spores of the *Pleuroti* are smooth, mostly spherical and then minute, or oblong; in a few species, elliptical. CYSTIDIA are known to be present in *P. serotinus*, *P. stratosus*, *P. petaloides* and *P. mastrucatus*. *P. ostreatus* is said to produce scattered conidia on top of its pileus, which represent another kind of spore. The ODOR is often fragrant and agreeable, and the flavor of most of the species makes them very desirable for the table.

The genus may be divided into three sections:

Section I. *Eccentrici*.

Section II. *Dimidiati*.

Section III. *Resupinati*.

The subdivision which was used by Fries and others for those forms with an inner veil is omitted here, since our two species *P. corticatus* and *P. dryinus* have been transferred to the genus *Armillaria*, where it seems to me they more properly belong, and for which they have often been mistaken. A few species not yet found in the State have been included in the key.

## Key to the Species

- (A) Stem eccentric; pileus entire or at least marginate behind; plants of medium size to very large.
- (a) Pileus brown or blackish brown, umbonate, 2-7 cm.; gills subdistant, broad; spores 5-6 x 4-5 micr. *P. umbonatus* Pk.
- (aa) Pileus yellow, yellowish or reddish. [See also (aaa).]
- (b) Pileus glabrous, gelatinous on top, coarsely-reticulate, pinkish or flesh color; spores globose, echinulate. 699. *P. subpalmatus* Fr.
- (bb) Pileus strigose hairy, scaly or fibrillose.
- (c) Very large; pileus lateral, cream-color then yellowish, strigose hairy; gills very broad; stem short. (See 12a. *Panus strigosus* B. & C.)
- (cc) Medium-size; stem medium long and not very eccentric.
- (d) Pileus and stem densely dotted with brown or blackish scales; spores globose, minute. (See 760. *Clitocybe decora* Fr.)
- (dd) Pileus unicolorous, silky-fibrillose, umbonate; spores elliptical, 7-9 x 5-6 micr. 698. *P. sulfuroides* Pk.
- (aaa) Pileus white when young or fresh.
- (b) Plant large, on standing elms, etc., stem rather long and stout; gills emarginate or sinuate, rounded behind, broad. 696. *P. ulmarius* Fr. 697. *P. elongatipes* Pk.
- (bb) Gills adnate, adnate-decurrent or long-decurrent.
- (c) Spore print pale dingy lilac; pileus thinner and more flaccid than *P. ostreatus*. 702. *P. sapidus* Fr.
- (cc) Spore print white.
- (d) Stem stout, usually quite short.
- (e) Gills running down the stem in lines and anastomosing; plant rather stout. 700. *P. ostreatus* Fr.
- (ee) Gills not anastomosing on stem, but strongly decurrent. Spores longer than in the preceding two, 12-15 x 5 micr. 701. *P. subareolatus* Pk.
- (dd) Stem slender, 2-5 mm. thick; gills narrow and crowded.
- (e) Pileus hygrophanous, hyaline-white, thin; stem solid, pruinose-floccose. 705. *P. fimbriatus* var. *regularis* var. nov.
- (ee) Pileus not hygrophanous, tough, medium size to small.
- (f) Dingy-white; pileus irregular; stem curved, subvillose, odor farinaceous-oily. 703. *P. lignatilis* Fr.
- (ff) Entirely white; pileus regular, orbicular; stem straight, glabrous; odor faint. 704. *P. circinatus* Fr.
- (AA) Stem none or very short; pileus sessile or continuous with the stem.
- (a) Pileus at first resupinate.
- (b) Upper layer of pileus gelatinous, forming a pellicle.
- (c) Pileus 2-5 cm. broad, more or less reniform to obovate.
- (d) Pileus gray or blackish-brown, margin paler, villose, gills not very broad, whitish. 714. *P. atrocaeruleus* Fr. var. *griseus* Pk.
- (dd) Pileus rich brown, covered with squarrose or erect scales; gills broad, grayish-white. 713. *P. mastrucatus* Fr.
- (cc) Pileus minute, in the shape of a pendulous, reversed vase or cup, pale gray; on herbaceous stems. *P. cyphellaeformis* Berk.
- (bb) Pileus without a gelatinous pellicle.
- (c) Pileus pure white, rarely varying to pale tan.
- (d) Pileus 3-7 cm. long, flabelliform, obovate or cuneate; gills narrow, crowded, forked.
- (e) Pileus tomentose; spores spherical; gills scarcely forked. 713. *P. albolamatus* Pk.
- (ee) Pileus glabrous, margin involute; spores longer than broad; gills forked. 710. *P. porrigens* Fr.

- (dd) Pileus minute, 3-10 mm. broad, plane; gills rather broad, subdistant. 711. *P. septicus* Fr.
- (cc) Pileus gray to blackish, minute.
- (d) Pileus glabrous, striate; gills few, distant. *P. striatulus* Fr.
- (dd) Pileus not glabrous.
- (e) Spores elliptical; pileus 7-16 mm. broad; gills close, blackish. 716. *P. atropellitus* Pk.
- (ee) Spores globose; gills broad, thick.
- (f) Pileus dark cinereous, subpruinose, margin striatulate. 715. *P. applicatus* Fr.
- (ff) Pileus black, plicate on margin, pulveraceous; gills close. *P. niger* Schw.
- (aa) Pileus never resupinate, sessile nor attached by a short lateral stem, but pileus not marginate behind.
- (b) Upper layer of pileus gelatinous or viscid.
- (c) Pileus smoky yellowish green, dimidiate; flesh thick; spores oblong, 4.5 x 1.5 micr. 706. *P. serotinus* Fr. (Syn. *P. serotinoides* Pk.)
- (cc) Pileus whitish or tinged alutaceous coreaceous-fleshy, cuneate, spatulate or fan-shaped, spores minute, globose; cystidia abundant. (See 16. *Panus angustatus* Berk.)
- (bb) Without a gelatinous surface layer.
- (c) Pileus hygrophanous, grayish-brown; gills rather distant, narrow, stem lateral. *P. tremulus* Fr.
- (cc) Pileus not hygrophanous.
- (d) Pileus sessile, pure white, small, flattened, radiately rugose; gills subdistant, broad. 709. *P. candidissimus* B. & C.
- (dd) Pileus not pure white, 1-2 cm. broad, cuneate, or spatulate.
- (e) Spores elliptical, 7.5 x 4-5 micr. 708. *P. spathulatus* Fr.
- (ee) Spores globose, 3-4 micr. diam. 707. *P. petaloides* Fr.

(Morgan, Cinn. Soc. Nat. History, Vol. 6, p. 78) reports *P. craspedius* Fr. a rather large, brown, stipitate species, margin of pileus crenate or lobed, gills close, narrow and white, spores globose, 5-6 micr.)

*Section I. Eccentrici.* Pileus entire or at least marginate behind; stem eccentric.

\**Gills sinuate emarginate, or obtusely adnate.*

696. *Pleurotus ulmarius* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Atkinson, Mushrooms, Fig. 102-3, p. 102, 1900.

Hard, Mushrooms, Fig. 119, p. 156, 1908.

Clements, Minnesota Mushrooms, Fig. 19, p. 32, 1910.

Chicago Nat. Hist. Surv. Bull. VII, Part I, Plate V, 1909.

N. Y. State Mus. Rep. 48, Plate 26, Fig. 1-4, 1906, Bot. ed.

Freeman, Minnesota Plant Diseases, Frontispiece, 1905.

Plate CXLI of this Report.

PILEUS 5-15 cm. or more broad, compact, firm, convex then expanded, obtuse, moist, *glabrous* or somewhat tomentose, *white or whitish*, becoming dull leather color in age, sometimes with yellowish or brownish shades, even on margin but often cracked in age. FLESH white, thick. GILLS *sinuate-adnexed* becoming emarginate or rounded behind, broad, close to subdistant, *white or whitish*. STEM 3-7 cm. long, variable, 1-2 cm. thick, *stout, solid*, firm, eccentric, straight or curved, *glabrous*, sometimes slightly or densely tomentose, whitish. SPORES spherical, 5-7 micr. diam., smooth, *white in mass*. ODOR and TASTE pleasant.

(Dried: Brownish-tan throughout.)

Solitary or caespitose. On decayed or living wood of elm, hickory, maple trunks, etc.; often from a crack or wound of the living tree. Throughout the State. September-November. Rather infrequent except locally.

This *Pleurotus* apparently occurs only on frondose trees, especially on the elm—whence its name. It is not known whether it is parasitic on the living trees or not. Shade-trees in cities are frequently its home. It is one of our best edible mushrooms when young, but in age it becomes somewhat leathery. Once located on a tree, it may often be found fruiting in successive seasons. It often appears on the pruned ends of branches, and may be found far up on the tree. This species is largely free from grubs, especially in the late fall, and often persists or dries in place. It forms a good article of diet in winter, if it is collected when young and the caps are dried. Some of its characters are quite variable. It may appear in dense clusters, or only as a single individual. When growing from the side of a trunk, the stems often grow downward and the cap develops horizontally. Others grow erect, especially when they appear on top of the branch. When the plant grows to considerable size, it is usually quite tomentose on the pileus and stem, which normally are *glabrous*. The color is often quite deceptive. Early, fast-growing individuals are pure white, but late, slow growing ones become brownish or tan-colored; all of them tend to become darker in age. The stems are mostly eccentric, but erect plants may have central stems. The mode of attachment of the gills is the most important distinction between this species and *P. ostreatus* and *P. sapidus*; for although the latter have short and lateral stems, *P. ulmarius* also may have stunted stems growing far to one side. As all of them are equally edible, this point is only of diagnostic importance. Several varieties have been described, based on the variations mentioned above.

697. *Pleurotus elongatipes* Pk. (EDIBLE)

Jour. of Mycology, Vol. 14, 1908.

PILEUS 5-10 cm. broad, convex or nearly plane, *glabrous*, white, even on the margin. FLESH *rather thin*, white. GILLS *adnexed then emarginate*, rounded behind, close, moderately broad, thin, white. STEM very long, 5-15 cm., 6-10 mm. thick, *stuffed then hollow*, variously curved or flexuous, usually eccentric, *glabrous* above, more or less tomentose toward base, white. SPORES minute, spheroid, 4-5 micr. in diam., smooth.

(Dried: Pileus and gills ochraceous-tan, stem dingy buff.)

Subcaespitose or solitary. On prostrate trunks or decaying logs. Whitmore Lake, Washtenaw County and Stevens Lake, Wayne County. October. Rare?

This species seems most closely related to *P. ulmarius*, and is no doubt often confused with it. Peck, who described it from the Wayne County specimens sent him by Dr. O. E. Fischer, considers it most closely related to *P. lignatilis*. It differs from *P. lignatilis* in its much stouter habit, and *adnexed-emarginate* gills. From *P. ulmarius* it seems separable by its stuffed to hollow stem. All of the cotype specimens in my possession have a rather large hollow stem when dried. Those in another collection have the habit and appearance of *P. ulmarius*, but with the characteristic hollow stem in the dried condition. Dr. Peck's acuteness has thus, I believe, found that our common *Pleurotus ulmarius* is composed, at least in this region, of two distinct species. It is no doubt edible and the separation is only of scientific interest. The stems of the type specimens were very long, but it is likely that those were plants of an extreme form.

698. *Pleurotus sulfuroides* Pk.

N. Y. State Mus. Rep. 23, 1872.

Illustration: Atkinson, Mushrooms, Fig. 108, p. 107.

PILEUS 2-7 cm. broad, convex, *umbonate*, subexpanded, silky-fibrillose or minutely scaly, *glabrescent*, pale yellow, variegated when moist. FLESH thin, soft. GILLS slightly decurrent at first, *soon emarginate* and rounded behind, close, rather broad, *sulfur-yellow to yellowish*, white-floccose on edge when young.

STEM 3-8 cm. long, 5-7 mm. thick, *eccentric*, rigid-elastic, variously curved, equal, fibrillose, *pale yellow*, *stuffed then hollow*, apex floccose, even. SPORES oval to short elliptical, 6-9 x 5-6 micr., granular within, smooth, white. CYSTIDIA none.

(Dried: Bay-brown throughout.)

Gregarious or subcaespitose. On decaying logs, hemlock or mixed woods. Bay View, New Richmond. September. Rare.

This species is usually rather long-stemmed, but it also occurs with a short, firm stem. Sometimes it is rather soft in texture but in dry weather it becomes firm. It is easily distinguished by the pale yellow color of the whole plant. In one collection the color was more truly sulfur-yellow. When it is dried, it assumes a bay-brown or dingy chestnut color.

699. *Pleurotus subpalmatus* Fr.

Epicrisis, 1836-38.

Illustrations: Lloyd, Mycological Notes, Vol. I, Fig. 23, p. 51.

Cooke, Ill., Pl. 255. (This has not the appearance of our plant.)

PILEUS 3-5 cm. broad, fleshy, convex-plane, obtuse, *the cuticle gelatinous*, *coarsely reticulated* and separable, *brick-red to flesh color*, glabrous. FLESH rufescent, thick except at margin. GILLS *adnate*, moderately broad, subventricose, close, thin, a few forked at times or interspaces venose, *becoming salmon color*. STEM coriaceous-fleshy, confluent with pileus, 2-3 cm. long, 5-6 mm. thick, equal, *somewhat eccentric*, curved, fibrillose, fibrous-stuffed, reddish within and without. SPORES globose, *echinulate*, whitish, *flesh color in mass*.

On prostrate maple trunk, cut timber, etc. Houghton, Detroit (Grosse Isle). August-September. Rare.

This rare species has been collected in this country in a small number of widely separated localities. Morgan and Lloyd both report it from Ohio. It seems to have been collected in Kansas and Minnesota. We have it from the northern and southern sections of our State. It departs so widely from the genus *Pleurotus* in its echinulate spores, which are flesh-colored, and the peculiar raised network of reticulations on the upper surface of the pileus, that it might be considered well marked as an independent genus. It is just as properly an *Entoloma* as a *Pleurotus*; and why not a

*Heliomyces*? Its flesh becomes tough at maturity, at least in dry weather. Lloyd's figure is an excellent illustration of the plant as I found it at Houghton.

\*\**Gills adnate-decurrent or deeply decurrent, narrowed to a point or line on the stem.*

700. *Pleurotus ostreatus* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Atkinson, Mushrooms, Pl. 30, Fig. 104, 1900.

Hard, Mushrooms, Pl. 18, Fig. 117, 1908.

McIlvaine, Amer. Mushrooms, Plates 35 and 35a, 1900.

Marshall, Mushroom Book, Pl. 9, 58, 1905.

Michael, Führer f. Pilzfreunde, Vol. II, No. 79 (dark form).

Plate CXLII of this Report.

PILEUS 5-20 cm. or more broad, firm, ascending or shelving, *conchate*, subdimidiate to elongated, convex or depressed, white or whitish becoming darker or brownish-ashy, moist, glabrous, margin thin and even, sometimes subrimose. FLESH thick, somewhat soft. GILLS, close to subdistant, *decurrent and running down the stem in raised lines which anastomose*, broad in the middle, narrowed at ends, white or whitish. STEM *lateral, short or almost lacking*, stout, solid, firm, often tomentose or strigose-hairy at base, whitish. SPORES oblong, 7-10 x 4 micr., smooth, *white in mass*. ODOR and TASTE agreeable.

Caespitose imbricated, often in large shelving clusters on standing dead trunks of poplar, maple, elm, birch, willow, etc.; rarely on hemlock or pine; often on sawed logs scarcely decayed. Throughout the State. May to November. Common.

Distinguished from *P. sapidus* and *P. ulmarius* by the peculiar cross-connections of the decurrent gills on the stem. It has usually stouter and thicker pilei than *P. sapidus* and has white spores. *P. ostreatus* is apparently more common in southern Michigan, while *P. sapidus* is the usual form in the north, although both are found in the same region. It varies in color from dirty-white to smoky-white, becoming brownish-tan in age like the two related species. In luxuriant specimens the gills are very broad, but taper at the ends. It is called the "Oyster Mushroom" because of its conchate pileus. Authors differ as to whether it is of first or

second quality for the table—the difference in quality is probably due to the manner of cooking. Dr. Cooke says it may be spoiled by improper preparation. Hard says they must be carefully and thoroughly cooked, and this is an important fact. My own preference is the method used in frying oysters, only it is better to cut the cap *into small pieces* since they do not cook as quickly as an oyster. The caps should be collected within a few days of their appearance, as they become infested with small beetles; these, however, usually hide only between the gills, and can be shaken out, leaving the plants still fit to eat. At the first signs of decay they are no longer desirable.

701. *Pleurotus subareolatus* Pk. var.

N. Y. State Mus. Rep. 30, 1878.

PILEUS 3-8 cm. broad, almost as long, firm, convex, spatulate, *cuneate or flabelliform*, lateral but marginate behind, *white then dingy*, tomentose behind, silky tomentose in front, obscurely areolate, margin at first involute. FLESH thick, surpassing width of gills, rather soft. GILLS decurrent, scarcely or not at all anastomosing on stem, *rather broad*, attenuate at ends, *subdistant*, white, at length brownish, edge entire. STEM short, almost lateral, ascending, 2-3 cm. long, about 1 cm. thick, firm, solid, sometimes spongy within, equal, even, white then dingy or subrufescent, tomentose. SPORES *long, subcylindrical*, 12-15 x 4-5 micr., smooth, white. CYSTIDIA none. BASIDIA about 45 x 7 micr., attenuated downward, 4-spored. ODOR and TASTE mild or slightly nauseous.

Solitary or few in cluster. On living trunks of maple, basswood, etc. Ann Arbor, New Richmond. September-October. Infrequent.

This species is referred here with some hesitancy. Peck described his plants from a single collection, and emphasizes the areolate character of the surface of the cap. He does not give the shape of the pileus, but the stem is said to be eccentric, so that the pileus was probably much more regular than in our plants. The spores, gills and most of the other essential characters agree. It is probable that if we had accounts of the spore-size of some of the European species, our plant could be easily placed. The margin remains involute a long time, and Peck, in a note (Rep. 54, p. 164) states that his species had a small, white membranous veil in the young condition, showing its relation to *Armillaria*. No such veil was observed in my plants.

702. *Pleurotus sapidus* Kalch. (EDIBLE)

Hymen. Hungariae, 1873.

Illustrations: Atkinson, Mushrooms, Plate 31, Fig. 105, 1900.

Hard, Mushrooms, Pl. 20, Fig. 123, 1908.

N. Y. State Mus. Rep. 48, Pl. 27, 1896, Bot. ed.

Cooke, Ill., Pl. 954.

PILEUS 5-10 cm. or more broad, firm, ascending or shelving, subdimidiate or elongated, convex to subexpanded, depressed behind, *glabrous*, often irregular and with wavy margin, white or whitish, often tinged tan, yellowish, gray or brownish, margin thin and even. FLESH white, moderately thick. GILLS close to subdistant, decurrent, *rarely anastomosing*, broad, white or whitish. STEM short or almost lacking, strongly eccentric or lateral, solid, firm, glabrous or slightly tomentose at base. SPORES narrowly oblong, 7-11 x 3-4.5 micr., smooth, *tinged lilac in mass* on white paper. ODOR and TASTE agreeable.

Caespitously imbricated, habit variable, as in *P. ostreatus*. On dead tree-trunks and firm logs, of maple, elm, beech, oak, birch, willow, etc. Throughout the State. May to November. Very common.

Like *P. ostreatus* in general appearance and in practically all of its characters except the lilac tinged spores. The gills anastomose only at times, and the flesh is on an average thinner in Michigan plants. Our plant is mostly shelving and lateral-stemmed as shown in Atkinson's figure. Only occasionally does one find suberect, eccentric or almost central-stemmed plants like those figured by Peck and Cooke. The lilac tinge of the spores is aberrant within the white-spored group, and yet the plant is so close to *P. ostreatus* in other respects that it would be a stranger in the pink-spored group; this species illustrates again that no grouping can be made perfect. Its edible qualities are just like those of the oyster mushroom, and the remarks made under that species apply equally here. Both of these species are much sought in Europe, and the peasants there often water the trunks of the trees where they occur, and in this way obtain a new crop of the mushrooms. Both are apt to appear, after the spring or autumn rains, in the same logs and trunks, so that one may visit the same place year after year and obtain a supply.

703. *Pleurotus lignatilis* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 257.

Hard, Mushrooms, Fig. 126, p. 163 (as *P. abscondens*).

Gillet, Champignons de France, No. 538.

Plate CXLIII of this Report.

PILEUS 2-5 cm. broad, tough, *irregular*, convex, sometimes depressed or umbilicate, flocculose-pruinose, then glabrous, *whitish*. GILLS adnato-decurrent, *crowded, narrow*, white. STEM 2-4 cm. long, 2-4 mm. thick, slender, *stuffed then hollow*, equal, irregular-curved, eccentric, somewhat villose. SPORES minute, oval, 3-5 x 2-3 micr., smooth, white. ODOR markedly *farinaceous*.

Gregarious on logs, etc. Bay View. August-September. Infrequent.

Var. *abscondens* Pk. has gills truly adnate becoming emarginate; spores elliptical, 4-5 micr. long.

The plants referred here agree with the figures of European authors in having the gills acuminate-adnate on the stem, so that as the pileus expands they appear subdecurrent. This is also true of the following two species. On account of this characteristic, it seems to me these three species had better be grouped under our second section than with *P. ulmarius*, where Fries and all others have placed them. *P. lignatilis* and *P. circinatus* and *P. fimbriatus* var. are very much alike in general appearance. To distinguish the species one has to rely on the farinaceous odor of *P. lignatilis*, on the subsolid stem and peculiarly hygrophanous pileus of *P. fimbriatus* var., and on the very regular cap of *P. circinatus*. The spores in all three are minute and somewhat alike. The pileus of *P. lignatilis* often tends to be subinfundibuliform.

704. *Pleurotus circinatus* Fr. (EDIBLE)

Epicrisis, 1836-38.

Illustrations: Fries, Icones, Plate 88.

Cooke, Ill., Pl. 257.

PILEUS 2-5 cm. broad, or less, *regular*, tough, convex, then plane and slightly depressed, *white or whitish*, *silky pruinose*. FLESH

thickish, white. GILLS adnato-decurrent, *crowded, narrow*, white. STEM 2-5 cm. long, *stuffed then hollow*, equal, eccentric, slightly curved or straight, *glabrous*, mycelioid at base. SPORES minute, elliptical, 4-5 x 2-3 micr., smooth, white. ODOR slight, *not farinaceous*.

(Dried: Gills yellowish-ochraceous; pileus and stem ochraceous-tan.)

Gregarious. On logs in hemlock woods of northern Michigan; frondose woods in the south. Bay View, Detroit (Grosse Isle). August-September. Infrequent.

The plant is white at first but becomes dingy-tan when old. It is toughish and the flesh is rather thick as in *P. lignatilis*. Both lack the thin, hygrophanous appearance of the next species. The stem is usually longer than the width of the pileus. It lacks the distinct farinaceous odor of *P. lignatilis*.

705. *Pleurotus fimbriatus* Fr. var. *regularis* var. nov.Syst. Myc., 1821. (As *Clitocybe fimbriatus*.)

Illustration: Plate CXLIV of this Report.

PILEUS 2-5 cm. broad, broadly convex, then plane, obtuse, depressed or subinfundibuliform, *pseudohygrophanous, hyaline-white*, then opaque-pruinose, wavy, irregularly lobed or almost regular, glabrous, even on margin. FLESH thin, slightly tough, white. GILLS acuminately adnato-decurrent, *narrow, crowded*, thin, whitish becoming yellowish in age. STEM 1-3 cm. long, 2-5 mm. thick, slender, curved, toughish, equal, *solid* except a narrow tubule, floccose at apex, pruinose or silky fibrillose, pallid. SPORES minute, ovate, 4 x 3 micr., smooth, white. CYSTIDIA none; sterile cells on edge of gills, slender. ODOR somewhat *farinaceous* to oily. TASTE slightly bitterish-astringent.

On hemlock, elm, etc., logs in woods. Bay View, Ann Arbor. June-September. Infrequent.

The pileus when moist has the appearance of a delicate, translucent, immature egg-shell; its margin is sometimes concentrically rivulose. The stem is at first firmly stuffed then tubular. For comparisons see notes on the preceding two species.

*Section II. Dimidiati.* Pileus lateral, not marginate behind, not at first resupinate, sessile or continuous with the stem-like base.

706. *Pleurotus serotinus* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Hard, Mushrooms, Fig. 24, p. 161, 1908 (as *P. serotinoides* Pk.).

Cooke, Ill., Pl. 258. (Without the olive tints, etc.)

Patouillard, Tab. Analyt., No. 629.

PILEUS 3-8 cm. broad, compact, convex or nearly plane, lateral, orbicular, dimidiate or reniform, with a gelatinous pellicle which becomes viscid when moist, olivaceous-umber but varying to yellowish greenish or brown, surface often covered with a short, dense tomentum. FLESH white, thick, firm. GILLS abruptly subdecurrent, thin, broad, narrow in front, close, whitish or tinged ochraceous or tan. STEM very short, lateral, continued above with the pileus, stout, 5-20 mm. long, 8-10 mm. thick, yellowish beneath, subtomentose or dotted with brown or blackish scales, solid. SPORES minute, linear-oblong, slightly curved, 4-6 x 1-1.5 micr., smooth, white in mass. CYSTIDIA fusiform, yellowish, about 25 micr. long. BASIDIA 4-spored. ODOR and TASTE none.

(Dried: Colors similar to those of fresh condition.)

Caespitose, imbricated, often laterally connate, sometimes solitary. On fallen elm trunks, or dead branches of various frondose trees. Southern Michigan; probably throughout the State. August-November. Frequent locally.

The mode of growth is similar to that of *Claudopus nidulans*, but lacks the odor of the latter and is usually more compact and the colors are dingy. The spores usually found deposited on the lower pilei from those above are white. The tomentum on the pileus often breaks up into punctate scales. The short stem, seen only below, has a yellow-tomentose covering. It may appear in considerable quantity on a single tree trunk.

707. *Pleurotus petaloides* Fr.

Syst. Myc., 1821.

Illustrations: Atkinson, Mushrooms, Fig. 109-10, p. 108, 1900.

Cooke, Ill., Pl. 259.

PILEUS 1-5 cm. broad, elongated in a wedge-shaped to spatulate manner, 2-10 cm. long, tapering to a stem-like base, glabrous except sometimes tomentose toward base, whitish to brown, tan or reddish-brown, margin at first inrolled and finely striate when moist. FLESH rather thin, white, homogeneous. GILLS decurrent, very narrow, crowded, whitish or yellowish, edge fimbriate. STEM not apparent from above, on the underside it is somewhat distinguishable as a compressed, short, somewhat villose portion on which the gills descend. SPORES globose, minute, 3-4 micr. in diameter, white in mass. CYSTIDIA abundant.

Caespitose on decaying wood, logs, stumps, from underground portions of wood, etc. July to September. Marquette. Infrequent.

Close to *P. spathulatus*, which has oval-elliptical spores. The European authors as a rule give the spores under the description of this species as oval-elliptical, so that if Peck's conception is correct their measurements were taken from a form like Peck's *P. spathulatus*. Fries and apparently most others have considered *P. spathulatus* as a variety with a more broadly expanded and lobed pileus. Our species is distinguished from *P. porrigens* and *P. albolantus* by the presence of cystidia, as well as by the non-resupinate pileus in the young stage.

708. *Pleurotus spathulatus* (Fr.) Pk.

N. Y. State Mus. Rep. 39, 1886.

Illustration: Hard, Mushrooms, Fig. 120, p. 108, 1908. (As *P. petaloides*.)

"PILEUS 1-5 cm. broad, ascending, spatulate," petaloid, sub-flabelliform, "tapering behind into the stem, glabrous, convex or depressed on the disk and there sometimes pubescent, alutaceous or brownish tinged with gray, red or yellow. FLESH rather thin. GILLS decurrent, crowded, linear, whitish or yellowish. STEM compressed, sometimes channeled above, grayish-tomentose. SPORES elliptical, 7.5 x 4-5 micr. ODOR and TASTE farinaceous."

This description was taken from Peck's Report. It is submitted, so that more data may be obtained on the relation of this and the preceding species. Patouillard's figure of *P. petaloides* var. *lobatus* (Tab. Analyt., No. 421) may be this species, as he figures the spores elliptical-ovate. Hard gives the spore measurements elliptical, although he says "globose." His figure could be either species. Galtfelter (Trans. St. Louis Acad. of Sci., Vol. XVI, No. 4, p. 44) gives the spores of *P. petaloides* as 3-4 micr., and globose. There is thus considerable discrepancy between European and American notices of *P. petaloides*, so that Peck appears justified in separating the one with globose spores from the one with elliptical spores. It is more than likely, however, that American authors have confused *Panus angustatus* Berk. with *P. petaloides* in which case *P. spathulatus* would revert to *P. petaloides* as a variety, just as Fries placed it, and the elliptical spores would belong to *P. petaloides* as in Europe. All these species are doubtless edible so that the mycophagist is unaffected by the situation. Both *Panus angustatus* and *Pleurotus petaloides* have abundant cystidia, and both have been found in northern Michigan.

709. *Pleurotus candidissimus* B. & C.

Ann. Nat. History, 1859.

PILEUS 2-18 mm. broad, flaccid, reniform or dimidiate, soft-membranous, ascending, convex then plane, attached laterally, *never resupinate*, subsessile i. e. stem very short, sometimes sessile, *pure white, pulverulent*, with a chalky lustre, villose at point of attachment, *margin sulcate*, varying to rugose-striate. GILLS radiating, decurrent, *subdistant to distant*, broader in front, narrowed to the villose base, thin, white. SPORES *globose*, 4-6 micr. diam., smooth.

Gregarious, on rotten wood. Mixed hemlock, maple and beech woods. Houghton, Bay View, New Richmond. July to September. Infrequent.

This little species is easily mistaken for *P. septicus* from which it differs in its globose spores and its sulcate and non-resupinate pileus. The pileus may become resupinate on drying or when old. It varies from sulcate to obscurely striate or lacunose-rugose, but vigorous specimens show this character well. Other Friesian species differ as follows: *P. mitis* has an even pileus; *P. limpidus* is hygrophalous and the gills are crowded and linear; and *P. acerosus* has

crowded gills. Our plant seems to be overlooked usually, as it is delicate and soon shrivels.

*Section III. Resupinati.* Pileus at first resupinate, then reflexed, sessile.

*\*Pileus fleshy, rather thick; trama homogeneous.*

710. *Pleurotus porrigens* Fr.

Syst. Myc., 1821.

Illustrations: Michael, Führer f. Pilzfreunde, Vol. III, No. 100. Cooke, Ill., Pl. 259.

PILEUS 2-4 cm. broad, elongated ear-shaped, obovate or fan-shaped, 3-8 cm. long, *at first resupinate* and suborbicular *with persistently inrolled margin*, then reflexed and prolonged, ascending or horizontal, *pure white, sessile, glabrous* except the base which is villose-tomentose, margin regular or lobed. FLESH thin, rather brittle. GILLS radiating, *narrow, crowded*, linear, thin, *much forked* or even anastomosing at base, at length creamy-yellowish. SPORES slightly longer than wide, oval, or subglobose, 6-7 x 5-6 micr., smooth. CYSTIDIA none.

Caespitously imbricated. On decayed wood of conifers. In the hemlock and pine regions of the State. August-September.

Easily confused with *Panus angustatus* and *Pleurotus albomentosus*. It differs from these in the absence of a gelatinous layer in the pileus. From *P. petaloides* it is distinguished by its white color and absence of cystidia on the gills. Its home is usually on very rotten wood of hemlock or pine. *P. nephretus* Ell. is said to be the same thing.

711. *Pleurotus septicus* Fr.

Syst. Myc., 1821.

Illustrations: Patouillard, Tab. Analyt., No. 627. Cooke, Ill., Pl. 259.

PILEUS 5-20 mm. broad, *resupinate at first*, then reflexed, convex then plane, *short-stipitate, white, pubescent, even on margin*. FLESH thin, not truly membranous. GILLS *subdistant, rather*

*broad*, radiating, white. STEM slender, short, incurved, *pubescent*, disappearing, surrounded at the base by a webby zone of filaments, white. SPORES elliptic-ovate, pointed-apiculate, 8-10 x 6 micr., white in mass. CYSTIDIA none.

On decaying wood, etc., in woods. Probably throughout the State. July-September. Infrequently found.

Often confused with *Claudopus variabilis* when the latter is young and white-gilled. It has no doubt also been mistaken for *P. candidissimus* which however is not resupinate at first and has globose spores. Probably several other small white species occur, but have not been distinguished.

\*\**Pileus fleshy, with a gelatinous layer on or just beneath the surface.*

712. *Pleurotus albolanatus* Pk., sp. nov.

Illustration: Plate CXLV of this Report.

PILEUS 5-10 cm. or more broad, *resupinate at first*, fleshy, lateral, sessile, becoming obovate, reniform or flabelliform, convex to subexpanded, trama slightly differentiated into several layers, upper part subgelatinous, surface pulverulent-tomentose, margin involute at first. FLESH rather thin, white, scissile, becoming brittle. GILLS decurrent on stem-like base, very crowded, narrow, white to yellowish, somewhat forked, thin. SPORES spherical, 4-6 micr. diam., smooth, white in mass. CYSTIDIA none.

Caespitously imbricated. On decaying logs of beech, hemlock, etc., of northern Michigan. Bay View, Marquette, Houghton. August-October. Frequent.

This species approaches *Panus angustatus*, but differs consistently in the lack of cystidia, in its larger spores, and perhaps in its resupinate pileus. No record seems to be on hand that *P. angustatus* is at first resupinate. The pileus has a gelatinous feel and is composed of several layers, but in some specimens these are hard to distinguish. Specimens referred to Peck, were labelled by him *P. porrigens* var. *albolanatus*. The spherical spores, which are constant, and the subgelatinous layer in the upper part of the pileus warrant me in using Peck's varietal name for a distinct species. Luxuriant specimens become lobed as in the related species, and measure up to 14 cm. in width. The flesh becomes brittle on drying and is rather thin throughout. The tomentosity extends usual-

ly over the whole pileus but sometimes the margin is glabrous. There are no striations. Sometimes the base arises from a white, mycelioid subiculum.

713. *Pleurotus mastrucatus* Fr.

Syst. Mycol., 1821.

Illustration: Cooke, Ill., Pl. 243.

"PILEUS 2.5-10 cm. broad, at first *resupinate* then reflexed and expanded, sessile, subdimidiate, obovate, sometimes lobed, flaccid, trama with an upper gelatinous layer, mouse-gray, rough-squamulose with blackish hairs and rigid points intermixed, margin involute at first. GILLS converging to the base of pileus, (without a rudimentary stem), broad, subdistant, whitish-gray. SPORES oblong, oblique, 8-9 x 4-5 micr., white.

"Caespitously imbricated. On logs or decaying wood. September-November."

This species has been found in surrounding States and no doubt occurs with us, though I have not found it. Reported in the Chicago Nat. Hist. Surv. Report, and in Morgan's Flora of the Miami Valley, Ohio. It is rare.

714. *Pleurotus atrocaeruleus* Fr. var. *griseus* Pk.

N. Y. Mus. Rep. 44, 1891. (Syst. Myc., 1821.)

PILEUS 2-5 cm. broad, at first *resupinate*, then reflexed and horizontal, obovate or reniform, upper layer of trama gelatinous and tough, dark grayish-brown shaded with bluish or blackish tints, coarsely villose toward the base, glabrous on margin, even or slightly wrinkled, margin often lobed. FLESH stratose, gelatinous above, composed of floccose-hyphae below, the lower layer varying in thickness, thinner in front. GILLS radiating, decurrent to the region of the attachment of pileus or to the hairy stem-like base, moderately broad, somewhat close, whitish or yellowish, edge minutely fimbriate. SPORES elliptic-oblong, narrower toward one end, 6-7.5 x 3-4 micr., smooth, white in mass. CYSTIDIA slender, acuminate and scattered on the sides of gills and then about 45 micr. long; more numerous but shorter, about 30 micr., on the edge of the gills, often capped with coarse granules.

(Dried: Pileus blackish, gills ochraceous-tan.)

Caespitose, subimbricate, on the bark of various trees, in woods, lawns, etc. On mountain ash on a lawn at Marquette. July-September. Throughout the State. Infrequent.

The plants, like the plants of the genus *Marasmius*, revive when moistened. Mounted in water under the microscope, a section through the pileus shows a gelatinous upper layer of uniform thickness, bounded by dark hyphae on both sides of this layer, the upper hyphae forming the villosity on the pileus, the lower forming an opaque line next to the white flesh beneath. In front the flesh is thinner than the pellicle, behind it is several times thicker. Whether the variety is entirely distinct from the European species, cannot be decided from data at hand. The cystidia are thick-walled, slender, penetrate deep into the subhymenium, and do not project far above the hymenium.

715. *Pleurotus applicatus* Fr.

Syst. Myc., 1821.

Illustrations: Atkinson, Mushrooms, Fig. 111, p. 109, 1900.

Hard, Mushrooms, Fig. 125, p. 162, 1908.

Cooke, Ill., Pl. 244.

Patouillard, Tab. Analyt., No. 519.

PILEUS 3-6 mm. broad, *minute*, arising from an orbicular resupinate tubercle, soon horizontal but *cupulate*, convex, submembranous, *trama mainly gelatinous*, surface pruinose to villose behind, obscurely striatulate, *dark gray to blackish*, tinged blue, sessile or with a villose, base-like tubercle. GILLS *subdistant*, relatively broad, radiating, whitish at first, soon gray or even darker than the pileus. SPORES spherical, minute, 4-5 micr. diam., smooth, white in mass. CYSTIDIA none.

Gregarious, on rotten wood, often on old stems of grape vines, in moist woods. Probably throughout the State; Ann Arbor, etc. June-September. Infrequently collected.

The dark color of this little *Pleurotus* causes it ordinarily to escape detection, but persistent examination of the lower side of moist logs or brush-heaps is likely to disclose it. It revives on moistening, and so simulates a *Panus*. It differs from *P. atropellitus* in its globose spores and gelatinous trama. A large portion of the thin pileus is composed of gelatinizing hyphae, on the top of

which are dark floccose threads which form the villose surface of a part of the pileus. The gills are subdistant with alternating shorter gills, which often develop poorly so that the main gills appear quite distant. When growing from the underside of wood the pileus is attached at its center.

\*\*\**Pileus membranous, trama homogenous, not gelatinous.*

716. *Pleurotus atropellitus* Pk.

N. Y. State Mus. Rep. 39, 1886.

PILEUS 5-15 mm. broad, small, *resupinate at first*, very thin, membranous, toughish, suborbicular, then obovate or reniform, convex to nearly plane, *villose-tomentulose*, glabrescent in front, sessile by a villose tubercle, ashy-gray to blackish, *widely-striate to subsulcate on margin* when moist. FLESH homogeneous, with dark hyphae on the surface of pileus. GILLS close to subdistant, relatively broad, short ones often narrow, concolor, radiating from the stem-like villose base. SPORES *elliptical-oval*, 7-9 x 4-5 micr., smooth, white in mass. CYSTIDIA none.

On decayed wood, low woods. New Richmond, Ann Arbor. March (21, 1909), September, etc. Infrequent.

This is similar to *P. applicatus*, but more flaccid, more definitely striate on the pileus, and with broadly elliptical spores. Our plants were paler than those described by Peck. The closeness of the gills varies in these small plants and makes a poor character to emphasize. It revives poorly when moistened as compared with *P. applicatus*. Another small species, related to these two, is *P. niger* Schw. This has subglobose spores and is plicate on the margin of the pileus. *P. striatulus* Fr. has very distant gills, subglobose spores and a pendulous, obconic, striate brown or ashy pileus. I have not found these two in the state.

*Tricholoma* Fr.

(From the Greek *thrix*, genitive *trichos*, a hair; and *loma*, a fringe, referring to the remnants of the cortina in some species.)

White-spored. Stem continuous with the pileus, *without an annulus, spongy-fleshy to fibrous*, central; partial veil in the form of a slight fibrillose or floccose cortina, or lacking. Volva none. Gills

adnate or truncate-adnexed, *becoming emarginate*. Pileus viscid or dry.

Putrescent, *terrestrial*, fleshy, firm and rather large mushrooms. A large genus, approaching Clitocybe and Pleurotus, being separated from the former by the non-decurrent gills, from the latter by the central stem. Collybia is distinguished by its cartilaginous stem, and by the absence of a cortina, and more often grows on wood or decayed leaves, etc. The trama of the gills is composed of parallel hyphae which distinguishes them from those Hygrophori which are similar in appearance. The genus corresponds to Hebeloma, Entoloma and Hypholoma of the ochre, pink and purple-spored groups. Many of them are edible, and their thick flesh furnishes considerable substance; on the other hand several species are known to be poisonous and must be avoided.

The PILEUS may be glabrous, silky or in some species scaly; viscid, dry or hygrophanous. Accordingly they are placed under *corresponding sections* of the genus. The colors are seldom bright, although several are sulfur-yellow and others purplish or lavender. Many of them are dull whitish to gray or tan, sometimes amber or blackish. The character of the *margin of the pileus* is used extensively to determine to which sub-genus they belong. It is, therefore, important to observe carefully the presence or absence of silky fibrils or flocci on the margin, as their presence indicates a slight *cortina* in the very young stage and suggests the sub-genus Cortinellus. The viscosity indicates the subgenus Limacina, although species of other sections sometimes become slightly viscid or gelatinous in very wet weather. The GILLS are used to separate this genus from Clitocybe. Theoretically, they are always *emarginate* behind, but this condition varies considerably. It is true, that in the mature plant, when the pileus is fully expanded, they become either sinuate or emarginate in most cases, although a single specimen may not always be normal in this respect. When young, however, they often do not show this character clearly, but are then adnexed, rounded-adnate, or adnate in such a way that they are merely a little less broad at the attached portion than they are a few millimeters away from the stem, and this short distance is often marked by a straight edge rather than by a rounded edge. Such a condition may be referred to as *truncately-adnate*, rather than as adnexed. In old stages the gills may even become spuriously decurrent, and their Tricholoma nature is then evident only by a slight sinuate portion near the stem, since in Clitocybe the

edge is uniformly continuous or straight. Fayod (Ann. d. Sci. Nat., 7 Ser., Vol. 9, p. 346), says that in the very young button stage they are truly decurrent but his observations were limited to few species. The *color of the gills* changes at maturity or in age in some species, and this character is used to separate the species under each section into two groups. The color changes to reddish-spotted, flesh-color, ashy or even black in age or when bruised, and hence it is often impossible to locate a species properly until it has been kept several hours after picking. In some species the gills are very narrow; in others, very broad, and this is a reliable character when well-developed plants are at hand; poorly-developed or stunted specimens often produce narrow gills in broad-gilled species. The gills of some species are easily separable from the trama of the pileus, and such species have been referred by some authors to a separate genus: Lepista. There is, however, not sufficient data at hand to know with certainty what species have this character and why, and hence in this report they are included under Tricholoma. The STEM varies from fibrous-fleshy to fibrous-spongy; more often quite firm, compact and stout. It lacks the cartilaginous rind of the stem of Collybia, although in dry weather forms a rind is sometimes simulated. *T. albiflavum* Pk. often has a distinct cartilaginous stem and is grouped under Collybia. There is no annulus, the cortina being evanescent when present at all, or in a few extreme cases leaving only slight fibrillose remnants on its surface, as in *T. vaccinum* Fr. and *T. imbricatum* Fr. It is nearly always dry, and scarcely ever sharply bulbous. The SPORES are white except in a small aberrant group including *T. personatum*, *T. nudum* and *T. panoeolum*, where they are tinged pale dingy-flesh color in mass. They vary from elliptical to oval or spherical, and are usually medium to small or minute in size. The epispore is rarely rough, e. g., in some of the species under the subgenus Melanoleuca. CYSTIDIA are lacking in this genus; *sterile cells* are seldom present on the edge of the gills; they have been noted in *T. rutilans* and *T. acre*. The ODOR is quite characteristic of many species; many have a farinaceous odor, while some are distinguishable by a heavy disagreeable odor. When it is not otherwise noticeable, the odor may often be obtained by crushing a piece of the cap between the fingers. The TASTE varies also. In those species with the farinaceous odor, there is a corresponding taste. Some species have an acrid taste. The Tricholomas usually have a *terrestrial habitat*. They are most

common in open woods, mossy places and thick forests. Some grow in meadows or grassy places, but these are rare in the vicinity of Ann Arbor. *T. rutilans* grows on wood, and *T. ustale* is partial to the remains of very rotten logs, etc. Their EDIBILITY varies. Some of them, like *T. resplendens* and *T. personatum* are among our very best mushrooms for the table. Others like *T. equestre*, *T. transmucans*, *T. sejunctum* and *T. terreum* are fairly good when properly cooked. Some, such as *T. laterarium*, are very bitter, or have various kinds of disagreeable flavors which, however, almost disappear in cooking. In serving those mushrooms of disagreeable flavor it is safer to discard the liquid in which they were prepared, as this contains the objectionable constituents. In several species, of which *T. sulfureum* is an example, the disagreeable flavor cannot be removed, and such should not be eaten. In all cases, except those species which are well-known, it is necessary to exercise extreme caution, since the genus includes several *poisonous* species. *T. venenatum* for example, has a mild taste and odor, and is yet known to cause severe sickness. Many of those with a farinaceous taste and odor, on the other hand, are known to be edible. One must therefore be able to discriminate in order to be on the safe side.

The grouping of this large genus is fraught with considerable difficulties. The separate species are often closely related, and some of them approach other genera in such a way as to cause disagreement among authors as to their generic position. I have attempted an arrangement along conservative lines until our data are more complete. The species included in this report do not, I am sure, represent more than half the species occurring within the State. It has been impossible to make a search for *Tricholomas* in the northern part of the State in the late fall, so that doubtless that region is poorly represented. Hence, also, it was impossible to study the genus in such a way as to form a definite opinion as to the value of various arrangements which have been proposed. Some have segregated it into four or more genera. Others have separated those species with rough spores under the genus *Melanoleuca*, while still others have placed those species in which the gills separate easily from the trama of the pileus under *Lepista* Fr. The most natural arrangement with the data at hand, seems to be a division into subgenera, based on (1) the viscid pileus: *Limacina*; (2) the dry pileus, with a fibrillose cortina when young: *Cortinellus*; and (3) the moist or hygrophaneous pileus: *Melano-*

leuca. I am inclined also to consider those with separable gills as a distinct subgenus, but have avoided that arrangement in this report for lack of data.

The key to the species includes a number which have not yet been found in Michigan but which occur in neighboring States.

#### Key to the Species

- (A) Pileus viscid, medium to large. [See also (AA) and (AAA).]
  - (a) Pileus pure white. 721. *T. resplendens* Fr.
  - (aa) Pileus not pure white.
    - (b) Gills sulfur-yellow; pileus not virgate. 717. *T. equestre* Fr.
    - (bb) Gills not sulfur-yellow.
      - (c) Gills becoming discolored in age, often spotted with brownish-red.
        - (d) Flesh and gills yellowish; stem at first viscid; pileus brown. *T. flavobrunneum* Fr.
        - (dd) Flesh and gills white at first.
          - (e) Pileus pale pink to rosy-red, margin at first involute. (See 163. *Hygrophorus russula* Fr.)
          - (ee) Pileus reddish-brown to bay-brown.
            - (f) Odor distinctly farinaceous when flesh is crushed; taste of surface of pileus bitter. 722. *T. transmucans* Pk.
            - (ff) Odor not farinaceous; stem mostly rooting. 723. *T. ustale* Fr.
  - (cc) Gills not discolored, not rufescent.
    - (d) Pileus streaked with innate blackish fibrils.
      - (e) Taste bitterish or nauseous; pileus whitish to yellowish. 718. *T. sejunctum* Fr.
      - (ee) Taste mild; pileus gray, smoky, lurid. 719. *T. portentosum* Fr.
    - (dd) Pileus not streaked.
      - (e) Stem floccose-fibrillose; pileus alutaceous. 720. *T. ter-riferum* Pk.
      - (ee) Stem glabrous.
        - (f) Pileus slightly viscid, greenish-yellow; stem white. *T. intermedium* Pk.
        - (ff) Pileus glutinous, yellow-tawny, disk reddish-brown; base of stem brown. *T. viscosum* Pk.
- (AA) Pileus hygrophaneous (water-soaked plants of the (AAA) group sometimes have an hygrophaneous appearance).
  - (a) Stem sulcate or coarsely striate; pileus reddish or reddish-fawn color (moist), 5-10 cm. broad. *T. grammopodium* Fr.
  - (aa) Stem not sulcate; pileus usually less than 6 cm. broad.
    - (b) Gills violaceous (young), then smoky; often in greenhouses, gardens, etc. 754. *T. sordidum* Fr.
    - (bb) Gills not at first violaceous.
      - (c) Pileus 1-3 cm. broad, stem hollow.
        - (d) Pileus olive-gray (moist); odor of rancid meal. *T. putidum* Fr.
        - (dd) Pileus watery-brown (moist); odor farinaceous. *T. rimosum* Pk.
      - (cc) Pileus 3-7 cm. broad.
        - (d) Odor strongly farinaceous; pileus grayish-brown or brown (moist); gills whitish. 753. *T. leucocephaloides* Pk.
        - (dd) Odor not farinaceous.
          - (e) Stem brown within and without, short; pileus ashy, grayish-brown, darker on disk. *T. brevipes* Fr.
          - (ee) Stem whitish within; in fields, gardens, open ground, etc.

- (f) Stem streaked with blackish fibrils, elastic; pileus smoky-brown. 752. *T. melaleucum* Fr.
- (ff) Stem covered with a cinereous pulverulence, soft; pileus gray. *T. humile* Fr.
- (AAA) Pileus neither viscid nor hygrophanous.
- (a) Pileus white or whitish at first, disk often with tints of other colors.
- (b) Taste acrid, bitter or unpleasant (often tardily).
- (c) Gills becoming dingy flesh color. 751. *T. panocolum* var. *caespitosum* Bres.
- (cc) Gills white or whitish, not becoming dingy incarnate in age.
- (d) Stem stuffed or hollow; pileus with grayish-brown disk; taste and odor strong, unpleasant. *T. terreolens* Pk.
- (dd) Stem solid.
- (e) Gills broad; pileus minutely scaly; taste slowly acrid or unpleasant.
- (f) Pileus with ochraceous, drop-like scales on disk. 726. *T. nobile* Pk. (*T. serratifolium* Pk.) (See also *T. venenatum* Atk.)
- (ee) Gills not broad; pileus glabrous.
- (f) Taste very bitter; gills narrow and crowded. 743. *T. acerbum* Fr.
- (ff) Taste tardily acrid; gills medium broad and close. 742. *T. album* Fr.
- (bb) Taste mild or farinaceous.
- (c) Stems connately joined at base or several growing from a thick fleshy mass.
- (d) Pileus mottled with reddish scaly spots. *T. albellum* Fr.
- (dd) Pileus mottled with watery spots. 741. *T. unifactum* Pk. var.
- (cc) Stems simple or subcaespitose.
- (d) Pileus small; gills broad; stem solid; taste farinaceous. *T. silvaticum* Pk.
- (dd) Pileus usually more than 2-3 cm. broad.
- (e) Odor and taste farinaceous.
- (f) Pileus large, 8-12 cm., scaly with brownish scales; spores 9-11 x 6 micr. *T. grande* Pk.
- (ff) Pileus 3-6 cm., glabrous; spores 6-8 x 3-4 micr. 745. *T. leucocephalum* Fr.
- (ee) Odor and taste mild.
- (f) Stem rooting and tomentose at base. *T. lascivum* Fr.
- (ff) Stem not rooting. (*Clitocybe candida* Bres. may be sought here.)
- (g) Margin of pileus with short, radiating ridges; gills narrow and crowded. 744. *T. laterarium* Pk.
- (gg) Margin even.
- (h) Gills rather broad.
- (i) Plant pure shining white, but without a separate pellicle. 727. *T. columbetta* Fr.
- (ii) Plant dingy whitish, pileus fibrillose-scaly. 725. *T. venenata* Atk.
- (iii) Plant whitish, caespitose. (See 774. *Clitocybe multiceps*.)
- (hh) Gills narrow and crowded, pileus not pure white; stem striate. (See 813. *Collybia albiflavum* Pk.)
- (aa) Pileus yellow, yellowish or smoky-yellowish. [See also (aaa).]
- (b) Growing on wood; edge of gills flocculose.
- (c) Pileus yellow beneath the dark reddish scales. 724. *T. rutilans* Fr.
- (cc) Pileus pale yellow, slightly silky. *T. flavescens* Pk.
- (bb) Growing on the ground.
- (c) Odor strong of coal tar, etc., disagreeable or farinaceous.

- (d) Plant sulfur-yellow to olivaceous-yellow; odor disagreeable, strong. 737. *T. sulfureum* Fr.
- (dd) Plant pale yellow or smoky-yellow.
- (e) Stem solid; gills yellowish, taste farinaceous. 738. *T. chrysenteroides* Pk.
- (ee) Stem stuffed or hollow; gills rather broad.
- (f) Pileus smoky-yellowish; taste and odor farinaceous; gills white. 746. *T. fumosiluteum* Pk.
- (ff) Pileus pale yellow; gills whitish tinged pink; odor rather strong. 739. *T. odorum* Pk.
- (cc) Odor none or slight.
- (d) Pileus large, 4-10 cm.
- (e) Pileus very fragile, bright yellow, variegated with other hues; gills broad, white. *T. davisiae* Pk.
- (ee) Pileus firm, yellow, umbonate; gills white; stem solid, white within; spores globose. *T. subluteum* Pk.
- (dd) Pileus small, 1-3 cm., dull saffron; gills yellow. *T. fallax* Pk. (See also *T. cerinum* Fr.)
- (aaa) Pileus neither white, whitish, yellow nor yellowish.
- (b) Pileus violet, lilac or purplish.
- (c) Pileus 6-12 cm. broad; stem stout, lavender or lilac; common. 747. *T. personatum* Fr.
- (cc) Pileus smaller; stem more slender.
- (d) Pileus at first conic-campanulate and flocculose on the margin; gills whitish. *T. ionides* Fr.
- (dd) Pileus at first convex and naked on margin, gills bluish to lavender. 748. *T. nudum* Fr.
- (bb) Pileus not violet, lilac or purplish.
- (c) On wood or rotten logs.
- (d) Pileus covered with dense, minute, blackish or brownish scales; flesh yellow. (See 760. *Clitocybe decora* Fr.)
- (dd) Pileus covered with reddish tomentum or scales, flesh yellow. 724. *T. rutilans* Fr.
- (cc) On the ground.
- (d) Pileus cinereous, grayish-brown, smoky or blackish. [See (dd).]
- (e) Gills becoming blackish or bluish-black when bruised. Pileus 2-7 cm. broad.
- (f) Gills narrow, crowded. 733. *T. fumescens* Pk.
- (ff) Gills moderately broad, close to subdistant. 734. *T. fuliginum* Pk.
- (ee) Gills not becoming black when bruised; some changing to ashy, yellowish or flesh color in age.
- (f) Taste acrid, peppery or disagreeable.
- (g) Stem rooting; gills white; pileus grayish-brown, taste disagreeable. *T. radicum* Pk.
- (gg) Stem not markedly rooting.
- (h) Pileus virgate with gray or blackish fibrils.
- (i) Pileus acutely and prominently umbonate; gills and stem white. *T. subacutum* Pk. (cf. *T. virgatum* Fr.)
- (ii) Pileus obtuse; gills at length pale cinerascens. 731. *T. acre* Pk.
- (hh) Pileus not virgate.
- (i) Pileus buff, grayish-brown or dingy-tan, large, caespitose; gills crowded, narrow, soon flesh color. 571. *T. panocolum* var. *caespitosum* Bres.
- (ii) Not caespitose; pileus livid-brown; flesh of stem becoming reddish. 735. *T. saponaceum* Fr.
- (ff) Taste mild or farinaceous.
- (g) Very large; pileus 10-20 cm. broad, grayish-tawny; stem rooting. *T. grave* Pk.

- (gg) Moderate size.
- (h) Pileus 2-6 cm. broad, innately fibrillose or fibrillose-scaly. 732. *T. terreum* Fr.
- (hh) Pileus 5-10 cm. broad.
- (i) Pileus smoky-umber to blackish; gills broad, cinerascens. 736. *T. laticeps* sp. nov.
- (ii) Pileus grayish or grayish-brown.
- (k) Gills broad, subdistant.
- (l) Streaked with darker fibrils; gills white. (See 816. *Collybia platyphylla* Fr.)
- (ll) Pileus usually water-spotted not streaked; gills slightly cinerascens; autumnal. 749. *T. tumidum* Fr.
- (kk) Gills close or crowded.
- (l) Gills easily separable from flesh of pileus, becoming dingy-yellowish in age; stem stuffed. 751. *T. cinerascens* Fr.
- (ll) Gills not separable, veined on the sides. *T. patulum* Fr.
- (dd) Pileus reddish, tawny, tan, fuscous-livid, etc.
- (e) Growing on wood; pileus and stem covered with tawny, tomentose scales. *T. decorosum* Pk.
- (ee) Not on wood.
- (f) Flesh of pileus or stem changing to reddish when bruised or in age; pileus red-brown.
- (g) Stem hollow. 729. *T. vaccinum* Fr.
- (gg) Stem solid. 728. *T. imbricatum* Fr.
- (ff) Flesh not turning reddish.
- (g) Becoming ferruginous-stained when handled; pileus whitish to brownish. *T. submaculatum* Pk.
- (gg) Not becoming rusty-stained.
- (h) In pastures, etc., in the spring; pileus pale tan, watery-spotted; odor farinaceous. *T. gambosum* Fr.
- (hh) In the woods.
- (i) Pileus pale alutaceous to russet; gills pale yellow; stem white. 730. *T. tricolor* Pk.
- (ii) Pileus flesh color, 1-2 cm. broad. 740. *T. carneum* Fr.

**SUBGENUS I. LIMACINA.** Pileus provided with a gelatinous pellicle, viscid, not hygrophanous. Cortina none.

\*Gills not at length brown or rufescent-spotted.

717. *Tricholoma equestre* Fr. (EDIBLE)

Epicrisis, 1836.

Illustrations: Cooke, Ill., Pl. 72.

Berkeley, Outlines, Pl. 4, Fig. 2.

Gillet, Champignons de France, Pl. 672.

Ricken, Blätterpilze, Pl. 90, Fig. 3.

PILEUS 5-10 cm. broad, compact, convex-expanded, obtuse, pale

yellow, variegated with reddish or smoky-reddish especially on disk, viscid, somewhat scaly on broad disk, not virgate, margin even and naked. FLESH white or tinged yellow under cuticle, thin on margin. GILLS slightly adnexed or nearly free, rounded-truncate behind, sulfur-yellow, close, rather broad, ventricose, edge entire or suberoded. STEM stout, 3-6 cm. long, 1-2 cm. thick, equal or sub-bulbous, solid rarely cavernous, pale yellow or white, white within, even, minutely scaly or glabrescent. SPORES elliptical-oval, 6-7 x 4 micr., smooth, white. CYSTIDIA and sterile cells none. ODOR slight or none; TASTE subfarinaceous, tardily disagreeable.

Gregarious or subcaespitose. On the ground among or under leaves in conifer and frondose woods. Ann Arbor, Detroit, Jackson, Houghton, Marquette. August-October. (Earliest record July 28.) Infrequent.

This is usually a large and noble species, but late in the fall it is often found with smaller dimensions. The color of the stem is pale yellow or even white, but in Europe it is said to be sulfur-yellow, as is also the flesh. The scales on the pileus are not always developed. The margin of the cap is at first incurved and irregularly wavy. It differs from *T. sejunctum* by lacking the radiating sooty lines which characterize the pileus of that species, and by its yellow gills. It is found sparingly, and rather late in the fall. When covered with leaves the yellow color of the cap is more highly developed.

718. *Tricholoma sejunctum* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Atkinson, Mushrooms, Fig. 89, p. 88, 1900.

Hard, Mushrooms, Fig. 60, p. 82, 1908.

Cooke, Ill., Pl. 53.

Gillet, Champignons de France, No. 700.

Fries, Icones, Pl. 23 (luxuriant form).

Ricken, Blätterpilze, Pl. 89, Fig. 2.

PILEUS 4-8 cm. broad, convex-expanded, obtuse or umbonate, subviscid, whitish to yellowish, streaked with innate blackish fibrils, often gibbous or irregular. FLESH white or slightly yellowish, fragile. GILLS emarginate, white, usually broad, subdistant to close, edge entire. STEM elongated, 5-8 cm. long, 1-1.5 cm. thick, subequal or variously thickened and flexuous, solid, some-

times cavernous, subglabrous, even, white or tinged yellowish. SPORES oval to subspherical, 6-7 x 4-5.5 micr., white. CYSTIDIA none. ODOR slight; TASTE bitterish to nauseous.

Gregarious or subcaespitose. On the ground in oak and maple woods. Ann Arbor, New Richmond. September-November.

Frequent around Ann Arbor in the late fall. Usually this species is more slender than *T. equestre*. Its virgate pileus and white gills distinguish it from that species. The color is quite variable; sometimes the pileus is a dull white with a few yellow stains, while the other extreme, with the pileus almost entirely smoky-brown or blackish on disk, is equally common. The disk of the pileus sometimes develops blackish fibrillose scales while normally it is glabrous. In any case there is usually some sign of the streaked condition. Specimens have been found in which slight yellowish stains appeared on the edge of the gills in the older specimens, but these could not be referred to *T. coryphaeum* Fr. which species is said to have yellow-edged gills. Peck remarks that the taste is scarcely bitter. In our plants a bitterish-nauseous taste was nearly always present. *Tricholoma intermedium* Pk. is said to be halfway between *T. equestre* and *T. sejunctum*, and is distinguished by its crowded gills. It should be considered as a variety, since it is doubtless an example of the extreme variation of *T. sejunctum*.

719. *Tricholoma portentosum* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Hard, Mushrooms, Fig. 63, p. 87, 1908.

Michael, Führer f. Pilzfreunde, Vol. II, No. 93.

Peck, N. Y. State Mus. Mem. 4, Pl. 45, Figs. 1-5, 1900  
(var. *centrale* Pk.)

Cooke, Ill., Pl. 54.

Gillet, Champignons de France, Pl. 692.

Fries, Icones, Pl. 24.

Ricken, Blätterpilze, Pl. 89, Fig. 3.

"PILEUS 6-12 cm. broad, convex-expanded, subumbonate, sometimes irregular and repand, *viscid*, even, glabrous, generally *fuliginous*, sometimes violet-tinged, *lurid*, virgate with innate black fibrils, margin always naked and thin. FLESH white, obsoletely lutescent, fragile. GILLS rounded behind, slightly adnexed, *broad* (up to 2 cm.), *distant* when mature, whitish at first, *finally yellow-*

*ish or grayish-tinged*. STEM 6-8 cm. long, 1-2 cm. thick, *stout*, firm, solid, subequal, *innately fibrillose-striate*, *whitish*. SPORES 6-7 x 3-4 micr., elliptical. ODOR none; TASTE *mild*."

Said to occur in conifer woods. Perhaps in the northern part of the State.

It has not been found with certainty in America, but is reported by some American authors. The figures of European authors vary considerably as to color of cap. Schroeter says it is gray or rusty-brown; Gillet figures it pale gray with black lines radiating from center. In Michael and Fries' Icones, the gray color is mixed with a dark lurid hue. It is in the sense of the last author that the description taken from the Icones applies. The spore measurement is Schroeter's; the English authors give smaller measurements. According to Fries' Icones, and others (see Louis Maire, Bull. d. 1. Soc. Myc. France, Vol. 26, p. 251) the lack of odor and taste separate it from *T. sejunctum*.

Var. *centrale* Pk. is said to have the sooty-brown color on disk only; elsewhere it is yellow or greenish-yellow. The gills are moderately broad and close, white or yellowish. The flesh is white and the taste is mild. Spores 7.5 x 5 micr. It has not been identified within our territory.

720. *Tricholoma terriferum* Pk.

N. Y. State Rep. 41, 1888.

PILEUS 6-12 cm. broad, convex-plane, irregular or wavy on margin, glabrous, *viscid*, *alutaceous*, even, margin at first incurved. FLESH white, thick on disk, thin on margin. GILLS adnexed, emarginate, *crowded*, thin, narrow, whitish, *not becoming rufescent*. STEM 2-3 cm. long, 1-2 cm. thick, equal or subequal, solid, *floccose-scaly at apex*, floccose-fibrillose elsewhere, white. SPORES *minute*, subglobose, 3 x 2 micr., white. CYSTIDIA none. BASIDIA 20-24 x 4-5 micr., 2 to 3-spored. TASTE and ODOR not marked.

Solitary or gregarious. Frondose woods. Detroit. October. Apparently rare.

Our specimens had a subhygrophanous character and the flesh was scissile. The minute spores separate it from related species. More data are needed to place this species on a firm footing.

721. *Tricholoma resplendens* Fr. (EDIBLE)

Hymen. Europ., 1874.

Illustrations: Fries, Icones, Pl. 29.

Hard, Mushrooms, Fig. 504, p. 600, 1908.

Cooke, Ill., Pl. 55.

Gillet, Champignons de France, 695.

PILEUS 4-10 cm. broad, convex-plane, *viscid*, glabrous, *white*, *shining* when dry, even, margin naked and at first straight. FLESH white, rather soft, thin on margin. GILLS narrowly adnexed, emarginate, *close*, medium broad, ventricose, scarcely thickish, white, sometimes intervenose, edge entire. STEM 4-8 cm. long, 7-15 mm. thick, subequal or tapering downward, often subbulbous at base, *solid*, rarely with tubule or cavernous, glabrous, *dry*, even, white. SPORES 6-7.5 x 4 micr., short elliptical, smooth, white. CYSTIDIA and *sterile cells* none. ODOR and TASTE mild.

Gregarious or scattered. On the ground, in conifer or frondose woods. September-November (earliest record August 9). Marquette, Bay View, New Richmond, Detroit. Common in the vicinity of Ann Arbor.

The viscid pileus distinguishes this from other white *Tricholomas* of this size which have a mild taste and odor. Slender forms imitate *Hygrophorus eberneus*, but that has a glutinous or viscid stem. Stout forms approach *Hygrophorus sordidus* Pk. which, however, has more distant gills, a stouter stem and waxy decurrent gills. When dry, it imitates *Tricholoma columbetta*, but the pileus of the latter is said to become silky-fibrillose and the margin is at first involute and subsquamulose. The pileus is sometimes yellowish or hyaline-spotted on the disk. The stem tends to be variously curved toward base. The plant varies considerably and several forms have been found. (A) Pileus conical-ovate when young, then expanded and subacutely umbonate; stem fibrillose striate. Entirely white. In woods of white pine, beech, etc., at New Richmond. (B) Stem blue-spotted toward base, with a narrow tubule. Entirely white elsewhere, stature smaller than type. After frosts in the late fall. In oak, etc., woods, at Ann Arbor. This would seem to correspond to the blue-spotted form of *T. columbetta* mentioned by various authors; in our plant the pileus was distinctly viscid, and the stem dry. They grew under the fallen leaves during November. The spores of both these forms were typical.

\*\*Gills becoming rufescent or reddish-spotted in age.

722. *Tricholoma transmutans* Pk. (EDIBLE)

N. Y. State Mus. Rep. 29, 1878.

Illustrations: Peck, N. Y. State Mus. Rep. 48, Pl. 21, Fig. 1-5, 1896.

PILEUS 4-10 cm. broad, convex-expanded, obtuse, *surface of pellicle bitter*, brownish, *reddish-brown* or tawny-red, *viscid*, glabrous or nearly so. FLESH white, rufescent in age, thin on margin. GILLS adnexed, emarginate, narrow, close, whitish or pale-yellowish, *at length rufescent or reddish-spotted*, finally sordid-blackish. STEM 6-8 cm. long, 6-12 mm. thick, equal or subequal, dry, glabrous or subfibrillose, *whitish or rufescent*, *solid*, sometimes cavernous above. SPORES oval-globose, 5 x 4 micr., sometimes nucleate. CYSTIDIA none. ODOR and TASTE of flesh distinctly *farinaceous*, pellicle of cap bitter.

Gregarious, scattered or subcaespitose. On the ground in frondose woods, sometimes *forming mycorrhiza on the roots of the black oak*. Ann Arbor, Jackson, Detroit, New Richmond. September-October (earliest record August 9). Common in southern Michigan.

It is related to the European species *T. flavobrunneum* Fr. and *T. frumentaceum* Fr. which possess a farinaceous odor. The former has a viscid stem at first and the flesh is usually yellow. As to *T. frumentaceum*, there seems to be some uncertainty. The English authors say the spores are elliptical, and Cooke figures it as an *Entoloma* (Ill., Plate 470). That cannot be our plant. On the other hand, continental authors are silent as to the size of spores, although Barla mentions a variety with spherical spores. The stem of *T. transmutans* is usually solid, but often tunnelled by grubs in warm weather. When growing in the open, in pastures, etc., it is usually tufted and the pileus is irregular. It is said to be excellent eating.

723. *Tricholoma ustale* Fr.

Syst. Myc., 1821.

Illustrations: Fries, Icones, Pl. 26.

Cooke, Ill., Pl. 88.

Michael, Führer f. Pilzfreunde, Vol. III, No. 115.

Ricken, Blätterpilze, Pl. 88, Fig. 3 (represents form B.).

Plate CXLVI of this Report.

PILEUS 4-10 cm., broadly convex, obtuse or subumbonate, subgibbous, reddish-bay to dark chestnut, sometimes paler, viscid, naked, even, not virgate nor scaly, margin persistently incurved. FLESH white, thickish, firm, rufescent. GILLS adnate-seceding or emarginate, moderately broad, crowded, pure white at first then rufescent or reddish-brown when bruised, edge eroded. STEM 5-8 cm. long, 8-15 mm. thick, subequal or irregularly compressed, often rooting, stuffed, sometimes hollow, white, becoming reddish downwards, floccose-pruinose, sometimes twisted. SPORES elliptical-ovate, 6-8 x 4-5 micr., white. CYSTIDIA and sterile cells none. ODOR none; TASTE bitter.

Solitary or subcaespitose. On very decayed wood or leaf-debris in conifer or frondose woods. Ann Arbor, New Richmond. September-October. Rare.

This is allied to the European species *T. flavobrunneum* and *T. pessundatum* which are said to possess a distinct farinaceous odor, while in *T. ustale* this odor is lacking. From *T. transmutans* it is separable by the spores and the rooting stem. Two forms—already mentioned by Fries (Icones)—have been found in the State. (A) Large, with the base of the stem ending in a root-like prolongation which is 2-5 cm. long, and occurs in conifer woods (white pine). (B) Smaller, with a narrowed, short subrooting base, growing in frondose woods. Form (A) is illustrated by Plate CXLVI, and is rather well represented by Cooke's figure of *T. flavobrunneum* (Ill., Plate 58), which may be the same plant. There was no yellow present in our specimens.

**SUBGENUS II. CORTINELLUS.** Pileus dry, not absorbing water, nor hygrophanous; silky, fibrillose or somewhat scaly, sometimes subglabrous. Margin of pileus slightly fibrillose or floccose with remains of an evanescent cortina, except in species of "Rigida." Cortinellus has been raised to the rank of an independent genus

by some authors, e. g. Roze, (Bull. de la Soc. bot. de France, 1876), Schroeter, (Die Pilze Schlesiens, Vol. 1, 1885), and Earle, (Bull. N. Y. Bot. Garden, Vol. V., 1908). The first two authors include only species whose cortina is sufficiently developed to leave a slight ring on the stem. Earle extended it as above. It seems better to keep the species which belong here subordinate on account of their close relation to the genus *Tricholoma* as a whole. Some of its species need further study to determine their exact position. The following sections are taken in the sense of Fries.

*Section I. Genuina.* Pellicle of pileus torn into fibrillose or floccose scales, its margin at first involute.

\*Gills not becoming rufescent, cinereous nor blackish.

724. *Tricholoma rutilans* Fr.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 89.

Gillet, Champignons de France, No. 697.

Michael, Führer f. Pilzfreunde, Vol. I, No. 54.

Ricken, Blätterpilze, Pl. 91, Fig. 1.

PILEUS 4-8 cm. broad, campanulate-expanded, dry, at first covered with a purplish-red tomentum, soon tomentose-scaly with dark reddish scales on the yellowish surface beneath, margin at first involute. FLESH yellow, moderately thick. GILLS rounded-adnate then emarginate, crowded, rather narrow, yellow or golden-yellow, thickish, edge flocculose. STEM 5-10 cm. long, curved, equal, stuffed then hollow, yellow or yellowish within and without or variegated with minute reddish tomentose scales, even. SPORES oblong, 6-7 x 3-4 micr., white. CYSTIDIA none; sterile cells on edge of gills numerous, large, clavate-inflated, narrowed toward base, 65-100 micr. long, 15-20 micr. thick above. ODOR and TASTE mild.

Solitary or caespitose on decaying wood of pine, balsam and hemlock. Isle Royale, Bay View, Houghton, New Richmond. July-October. Infrequent.

This is one of the few species of *Tricholoma* inhabiting wood. It also departs from the other *Tricholomas* in having well-developed sterile cells on the edge of the gills, a modification which

causes the fine floccosity and is sometimes abnormally developed. The fine tomentum of the pileus is seen under the microscope to be composed of long, intertwined fibrils filled with reddish-yellow substance. This covering of pileus and stem in well-developed specimens is quite marked and represents a sort of universal veil. This species must not be confused with *Clitocybe decora* Fr., in which the gills do not become emarginate, and the scales are blackish-brown and fibrillose.

Var. *variegatus* (*T. variegatus* Fr.). Differs in smaller size, gills white or whitish, scarcely tinged yellowish, and without sterile cells. Flesh white or yellowish-white. New Richmond. Infrequent. In both the color varies somewhat, and the reddish scales are sometimes practically lacking on the stem.

725. *Tricholoma venenata* Atk. (POISONOUS)

Botanical Gazette, Vol. 46, 1908.

"PILEUS 4-7 cm. broad, convex-expanded, subumbonate, center fleshy, moist, not viscid, *pale buff to clay-color*, minutely scaly with fibrous scales, with a subtomentose area over the center, the scales possessing the darker color, under the lens some of them appear nearly black. FLESH white with a dull clay-colored tinge and stain. GILLS adnexed, broadly sinuate, subdistant, whitish, thin, *dull clay color where bruised*. STEM subbulbous, with a bulb like that of *Lepiota lenticularis* (see *L. fisheri*), fibrous-striate, solid, sordid white, becoming *dull-clay color* in age or when handled. SPORES oval to broadly elliptical, smooth, 5-7 x 3.5-5 micr., white. CYSTIDIA none. ODOR and TASTE mild."

Gregarious. On the ground in frondose woods. Rochester, Oakland County. September.

This *poisonous* *Tricholoma* caused severe illness of a family at Rochester, Michigan, who were advised that it was harmless because of its mild taste and odor. The species was not known to the persons to whom it was referred but it was thought to be a *Tricholoma* and hence, since mushroom amateurs usually think that the species of that genus when mild are perfectly safe, they felt safe in its use. It is only another case in favor of the argument that it is necessary to know mushrooms by their specific distinctions, and to use only those whose identity is known to the user. Better learn a few species well than take chances. The description is adapted from that of Atkinson,

and was made from some of the specimens growing in the same place as those which caused the sickness. It does not have very striking characteristics, but can be distinguished by the tendency of the plant to assume an ochraceous or dull clay color in age or when bruised. Specimens which were doubtless the same species were collected at Ann Arbor, September, 1907, and August, 1909, and were at first thought to be *T. nobilis*; the spores, however, were found to be elliptical and the plants could not be placed until after the publication of Atkinson's species. The spores of our plants were up to 8.5 micr. long, the gills rather broad, and the pileus covered with delicate ochraceous, fibrillose scales except toward the margin which was silky-fibrillose to silky-tomentose. There was no odor at first, but a slight, disagreeable odor developed. The species seems closely related to the following, and apparently imitates it in its general appearance. Hence both species should be let alone.

726. *Tricholoma nobile* Pk. (SUSPECTED)

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

Illustration: Plate CXLVII of this Report.

PILEUS 5-10 cm. broad, convex-expanded, subplane, obtuse, dry, whitish, *dotted by minute, drop-like grayish-ochraceous scales*, at least on disk, even, margin irregularly-wavy at maturity. FLESH pure white, thick on disk, brittle, thin on margin. GILLS truncate-adnate, varying emarginate-adnexed to spuriously decurrent, *broad*, close to subdistant, white becoming dingy yellowish in age, edge entire. STEM 4-7 cm. long, 8-16 mm. thick, *stout*, equal, sometimes slightly tapering downward, *solid*, subglabrous, innately fibrillose-striate, white becoming dingy in age. SPORES minute, spherical, smooth, subnucleate, 5-6 micr., white. CYSTIDIA and *sterile cells* none. BASIDIA 35 x 5-6 micr. ODOR slight or lacking; TASTE at first slight, slowly *unpleasant or burning*.

Gregarious. On the ground, on a lawn which was recently a grove. Ann Arbor. October. Infrequent.

This species has superficial resemblances to *T. album*, both in stature and color, but differs in its slightly scaly cap and in spores. In moist weather the pileus appears watery-stained and this indicates an affinity to the section *Guttata*, but the presence of scales on the pileus and its rather dry flesh point to the position here