

RUSSULA COMPHIDIUS LEPIOTA
AND
FUNGOUS FLORA OF MT. HOOD
AND HIGHER ROCKIES

C.H. KAUFFMAN

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RUSSULA Fr.

BY C. H. KAUFFMAN

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RUSSULA Fr.

(From the Latin, *russula*, reddish.)

Veil none; the trama composed of *vesiculose* tissue, *without a milky juice*; gills rigid, fragile, acute on edge; stem central, confluent with the pileus; spores globose or subglobose, usually echinulate or verrucose, white cream-color, yellow or ochraceous.

Fleshy, putrescent, rigid-brittle mushrooms, mostly terrestrial, a few on much decayed wood, on sphagnum or on other mosses. A very distinct genus, most closely related to *Lactarius*, from which it differs by its lack of a milky juice. *Hygrophorus* differs in the thicker and more waxy nature of the gills although here there are evident certain signs of relationship with species of *Russula*. Almost all of the species are *edible* after careful cooking since even the peppery forms then lose their sharp taste; in any case the mild species are perfectly safe when fresh, young and clean.

The PILEUS may be red, purple, violet, bluish, yellow, green or white, except in the *Compactae*, a differentiated pellicle is present on the surface of the cap. This pellicle is often composed of more or less gelatinous hyphae and becomes viscid in wet weather, or it may remain dry and become pruinose or velvety. The pellicle is somewhat separable along the margin of the pileus and in many of the *Fragiles* can be peeled easily on the whole surface. The margin of the pileus is often striate at least in age. In the species with a thin cap, the lines of attachment of the gills to the cap show through as raised ridges which are often tuberculate because of the presence of the interspatial veins beneath and these striae may extend far toward the center of the pileus. In the species with firm and thick caps, the striations are not as marked or are obscurely developed on the margin only when the plant becomes old. Still, this character is so variable that it must be used with caution as a diagnostic character. The surface is usually glabrous or merely pruinose to velvety; the latter appearance is due to cystidia-like erect hyphae closely covering the pellicle. The GILLS of the differ-

ent species are of all shades between shining white and egg-yellow, and this fact alone separates them from any one of the spore-color groups of the Agaricaceae. Some authors consider the forking of the gills as well as the veining in the interspaces of the gills important diagnostic characters. These two characters are intimately related and forking is for the most part merely a pronounced development of veining. In fact such a large number of species have been observed with veined interspaces and some forked gills that this character loses most of its value. In *R. variata* the forking is dichotomous or mostly so and reaches its highest development. The different lengths of the gills are, on the contrary, much more important characteristics. They may be alternately long and short as in the Compactae, or they may be all of one length with rarely any secondary or shorter gills. Intermediate cases occur in the Subrigidae, but even here the short gills are not numerous. Their shape and width are also of value, since the anterior and posterior ends have a characteristic width which accompanies other characters of the given subgenera. The STEM is usually white, sometimes red or slightly ochraceous, in some species changing to ashy, etc., with age. The reticulations on the surface are obscure and of no diagnostic value. It is usually spongy-stuffed within and may become cavernous in age or hollowed by grubs; in the Compactae, however, it is usually solid. The TRAMA is composed of large bladder-like cells arranged in groups and surrounded by strands of slender hyphae, as in *Lactarius*. Such a structure is said to be *vesiculose* and accounts for the more or less brittle consistency of the plants. Since the difference in this consistency is accompanied by other good characters, it is made the basis of a division of the genus into its subgenera. The TASTE as in the *Lactarius*, is sharply acrid in some species, slowly or slightly acrid in others, and entirely mild in a considerable number. This is an important character for the identification of the species and is fairly constant. It is necessary to have fresh plants to be sure in some cases that the acidity is present. Sometimes plants which are apparently mild will be found to have a slight acidity only when very young, or only in the gills and not elsewhere. The ODOR of some species, e. g., *R. foetans*, *R. foetantula*, *R. compacta*, etc., is quite characteristic and should never be unconsidered. One must not confuse this test by applying it to plants already in the first stages of decay. SPORE PRINTS are considered by most as the most essential means of settling the identity of closely related species. It has been claimed that the color is constant and with this claim I agree. It is also

known that the spore prints fade or change after a time, and hence old herbarium spore-prints are not reliable unless accompanied by careful notes of the print when fresh.

The genus may be divided into four natural groups which are here considered as subgenera: Compactae, Rigidae, Subrigidae and Fragiles. Of these, the first and last correspond to the tribes of that name in Fries. (Hymen. Europ.) As shown in a former paper, (Kauffman, Mich. Acad. Sci., Rep. 11, p. 60, 1909), the forking of the gills and the striations on the pileus are not very reliable for the characterization of the main groups. It has seemed practicable to establish a new division, viz., the Subrigidae, to include forms with a pruinose or velvety dry pellicle and rather firm consistency, which are out of place elsewhere, and seem to be closely related. Some have divided the genus into two large groups on the basis of the mild and acrid taste (Massee, British Fungus Flora, Vol. III.). Others have used the spore-color (Schroeter, Pilze Schlesiens and Hennings, Engler. u. Prantl Pflanzfamilien). Earle has raised the five "tribes" to generic rank (Bull. N. Y. Bot. Gard. 5, p. 373, 1909), and finally, Maire has proposed a division of the genus into eight sections based in part on microscopical characters (Soc. Myc. de France, Bull. 26, p. 120, 1910). The last author appreciates that the groups of Fries are fairly natural and has kept the main features, while emphasizing the presence or absence of cystidia-like spicules on the surface of pileus and stem. These "cystidia" cause the velvety or pruinose character which I have used in the group Subrigidae. Further studies of all young buttons and their development will aid materially in a proper arrangement, especially with reference to the character of the margin of the very young pileus.

The claim of Maire (l. c.) that microchemical tests can be used to advantage, has been given a trial in ten of the following species. This work was done at my request by Dr. W. B. McDougall in our laboratory during the summer of 1912. The results are appended under the corresponding descriptions of the species studied.

The abbreviations of Maire are used as follows: G = Tincture of Guaiac. S V = Sulfovanilline. F S = Sulfoformalin. The last two are prepared as follows:

Sulfovanilline.

Distilled water	2.cc.
Sulfuric acid, pure	2.cc.
Vanilline (c. p.)	25 g.

Sulfoformalin.

Distilled water 25 drops
Sulfuric acid, pure 5.cc.
Formalin (4% sol.) 75 drops

The action of *guaiac* is to turn the flesh blue and should react in one or two minutes. Sometimes only certain parts of the plant react, e. g., in *R. subpunctata*, the gills are unaffected. The *sulfovanilline* turns the parts blue, sometimes at first pink, while the *sulfoformalin* intensifies the brownish color of the cystidia and the lactiferous hyphae in the gills. We did not test the "cystidia" of the surface of the pileus and stem, where the test was effectively used by Maire. In *R. virescens* and *R. crustosa* the last two chemicals had hardly any effect as compared with the quick reaction in other species. Our work has been merely preliminary and covered only a small number of species.

The key includes a few species not yet found in the state. Every season seems to differ in the particular species one finds and a number of forms still remain unidentified, but the following list comprises all the species frequent from year to year, at least in the southern part of the state.

The genus has been largely gone over and revised since the publication of the Monograph (Mich. Acad. Rep. 11, 1909), and several additional species have been included and others more fully described and discussed. The recent critical papers by Maire, Romell, Battaille, Ricken, and others in Europe, have thrown much needed light on a number of species.

Key to the Species

- (A) Gills unequal, alternately long and short, flesh thick to the margin of the pileus, which is at first incurved and never has striations. (Compactae).
 - (a) Flesh white, unchangeable.
 - (b) Gills subdistant; plant entirely whitish; pileus 8-15 cm. 99. *R. delicata* Fr.
 - (bb) Gills close.
 - (c) Pileus whitish then sooty-gray, 5-7 cm. broad. 102. *R. adusta* Fr.
 - (cc) Pileus not becoming sooty in age.
 - (d) Odor strong, alkaline; pileus large, 10-30 cm. broad, whitish then pale rusty-ochraceous. *R. magnifica*. Pk.
 - (dd) Odor none; pileus 4-8 cm. broad, whitish. 99. *R. decila* var. *brevipes* Pk.
 - (aa) Flesh changing to reddish or blackish in age or when bruised.
 - (b) Flesh at length incarnate or rusty-reddish; odor disagreeable when drying. 104. *R. compacta* Frost.
 - (bb) Flesh at length blackish.
 - (c) Gills subdistant to distant; flesh at first reddish when bruised, then black. 100. *R. nigricans* Fr.

- (cc) Gills close or crowded.
 - (d) Gills etc. becoming reddish then black; gills crowded. 101. *R. densifolia* Secr.
 - (dd) Gills etc. becoming bluish-black, not at first red; pileus dry. 103. *R. sordida* Pk.
- (AA) Gills mostly equal, sometimes with shorter ones scattered promiscuously.
 - (a) Gills dichotomously forked throughout; pileus dull pink to purplish when young, later olivaceous, or greenish-umber. 116. *R. variata* Bann.
 - (aa) Gills forked only at the base, or forking not extensive or lacking.
 - (b) Spores white in mass. (*R. aeruginea*, *R. foetentula*, *R. rosacea*, *R. mariae* and *R. subpunctata* have creamy-white spores).
 - (c) Pileus white.
 - (d) Taste acrid. 133. *R. albidula* Pk.
 - (dd) Taste mild.
 - (e) Pileus viscid, sometimes tinged yellowish; remaining white when dried. 139. *R. albida* Pk.
 - (ee) Pileus dry, sometimes tinged pink. 133. *R. albella* Pk.
 - (cc) Pileus some shade of green or dingy greenish-white. [See also (ccc)].
 - (d) Pileus with a continuous separable pellicle; taste mild. 120. *R. aeruginea* Lindb.
 - (dd) Pellicle adnate, becoming pulverulent or areolate-cracked; gills close.
 - (e) Pileus dry, dark green when young, substriate on margin. 105. *R. virescens* Fr.
 - (ee) Pileus viscid, glabrous on disk, mouldy-white to pale greenish-white, striate on margin. 106. *R. crustosa* Pk.
 - (ccc) Pileus some shade of red, pink, purple or bluish. [See also (cccc)].
 - (d) Taste mild.
 - (e) Gills floccose-crenulate on edge; pileus viscid, shining blood-red; stem tinged red. 141. *R. purpurina* Q. & S.
 - (ee) Edge of gills not crenulate.
 - (f) Pileus firm and hard, or compact; pellicle adnate or disappearing in places.
 - (g) Pileus pruinose-velvety, dark red, or purple-red; stem rosy or dark red; gills at length dingy cream-color. 119. *R. mariae* Pk.
 - (gg) Pileus not markedly pruinose.
 - (h) Pileus 5-10 cm. broad.
 - (i) Pileus pale bluish-purple, at length rosy to white on disk, viscid, stem white. 117. *R. cyanoxantha* Fr. var.
 - (ii) Pileus pale red, soon dry, unpolished; stem rosy-tinged or white; taste rarely slightly acrid. 108. *R. lepida* Fr.
 - (hh) Pileus 3-6 cm. broad.
 - (i) Pileus dull lilac-purplish. *R. lilacea* Quel.
 - (ii) Pileus incarnate to pale livid pink. 114. *R. vesca* Fr.
 - (ff) Pileus rather thin, fragile or subfragile.
 - (g) Pileus usually 2-4 cm. broad, clear pink; in oak woods. 142. *R. uncialis* Pk.
 - (gg) Pileus 4-6 cm. broad, dark violet-purple or purplish-red, silky-shining, in conifer woods. 143. *R. sericeoniteus* Kauff.
 - (ggg) Pileus 6-12 cm. broad, bright rose-red with yellowish spots; stem white. 140. *R. subdepallens* Pk.
- (dd) Taste very acrid.

- (e) Pileus 2-6 cm. broad.
- (f) Spore-mass pure white; stem white, fragile.
- (g) Pileus uniform rosy-red; gills close to subdistant. 131. *R. fragilis* Fr.
- (gg) Pileus rosy-red on margin, disk olivaceous or purplish and livid; gills subdistant; usually in mossy places. 132. *R. fallax* Cke.
- (ff) Spore-mass creamy white; stem white or rosy.
- (g) Pileus rigid, not striate, soon dry; cuticle adnate, unpolished, red. 115. *R. subpunctata* sp. nov.
- (gg) Pileus subfragile; pellicle separable and striate on margin, viscid, shining rosy-red. 134. *R. rosacea* Fr. *R. sanguinea* Fr.
- (ee) Pileus 5-10 cm. broad, rarely larger.
- (f) Rigid. Pileus dark red, not fading, cuticle adnate, even on margin. 118. *R. atropurpurea* Maire.
- (ff) Fragile; pileus rose-red to scarlet.
- (g) Taste tardily acrid. 130. *R. rugulosa* Pk.
- (gg) Taste quickly acrid.
- (h) On sphagnum; in troops. 129. *R. emetica* var. *gregaria*.
- (hh) On debris of very rotten wood and on the ground. 129. *R. emetica* Fr.
- (cccc) Pileus some shade of brown, yellowish, etc.
- (d) Odor aromatic, becoming foetid; pileus very striate.
- (c) Pileus 7-12 cm. broad, sordid yellowish-whitish. 111. *R. foetens* Fr.
- (cc) Pileus 3-7 cm. broad, pale livid ochraceous; base of stem with rusty-red stains. 110. *R. foetentula* Pk.
- (dd) Odor not aromatic.
- (e) Pileus 6-12 cm. broad, straw-color to ochraceous-reddish, rigid, not striate, 107. *R. ochroleucoides* sp. nov.
- (ee) Pileus 3-6 cm. broad.
- (f) Taste acrid; pileus grayish-brown, substriate. 113. *R. sororia* Fr.
- (ff) Taste mild.
- (g) Pileus yellow or yellowish, at least when young, not ashy under the cuticle.
- (h) Pileus 5-8 cm. broad, scarcely striate in age, chrome yellow; stem yellow. *R. flavida* Frost.
- (hh) Pileus 3-5 cm. broad, very tuberculate-striate in age, at first sulphur-yellow then dingy yellowish-brown. 109. *R. Pulverulenta* Pk.
- (gg) Pileus pale yellowish-brown, ashy under the cuticle, strongly striate. 112. *R. pectinatoides* Pk.
- (bb) Spores and gills some shade of ochraceous, yellowish or creamy-yellowish (spore-print necessary).
- (c) Stem whitish, changing to ochraceous-brown where bruised or handled; odor disagreeable in age; color of pileus purplish-red, olivaceous, yellowish, etc., very variable, colors mixed. 121. *R. xerampelina* Fr. 122. *R. squalida* Pk.
- (cc) Stem not with this peculiarity.
- (d) Pileus some shade of red.
- (e) Taste acrid; fragile.
- (f) Pileus reddish-buff to purplish; spores pale yellow; in swamps. 137. *R. palustris* Pk.
- (ff) Pileus rosy-red to scarlet.
- (g) Gills straw yellowish to pale ochraceous; margin of pileus even, rather firm. 135. *R. veterinosa* Fr.
- (gg) Gills deep ochraceous-yellow; margin of pileus striate, gills and pileus fragile. 136. *R. tenuiceps* Kauff.
- (ee) Taste mild.

- (f) Stem at length ashy or blackish where bruised.
- (g) Wound at first reddish then black; pileus dull red, variegated with yellow etc., firm. 126. *R. rubescens* Beards.
- (gg) Wound not at first reddish.
- (h) In coniferous regions; stem stout.
 - (i) Pileus 5-12 cm. broad, orange-red. 123. *R. decolorans* Fr.
 - (ii) Pileus 5-10 cm. broad, crimson-red. 123. *R. decolorans* var. *rubriceps* Kauff.
- (hh) In frondose regions; stem not very stout; pileus dark red to blackish on disk. 125. *R. obscura* Rom.
- (ff) Stem not becoming ashy.
- (g) Pileus 5-10 cm. broad or more.
- (h) Plants usually solitary or scattered.
 - (i) Pileus firm, large, dingy or dull red to purplish, often faded; gills ochraceous from the first. 128. *R. alutacea* Fr.
 - (ii) Pileus and stem very fragile; colors of pileus mixed varying pink, incarnate, yellowish; spores bright yellow. 145. *R. amygdaloides* sp. nov.
 - (iii) Pileus firm, blood-red. 127. *R. borealis* Kauff.
- (hh) Closely gregarious, sometimes in troops; fragile.
 - (i) Pileus dull and variable in color, not bright red; gills white at first, then creamy-yellowish to pale ochraceous. 144. *R. integra* Fr. and forms.
 - (ii) Pileus dark violet-purple to dark red; rather firm; spores ochraceous-buff. *R. ochrophylla* Pk.
- (gg) Pileus 2-5 cm. broad or less.
- (h) Spores pale yellow or cream color.
 - (i) Pileus umbonate, very fragile; on sphagnum. 148. *R. sphagnophila* Kauff.
 - (ii) Pileus not umbonate; stem and gills translucent, honey-yellowish in age; fragile. 147. *R. puelaris* Fr.
- (hh) Spores truly ochraceous in mass.
 - (i) Stem rosy-dusted; pileus rose-red, fragile. 146. *R. roseipes* (Sec.) Bres.
 - (ii) Stem white; pileus pinkish red, lilac etc., fading to yellowish. 149. *R. chamaeolentina* Fr. 150. *R. abietina*, etc.
- (dd) Pileus some shade of yellow.
- (e) Flesh of stem cinereous when old.
- (f) Pileus orange-red, fading in age. 123. *R. decolorans* Fr.
- (ff) Pileus dull yellow (flavus), color not changing, scarcely viscid. 124. *R. flava* Rom.
- (ee) Flesh not becoming ashy.
- (f) Edge of gills vivid lemon-yellow. *R. aurata* Fr.
- (ff) Edge of gills concolor.
 - (g) Taste mild; pileus 2-6 cm. broad, gills egg-yellow. 151. *R. lutea* Fr.
 - (gg) Taste tardily acrid; pileus 5-10 cm. broad; gills pale yellow. 138. *R. aurantialutea* Kauff.

COMPACTAE Fr. Flesh thick, compact and firm. Pileus without a separable pellicle, its margin non-striate and at first involute. With entire and short gills alternating regularly. Spores white in mass.

This group is closely related to the Piperites division of the genus *Lactarius*. Some of the species, e. g. *R. delica*, are very similar to *L. vellerius*, *L. deceptivus*, etc., when the latter are dried out by the wind or dry weather and then lack the milky juice. The *Compactae* are a very natural group, easily distinguishable.

99. *Russula delica* Fr. (EDIBLE)

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1068.

Gillet, Champignons de France, No. 607.

Bresadola, Fung. Trid., Vol. 2, Pl. 201.

Ibid, Fung. mang. e. vel., Pl. 68.

Ricken, Blätterpilze, Pl. 15, Fig. 1.

Patouillard, Tab. Analyt., No. 514.

Peck, N. Y. State Mus. Rep. 54, Pl. 71, Fig. 1-5 (as *R. brevipes* Pk.).

Ibid, N. Y. State Mus. Rep. 43, Pl. 2, Fig. 5-8 (as *R. brevipes* Pk.).

PILEUS 8-15 cm. broad, firm, convex-umbilicate then depressed to infundibuliform, *dull white*, sometimes with rusty-brown stains, *unpolished*, glabrous, pubescent or obscurely tomentose, even, *dry*, margin at first involute not striate. FLESH compact, white or whitish, not changing where bruised. GILLS subdecurrent, narrowed behind, broader in the middle, *subdistant*, or distant, thickish, short and long alternating, few forked, *white or whitish*, edge often distinctly greenish. STEM 2-5 cm. long, 1.5-2 cm. thick, *short*, stout, *solid*, equal or subequal or tapering down, white becoming dingy, *not turning blackish* when bruised, glabrous or subtomentose above, often with a narrow pale-green zone at apex. SPORES globose, 9-10 (rarely 11 or 12) micr., tuberculate, white in mass. TASTE mild to tardily but weakly acrid. ODOR none.

Gregarious, in sandy soil. In maple, birch, oak and coniferous woods throughout the state; most abundant along the Great Lakes in conifer regions. July-October. Common locally.

Var. *brevipes* Pk. (= *R. brevipes* Pk., N. Y. State Mus. Rep. 43, 1890). has been found at New Richmond. The gills are crowded and the pileus is smaller, 4-6 cm. broad. It was found in hard clay soil, through which it pushed with difficulty. It is apparently an ecological variety conditioned by dry weather and hard soil. It is uncommon.

The typical *R. delica* is usually a large plant, simulating *Lactarius vellerius* in size, color, etc. Fries in the *Epicrisis* says the cap is "shining." This error was omitted in his *Monographia* but copied again in *Hymenenyomycetes Europaei*. The error has since been repeated by other authors, including Cooke on his plate in the *Illustrations*. The Michigan plants are exactly like those growing in Sweden, where in some of the specimens the edge of the gills and the apex of the stem were tinged green, as is the case in ours, especially in the plants of the northern part of the state. *R. lactea* Fr. is said to have very broad, distant, free gills and milk-white cap and stem. I have not seen any plants with the glaucous green gills of *R. chloroides* Bres.

100. *Russula nigricans* Fr. (EDIBLE)

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1015.

Gillet, *Champignons de France*, No. 625.

Michael, *Führer f. Pilzfreunde*, Vol. III, No. 75.

Ricken, *Blätterpilze*, Pl. 15, Fig. 2.

Peck, *N. Y. State Mus. Rep.* 54, Pl. 71, Fig. 6-9.

Hard, *Mushrooms*, Fig. 146, p. 184, 1908.

PILEUS 7-15 cm. broad, subrigid, convex then depressed to subinfundibuliform, margin at first incurved then spreading and elevated, often irregularly wavy, at first whitish and clouded with umber, *soon smoky-umber*, subviscid at first, glabrous, even on margin. FLESH compact, white, *changing to reddish* where bruised, *then blackish*. GILLS narrowed or rounded behind, adnexed, *thick* and firm, *subdistant to distant*, sometimes intervenose, short and long alternating, white becoming grayish, reddish at first when bruised. STEM 2-6 cm. long, 1-3 cm. thick, *solid*, hard, stout, glabrous, even or lacunose-depressed in places, white at first, *at length smoky-umber*, reddish then blackish where bruised. SPORES subglobose, 8-10 micr., echinulate, whitish in mass. TASTE mild, sometimes tardily but slightly acrid. ODOR none.

Gregarious or solitary. On the ground in coniferous or frondose woods. Throughout the state, rarely in the southern part, more plentiful in the north. July-September.

This *Russula* usually persists in ordinary weather without decaying and is then frequently inhabited by another mushroom,

Nyctalis asterophora, as shown in the illustration. It is usually a rather large, firm plant, distinguished from the following by the subdistant, thick gills. The flesh of all parts when bruised turns first reddish then blackish, but the red stain may not appear in old plants; this is to be expected because of the drying up of the scanty juice which is supposed to cause this phenomenon where it is exposed to the air. Peck, McIlvaine and others have eaten it and consider it fairly good.

101. *Russula densifolia* Secr. (EDIBLE)

Mycographie I, 1833.

Illustrations: Cooke, Ill., Pl. 1017.

Gillet, Champignons de France, No. 608.

Patouillard, Tab. Analyt., No. 319.

Hard, Mushrooms, Figs. 157 and 145, 1908.

Kauffman, Mich. Acad. Sci. Rep. 11, Fig. 1, op. p. 90, 1909.

PILEUS 5-12 cm. broad, somewhat firm, convex then depressed to subinfundibuliform, margin at first incurved then elevated, dull whitish at first, *soon clouded with pale smoky-brown*, without a pellicle, usually *subviscid*, even, pruinose when dry. FLESH compact, thick, grayish-white, pale smoky in age, *changing to reddish* when bruised, *then blackish*. GILLS narrowly adnate to subdecurrent, *rather narrow*, thick, *crowded* then close, alternately long and short, few forked, subvenose, whitish soon dingy grayish, reddish when bruised then black. STEM 5-6 cm. long, 1.5-2.5 cm. thick, stout, equal or tapering downward, rigid, spongy-solid, whitish then cinereous, soon dark ashy within, *turning reddish then blackish where bruised*, obscurely wrinkled, glabrous or subpruinose. SPORES globose, coarsely reticulate, 7-9x6-8 micr., white in mass. STERILE CELLS on edge of gills, hyaline, slender, flexuous, acuminate, 60x3-4 micr., abundant. TASTE slowly acrid in fresh plant. ODOR none.

Gregarious, subcaespitose or solitary. On the ground in frondose woods among fallen leaves. Ann Arbor, Detroit, Palmyra. July-September. Usually rare, but abundant in August, 1912, in oak woods at Ann Arbor.

As pointed out by Peck, the American plant is slightly subviscid on the cap but this character is easily overlooked. The viscosity is slight, even after rains. It comes nearest to *R. adusta*, in size,

natural coloring and gills, but differs in the change which the flesh undergoes when bruised. Authors consider *R. adusta* to have a mild taste and if this is true our plant differs also in this respect. The gills are usually markedly crowded and narrow, while those of *R. nigricans* are broad and subdistant. The latter is more common in coniferous regions, while *R. densifolia* has so far been found in Michigan only in frondose woods. Maire (Bull. Soc. Myc. France, 26, p. 87) states that *R. densifolia* lacks the hair-like sterile cells on the edge of the gills; that they are abundant in *R. nigricans* and less numerous in *R. adusta*. In our specimens of *R. densifolia* they were abundant, which would indicate that this is not a very constant character.

102. *Russula adusta* Fr.

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1051.

Michael, Führer f. Pilzfreunde, Vol. II, No. 64.

Ricken, Blätterpilze, Pl. 15, Fig. 3.

"PILEUS 5-7 cm. broad, convex then depressed or subinfundibuliform, *white or whitish*, becoming brownish or sooty-gray, glabrous, dry, even. FLESH compact, white, *not changing when bruised*. GILLS adnate to subdecurrent, *thin, close*, short and long alternating, narrow, white becoming sordid. STEM 2-5 cm. long, about 1.5 cm. thick, *short, solid*, equal or subequal, glabrous, even, *white then sooty-gray*. SPORES subglobose, slightly echinulate, 6-9 micr., white in mass. Taste *mild*. Odor slight."

Gregarious or solitary. On the ground in mixed woods of northern Michigan. July-September. Infrequent.

The smaller size, unchanging flesh when bruised, and thin close gills characterize it. At first the whole plant is nearly white, but it gradually takes on a grayish or sooty cast. Michael, who gives an excellent figure, says it has a rather strong odor which is almost nauseating. This seems not to have been noticed by others. In Europe, also, it is said to be soon attacked by grubs especially in the stem; as the same insects do not always occur in this country, such facts are only of local interest. It usually hugs the ground closely.

103. *Russula sordida* Pk. (EDIBLE)

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

Illustrations: N. Y. State Mus. Bull. 105, Pl. 98, Fig. 1-3, 1905.
Plate XIV of this Report.

PILEUS 5-12 cm. broad, *dry*, convex-depressed, margin at first incurved, glabrous, even, *dingy white becoming smoky with age*. FLESH whitish, compact, *becoming blackish-brown or bluish-black* when bruised, *without first turning reddish*. GILLS adnate to sub-decurrent, rather narrow, *close*, long and short alternating, *white becoming blackish in age*, few forked. STEM 3-5 cm. long, 1-2 cm. thick, short, solid, rigid, equal, whitish becoming black when handled. SPORES globose, 7-8 micr., white in mass. TASTE mild or tardily and slightly acid. ODOR none.

Gregarious or solitary. On the ground in the hemlock regions of the north, rarely in southern Michigan. July-August. Infrequent.

This differs from the European *R. albonigra* (Kromb.) in its dry pileus. A species has been named by Peck with viscid cap, viz., *R. subsordida*; this is probably identical with *R. albonigra*. Our plant has a dry pileus and differs from *R. nigricans* and *R. densifolia* in the lack of the change to red immediately after bruising. In specimens found near Ann Arbor the gills of the young plants were easily separable from the trama of the pileus; whether this is a constant character I cannot say. Peck found the same to be true in specimens of *R. densifolia*. The stems are said to be often infested with grubs.

104. *Russula compacta* Frost & Peck (EDIBLE)

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

Illustration: Peck, N. Y. State Mus. Bull. 116, Pl. 109, 1907.

PILEUS 5-10 cm. broad, firm, convex then depressed to subinfundibuliform, margin at first incurved, thin, then elevated, *dry, unpolished*, minutely tomentose in age, even, whitish when young, *at length sordid-pale-reddish or rusty-ochraceous* either wholly or in spots. FLESH thick, compact, rather brittle, white, *changing to reddish in age or when wounded*. GILLS narrowly adnate, close, rather *narrow*, alternately short and long, sometimes much forked toward base, sometimes few forked, white at first, then stained

sordid reddish or reddish-brown. STEM 3-6 cm. long, 1.5-3 cm. thick, *stout*, spongy-stuffed, *rather brittle*, equal or tapering down, uneven, white at first becoming reddish or reddish-brown in age or from handling. SPORES subglobose, echinulate, with large oil-globule, 8-10x7-8 micr., white in mass. TASTE mild or slightly and tardily acrid. ODOR *becoming disagreeable* in age or on drying, like that of *R. squalida* Pk.

Gregarious. On the ground in beech and maple woods. New Richmond. August-September. Rare.

This is a very distinct species. The whole plant becomes diffused with the rusty-reddish color which is at first pale incarnate, but becomes more marked as the plant ages. The stem has the consistency of that of *Boletus castaneus* or *B. cyanescens* but the interior becomes cavernous less readily than in those plants. The scanty juice which causes the color change has the same relation to the flesh as that which causes the reddish and then blackish color in *R. nigricans*. The disagreeable odor of the drying plant is quite marked, and is an aid to its identification. It is probably quite rare; it was found only a few times in New York by Peck but has been reported by Van Hook from Indiana. *R. incarnata* Morgan (Cinn. Soc. Nat. Hist., 1883) is probably identical. The edges of the gills are provided with microscopic, subcylindrical, sterile cells. In age the plant becomes quite fragile. Peck's figure is not at all illustrative of the colors.

RIGIDAE. Flesh compact, rather thick. Pileus rigid, provided with an adnate cuticle which often cracks or disappears in parts of the surface, especially on disk, mostly separable only at the margin. Gills usually somewhat forked, and with shorter ones intermingled.

The subgenus differs from the *Compactae* in that the gills do not alternate regularly as long and short and by the presence of an adnate pellicle; it differs from the *Subridgidae* and *Fragiles*, by the more rigid substance of the pileus, the adnate pellicle, the presence of short gills and usually by the forking of some of the gills especially at or near the stem. Most of the species are mild or very slightly acrid.

Section I. Margin of pileus obtuse, cuticle soon dry, at length pulverulent, granular or rimosely-cracked in places. Gills broader anteriorly.

105. *Russula virescens* Fr. (EDIBLE)

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1039.

Gillet, Champignons de France, No. 639.

Bresadola, Fungh. mang. e. vel., Pl. 69.

Michael, Führer f. Pilzfreunde, Vol. II, No. 62.

Atkinson, Mushrooms, Pl. 36, Fig. 1, 1900.

Marshall, Mushroom Book, Pl. 18, p. 69 (poor).

Gibson, Edible Toadstools and Mushrooms, Pl. 11, p. 126, 1903.

Peck, N. Y. State Mus. Rep. 48, Pl. 31, 1896.

Hard, Mushrooms, Fig. 150, p. 189, 1908.

McIlvaine, Amer. Fungi., Pl. 44, Fig. 6, p. 184, 1900.

PILEUS 5-12 cm. broad, at the very first globose, soon convex and expanded, often somewhat depressed on disk, firm, *dry*, as if velvety, the surface (especially the disk) broken into many floccose or pulverulent *areas or patches*, *green* or grayish green, the margin *not striate* or rarely so, cuticle scarcely distinguishable or separable. FLESH white. GILLS *white*. rather close, narrowed toward the stem, almost or entirely free, few shorter or forked. STEM 3-7 cm. long, 1-2 cm. thick, white, firm, equal or subequal, solid or spongy. SPORES white, subglobose, 6-8 micr. CYSTIDIA none. No differentiated subhymenium. TASTE *mild*. ODOR none.

Oak and maple or mixed woods, probably throughout the state. Occasional. July and August.

Under this name was included in this country, for a time, a more common form with viscid striate cap which has been segregated by Peck under the name of *R. crustosa*. The two seem to run into each other at times, but Peck distinguishes the pileus of *R. crustosa* "by its smooth, not warty center, its paler color and usually striate margin." The latter is also distinctly viscid when young but this depends considerably on the weather conditions. *R. virescens* might be confused with green specimens of *R. variata* whose surface is sometimes areolate, but the gills of *R. virescens* are not as pure white, are not decurrent nor much forked, and the taste is mild.

Microchemical tests: G. (Flesh and gills slowly bright blue.) F S. (No effect.) S V. (No effect.)

106. *Russula crustosa* Pk. (EDIBLE)

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

Illustration: N. Y. State Mus. Bull. 67, Pl. 84, Fig. 1-7, 1903.

PILEUS 5-12 cm. broad, firm, convex then expanded and depressed in the center, surface cracked except on disk, the *areas crustlike*, sordid cream-color, dirty brownish or ochraceous, usually tinged with olive or green, *viscid* when young or moist, especially on the disk, *striate on margin* when mature. FLESH white. GILLS *dull white*, becoming somewhat dingy cream color in age, rather broad in front, narrowed toward the stem, adnexed or free, *thick, distinct*, not crowded, rather brittle, few forked, few short. STEM 3-6 cm. long, 1-2.5 cm. thick, short, stout, spongy-stuffed, subequal or ventricose, white. SPORES white, subglobose, 8-10 micr. CYSTIDIA rather numerous, extending clear through the subhymenium. *Subhymenium* sharply separated from gill-trama. TASTE *mild*. ODOR none.

Scattered or gregarious. Oak and maple woods in southern Michigan. July to September. Common.

This is near *R. virescens* and is apparently much more common. It seems to be still referred to *R. virescens* by some authors, although in that case the Friesian description will have to be modified to include it.

Microchemical tests: G. (Flesh and gills become deep blue.) S V. (Gills and flesh very slowly tinged blue.) F S. (Cystidia colored brown.)

107. *Russula ochrালেucoides* sp. nov.

Illustration: Plate XV of this Report.

PILEUS 6-12 cm. broad, *large, rigid*, convex, soon expanded-plane, varying *straw-yellow to pale ochraceous*, usually dull ochre to reddish-ochre toward center, pellicle adnate, soon dry, and *pulverulent* or subrimose, *even* on the *obtuse* margin. FLESH *thick*, compact, white, unchanging or slightly sordid in age. GILLS adnexed or free, *rather narrow*, rounded and slightly broader in front, *white* or whitish, close to subdistant, shorter ones intermingled, often forked in posterior part, intervenose. STEM 4-6 cm. long, 1.5-2 cm. thick, short, *rigid*, equal or tapering slightly downward, *white*, glabrous or subpruinose, spongy-solid, even or obscurely

wrinkled. SPORES globose, very minutely rough, 7-9 micr. (incl. apiculus), *white in mass*. CYSTIDIA very few. BASIDIA about 40x9 micr. TASTE tardily and slightly bitterish-acrid or disagreeably bitter. ODOR faintly aromatic or none.

Gregarious. On the ground in open oak-maple woods. Ann Arbor. August. Rare.

Related to *R. virescens* by its rigidity and the nature of the surface of the pileus. The surface is pulverulent, somewhat rimose in age, soft to the touch and under the microscope is seen to be composed of slender, hyaline, erect cystidia-like hairs. A subhymenium is lacking. It has a short, stout stem and relatively much broader cap. It differs from *R. ochroleuca* in size and in the thick flesh of the cap, in that the flesh of the stem does not become ashy when bruised, as well as in the bitter taste and the unpolished pileus. *R. granulosa* Cke. is said to have a granular stem and pileus, and many cystidia in the hymenium according to Masee. It is far from belonging to the Fragiles where Fries placed *R. ochroleuca*. *R. granulata* Pk. is said to be tubercular-striate on the margin of the cap and is smaller. The gills are often abundantly forked toward the stem.

108. *Russula lepida* Fr. (non Bres.) (EDIBLE)

Epicrisis, 1836-38.

Illustrations: Fries, Sverig. Swamp., Pl. 59, form minor.

Cooke, Ill., Pl. 1072.

Gillet, Champignons de France, No. 620.

Ricken, Blätterpilze, Pl. 16, Fig. 4.

Hard, Mushrooms, Fig. 149, Pl. 188, 1908. (Doubtful.)

Gibson, Edible Toadstools, etc., Pl. 12, p. 131, 1903. (Doubtful.)

Atkinson, Mushrooms, Pl. 36, Fig. 3, p. 126, 1900. (Doubtful.)

PILEUS 4-10 cm. broad, *rigid*, convex, then expanded-depressed, cuticle adnate and disappearing on disk, *unpolished*, *soon dry*, rose-red to pale blood-red, *fading*, disk soon pallid or variegated with paler yellowish-reddish hues, sometimes rimulose-cracked or rugulose on disk, margin obtuse, not striate. FLESH compact, *white* or reddish under the cuticle, thick, abruptly thin on margin. GILLS narrowed behind and narrowly adnate or almost free, close, *rather narrow*, broader and rounded in front, *white then whitish* (albus), few shorter, occasionally forked. STEM 4-7 cm. long, 1-2 cm. thick,

equal or slightly tapering downward, *white or tinged rosy-pink*, spongy-stuffed, rather rigid, obscurely wrinkled. SPORES subglobose, 9-10 x 7-8 (incl. apiculus), with oil-drop, rough or partly smooth, *almost pure white in mass*. ODOR none or very slightly disagreeable. TASTE *mild*, sometimes slightly bitterish-subacid. CYSTIDIA moderately abundant, subcylindrical, 70-75x10-12 micr.

Gregarious or solitary. On the ground in frondose woods. Ann Arbor, Detroit. July-August. Rather rare.

This plant occurs rather rarely in southern Michigan. It differs from the description given by Bresadola (see translation Mich. Acad. Rep. 11, p. 68, 1909) in that the spore-mass is nearly white, not straw color, and the gills are only slightly thickish. I have found specimens only during a few seasons. Peck also reports it uncommon in New York. The margin of the pileus is sometimes slightly viscid and the cuticle slightly separable on the margin. It must not be confused with *R. mariae* whose cap and stem are less rigid and more deeply colored, and which has creamy-yellowish spores and larger cystidia. Our plant sometimes has an entirely rose-red cap, sometimes, especially when older, approaching the colors of *R. decolorans* but paler and duller, subpruinose when dry and variegated with pinkish, yellowish or pale-orange hues becoming white in spots. It is often rigid for a long time.

Section II. Margin of pileus acute or subacute, at first incurved; cuticle *viscid*, slightly separable only on margin, often disappearing on disk or in spots.

109. *Russula pulverulenta* Pk.

Torr. Bot. Club, Bull. 29, 1902.

Illustration: Plate XVI of this Report.

PILEUS 3-5 cm. broad, rather rigid at first, *then fragile*, rather thin, broadly convex at first, expanded and depressed to subumbilicate, at first even on the margin, at length *distinctly tuberculate-striate*, cuticle adnate, viscid, separable on margin, in very young stage sulphur-yellow, soon ochroleucous, finally *dingy yellowish brown*, surface *dotted* by small, numerous, *pale yellow, somewhat mealy or flocculent scales or granules*, margin at very first incurved-subinrolled. FLESH white, at first firm and tough, finally soft. GILLS narrowly adnate, close, rather narrow, broader toward front, *white*, unchanging, often bifurcate at stem, intervenose. STEM 3-5

cm. long, 1-1.5 cm. thick, subequal or irregularly enlarged, *rigid-fragile*, surface at the very first covered by a sulphur-yellow pulverulence, *at length dotted by sulphur-yellow granules, especially at base*, white beneath, spongy-stuffed, *becoming cavernous*. SPORES globose, echinulate, 6-8 micr. (incl. apiculus), *white in mass*. CYSTIDIA numerous, subhymenium scarcely differentiated. BASIDIA 45x9 micr., 4-spored. TASTE and ODOR slight or somewhat disagreeable.

Gregarious. On lawns, roadsides, or in frondose woods among grass, etc. July-September. Southern Michigan. Not infrequent during a few seasons.

This *Russula* is closely allied to the preceding section. Its development has been carefully studied. When the caps are 4 mm., or less broad the margin is definitely subinrolled. The texture of the trama is then very firm and tough and the entire surface of both cap and stem is covered, as seen under the microscope, by a differentiated thin layer composed of short, dense, erect yellow hairs or hyphae. These hyphae are continuous at first with the trama but become separated in masses as the pileus and stem enlarge, adhering at length to the surface of the mature pileus and stem as delicate, appressed, pulverulent-flocculose, sulphur-yellow granules. The hymenium contains very numerous cystidia with a dark-brown, granular content, which project into the subhymenium and often connect with similarly colored hyphae which intermingle with the gill-trama. (Lactiferes.) The young cystidia project above the basidia but later are even with them. These brownish cystidia give a brown-dotted appearance to the sides of the gills as seen under low power of the microscope.

Microchemical tests: G. (Flesh and gills become rapidly light blue, then dark blue.) S V. (Gills first turn reddish then slowly blue; flesh scarcely affected.) F S. (Cystidia colored brown.)

This species is easily confused in the old, discolored stage with *R. pectinatoides* and *R. foetentula*, since both have a livid yellowish-brown cap at times when mature, well marked tuberculate striations, and are about the same size. They lack, however, the peculiar yellow granules of *R. pulverulenta*. (For further remarks see Mich. Acad. Rep. 11, p. 77, 1909.)

110. *Russula foetentula* Pk.

N. Y. State Mus. Bull. 116, 1907.

PILEUS 3-7 cm. broad, soon fragile, at first subhemispherical then convex to plane and depressed; *viscid*, *livid-ochraceous*, *russet-tinged*, disk darker and innately granular, long tuberculate-striate. Margin at first incurved. FLESH thin, whitish. GILLS adnexed or nearly free, close, rather narrow, broader in front, thin, whitish, *often spotted or stained reddish*. STEM 2.5-5 cm. long, 6-12 mm. thick, subequal, somewhat firm, spongy-stuffed, soon cavernous, whitish or sordid-white, *stained at the very base by cinnabar-red stains*. SPORES 7-9 x 6-7 micr., echinulate, *creamy-white in mass*. CYSTIDIA moderately abundant. BASIDIA 40-45x9 micr., 4-spored; *subhymenium* scarcely differentiated. OROR none or somewhat like oil of bitter almonds, varying in intensity. TASTE very slightly acid.

Scattered or gregarious. On the ground in frondose woods. Ann Arbor. Abundant in 1911.

This species has characters intermediate between *R. foetens* and *R. pectinatoides* and is most easily distinguished from both by the reddish stains at the base of the stem; this character was very constant in many individuals during a single season. The oror varies much in intensity and is often lacking. The pileus is sometimes tinged with reddish-yellow but most of our plants had a decided russet color at maturity. Micro-chemical tests as in *R. pulverulenta*.

111. *Russula foetens* Fr.

Syst. Myc., 1821.

Illustrations: Fries, Svamp. Sverig., Pl. 40.

Cooke, Ill., Pl. 1046.

Gillet, Champignons de France, No. 612.

Michael, Führer f. Pilzfreunde, Vol. I, No. 45.

Ricken, Blätterpilze, Pl. 19, Fig. 4.

Hard, Mushrooms, Fig. 147, p. 185, 1908.

Plate XVII of this Report.

PILEUS 7-12 cm. broad, fleshy, hard then fragile, *subglobose* then expanded and depressed, viscid when moist, thin margin at first incurved, *tuberculate-sulcate* when expanded, yellowish or dingy ochraceous, pellicle adnate. FLESH thin, rigid but fragile, dingy

white. GILLS white, at *first exuding drops of water*, sordid when old or bruised, rather close, adnexed, few forked, interspaces venose, shorter ones present. STEM 4-6 cm. long, 1-2.5 cm. thick, whitish, short, stout, stuffed then cavernous. SPORES *white* in mass, subglobose, 7.5-10 micr. CYSTIDIA numerous; subhymenium narrow, not sharply differentiated. TASTE *acid*. ODOR *strongly amygdaline, becoming foetid*.

Gregarious. In mixed woods in the north; in oak, maple, etc., in southern Michigan. July, August and September.

The odor of the fresh young plant is like oil of bitter almonds or cherry bark; when old or decaying it becomes quite disagreeable. The margin of the young pileus is strongly incurved. Not edible.

Micro-chemical tests: G. (Flesh and gills quickly light blue, then dark blue.) S V. (Gills slowly deep blue.) F S. (Cystidia colored brown.)

112. *Russula pectinatoides* Pk.

N. Y. State Mus. Bull. 116, 1907.

Illustrations: Ibid, Pl. 105, Fig. 6-10.

PILEUS 3-7 cm. broad, rather firm, *becoming fragile, thin*, convex, then plano-depressed, viscid when moist, covered by a thin separable pellicle, radiately rugose-striate on the margin, often halfway to the center, or *strongly tubercular-striate*, dingy straw color, brownish, yellowish-brown or umber-brown. FLESH white, thin, becoming fragile, slightly *ashy under the cuticle*, not changing. GILLS whitish, close to subdistant, thin, distinct, equal, moderately broad, broadest in front, narrowed behind, often stained or broken halfway from stem, some forked at base. STEM 2-5 cm. long, .5 to 1 cm. thick, white or dingy, subequal, glabrous, spongy-stuffed *then hollow*, even. SPORES whitish or creamy-white in mass, subglobose, 6-8 micr. diam. TASTE mild or slightly and tardily acid. ODOR *not noticeable*.

Gregarious. Grassy places, lawns, groves and woods. Throughout the state. July and August.

Cooke's illustrations of *R. pectinata* and *R. consobrina* var. *sororia* remind one very much of this plant. Peck points out that it differs from these by its mild taste, adnate gills and grayish color under the cuticle. It is also close to *R. foetentula*, which sometimes lacks the odor. *R. subfoetens* Smith as known to Romell, also reminded me of this species. The color of *R. pectinatoides*, the

long striations and the medium size are the best recognition marks in the field. It differs, of course, from *R. foetens* by lack of a strong odor. Whether the margin is at first incurved is nowhere noted.

113. *Russula sororia* Fr.

Epicrisis, 1836-38 (as subspecies of *R. consobrina*).

Illustration: Cooke, Ill., Pl. 1057.

PILEUS 3-6 cm. broad, rather firm, convex then subexpanded, *viscid* when moist, margin substriate when mature, pellicle somewhat separable along margin, *gray*, olivaceous-brown or grayish-brown. FLESH white, unchanged. GILLS narrow, subdistant, distinct, white for a time, then discolored, adnate, shorter ones intermingled, rarely forked, interspaces venose. STEM 2.5-5 cm. long, 1-2 cm. thick, white, not becoming cinereous, short, spongy-stuffed. SPORES *white*. TASTE *acid*. ODOR none.

Solitary. Woods in southern Michigan. August and September. Rare. This species used to be placed under *R. consobrina*.

114. *Russula vesca* Fr.-Bres.

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1075.

Bresadola, Fungh. mang. e. vel., Pl. 72.

Ibid, Fung. Trid., Pl. 128 (as *R. lilacea* var. *carnicolor*).

Michael, Führer f. Pilzfreunde, Vol. I, No. 41 b.

PILEUS 3-6 cm. broad, fleshy, firm, convex then expanded and depressed in the center, *viscid*, *soon dry*; more or less rugulose or wrinkled, reddish, *pale livid-pink*, or sordid flesh-red, becoming paler, cuticle thin and disappearing, *not quite reaching the edge of the pileus* so that a narrow white exposed margin results, margin even and spreading. FLESH white. GILLS white, thin, at length *stained* lurid-brownish or rusty, close, moderately narrow, adnate, forked or anastomosing at base. STEM white, obscurely rivulose, *hard* and compact, subequal, solid, 3.5-4.5 cm. long, 1.5 cm. thick, often discolored by yellowish-rusty stains. SPORES *white in mass*, subglobose, minutely echinulate, 7-8 micr. TASTE *mild*. ODOR none. Rare.

Only a few doubtful collections have been made in southern

Michigan. The above description is taken from my notes of the Swedish plant as known to Romell, and agrees mostly with that of Bresadola. Most modern mycologists consider the Friesian "rugulose-reticulate" character of the stem as too uncertain to be practicable. The important characters are: the hard consistency, the wrinkled or veined rarely "cutefracta" surface of the cap, the cuticle not reaching to the margin of the cap, and the gills discolored in spots. The cuticle apparently ceases to grow so that the surface of the expanding pileus may become somewhat areolate cracked and the margin naked.

115. *Russula subpunctata* sp. nov.

PILEUS 2-5 cm. broad, *rigid*, convex then expanded-plane to depressed, cuticle adnate and scarcely separable on margin, subviscid, soon dry, *pale dull red to rosy-red*, often white-spotted where cuticle disappears, minutely rivulose or subgranular, margin even, acute. FLESH compact, firm, rather thick on disk, abruptly thin on margin. GILLS adnate to subdecurrent, thin, slightly attenuate at both ends, not broad, close to subdistant, whitish *then pale cream-colored*, few short or forked at base, pruinose, intervenose. STEM 2-4 cm. long, 4-10 mm. thick, subequal or tapering down, spongy-stuffed, *becoming cavernous*, white or rosy-tinged, unchanging, attached at times to roots and forming mycorrhiza. SPORES subglobose, rough-reticulate, 9-11x7-9 micr. (incl. apiculus), *creamy-white in mass*. CYSTIDIA abundant, subcylindrical, rough, with dark brown granular content, 90-110x8-12 micr. BASIDIA about 65x9 micr. *Subhymenium* markedly differentiated. TASTE *quickly and very acrid*. ODOR none.

Gregarious. On the ground in frondose woods. Ann Arbor. July-August. Infrequent.

The appearance of this *Russula* is well shown in Patouillard's figure of *R. punctata* Gill. (Tab. Analyt., No. 621) with which it agrees except in its very acrid taste. The gills of our plants have only rarely a red edge. The spore print is cream-colored or almost light yellowish. Dr. McDougal found one group of specimens forming mycorrhiza on roots of *Tilia americana*.

Micro-chemical tests: G. (Flesh slowly light blue; gills unaffected.) S. V. (Flesh and gills quickly deep blue.) F. S. (Cystidia colored brown.)

116. *Russula variata* Banning—Pk. (EDIBLE)

N. Y. State Mus. Bull. 105, 1906.

Illustrations: Ibid, Pl. 101, Fig. 1-5.

Hard, Mushrooms, Fig. 154, p. 194, 1908 (as *R. furcata*).

PILEUS 5-12 cm. broad, fleshy, firm, convex then depressed to subinfundibuliform, viscid, *not striate*, purplish or *deep rose pink when young*, later variegated with olive or dark umber or sometimes *greenish* with only a trace of *purple*, opaque and reticulate-wrinkled under lens, the thin pellicle slightly separable on the thin margin, with a subsilky or dull luster when dry. FLESH white, firm, cheesy, tinged grayish under pellicle. GILLS shining and *persistently white*, adnato-decurrent, thin, *rather crowded*, narrowed at both ends, not broad, *subdichotomously forked*, interspaces venose. STEM 4-7 cm. long, 1-3 cm. thick, white, firm, solid, equal or subequal, sometimes tapering downward, even. SPORES *white in mass*, subglobose, 7-10 micr. TASTE *mild to tardily acrid* or slightly astringent. CYSTIDIA very few and short. *Subhymenium* not clearly differentiated. ODOR none.

Gregarious. Under conifers at Marquette, in deciduous woods about Ann Arbor. July, August and September. Frequent.

Superficially nearest to the descriptions of *R. furcata* Fr. and *R. virescens* Fr. The former species is rare in Europe, and most authors have consigned it to oblivion or consider it a variety of *R. cyanoxantha*. The plants which used to be referred to *R. furcata* in this country, have found a more appropriate resting place in *R. variata*. The figures of *R. cutefracta* Ck . (Cooke, Ill., Pl. 1024 and 1040) show the color of the young and old plants much better than do Peck's figures, and if Cooke's species had pure white spores and white and dichotomously forked gills, they could be considered identical; however, these points are not clear. Peltereaux thinks *R. cutefracta* Cke. occurs in France and has ochraceous spores and that the cracked margin of the cap is a weather effect; this then could not be our species with white spores. When one finds single old plants with much green, it is quite difficult to distinguish them from *R. virescens*; they are to be separated by their dichotomously forked gills which are slightly decurrent and more persistently white, and by the slight acidity. The cuticle is sometimes cracked toward the margin as in *R. virescens*, but its margin is at first incurved while in *R. virescens* it is straight on the stem. Peck says

it has a good flavor after cooking, which destroys the slight acrid taste.

Micro-chemical tests: G. (Flesh and gills quickly deep blue.) S V. (Gills slowly blue; flesh slightly blue-tinged.) F S. (No effect.)

117. *Russula cyanoxantha* Fr. var. (EDIBLE)

Monographia, 1865.

Illustrations: Michael, *Blätterpilze*, Vol. II, No. 59.

Gillet, *Champignons de France*, No. 605.

Cooke, Ill., Pl. 1076 and 1077. (Doubtful.)

Bresadola, *Fung. Mang. e. vel.*, Pl. 71. (Doubtful.)

PILEUS 5-10 cm. broad, *rigid*, convex then expanded and depressed in the center or subinfundibuliform, *dark bluish-purple or lilac* on margin, *disk dingy white tinged rose-pink*, cuticle thin and adnate, *viscid*, separable on margin, *even*, or substriate only near edge, surface somewhat wrinkled or streaked. FLESH white, compact, purplish or lilac under cuticle. GILLS *white*, a few forked toward base, few shorter, moderately broad, not very distant, narrowed behind, intervenose. STEM 6-9 cm. long, 1-2 cm. thick, *white*, subequal, spongy-stuffed, cortex hard, sometimes cavernous and compressed, glabrous, even or obscurely wrinkled. SPORES *white in mass*. TASTE *mild*. ODOR none.

Scattered or gregarious. Maple and birch, or mixed woods of northern Michigan, oak and maple woods of the southern part. July-August. Not infrequent.

The above description applies to a definite form which occurs in Michigan and is quite constant. It does not agree with the species understood by Romell, Maire and Peltereaux in Europe, whose typical plant has creamy-white gills and spores. Our species approaches *R. azurea* Bres. in color, but that plant is rather fragile and is related to the *R. emetica* group. Michael's figures show the colors of the cap when young and not yet decolorized on the disk. It is more frequent northward and may be distinct from the European plant.

118. *Russula atropurpurea* Maire (ex. Kromb. non Pk.)

Bull. Soc. Myc. de France, Vol. 26, p. 167, 1910.

Illustrations: Cooke, Ill., Pl. 1025 and 1087 (as *R. rubra*).

PILEUS 5-14 cm. broad, rigid, medium to large size, convex then plane, soon depressed, rather firm, viscid, pellicle adnate and scarcely separable on the margin only, scarlet to dark crimson when fresh and young, *becoming darker to purplish when mature or on drying, pruinose*, disk often darker, sometimes blackish-red to livid olivaceous-purple, sometimes yellow spotted, margin even or only slightly striatulate in age. FLESH dark red under the pellicle, white elsewhere, not changing to ashy. GILLS *white*, dingy in age, *rather narrow*, close behind, subdistant in front, adnexed, few short, interspaces venose. STEM 4.7 cm. long, 1-3 cm. thick, subequal, medium stout, white with a dull lustre, *pruinose*, even, spongy-stuffed, apex floccose-punctate. SPORES white in mass, oval, 8-10 micr. diam., strongly echinulate, nucleate, apiculus long and stout. TASTE *acid*. ODOR none.

Gregarious or solitary. On the ground, on much decayed logs or debris, sometimes at base of white pine or beech trees, in pine-beech woods. New Richmond. Sept. Frequent locally.

Distinguished among the "ruber" group by the mode of color change while maturing, the white gills, spores and stem, and the acid taste. In wet weather the cap is viscid, on drying its surface is distinctly pruinose. Except for the colors of the pileus it agrees with *R. ruber* Fr. in the sense of Peck. The stem is rarely inclined to ashy in age but not distinctly so. According to Maire's conception the species is quite variable and includes plants whose stem readily turns ashy.

SUBRIGIDAE. Pileus subrigid, rather compact; cuticle soon dry, *pruinose or pruinose-velvety*; margin obtuse. Gills broader in front, equal. Spore-mass never pure white.

This group approaches the preceding by its rather compact and thick pileus, and the following by its equal gills. The pellicle is soon dry and pruinose or pruinose-velvety by which character the species are best recognized. Several aberrant species are, however, included, e. g., *R. xerampelina* with intermixed short gills and *R. mariae* with margin of pileus at first incurved.

119. *Russula mariae* Pk. (EDIBLE)

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

Illustrations: N. Y. State Mus. Bull. 75, Fig. 1-8, 1904.

Plate XVIII of this Report.

PILEUS 3-9 cm. broad, firm, subhemispherical at first, then broadly convex to plane and depressed, *dry*, subviscid when wet, *pruinose-velvety*, dark crimson, *reddish-purple* or maroon-purple, *even*, substriate only when old, margin at first incurved. FLESH thick, thinner toward margin, compact, becoming softer, white, sometimes reddish under pellicle. GILLS narrowly adnate or almost subdecurrent, *rather narrow*, of nearly uniform width, *white then dingy cream-color*, close to subdistant, equal, bifurcate at base. STEM 3-9 cm. long, 8-15 mm. thick, subequal or tapering downward, firm then fragile, spongy-stuffed, *pruinose, rosy-red to dull purplish-red*, especially in the middle, rarely white except at ends, white within and unchanging. SPORES globose, tuberculate-crystallate, 7.8 micr., *creamy-whitish in mass*, scarcely yellowish-tinged. CYSTIDIA rather abundant, lanceolate, 90-95x12 micr. BASIDIA 36-42 x9 micr. *Subhymenium* of small cells, not sharply limited. TASTE mild or rarely very slightly acrid. ODOR none.

Gregarious. On the ground in frondose woods. Southern Michigan. July-August. Infrequent.

I have examined the type specimens and submitted drawings, photographs and specimens to Peck. His plants average smaller and his figures and descriptions are deceptive as to size as compared with most of the specimens found in Michigan. With us *R. mariae* is nearly always larger and has much of the appearance of Cooke's figure of *R. expallens* (Ill., Pl. 1029), but that species is said to have a very acrid taste. The pileus varies scarlet-red, reddish-purple, maroon or dark purple. The caps of the purple forms have the appearance of those of *R. queletii*, *R. purpurea* and *R. drimeii* of Cooke's plates; but all of these have a very acrid taste. The red forms agree quite well with Gillet's and Michael's figures of *R. linnaei*, but Romell, Maire, Bresadola and others consider *R. linnaei* as a doubtful species. The stems of *R. mariae* are nearly always somewhat colored. The pruinosity of the cap and stem is due to minute tufts of purplish or reddish hairs as seen under the microscope. The plant was named by Dr. Peck in honor of his wife Mary. The interpretation of this species in my previous paper (Mich. Acad. Rep. 11, p. 70, 1909) was an error.

120. *Russula aeruginea* Lindb. (non Fr.) (EDIBLE)

Svampbok, 1902.

Illustrations: Ibid, Fig. 52.

Cooke, Ill., Pl. 1044 (as *R. heterophylla* Fr.). (Doubtful.)

Michael, Führer f. Pilzfreunde, Vol. II (as *R. livida* Pers.).

Ricken, Blätterpilze, Pl. 16, Fig. 2 (as *R. graminicolor* Quel.).

PILEUS 5-8 cm. broad, *moderately firm*, then fragile, convex to expanded, subdepressed, *dull greenish, dark green* to smoky-green, paler on margin, pellicle adnate, subviscid when moist, soon dry with a dull luster and *subpulverulent to pruinose-velvety*, slightly separable on margin, even or substriate in age. FLESH thick on disk, thin on margin, white, sometimes cinereous to greenish under pellicle. GILLS narrowly adnate or almost free, close to subdistant, *rather narrow*, slightly broader in front, entire or very few short ones, distinct, white at first *then pale creamy-white*, becoming dingy in age, bifurcate at base, intervenose. STEM 4-5 cm. long, 1 cm. thick, subequal or tapering downward, glabrous, *white*, spongy-stuffed, firm, even. SPORES subglobose, *creamy-white*, 6-9 micr. TASTE *mild*. ODOR none.

Gregarious or solitary. On the ground in coniferous or mixed woods of the Northern Peninsula. Marquette, Sault Ste. Marie. July-September. Infrequent.

This species is considered identical with *R. graminicolor* Quel. by the French mycologists. The "shining-white gills" (candidae) of the Friesian description is probably an error. *R. heterophylla* Fr. is now limited by most writers to a plant with pure white gills and spores and is rare. *R. olivascens* Fr., reported (Mich. Acad. Sci. Rep. 11, p. 76, 1909), has been omitted as it appears too close to this species; the specimens referred to it had a more yellowish tint to the spore-mass.

121. *Russula xerampelina* Fr. (SUSPECTED)

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., 1041 (as *R. olivacea*).

Gillet, Champignons de France, No. 628 (as *R. olivacea*).

Ricken, Blätterpilze, Pl. 18, Fig. 4 (as *R. olivacea*).

PILEUS 5-10 cm. broad, *firm*, convex then plano-depressed, dry or very slightly viscid in wet weather, pellicle hardly separable,

not striate on margin, surface glabrous or subpruinose, purplish-red to purplish-olive, disk olivaceous, variegated. FLESH *compact*, whitish then dingy. GILLS *creamy-white* to creamy-yellowish, then sordid, rather close, adnexed, moderately broad throughout, thickish, often forked, shorter ones usually intermingled, interspaces venose. STEM white or *rosy-tinged*, soon dingy olivaceous-yellowish where handled, 5-7 cm. long, 1.5-2.5 cm. thick, firm, subventricose or equal, spongy-stuffed, even or obscurely wrinkled, *changing* where bruised to *dirty ochraceous-brown*. SPORES creamy-yellowish, globose, echinulate, 9-10 micr. TASTE *mild*. ODOR *disagreeable with age* or when drying.

Scattered. Hemlock and coniferous or mixed woods of the Northern Peninsula. July and August.

This has usually been referred to *R. olivacea* Fr. in this country. In Europe, *R. olivacea* is a very much debated species. Fries' description requires truly yellow gills (luteis), and with this character it has seldom been found. Romell has never seen such a plant in Sweden and unites *R. olivacea* and *R. serampelina* under the name *R. graveolens*. The series of color forms included under the last name is quite common about Stockholm, and as far as I could see it is the same as our northern Michigan species. I assume, then, that we can drop the name *R. olivacea* from our list of American Russulas, in which case our olive form goes into the present species. Our plant is near *R. squalida* Pk. as the latter is diagnosed in this paper. It differs, however, from that species in the more firm consistency, in the stem being often reddish, and its habitat in coniferous regions. *R. squalida* is soft and flexible in age.

122. *Russula squalida* Pk. (SUSPECTED)

N. Y. State Mus. Rep. 41, 1888 (as *R. atropurpurea* Pk.).

N. Y. State Mus. Bull. 116, 1907.

Illustration: Kauffman, Mich. Acad. Sci. Rep. 11, 1909.

PILEUS 7-11 cm. broad, convex then plano-depressed, firm, soon subflaccid, margin *even when young*, becoming slightly tubercular-striate in age, the pellicle continuous but rather adnate, not easily separable, subviscid in wet weather, *soon dry* and then *pruinose-velvety*, even, color varying from reddish-purple to pallid and mixed with olivaceous, tan or ochraceous, often shades of all these colors are seen in one cap, opaque and dull, not shining. FLESH white, thick on

disk, rather thin elsewhere, grayish or grayish-purple under the *cuticle*. GILLS white when young, later *creamy-yellow to ochraceous*, subdistant, becoming fragile, moderately broad, broadest toward the front, more or less forked toward base, few shorter ones, interspaces venose. STEM *white, changing to ochraceous if bruised* when fresh and young, when older becoming dirty-brown or ochraceous-brown where handled, equal and subcylindrical, rather long, 5-9 cm. by 1.5 cm. thick; glabrous, spongy-stuffed, obscurely rivulose. SPORES ochraceous to buff, globose, 7.5-10 micr. TASTE *mild*. ODOR *unpleasant*, very characteristic when plants are old or drying.

Solitary or gregarious. Hemlock and maple woods in the north, oak and maple woods in southern Michigan. July, August and September.

This is our early, abundant *Russula* about Ann Arbor. It occurs in great quantities during July if the weather is favorable and only sparingly later. Once recognized by its odor and changeable flesh, its many color disguises are not as deceptive as they at first seem. The colors run into each other in a rather definite way, so that the general effect to the observer, after he has compared many individuals, is quite characteristic for the species. Hundreds of individuals were examined about Ann Arbor and all had white stems, never red. When old the effect of the whole plant is that of dinginess. Although the above description extends beyond the limits allowed by Peck's description, it is doubtless his species. Originally it included only the purple or dark red forms and was called *R. atropurpurea* Pk. but since this name was pre-empted, he changed it to *R. squalida*. It seems close to the preceding.

123. *Russula decolorans* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1079.

Ricken, Blätterpilze, Pl. 17, Fig. 5.

PILEUS 5-12 cm. broad, *often large*, firm, *globose at first* then convex and plano-depressed, *orange red*, usually ochre on disk and dark red on margin, pellicle separable, subviscid, margin even, slightly striate in age. FLESH white, *becoming cinereous* with age or where broken, becoming fragile. GILLS pale yellowish-ochraceous at maturity, white at first, thin, fragile, moderately broad, close, adnexed, forked at base, few short. STEM 5-12 cm. long,

1-2.5 cm. thick, *stout*, long, spongy or solid, wrinkled-rivulose, white, *the flesh becoming cinereous with age or where bruised*. SPORES subglobose, echinulate, pale ochraceous-yellow, 7-9 micr. TASTE *mild*. ODOR none.

Solitary or scattered. In coniferous or mixed woods of northern Michigan. July, August and September. Frequent.

The large size, globose young pileus, orange-red color and the changing flesh easily distinguish it. *R. depallens* Fr. in which the flesh turns ashy has not with certainty been found. It is said to have whitish gills, and the color of the pileus is dirty red to fawn. *R. decolorans* appears to prefer the regions of the pine and fir, both in this country and in Europe.

Var. *rubriceps* Kauff.

Mich. Acad. Sci. Rep. 13, p. 215, 1911.

The shape of the young and old pileus of this variety is well represented in Cooke's figure of *R. decolorans*, Plate 1079. The color of the pileus is, however, *ruber-red* (Sacc. colors) and persistent, changing only in age or on drying as a result of the cinerescence of the flesh. The pellicle is adnate, scarcely separable except on the margin, vanishing on the disk and sometimes ochraceous-spotted where the pellicle has disappeared. It is firm and the margin is not striate or very slightly so in age. These characters ally it to the *Rigidæ*. It is slightly viscid. FLESH is firm, white, tinged ashy in age, *becoming dark cinereous on the stem where bruised*. The taste is *mild* and when fresh was taken for *R. lepida*. SPORES creamy-white in mass. It is smaller, at least in our specimens, than the type.

On the ground in beech and white pine woods. New Richmond, Allegan County. September. Apparently rare.

124. *Russula flava* Romell (EDIBLE)

Lönnegren's Nordisk Svampbok, 1895.

Illustration: Mich. Acad. Sci. Rep. 11, p. 55, Fig. 3.

PILEUS 5-8 cm. broad, *rather fragile*, convex, then plano-depressed, *even or slightly striate* in age, dry in dry weather, somewhat viscid when moist, pellicle separable, *dull yellow* (flavus, Sacc.), color hardly fading, but sometimes ashy, discolored in age. FLESH white *becoming cinereous* with age. GILLS white at first, becoming yellowish, broadest towards front, narrowly adnate, close, distinct, becoming slowly gray in age. STEM chalk-white at first,

the flesh becoming ashy, equal or subequal, spongy-stuffed, obscurely reticulate-rivulose, rather fragile, 6-8 cm. long, 1-2 cm. thick. SPORES *yellowish*, globose, echinulate, 8-9 micr. TASTE *mild*. ODOR none.

Solitary or scattered. In coniferous or mixed woods of northern Michigan. July, August and September. Frequent.

This mild, dull or pale yellow, rather large *Russula*, with flesh, gills and stem becoming ashy when old, is quite easily recognized. This is *R. constans* Karst. which name was pre-empted. It differs from *R. ochrালেuca* Fr. in the mild taste and unpolished pileus, etc. Its habit is very similar to that of *R. decolorans*, but it rarely reaches the same size and differs constantly by its yellow cap.

125. *Russula obscura* Romell (EDIBLE)

PILEUS 4-7 cm. broad, rather pliant, convex then plano-depressed, dull, *dark blood-red*, pileus sometimes blackish on disk, thin, the pellicle continuous and separable, hardly viscid when moist, *subpruinose* when dry, even or slightly striate in age. FLESH whitish, becoming ashy. GILLS white at first, then dingy straw-color, moderately broad, narrowly adnate, close, mostly forked at base, equal, interspaces sometimes venose. STEM white, *becoming ashy or blackish*, rarely tinged red, subequal, 4-6 cm. long, 10-15 mm. thick, spongy-stuffed, rigid, soon soft, obscurely wrinkled. SPORES *pale ochraceous in mass*. TASTE mild. ODOR none.

Gregarious or scattered, in low woods of southern Michigan. July and August.

It is found frequently around Stockholm. The examples pointed out by Romell did not seem to possess such a blackish stem as some of ours. This species does not remind me of *R. decolorans*, being a more slender and smaller plant. It might be confused with *R. nigrescentipes* Pk., but that species is said to have white spores. Romell (Hymen. Lapland, 1911) suggests that a better name for this plant is *R. vinosa* Lindb. since the latter name was used by Lindbladt in his Svampbok prior to the use of *R. obscura*.

126. *Russula rubescens* Beards. (EDIBLE)

Mycologia, Vol. 6, p. 91, 1914.

Illustrations: Beardslee, Mycologia, Vol. 6, Pl. 121, Fig. 1.
Plate XIX of this Report.

PILEUS 4-10 cm. broad, firm, becoming fragile, convex-plane, *dull-red, variegated* with yellowish, ochraceous or olivaceous-purplish hues, at first darker, *fading*, pellicle adnate, *dry*, scarcely separable and substriate on the margin, subglabrous, margin acute and at first straight. FLESH whitish, *staining slowly red then black where wounded*, becoming cinereous from age. GILLS narrowly adnate, broader in front, close to subdistant, medium broad, *equal*, rarely forked, white at first *then pale creamy-ochraceous*, intervenose. STEM 3-7 cm. long, 1-2.5 cm. thick, subequal or tapering down, spongy-stuffed, glabrous, even, white, becoming cinereous in age, *changing slowly* to red then blackish where bruised. SPORES globose, pale ochraceous, 7-10 micr. CYSTIDIA few and short, *subhymenium* not differentiated. TASTE *mild*. ODOR none.

Gregarious or scattered. On the ground in frondose woods. Ann Arbor. July-August. Infrequent.

Remarkable among the Subrigidae for the changes which the flesh assumes on bruising. It approaches *R. nigrescentipes* Pk., but that species is said to have a shining red cap and crowded white gills, and the stem turns blackish; no mention is made of any red stains preceding the black and since the change is slow it could scarcely be overlooked. Our species has appeared from season to season but never in abundance. It is a firm plant when fresh, becoming fragile only in age. It is apparently also related to *R. depallens* Fr. but Maire says "nobody knows this, even in Sweden." *R. obscura* Rom. has a velvety-pruinose pileus whose color is rather uniform, and whose flesh is of a different consistency.

Micro-chemical tests: G. (Gills and flesh turn blue.) S V. (Gills and flesh turn bluish very slowly.) F S. (Cystidia colored brown).

As this report was ready for the press there appeared in print the above name applied by Beardslee to a species from Asheville, N. C., which seems identical with ours.

127. *Russula borealis* Kauff. (EDIBLE)

Mich. Acad. Sci. Rep. 11, p. 69, 1909.

PILEUS 5-9 cm. broad, *firm and rather compact*, convex then plano-depressed, outline broadly elliptical, often with a sinus on one side, *blood-red*, disk darker or color uniform and not fading, pellicle somewhat separable, hardly viscid, margin even or obscurely striate. FLESH white, red under the cuticle, not very thick. GILLS *ochraceous*, subdistant or moderately close, *medium broad*, broader in front, narrowly adnate, rather distinct, edge often reddish anteriorly, equal, a few forked toward base, interspaces venose. STEM white and *tinged red* in places, *firm*, spongy-stuffed, thickened below, 5-7 cm. long, 1.5-2 cm. thick. SPORES deep *ochraceous-yellow* in mass. TASTE *mild*, sometimes slightly and tardily acrid. ODOR none.

Solitary. In mixed woods of hemlock, yellow birch and hard maple, in the Northern Peninsula. Huron Mountains, Marquette and Munising. August.

Russula alutacea is usually larger, stouter, the cap dull or sordid red, and with broader gills. *Russula ochrophylla* occurs in oak woods, has "buff spores, dusted" on yellow gills, and has violaceous-purple or purple-red cap. Peck saw our plant but did not refer it to either species. This species and *R. alutacea* show the futility of using the striations on the margin of the cap as an important character to distinguish the main groups. A true pellicle is present in both and is often quite easily separated especially on the margin, and this with the character of the gills connects them very closely with the Fragiles. *R. linnaei*, which is not well known in Europe, looks like it according to Cooke's figures, but is said to have white gills and spores.

128. *Russula alutacea* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1096 and 1097.

Gillet, Champignons de France, No. 597.

Berkley, Outlines, Pl. 13, Fig. 8 (reduced in size).

Bresadola, Fungh. mange. e. vel., Pl. 76.

Patouillard, Tab. Analyt., No. 513.

Michael, Führer f. Pilzfreunde, Vol. II, No. 65 (as *Russulina alutacea*).

Atkinson, Mushrooms, Pl. 36, Fig. 2, 1900 (much reduced in size).

Gibson, Edible Toadstools and Mushrooms, Pl. 12, Figs. 2, 4, 6, p. 131, 1903 (much reduced in size).

PILEUS 8-15 cm. broad, large, firm, convex then depressed, with dull colors, dark reddish-purple, sordid red, sometimes mixed with other shades, the reddish color predominating, *with somewhat separable pellicle*, glabrous, somewhat viscid in wet weather, soon dry, *pruinose and subgranulose*, margin even or somewhat short-striate in age. FLESH white, thick. GILLS *ochraceous from the beginning*, deeper ochraceous to tan-colored when mature, *rather broad, thick, subdistant*, broader in front, rounded adnexed, of equal length. STEM 7-10 cm. long, 3-4 cm. thick, very firm, stout, solid, *tinged red* or entirely white, subequal or ventricose, almost even. SPORES ochraceous-yellow to alutaceous, subglobose, 9-11 micr. TASTE mild. ODOR none or pleasant.

Usually solitary and rather late. Oak and maple woods of southern Michigan. Not very common. August and September.

As limited above, no bright or shining red forms are admitted from our territory. This species and *R. integra* have been the receptacle for a good many reddish species with ochraceous gills, and even experienced mycologists cannot agree on their identification. I have kept this name for a large, solitary, often late plant, with firm or hard consistency and dull, dark red and purplish cap, with truly ochraceous gills and spores. *R. integra* has cream-colored or at least paler spores and is more fragile and often grows in troops. The descriptions of this and *R. ochrophylla* run close together. Cooke's illustration of *R. alutacea* fits our plants well.

FRAGILES. Pileus thin, fragile, the viscid pellicle continuous and quite separable, margin connivent, not incurved when young, usually strongly striate. The gills are of equal length, broader anteriorly, narrowed behind.

Section I. Taste acrid. Spores white in mass.

129. *Russula emetica* Fr.

Syst. Myc., 1821.

Illustrations: Fries, Sverig. Svamp., Pl. 21.

Cooke, Ill., Pl. 1030.

Gillet, Champignons de France, No. 610.

Bresadola, *Fungh. mang. e. vel.*, Pl. 68.

Marshall, *Mushroom Book*, Pl. 17, p. 68, 1905 (reduced).

Gibson, *Edible Toadstools and Mushrooms*, Pl. 13, p. 139, 1903 (reduced).

Atkinson, *Mushrooms*, Pl. 36, Fig. 4, 1900 (reduced).

McIlvaine, *American Fungi*, Pl. 41, Fig. 2, 1900.

PILEUS 5-10 cm. broad, fleshy, soon *fragile*, convex to plano-depressed, *rosy to blood-red*, sometimes faded to white, pellicle separable, *margin strongly tubercular-striate* or even sulcate, viscid and shining. FLESH white, *red under the cuticle*. GILLS *pure white*, subdistant or close, distinct, rather broad, equal, broadest toward front, narrowly adnexed or free, interspaces venose. STEM 4-7 cm. long, 1-2 cm. thick, white or tinged red, subequal, spongy-stuffed, even. SPORES *white in mass*, globose, echinulate, 7.5-10 micr. TASTE *very acrid*. ODOR none.

Scattered or gregarious. On the ground or on debris of very rotten logs in woods. Throughout the state. July to October. Common.

The mycelium has been found to be attached to oak tree roots where it forms mycorrhiza. The very acrid taste gives it a bad reputation and it is avoided by mushroom-eaters. Some think it is harmless when thoroughly cooked. There are variations of habitat. It grows quite constantly on the crumbling remains of wood or logs, where its white strings of mycelium are easily seen; here the gills are close. One form has been found growing in troops; such were found in a tamarack swamp in late October, growing on thick beds of sphagnum. They had developed somewhat differently in this habitat as was to be expected. The stems were white, long and stout, narrower above and obsoletely wrinkled. The gills were subdistant. The taste was sharp but not as excruciating as that of the type. The disk of the pileus was glabrous and very viscid. It was a beautiful plant, apparently appearing late; it might be referred to as var. *gregaria*.

130. *Russula rugulosa* Pk.

N. Y. State Mus. Rep. 54, 1901.

Illustration: *Ibid*, Pl. 72, Fig. 12-18.

PILEUS 5-10 cm. or more broad, thin, *fragile*, convex then plano-depressed, *dark rose-red*, color sometimes thin, *surface* almost entirely *rugulose*, the rugae radiating somewhat, rather viscid, pellicle

separable, margin at length distinctly tubercular-striate. FLESH thin, white, red under the pellicle. GILLS shining white, rather close, narrowly adnate, not very broad, broadest in front, few forked, equal, interspaces venose. STEM white, subequal, unchanged, glabrous, spongy-stuffed, 6-7 cm. long, 1-2 cm. thick. SPORES *white in mass*, globose, echinulate, 8-9 micr. TASTE tardily but very acrid.

In troops. Hemlock and mixed woods on the ground. August and September. Northern Michigan.

Differs from *R. emetica* in that its acrid taste develops slowly, in the uneven and rather dull pileus and in the habit of appearing in troops on the ground. It was formerly referred to *R. emetica*, and is close to it.

131. *Russula fragilis* Fr.

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1091.

Gillet, Champignons de France, No. 614.

Patouillard, Tab. Analyt., No. 622.

Michael, Führer f. Pilzfrende, No. 43 (var.).

Ricken, Blätterpilze, Pl. 19, Fig. 3.

Hard, Mushrooms, Fig. 172, p. 192, 1908.

PILEUS 2.5-5 cm. broad, *very thin* and fragile, convex then plano-depressed with a thin viscid pellicle, tubercular-striate on the thin margin, glabrous, rather uniform rosy or *pale red*, sometimes faded or bleached to white. FLESH *white under the pellicle*, thin. GILLS white, thin, close, crowded, adnexed, ventricose, moderately broad. STEM 2.3-5 cm. long, .5-1 cm. thick, white, spongy then hollow, equal, fragile. SPORES *white in mass*, subglobose, 8-9 micr. TASTE promptly and *very acrid*. ODOR none.

Scattered. On the ground in woods. Throughout the state. July-August. Infrequent.

This species, as limited here, is only distinguishable from *R. emetica* relatively; it is smaller, color paler, flesh thinner and more fragile and white under the cuticle. Maire says the taste is more quickly acrid on the tongue than *R. emetica*, but not as violent. It grows in somewhat dryer situations. Var. *nivea* is a white plant, otherwise the same. *R. fallax* Cke. used to be considered a variety of it.

132. *Russula fallax* Cke.

Illustration: Cooke. Ill., Pl. 1059.

PILEUS 3-7 cm. broad, *thin, fragile*, color incarnate or pale rose, the *disk pale olivaceous or livid*, sometimes darker or purplish, soon plane or slightly depressed on disk, quite viscid, margin striate and becoming elevated, surface faintly rugulose under lens. FLESH white. GILLS white, unchanged, subdistant, attached by a point, *narrow*, edge even. STEM 3-4 cm. long, 6-10 cm. thick, pure white, cylindrical or compressed, equal, spongy-stuffed, soon hollow, longitudinally-wrinkled **under a lens**. SPORES *white in mass*, subglobose, 7.5 micr. TASTE promptly and very acrid.

Solitary or gregarious. In sphagnum bogs, low mossy ground in woods, etc., often attached to sphagnum. Distributed throughout the state. Not rare. July, August and September.

This species differs in two important particulars from *R. fragilis*. The gills are subdistant and the pileus is livid or olivaceous in the center. It is very characteristic of the sphagnum flora of the state. It has often been referred to *R. fragilis* as a variety. The pileus is not as lilac as shown in Cooke's figure.

133. *Russula albidula* Pk.

Torr. Bot. Club. Bull. 25, 1898.

PILEUS 2.5-5 cm. broad, *white*, broadly convex, glabrous, the pellicle *viscid* and separable when fresh, the margin even. FLESH white, subfragile. GILLS white, rather crowded, adnexed, not broad, *of equal length*, some basifurcate, interspaces venose. STEM 2.5-4 cm. long, 8-12 mm. thick, white, equal, spongy-stuffed, even. SPORES white in mass, subglobose, 7-10 micr. TASTE acrid. ODOR none.

Solitary. In oak woods. Ann Arbor. July and August.

In dried specimens the pileus and gills are ochraceous to yellowish, and stem whitish. The taste and viscosity seem to be the only marked differences between this species and the other two white *Russulas* of Peck, *R. albida* and *R. albella*. All three are rather fragile, while *R. lactea* is a compact firm plant with thick, broad, distant gills. There is a white variety of *R. emetica* which is very acrid and fragile and whose striations on the margin of the cap are like those of that species.

Section II. Taste acrid. Spore-mass cream-color, yellowish, ochraceous to alutaceous.

134. *Russula sanguinea* Fr. (*R. rosacea* Fr.)

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1020 (as *R. rosea*).

Michael, Führer f. Pilzfrennde, Vol. II (as *R. rosacea*).

PILEUS 3-6 cm. broad, rather firm at first, *subfragile*, convex-plane or depressed, *rosy-red*, *viscid*, margin acute and thin, pellicle subadnate, easily separable on margin and tubercular-striate. FLESH rather thin, white, red under the pellicle. GILLS slightly adnate, close to subdistant, *equal*, not broad, *creamy-white*. STEM 4-6 cm. long, subequal or tapering down, often eccentric, *white or tinged rosy-red*, spongy-stuffed then cavernous, rather fragile, glabrous, even. SPORES *creamy-white in mass*. TASTE tardily but truly acrid.

Gregarious. On the ground among grass in frondose woods. Ann Arbor. September-October. Infrequent.

The plants referred here are *R. rosacea* in the sense of Romell, and *R. sanguinea* according to most of the modern French mycologists. They are distinguished by the cream color of the spores and gills. The gills are not decurrent as they are supposed to be in *R. rosacea*, but the stem is often eccentric as that species is described by Fries. Bresadola, Maire, etc., conceive *R. rosacea* Fr. as a plant with pure white gills and spores. Our plant agrees with a species, common around Stockholm, whose gills are usually creamy-white. It was placed by Fries among the rigid forms but is almost too fragile. It is not large and except for the color of the spores small forms might be mistaken for *R. fragilis*.

135. *Russula veteriosa* Fr.

Epicrisis, 1836-38.

Illustrations: Bresadola, Fungh. mang. e. vel., Pl. 75.

Cooke, Ill., Pl. 1033.

PILEUS 5-7.5 cm. broad, convex then expanded, with a somewhat separable pellicle, *indistinctly striate* on the margin, deep rose-red (like *R. emetica*), *viscid* when moist. FLESH white, red under the cuticle. GILLS white at first, *then straw-color or pale ochraceous*,

narrow; adnate, close, broader in front, equal or few shorter, few forked, interspaces venose. STEM white, *never red*, equal or subequal, spongy-stuffed, somewhat slender, fragile, hollow, even, 1.5 cm. long, 1-1.5 cm. thick. SPORES pale *yellowish-ochraceous*, subglobose, echinulate, 8-9 micr. TASTE *very acrid*. ODOR none.

Scattered or gregarious. Oak and maple woods of southern Michigan. July and August.

This represents a group of red *Russulas* with acrid taste and gills varying pale ochraceous or somewhat yellowish in the different forms. I have limited the name to those with white stem and a rather firm and hardly striate pileus, although it may include several forms of which only the spore-color has so far been a distinguishable character. The separable, viscid, distinct pellicle and rather fragile stem, relates it to the *Fragiles*. From *R. tenuiceps* it is separated by the less deep ochraceous spores and gills, the firmer consistency of pileus and gills, and the uniform red color and even margin of the pileus.

136. *Russula tenuiceps* Kauff.

Mich. Acad. Sci. Rep. 11, p. 81, 1909.

Illustration: Plate XX of this Report.

PILEUS 7-12 cm. broad, thin, fragile, convex to expanded, the somewhat viscid pellicle easily separable, margin at first connivent, *striate*, deep rosy-red or blood-red, sometimes white, spotted or tinged with orange blotches, sometimes uniform red, with or without minute rugae. FLESH white, red beneath the cuticle, *very fragile at maturity*. GILLS white, then yellow-ochraceous, *crowded*, narrow, *fragile*, narrowly adnate to free, few forked, interspaces venose, equal. STEM fragile, white or rosy-tinged, spongy-stuffed, subequal or ventricose, obscurely rivulose, white within and unchanged, 5-9 cm. long, 2-2.5 cm. thick. SPORES *yellow-ochraceous*, subglobose, 6-8 micr., echinulate. TASTE acrid, sometimes tardily but very acrid. ODOR not marked.

Gregarious. Mixed woods at Marquette; in oak and maple woods at Ann Arbor. July and August. Rather frequent.

As in *R. veteriosa*, it is probable that several forms are represented here. The red *Russulas* are very troublesome, and we seem to have a considerable number of forms with acrid taste and yellowish to deep ochraceous gills, which cannot be easily kept separate. All efforts to refer them to old species like *R. sardonias*, *R. rugulosa*,

R. rosacea, etc., failed repeatedly; the fragile flesh and ochraceous, almost alutaceous gills are too distinctive. The maturing of the spores is sometimes slow and care must be taken to get a good spore print in these red species. All the collections which I have referred here showed red on some or all of the stems of each collection. Their edibility was not tested.

137. *Russula palustris* Pk.

N. Y. State Mus. Rep. 53, 1900.

PILEUS 4-7.5 cm. broad, *fragile*, subglobose or hemispheric, then convex or nearly plane, viscid, pellicle separable, obscurely tubercular-striate on margin, *reddish*-buff or purplish-red especially on disk, glabrous. FLESH white, thin, tinged with the color of the pileus under the pellicle. GILLS narrowed behind, broader in front, close to subdistant, entire, *whitish then yellowish*, intervenose. STEM 3-7 cm. long, 6-12 mm. thick, equal, glabrous, spongy-stuffed then hollow, fragile, white or tinged red. SPORES subglobose, *pale yellow in mass*, 7.5-10 micr. TASTE *tardily acrid*.

Gregarious or scattered. In low woods or swamps. Marquette, New Richmond, Ann Arbor. August-September. Infrequent.

The pileus is sometimes faintly glaucous.

138. *Russula aurantialutea* Kauff.

Mich. Acad. Sci. Rep. 11, p. 81, 1909.

PILEUS 5-10 cm. broad, *thin*, fragile, convex then plano-depressed, *yellow* (citron to luteus), or *with orange shades* intermingled, especially on the margin, slightly tubercular-striate, pellicle viscid, shining and somewhat separable for some distance. FLESH *white*, thin toward the margin, *unchanged with age*. GILLS *pale yellow*, close, or subdistant at the outer extremity, equal or a few shorter, narrowly adnate, seceding with age, broadest toward front, often forked at the base, rarely elsewhere, interspaces venose. STEM 4-8 cm. long, 1.5-2 cm. thick, white, flesh concolor and unchanged, subequal, glabrous, even, spongy-stuffed. SPORES *ochraceous-yellow*, subglobose, 8-9 micr. TASTE acrid in all its parts, often very acrid. ODOR not noticeable.

Solitary or scattered. On debris or forest mould in hemlock or mixed woods of northern Michigan, in deciduous woods in the southern part of the state. July, August and September. Earlier in southern Michigan. Infrequent.

R. ochroleuca Fr. differs in having white to pallid gills and spores, and a cinerescens stem; *R. granulosa* Cke. has white gills and spores and a granular cap and stem; *R. fellea* Fr. has ochraceous or straw-yellow flesh and the more firm pileus is either straw or gilvous color, and its gills exude watery drops; *R. claroflava* Grove has a cinerescens stem and its gills are white then lemon yellow with an ochre tinge; *R. ochracea* Fr. has a mild taste, and the flesh of the cap, gills and stem is ochraceous; *R. simillima* Pk. has white spores and a pale ochraceous pileus and stem; and *R. decolorans* Fr. has cinerescens flesh and is stouter. Our species could be made on ecological variety of almost any of the above species, depending on the guess of the author who so interpreted it.

Section III. Taste mild. Spore-mass white.

139. *Russula albida* Pk.

N. Y. State Mus. Bull. 2, 1887 (*R. albida*).

N. Y. State Mus. Rep. 50, 1897 (*R. albella*).

Illustration: N. Y. State Mus. Bull. 105, Pl. 96 (*R. albida*).

PILEUS 3-6 cm. broad, *thin, fragile*, broadly convex to plane, slightly depressed in the center, white or whitish, even or slightly striate on the margin, not shining. FLESH white, fragile. GILLS white or whitish, thin, moderately close, entire, equal, not broad, broadest in front, rarely forked at base, adnate or subdecurrent. STEM 2.5-6 cm. long, white, subequal, glabrous, spongy-stuffed or solid. SPORES about 8 micr. diam., *white*. TASTE mild or *slightly bitterish*.

Solitary. Hemlock or mixed woods in the Northern Peninsula. July and August.

Peck's description of both *R. albida* and *R. albella* differs in minor particulars from our plants. The pileus of *R. albida* has a viscid, separable pellicle, while that of *R. albella* is dry. *R. albida* is said to have a "slightly bitterish or unpleasant taste," while our plants were sometimes bitterish, sometimes tardily and slightly acid. *R. albida* is described with a stuffed or hollow stem; in one of my collections the stem was solid, in another it was spongy-stuffed. It is worth noting whether the spore prints are pure white or with yellow tinge; some of Peck's specimens of *R. albida* had spores with a faint yellowish tinge. In my specimens the whole plant is ochraceous when dried; specimens seen at the N. Y. Botan-

ical Gardens were white when dry. As these species occur so seldom and far apart, it is difficult to obtain exact data with regard to their characters. *R. anomala* Pk. and *R. albidula* differ in the acrid taste.

140. *Russula subdepallens* Pk. (EDIBLE)

Torr. Bot. Club Bull., Vol. 23, 1896.

PILEUS 5-14 cm. broad, *fragile*, convex then plane and depressed, margin elevated in age, *bright rosy-red*, shading into yellowish blotches as if the red color were put over the yellow, disk paler in old specimens, disk dark-red in very young plants, with a thin, separable, viscid pellicle, *tubercular-striate* on margin, obscurely wrinkled elsewhere. FLESH white, rosy under the cuticle, becoming slightly cinereous, *very fragile*. GILLS *white*, broad in front, narrowed behind, adnate, subdistant, few forked, interspaces venose. STEM white, spongy-stuffed, rather stout, 4-10 cm. long, 1-3 cm. thick, subequal. SPORES *white in mass*, globose, echinulate, 7.5-8 micr. TASTE mild. ODOR none.

Gregarious. In woods of maple, yellow birch and hemlock of northern Michigan. August.

Found in a number of places in considerable abundance. The fragile character, especially of the gills, is very marked and the mild taste, white gills and red cap help to distinguish it. The flesh does not turn so strongly ashy as in Peck's plants, and this character did not seem to be always noticeable. It is distinguished from *R. purpurina*, the brilliant-red *Russula*, by its gregarious habit, large size and less viscid cap; also the gills are not crenulate. Our specimens had the stature and appearance of *R. rugulosa* and *R. emetica* var. *gregaria*. Peck's plants were found in Pennsylvania by Dr. Herbst, and reported but once; the species is not included in Peck's New York monograph. Our plant has so far been limited to the north.

141. *Russula purpurina* Quel. & Schultz (EDIBLE)

Hedwigia, 1885.

Illustrations: McIlvaine, American Fungi, Pl. 45 [a. p.] 188, 1900.

Plate XXI of this Report.

PILEUS 3-7 cm. broad, *fragile*, *viscid*, usually very viscid, subglobose then expanded and slightly depressed at the disk, *brilliant rosy-red* to blood-red or even darker, pellicle somewhat separable.

margin thin but *not striate* except when fully expanded, surface when dry as if with a bloom. FLESH white, red under the cuticle, thin, fragile, unchangeable. GILLS *white*, later dingy-white or "yellowish," medium close to subdistant, adnexed, not broad, broadest in front, mostly equal, few or none forked, interspaces sometimes venose, *edge floccose-crenulate*. STEM rather long, 5-8 cm., 8-12 mm. thick, sprinkled rosy-pink, equal or subequal, spongy-stuffed, fragile but rather soft. SPORES *white in mass*, globose, 8-10 micr. TASTE mild. ODOR none.

Solitary or scattered. In mixed or maple-birch woods of the Northern Peninsula. Infrequent. August and September.

Distinguished by its brilliant red, viscid cap, small to medium size, mild taste and white crenulate gills and spores. Peck also notes the floccose-crenulate edge of the gills, which is due to cystidia. *R. uncialis*, *R. sericeonitens* and *R. subdepallens* are the only others of the Fragiles group with mild taste, red cap and white spores. From *R. uncialis* it differs by the deep color, character of gills and habitat. *R. sericeonitens* is hardly viscid and becomes silky-shining; it has a different stature and color. Maire points out that *R. punctata* Gill. and *R. pseudointegra* A. & G. have gills with a floccose-crenulate edge.

142. *Russula uncialis* Pk. (EDIBLE)

N. Y. State Mus. Bull. 2, 1887.

Illustrations: Peck, N. Y. State Mus. Bull. 116, Pl. 107, 1907.

PILEUS 2-5 cm. *broad*, thin, rather fragile, convex then expanded-depressed, *pink or bright flesh-color, unicolorous*, the rather adnate pellicle slightly separable, slightly viscid when moist, pruinose and pulverulent when dry, margin not striate till old. FLESH white, pink under the pellicle, unchanged. GILLS pure *white*, hardly changed, *rather broad*, broadest in front, narrowed behind and adnate, subdistant or moderately close, distinct, entire on edge, few forked, interspaces venose. STEM white, rarely tinged pink, rather short, 1-3.5 cm. long, 4-10 mm. thick, spongy-stuffed, equal, glabrous. SPORES *white in mass*, subglobose, echinulate, 7-8 micr. TASTE mild. ODOR none.

Gregarious. In oak woods of southern Michigan. July and August. Quite common in places.

The persistently white gills and spores, the mild taste, uniform pink color and size, distinguishes this *Russula*. It is sometimes more than an inch in width.

143. *Russula sericeo-nitens* Kauff. (EDIBLE)

Mich. Acad. Sci. Rep. 11, p. 84, 1909.

PILEUS 4-6 cm. broad, very *regular*, rather thin, convex then plano-depressed, *dark violet-purple* or dark blood-red tinted purplish, disk sometimes livid-blackish, the *separable pellicle* slightly viscid when moist, not striate or substriate in age, surface with a silky sheen. FLESH white, thin on margin, unchanged, purplish under the pellicle. GILLS *white*, subdistant or medium close, becoming flaccid, moderately broad, broad in front, narrowed behind, dry, equal, few forked near base, interspaces venose. STEM white, equal or thickened at apex, spongy within, unchanged, glabrous, even or obscurely rivulose, 3-5.5 cm. long, 1 cm. thick. SPORES *white in mass*, globose, echinulate, 6-7.5 micr. TASTE *mild*. ODOR none.

Usually solitary. In mixed woods of hemlock, maple and yellow birch in northern Michigan. July and August. Not uncommon.

Its thin pileus is *flexible* at maturity. The *silky sheen* and regular pileus are quite characteristic. The cap has the color of Cooke's figures of *R. queletii* Fr., *R. drimeia* Cke. and *R. purpurea* Gill. These three, including *R. expallens* Gill., have been placed together by some modern authors as one species, characterized by "a pruinose, violaceous, decolorate stem, and very sharp taste." The taste is said to be so peppery that even when the color is washed out by rains they can be recognized by this character. All of the four are violet or reddish on the stem. Our specimens all had a white stem and an impeachable mild taste.

Section IV. Taste mild; spore-mass cream-white, yellowish or ochraceous.

144. *Russula integra* Fr. (EDIBLE)

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1093 and 1094.

PILEUS 5-10 cm. broad, firm, *soon fragile*, discoid, convex or campanulate then plano-depressed covered with a *viscid separable pellicle*, thin on the margin, at length *coarsely tubercular-striate*, variable as to color in different plants, *colors dingy or sordid*, from buff through to reddish-brown and dark dull red, *fading*. FLESH white, not changing. GILLS *white at first*, then creamy-yellow

to buff-ochraceous, not strongly ochre, *broad, distinct*, equal, nearly free. STEM white, unchanged, *never red*, soon quite fragile, conic or short-clavate at first, then subequal or ventricose, spongy-stuffed, even. SPORES *creamy-yellow to pale ochraceous*. TASTE mild. ODOR none.

Gregarious. In woods, probably throughout the state. Ann Arbor. July and August. Not common.

This species is a sort of clearing house for various colored Russulas with broad, pale ochraceous gills and mild taste, especially reddish forms. I have given Fries' description above, supplemented for the most part from notes of my own collections about Stockholm. Romell describes the cap as "brown, blackish-brown, reddish-brown, dark red, violaceous, yellow or greenish, either unicolorous or with whitish or yellowish spots." I saw only the dirty reddish-brown, dark dull red and sordid-buff forms at Stockholm. In favorable weather or situations they occur in troops and seem very common in Sweden. Peck says they are rare in New York state. The European mycologists do not agree among themselves as to this species, but there seems to be a fair unanimity that the "dusting" of the gills by the spores is too deceptive for practical use in identification. *R. integra* is to be separated from *R. alutacea* by its gills being white at first, by the white fragile stem, the paler spores and more striate pileus; under certain conditions these two species are hardly distinguishable.

The two plates of Cooke referred to, give the best idea of the species as here limited. The figures of this species with bright red caps, shown by various authors, illustrate segregated species for the most part. Maire (Soc. Myc. Bull. 26, 1910) has named one form, *R. romelii*, and considers another to be *R. melliolens* Quel. As Fries pointed out long ago, it is easy to separate new species from the mass of plants usually referred here, and the more exact method with the microscope will doubtless produce many more. I have found this species rarely but then in quantity, as they usually cover quite an area from the same mycelium.

145. *Russula amygdaloides* sp. nov. (EDIBLE)

(See under *R. barlae* Quel., Mich. Acad. Sci. Rep. 13, p. 221, 1911.)

PILEUS 4-8 cm. broad, thin, medium size, ovate at first with straight margin, then convex-plane or depressed, very viscid, *fragile*, *pale rosy-flesh color tinged with yellow*, sometimes *peach color*, sometimes dull citron-yellow, varying in color from young to old,

pellicle continuous and entirely separable, *margin becoming* strongly tuberculate-striate. FLESH thin, white, not changing color, soft. GILLS *bright ochraceous-yellow* (flavus, Sacc.), white at first, *rather narrow*, broadest in front, narrowed and adnexed behind, subdistant at maturity, dusted by the spores. STEM 4-8 cm. long, 1-2 cm. thick, *subequal to ventricose, soft and fragile*, loosely stuffed then cavernous (but not from grubs), white, rarely tinged with delicate pink, slightly wrinkled, subglabrous. SPORES subglobose, 7-9 micr., echinulate, nucleate, bright ochre-yellow in mass. TASTE mild. ODOR none. CYSTIDIA very few. *Subhymenium narrow*, sharply differentiated from gill-trama.

Solitary or scattered. In mixed woods of hemlock and beech, among beds of white pine needles at New Richmond; among grass, etc., in oak woods at Ann Arbor. July-October. Frequent.

This very fragile *Russula* is known from the other members of the "Fragiles" group by its medium size, bright yellow-ochraceous spores and gills, the hollow, often subventricose stem, the mild taste and the pinkish-yellow to peach-colored pileus. The stem is sometimes enlarged at the apex, sometimes at the base, always fragile. Very few of our *Russulas* have such bright-colored spores and gills. The color of the cap varies rather rarely to a deeper red on the one hand or to ochraceous-tan and straw-color on the other. The flesh does not change on bruising, and the odor is not noticeable even in age. It is very different from *R. integra* Fr. It approaches *R. nitida* and is no doubt the plant usually referred to that species in this country. It differs in the lack of the nauseous, disagreeable odor which is known to be constant in *R. nitida*. I formerly referred it to *R. barlae* Quel. which, however, is described as compact and firm. *R. aurata* Fr. has gills with a chrome-yellow edge.

Micro-chemical tests: G. (Flesh turns blue quickly; gills become greenish-blue.) S V. (Flesh and gills slowly pinkish then blue.) F S. (Cystidia colored brown.)

146. *Russula roseipes* Secr.—Bres. (EDIBLE)

Fung. Trid., Vol. I, 1881.

Illustration: Ibid, Pl. 40.

PILEUS 2.5-5 cm. broad, *thin, fragile*, convex then plano-depressed, with a viscid, separable pellicle, margin tubercular-striate when mature, soon dry, *rosy-red or flesh-red*, disk tending to ochre-yellowish. FLESH white, thin, unchanged. GILLS soon truly

ochraceous, subdistant, mostly equal, broadest in front, ventricose, narrowly adnate or almost free, few forked, interspaces venose. STEM white and *rosy-sprinkled*, stuffed then cavernous, equal or tapering upward, even, 2.5-5 cm. long, 5-12 mm. thick. SPORES *ochraceous*, globose, echinulate, 8-10 micr. TASTE mild. ODOR none or pleasant.

Solitary or scattered. In mixed woods, but usually under conifers. Only found in the northern part of the state. July and August.

A middle-sized to small plant, fragile, and with a rosy mealiness on the stem. This last is quite characteristic of the species. It occurs under spruces and balsams in moist places. It is quite distinct from *R. puellaris* Fr. to which Fries, who had never seen Secretan's plant, referred it as a variety. *R. purpurina* also has a rosy-sprinkled stem, but is very viscid and more brilliant shining red on the cap. Peck (Rep. 51, p. 307) says the stem is not rosy-sprinkled in his plants, but that the color resides in the stem; he does not seem to have had the typical plant.

147. *Russula puellaris* Fr.

Monographia, 1863.

Illustrations: Cooke, Ill., Pl. 1065.

Bresadola, Fung. Trid., Vol. I, Pl. 64.

Ricken, Blätterpilze, Pl. 17, Fig. 2.

PILEUS 2-4 cm. broad, *very thin*, convex then plano-depressed, viscid, *tubercular-striate* on the margin, livid-purplish or livid-brownish, then sometimes yellowish. FLESH white at first, soon watery subtranslucent, fragile. GILLS pallid white to pale yellow, watery honey-colored in age, equal, thin, subventricose, narrowed behind and adnexed, interspaces venose. STEM whitish, then *watery honey-colored toward base*, spongy-stuffed, soon cavernous, soft and fragile, subequal or subclavate at base, 4-5 cm. long, 7-10 mm. thick. SPORES subglobose, echinulate, *pale yellow*, 6-8 micr. TASTE mild or slightly acid. ODOR none.

Found in low, moist places in conifer or mixed woods of Europe. It has not yet been reported from Michigan with certainty. I have given Bresadola's description as that of a typical plant, which is verified by my notes of the Stockholm plants. I have not seen the typical Swedish plant in this country, and Peck's specimens were evidently not typical as he says no yellowish stains occur in the stem. The stem soon becomes soft and then develops this charac-

teristic, translucent, light-yellowish color. Several varieties occur in Michigan differing mainly from the above description in the red caps and non-lutescent stems; these are referred here for the present.

148. *Russula sphagnophila* Kauff.

Mich. Acad. Sci. Rep. 11, p. 86, 1909.

PILEUS 2-4.5 cm. broad, *very fragile*, convex, *umbonate*, margin at length elevated and disk depressed and purplish-red or rosy-red, the space between the umbo and the margin pale olive-brown, covered by a viscous pellicle, glabrous, margin slightly striate. FLESH reddish under the cuticle and under the surface of the stem fragile. GILLS white then pale ochraceous, narrow, adnato-decurrent, rather close, narrowed toward both ends, few forked here and there. STEM *rosy-colored*, usually *ventricose* or irregularly swollen, spongy-stuffed *then cavernous*, very fragile, rivulose-uneven, 4-5 cm. long, 7-12 mm. thick. SPORES cream-color, globose, echinulate, 6-7 micr. TASTE *mild*.

Scattered. On sphagnum, in swamps. Cold Spring Harbor. August and September. Rare.

Whole plant very fragile, always with an umbo, subpellucid and rosy stem, and pale gills. The only other *Russula* with an umbo, known to me, is *R. caerulea* Pers. which differs in color and habitat. The red color rubs off on paper when moist. In some points it is near *R. roseipes*, in others it is nearest *R. puellaris*, and might perhaps be referred to the latter as a variety but without settling anything as to its origin.

- 149. *Russula chamæleontina* Fr. (EDIBLE)

Epicrisis, 1836-38.

Illustrations: Cooke, Ill., Pl. 1908.

Gillet, Champignons de France, No. 600.

Ricken, Blätterpilze, Pl. 18, Fig. 2.

PILEUS 2-5 cm. broad, *rather small*, fragile, thin, plano-depressed, with a viscid separable pellicle, margin even at first then striatulate, *color varying for different pilei*, mostly some shade of red, purple, etc., fading to yellowish especially on disk. FLESH white, thin. GILLS thin, crowded or close, adnexed or almost free, equal, rather broad, sometimes almost narrow, few forked. interspaces venose.

ochraceous or *ochraceous-yellow*. STEM 2-5 cm. long, 4-6 mm. thick, white, spongy-stuffed then hollow, *slender*, equal or subequal to subventricose, sometimes subclavate, even or obscurely rivulose. SPORES *ochraceous*. TASTE mild. ODOR none.

Scattered or gregarious. In coniferous or mixed woods. So far reported only from northern Michigan.

Like *R. integra* this has to be considered at present a composite species, from which several species have, from time to time, been segregated. According to von Post, a pupil of Fries, the master himself included many forms which do not fit into his own description; and Romell follows the Swedish tradition and refers to *R. chamaeleontina* all small forms with mild taste and ochraceous gills not otherwise accounted for. "No subacid forms are included" writes Romell. Specimens with the caps a uniform red, rose colored, purplish, lilac, etc., and accompanied with a yellowish tint, are always included; sometimes also, whitish, faded forms must be placed here.

150. *Russula abietina* Pk.

N. Y. State Mus. Rep. 54, 1901.

Illustration: Ibid, Pl. 72, Fig. 1-11.

"PILEUS 1-2.5 cm. broad, thin, fragile, convex becoming plane or slightly depressed in the center, covered with a viscid, separable pellicle, tubercular-striate on the thin margin, *variable in color*, purplish, greenish-purple or olive-green with a brown or blackish center, or sometimes purplish with a greenish center. FLESH white. GILLS narrowed toward the stem, subdistant, equal, rounded behind and nearly free, ventricose, whitish becoming *pale yellow*. STEM 1-2.5 cm. long, equal or tapering upward, stuffed or hollow, white. SPORES bright yellowish-ochraceous, subglobose, 8-10 micr. TASTE mild."

Its place of growth is only *under balsm fir*. It has been reported from Michigan, but the description given is that of Peck. The important characters seem to be the bright yellow tinged spores. It is separable from *R. puellaris*, "by the viscid cap, the gills rather widely separated from each other and nearly free, the stem never yellowish nor becoming yellow where wounded, and the spores having an ochraceous hue."

151. *Russula lutea* Fr. (EDIBLE)

Syst. Myc., 1821.

Illustrations: Cooke, Ill., Pl. 1082.

Gillet, Champignons de France, No. 622.

Patouillard, Tab. Analyt., No. 321.

Bresadola, Fungh. mang. e. vel., Pl. 79.

Michael, Führer f. Pilzfreunde, No. 61.

Ricken, Blätterpilze, Pl. 18, Fig. 3.

Plate XXII of this Report.

PILEUS 3-6 cm. broad; *small, thin*, convex then plano-depressed, pellicle easily separable, viscid, margin *even*, becoming slightly striate in age, unicolorous, bright *yellow* or pale golden yellow. FLESH white, very thin, fragile. GILLS at length *deep yellow-ochraceous, subdistant*, rather broad in front, narrowed behind and free, equal, interspaces often venose. STEM white, unchanged, subequal, stuffed then hollow, soft, fragile, even or obscurely wrinkled, glabrous, 3-5 cm. long, 4-8 mm. thick. SPORES globose, echinulate, yellow, 8-10 micr. in diam. TASTE *mild*. ODOR none.

Solitary, in coniferous and mixed woods of northern Michigan, in frondose woods in the south. July and August. Infrequent and few in number.

Our plant is the same as the one occurring about Stockholm. It agrees with the characters as given in *Hymenomyces Europaei*, except that the gills are subdistant, not truly narrow but relatively broad in front. The Stockholm specimens had the thin margins of the pileus at length slightly striate, as is also the case with the Michigan plants. Peck says he has found it but once in New York. I have found it a number of times in Michigan. *R. vitellina* Fr. which is said to resemble this species, is not known to Romell for Sweden, and he refers all their forms to *R. lutea*. It may be that *R. lutea* and *R. vitellina* represent extremes of the species. Our plant described above and that about Stockholm do not agree with either of the descriptions, but is a compromise between the two. Our plants are not strongly striate nor have they any marked odor like *R. vitellina*; on the other hand they have broader and more distant gills than is warranted by the description of *R. lutea*. According to Fries, *R. lutea* is found in beech forests and *R. vitellina* in coniferous woods. *R. flaviceps* Pk. is said to be larger, with narrow and close, pale yellow gills.

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STUDIES IN THE GENUS INOCYBE

C. H. KAUFFMAN

I The Species of *Inocybe* in Peck's Collections

The genus *Inocybe* has been partially monographed both in Europe and in the United States. The species of Fries and Quelet, as well as those of older date, have been critically studied in part by Bresadola, Patouillard, Masee and others, and more or less uniform conceptions have been evolved for the European species. A considerable number of species were described from the United States by Doctor Peck, mostly from New York State; but with the exception of these species of Peck, comparatively few had been named in this country

by anyone else up to the time of Doctor Peck's death. Since then, Professor Atkinson (*Am. Jour. Bot.*, 5:210, 1918) published names and descriptions of twenty-five additional new American species, an accumulation of many years.

During an extensive study of American collections toward a more complete monograph of the American species, I had the opportunity, through the kindness of Dr H. D. House, to make a critical examination of all the collections of *Inocybe* which had accumulated at Albany during Doctor Peck's régime, including of course, types of his species. About 275 collections were gone over; each of these, except in a few cases, must be considered a separate collection. Of these, Doctor Peck himself collected by far the greater part and his own handwriting is present on practically all his own finds. The data of Doctor Peck's own collections are very meager, usually giving no more than the locality, sometimes the county, and the month in which the material was obtained; rarely does he mention the year or the day of the month.¹

A number of the types and other species from extralimital regions were communicated to him by collectors of fungi living in other states. Simon Davis sent material from Massachusetts; Dr N. M. Glatfelter, from St Louis, Mo.; F. J. Braendle, from the District of Columbia; J. M. Macoun, from Ottawa, Canada; B. O. Longyear, from Michigan; Baker, from California; and Morgan, from Ohio. Only a few other donors sent *Inocybe* material from outside the State.

In 1910, as a part of the New York State Museum Bulletin 139, Doctor Peck got together an account of the New York species of *Inocybe*, which is in the main a compilation of the scattered descriptions and commentaries of previous State Botanist's reports. I shall refer to this hereinafter as Peck's Monograph. In going over the collections, it soon became evident to me that Doctor Peck had not attempted to base the monograph on all his collections but had carefully examined selected packets, many of which belonged to the type collections, a part of which in each case was mounted on sheets. At least such a set of packets has been kept together and apart from

¹ In the case of type specimens, and species reported for the first time, the year can be ascertained by reference to the published description or report, since Doctor Peck appears rarely to have reported or described a species later than in the report for the year in which the specimen was collected. In other cases his collections can be checked up with his voluminous notes, occupying over forty large notebooks and the exact year of collection determined. *H. D. House*

the general collection, and these I found to agree with the conceptions of the species as given in the monograph.

The rest of the collections, although the packets were, with few exceptions, marked with the name of a species of *Inocybe*, were found to be in considerable confusion. It should be remembered at this point, that this is inevitably to be expected under the circumstances, and does not, in my opinion, reflect in the slightest on the perspicacity of Doctor Peck. He had many duties as State Botanist; in the earlier years of his collecting, accurate microscopical information on European species was practically lacking; later, the accumulations of any season, his own and those from many parts of the country, naturally made it impossible to go back over all former collections and keep them revised to date. It would have been possible in dealing with the genus *Inocybe* alone, but impossible in the whole field of fungi, to say nothing of the plant kingdom as a whole. It is not surprising, then, to find that, for example, many packets marked *Inocybe subochracea* Pk., did not contain that species at all, but on examination were found to be scattered over half a dozen other species. A glance in the microscope was sufficient to show that no cystidia were present in some instances, or that the spores were angular in others. This shows, I think, that Doctor Peck did either not at first realize the importance of cystidia as he did later, or that he found it impracticable to examine microscopically the mass of collected material, and wishing to preserve it, depended on his undoubted wonderful memory to decide the species from external characters alone.

The dried herbarium specimens of the species of this genus are far more easily and satisfactorily diagnosed than is usually the case in dried Agarics. This is due to a number of sharply defined microscopic morphological characters which persist in the dried plants. Since these characters are fundamental with regard to the relationships of the species in the genus, their study should give us a better clue to such relationships and mark a step toward a phylogenetic system of the Agarics. It seems worth while, then, to present below a scheme based on the microscopical features of the species. This has been arrived at, not only by the study of the Albany collections, but of those in the New York Botanical Garden, my own collections, the published descriptions of Professor Atkinson, those from the collections at several universities, and especially the extensive collections of Simon Davis of Brookline, Mass. Only the plants in the

Peck collections will be used in this paper to illustrate the proposed arrangement.

The *spores* of the different species of *Inocybe* are of two main types. In one type the epispore is smooth and rounded. In the other type it is ornamented by spines, nodules, or a more or less tuberculate roughness, which is usually associated with somewhat angular shape. This angularity may be sharply marked or obscure and is somewhat masked by the roughness due to the tubercles. In a very few cases (for example *I. decipiens* Bres. and *I. maritimoides* Pk.), the spores are merely angular or with only very slight or few elevations on the surface. The nodules (tubercles meaning practically the same) may be crowded, or, as is frequently the case, scattered on the surface of the spore. Furthermore, they may be coarse and prominent under the ordinary high-power magnifications (that is, without the use of the oil-immersion lenses), or may be indistinct and then best seen by causing the spores to roll over during observation under the microscope.

The *cystidia* are either present or lacking and the species are thus easily grouped into two parts. They may be very numerous or rather thinly scattered over the hymenium and in a few species so few that a very small portion or section of the gills may fail to show any. They may be present all over the surfaces of the gills or mostly on the edge of the gills or near the edge. The latter statement contradicts the statement of Masee (*Annals of Botany*, 18:462, 1904) in which he claims that "true cystidia are only met with on the surface of the gills." In order to discriminate on the subject, it must be noted that all species of *Inocybe* develop on the edges of the gills sac-shaped or rounded-clavate, more rarely subacute or capitate cells, which I have designated "*sterile cells*" (*Agaricaceae of Michigan*, p. 444), and which are shorter than the true cystidia and thin-walled, and probably do not exude the contents through the dissolved apex as generally do the cystidia. Masee calls these cells "*marginal cells*." In addition to these sterile cells, many species of *Inocybe* bear typical cystidia on the edge of the gills, while some species have them only on the surfaces, and in the case of a few, like *I. paludinea* Pk., the edge of the gills is so thickly beset with the genuine thick-walled cystidia that the "sterile cells" are almost always obscured. Masee's statement that the larger "marginal cells," which I am calling true cystidia, are always thin-walled, must therefore be set aside, since I have observed typical thick-walled cystidia on the edge of the gills of a large number of species.

The question of whether these cystidia on the edge differ from the sterile cells in origin has not been settled, and depends somewhat on how much of the surface of the edge is meant when referring to "edge" of the gills. Masee shows no figure demonstrating that the larger "marginal cells" are different in origin from the cystidia on the sides of the gills.

The cystidia may, like the spores, be classed under two main types: the *thick-walled cystidia*, and the *thin-walled cystidia*. (a) The former are the "true cystidia" of Masee. Their walls are quite thick and highly refractive, frequently thickened only along the upper two-thirds of the cystidia, so that the wall of the pedicels remains unthickened. At the apex they exude crystalloid masses at maturity by the deliquescence of a small area or pore at the apex. I agree with Masee that the presence or absence of these caps at the apex of the cystidia is of no morphological value in classifying the species. The different age of the gills or influence of external conditions during development would modify the observation on different specimens of the same species. The thick-walled cystidia are generally, although not in all cases, quite ventricose above the pedicel, while above this enlargement they taper more or less toward the subacute or subrounded apex. This type is usually numerous, especially toward the edge of the gills. (b) The thin-walled type of cystidia has either thin walls corresponding in thickness to that of the pedicel, or when somewhat thickened as is frequently the case in older plants, the thickening tends to run around the apex and is uniform, whereas in the thick-walled type the wall varies markedly in thickness, usually thickest a short distance from the apex. Furthermore, the majority of the thin-walled type are entirely subcylindrical above the pedicel or if ventricose at all, the portion above is not abruptly narrowed to a lance-like neck as in many thick-walled cystidia, but remains broadly cylindrical to the broadly rounded or subtruncate apex. However, this type may show considerable variation from the commoner shape just described, and this is not unusual in the same plant. The commonest variation is that where there is a gradual tapering from the broadest part of the cystidium to its apex, which may even be acute; there is also a tendency in this type of cystidia to taper gradually, instead of abruptly, to the slender pedicel. The thin-walled cystidia also tend to be less numerous; in most species of this group they are scattered or scanty and may be almost lacking. In *I. subulva* Pk. they are reduced to the condition of "sterile cells" and are often found with difficulty.

Doctor Peck named and described 41 species of *Inocybe*, some of which were originally placed in the old sections of *Hebeloma* and *Inocybe* in the system of Fries. Of these, 8 are referable to European species as synonyms, 2 are better *Hebelomas*, and 30 are retained as valid. *Paxillus strigosus* Pk., later included by Peck in his monograph as an *Inocybe*, is a plant with anomalous characters and here excluded. *Inocybe sterlingii* Pk. and *Inocybe vaticosoides* Pk., are referred to *Hebeloma* because of the viscid pileus on the one hand, and the absence of cystidia on the other.

From the standpoint of morphology, the species with smooth, subellipsoid spores and no cystidia can be considered as the simplest form of *Inocybe*, intimately related to the simpler forms of *Cortinarius* and *Hebeloma*, the three genera each in its own way becoming specialized from this common base. The next step could be conceived in the appearance of the subreniform spore with obtuse ends which is peculiar to most of the section of *Inocybes* lacking cystidia. It would appear probable that the next section with ellipsoid spores and cystidia was differentiated from the simplest form with ellipsoid spores. That the thin-walled cystidia came first is evident by their rarity in some species and possibly by other, at present obscure, characteristics due to their origin in the early stages of the plants. In certain few species, not included here, the spores show only a slight and obscure angularity, but marked enough to be detected repeatedly. A few species, of which *I. maritimoides* Pk. is an example, have angular spores and cystidia but the spores are not, or very faintly, nodulose. Here it would appear, then, is the bridge to the rough-spored species with cystidia, and it is a significant fact that scarcely a half dozen, if that many, species are authentically known in the whole genus which have rough spores and at the same time lack the cystidia. Even in the few species included here, for example, *I. leptophylla* Atk. and *I. subfulva* Pk., these are segregated with difficulty from *I. lanuginosa* Fr.-Bres. and *I. calospora* Quel. respectively. *I. leptophylla* was connected to *I. lanuginosa* by Atkinson himself by proposing a variety, which he called *I. leptophylla* var. *cystomarginata*, because true cystidia occur on the edge of the gills only in this form. In the case of *I. subfulva*, cystid-like cystidia, intermediate between sterile cells and thin-walled cystidia can be observed in the hymenium. Here we have, however,

highly differentiated spores in both cases, and on this account these two species are not suited as a bridge from the smooth-spored to the rough-spored species, a step more easily conceived by the suggestion above that the simply angular spores represent this intermediate stage of differentiation. I assume, also, that the simplest type of pileus is represented by the *Velutinae* section, in the sense of Fries, initiated in a simple *Cortinarius* type, and passing through the *Rimosae* and *Lacerae* to the *Squarrosae* as the highest type of development in any branch of the genus. As a parallel possibility, we can start with the *Viscidae*, representing a simple type of *Hebeloma*, and go up through the same series. On this hypothesis, I have arranged below the species in the Peck collections as a suggestion of possible phylogeny in the genus.¹

Synopsis

I *Cystidia* lacking

A Spores smooth

(a) Spores subellipsoid

Connecting
with *Cortinarius*

Sect. *Velutinae*

1 *Inocybe subtomentosa* Peck. Five New York collections.

Sect. *Lacerae*

2 *Inocybe subdecurrens* E. & E. (Syn. *I. tomentosa* E. & E.).
Two New York collections; also from Canada.

Sect. *Squarrosae*

3 *Inocybe marmoripes* Atk. One New York collection.

(b) Spores subreniform

Sect. *Rimosae*

4 *Inocybe lanatodisca* Kauff. One New York collection.

5 *Inocybe fastigiella* Atk. (*I. rimosa* of Am. authors). Thirteen
New York collections; also from Missouri.

6 *Inocybe rimosoides* Pk. Two New York collections; also from
Massachusetts.

7 *Inocybe fastigiata* Schaeff-Bres. Four New York collections.

Sect. *Lacerae*

8 *Inocybe squamosodisca* Peck. Two New York collections.

Sect. *Squarrosae*

9 *Inocybe lorillardiana* Murr. (American form of *I. dulcamera*
A. & S.). Two New York collections; also from New Jersey
and Missouri.

10 *Inocybe caesariata* Fr. (Syn. *I. fibrillosa* Pk.). Three New
York collections; also from Minnesota and Missouri.

¹The two species from California, *I. bakeri* Pk. and *I. bullosa* Fr., are omitted for lack of data.

- 11 *Inocybe unicolor* Pk. Four New York collections; also from Ohio.
- 12 *Inocybe mutata* (Pk.) Masee. Three New York collections; also from Massachusetts.
- 13 *Inocybe calamistrata* Fr. Three New York collections; also from Ohio and Maine.
- II Cystidia present Connecting with Hebeloma
 A Spores smooth
 (a) Cystidia of thin-walled type
Sect. Viscidae
- 14 *Inocybe fuscodisca* (Pk.) Masee. Seven New York collections; also from Missouri.
Sect. Velutinae
- 15 *Inocybe agglutinata* Pk. Two New York collections.
- 16 *Inocybe leptocystis* Atk. Two New York collections; also from Massachusetts.
- 17 *Inocybe griseoscabrosa* (Pk.) Earle. Three New York collections.
- 18 *Inocybe infelix* Pk. (Syn. *I. cuthellella* Pk.). (American form of *I. lacera* Fr.). Thirty-five New York collections; also from Massachusetts and Michigan.
Sect. Rimosae
- 19 *Inocybe eutheles* B. & Br.-Bres. One New York collection.
 (b) Cystidia of the thick-walled type
Sect. Velutinae
- 20 *Inocybe geophylla* Fr. Thirty New York collections; also from Massachusetts.
- 21 *Inocybe lilacina* Fr.-Boud. (= *I. geophylla* var. *lilacina* Pk.). Four New York collections.
- 22 *Inocybe violaceifolia* Pk. One New York collection.
- 23 *Inocybe subochracea* (Pk.) Masee, and var. *burtii* Pk. Nine New York collections; also from Massachusetts.
- 24 *Inocybe serotina* Pk. One New York collection.
- 25 *Inocybe minima* Pk. Two New York collections.
- 26 *Inocybe comatella* (Pk.) Masee. One New York collection.
Sect. Rimosae
- 27 *Inocybe eutheloides* Pk. Eight New York collections.
- 28 *Inocybe pallidipes* E. & E. Four New York collections.
- 29 *Inocybe destricta* Fr. var. *minor* Kauff. Twelve New York collections; also from Pennsylvania.
- 30 *Inocybe excoriata* Pk. Two New York collections.
Sect. Lacerae

31 *Inocybe flocculosa* (Berk.) Sacc. One New York collection; also from Massachusetts.

32 *Inocybe pyriodora* Fr.-Bres. Two New York collections.

Sect. *Squarrosae*

33 *Inocybe hystrix* Fr. One New York collection.

B Spores angular (not nodulose)

(a) Cystidia of the thin-walled type

Sect. *Lacerae*

34 *Inocybe maritimoides* Pk. One New York collection.

C Spores rough, nodulose or spiny

(a) Cystidia of the thin-walled type

Sect. *Rimosae*

35 *Inocybe umbrina* Bres. (Syn. *I. castaneoides* Pk.). Four New York collections; also from Massachusetts.

36 *Inocybe umboninota* (Pk.) Masee. Two New York collections; also from Massachusetts.

37 *Inocybe hiulca* Fr.-Bres. One New York collection.

38 *Inocybe radiata* Pk. One New York collection; also from Massachusetts.

Sect. *Lacerae*

39 *Inocybe decipientoides* Pk. Six New York collections; also from Massachusetts and District of Columbia.

Sect. *Squarrosae*

40 *Inocybe lanuginosa* Fr.-Bres. (Syn. *I. nodulosa* Pk.). Three New York collections.

(b) Cystidia of the thick-walled type

Sect. *Viscidae*

41 *Inocybe trechispora* (Berk.) Karst. Three New York collections.

Sect. *Velutinae*

42 *Inocybe subexilis* Pk. Two New York collections.

43 *Inocybe paludinella* Pk. One New York collection.

44 *Inocybe fallax* Pk. Two New York collections.

45 *Inocybe infida* (Pk.) Masee. Two New York collections; also from Vermont and District of Columbia.

46 *Inocybe repanda* Bres. (Syn. *I. desquamans* Pk.). One New York collection.

Sect. *Rimosae*

47 *Inocybe castanea* Pk. One New York collection.

48 *Inocybe albodisca* Pk. Two New York collections; also from Massachusetts and Missouri.

49 *Inocybe cicatricata* E. & E. Two New York collections.

- 50 *Inocybe intricata* Pk. One collection from Massachusetts.
 51 *Inocybe proximella* Karst. From Massachusetts and Missouri.
 52 *Inocybe asterospora* Quel. (Syn. *I. diminuta* Peck). Seven
 New York collections; also from Massachusetts and Missouri.

Sect. *Lacerae*

- 53 *Inocybe nigrodisca* Pk. One New York collection.
 54 *Inocybe ochraceo-scabrosa* Atk. One New York collection
 from Ithaca.

Sect. *Squarrosae*

- 55 *Inocybe stellatospora* (Pk.) Masee. Two New York collec-
 tions.
 56 *Inocybe calospora* Quel. (Syn. *I. rigidipes* Peck). Three New
 York collections; also from Missouri, Massachusetts and
 Michigan.

III *Cystidia* lacking

A Spores nodulose or spiny

Sect. *Squarrosae*

- 57 *Inocybe leptophylla* Atk. (segregate of *I. lanuginosa* Fr.-
 Bres.). Two New York collections; also from Massachusetts.
 58 *Inocybe subfulva* Pk. (Syn. *I. echinocarpa* E. & E.). Three
 New York collections.

Comments

I *Inocybe subtomentosa* Peck. This belongs to a very confusing series of species, especially as to their macroscopic characters, including *I. subdecurrens* E. & E., *I. caesariata* Fr., *I. dulcamera* A. & S., *I. unicolor* Peck and *I. lorillardiana* Murrill. They all lack cystidia. The tomentose or fibrillose-tomentose covering of the pileus of these species is of a texture easily affected by weather conditions, so that mature plants or herbarium specimens of the same species can be referred to the Sections *Velutinae*, *Lacerae* or *Squarrosae* according to the weather conditions under which the plants developed. However, all of the series mentioned are clearly separable from *I. subtomentosa* and *I. subdecurrens* by the subreniform spores. The type of *I. subtomentosa* approaches more nearly in its external appearance *I. caesariata*. The spores, however, are of the variable kind, ranging in the type specimens from 7-9 micr. in length with a few up to 10 and 11 micr., by 5-6 micr. wide, a few 7 micr. Hereafter such a condition will be referred to thus: 7-9 (10.11) x 5-6 (7). Other collections show a larger per cent, up to 5 or 10 per cent of

the larger spores, in which case mycological practice undoubtedly would represent them thus: 7-11 x 5-7 micr.; and such a kind of variability must be reckoned with as a morphological character, giving us, in addition to the elliptical nonreniform spore, also a "variable" spore as compared to many other species, especially in this connection *I. caesariata*.

Both *I. subtomentosa* and *I. subdecurrens* lack a well-developed fibrillose sheath on the stem (subperonate), as do the other species mentioned, and hence the tomentose covering on the caps is also less highly developed, so that they rarely approach the *Lacerae* or *Squarrosae*, at least in material at present available. *I. subdecurrens* must remain a somewhat doubtful species; the cap of *I. subtomentosa* is described as "brownish-tawny" and dries deep ochraceous, while *I. subdecurrens* is said to have a "yellow-drab" pileus, and dries alutaceous. Whether the gills of *I. subdecurrens* are consistently decurrent and whether this character holds, needs to be established more definitely. The cap is described more pilose than in *I. subtomentosa* and for the present the species must be recognized.

5 *Inocybe fastigiella* Atkinson. This is a common species in the United States and is doubtless the plant referred to *I. rimosa* Fr. in many American lists. Even a cursory examination of European notices should convince one that the most widely accepted conception of the Friesian species can not be that of ours. Patouillard, Bresadola and Masee consider the Friesian plant to possess cystidia, and European specimens bear this out. Ricken in "Blätterpilze" evidently has a plant identical or close to ours, and in my reference to this species in "Agaricaceae of Michigan" it was referred to Ricken's *I. rimosa*. This is a strong indication that *I. fastigiella* occurs also in Europe. I have no evidence that it has been named before. The specimens described by Doctor Peck as possessing cystidia can not be the species as it is known in Europe, but are probably referable to *I. stricta* var. *minor* and elsewhere.

6 *Inocybe rimosoides* Peck. The pale yellow pileus distinguishes this from *I. fastigiella*; and the lack of a submarginate bulb, from *I. cookei* Bres.

8 *Inocybe squamosodisca* Peck. This has many similarities to *I. caesariata*, but the pileus has apparently at first a definite continuous glabrous cuticle, which under certain weather conditions easily cracks to form scales, that is, becomes diffracted-scaly; while

I. caesariata has a tomentose-fibrillose covering when young and this may be torn into ascending or recurved scales.

11 ***Inocybe unicolor*** Peck. The non-variable subreniform, large spores (9-12 x 5-6), and the paler ochraceous, whitish or grayish ochraceous color of the pileus distinguishes this from its relatives. The color fades and the dried specimens are dull or sordid whitish.

12 ***Inocybe mutata*** (Peck) Masee. A good species, separable from *I. hystrix* by the lack of cystidia. It has the stature of small specimens of *I. calamistrata*, but the base of the stem is not blue or green. The spores measure 8-10 (12) x 5-5.5 (6) micr.

14 and 15 ***Inocybe fuscodisca*** (Peck) Masee. This is separated with difficulty from *I. agglutinata* Peck in dried specimens. Some of Peck's collections marked *I. agglutinata* doubtless belong here. The cystidia are of the thin-walled type in both, but somewhat aberrant in that the wall is often unusually thick. The thickening, however, passes equally around the rounded apex and the shape and their variability also indicate their thin-walled relationship. The spores average slightly larger in *I. agglutinata*, and Peck has unduly emphasized this in the monograph. In some specimens of *I. fuscodisca* the spores are scarcely more than 9 micr. long, but in general, the spores may be said to measure 8-10 (11) x 5-6 micr., whereas those of *I. agglutinata* vary from 8-12, usually 8-10 (12) x 5-6 micr. It appears, then, that we must rely on the characters of the fresh plants. I have never, knowingly, collected either species. Peck says the pileus of *I. fuscodisca* has a separable, viscid pellicle, while in *I. agglutinata* it is covered with fibrils which appear agglutinated, but there is no viscosity. He gives the size of the plants approximately the same, but I suspect *I. agglutinata*, if distinct, averages larger.

16 ***Inocybe leptocystis*** Atkinson. I have long known this species of Atkinson's. The cystidia tend to the shape of a cylindrical funnel with slender stem, such as are used in chemical apparatus; they are more abundant than is usual in species with the thin-walled type of cystidia. The pileus is bay-brown, silky, becoming slightly appressed-scaly at times. The stem is pallid and solid; the gills are crowded and narrow. The spores measure 7-9 x 4-5 micr., smooth and sub-elliptical. Three collections were found in the Peck herbarium; they were marked *I. subochracea*, *I. rimosa* and *I. hirtella* respectively.

17 *Inocybe griseoscabrosa* (Peck) Earle. In the original description of this species in the 26th report, page 57, 1874, Peck gives the spore measurements 8.75×5 micr. In this he was followed by Masee (Ann. Bot., 18: 484, 1904) who says he examined the type. Later, in his monograph, Peck corrected this manifest error and gives the measurements larger. I have found them to be $10-12$ (13) $\times 5-7$ micr. The cystidia are thin-walled, scattered to few on the sides of the gills, more abundant on edge, and as a rule, broadly fusiform in shape.

18 *Inocybe infelix* Peck. This is without doubt the American form of *I. lacera* Fr. of Europe. The species is very common in this country, but our plants do not seem to have the reddish flesh of the stem which is said to be a characteristic of the European plant. *I. infelix* is very variable. The peculiar lanuginose covering of the pileus is readily affected by weather conditions, and hence a more or less scaly pileus is often met with. The spores are characteristic but quite variable in length. As far as I know, no other species of *Inocybe* has just such spores, and the species could be segregated on spore-lengths, if one did not take into account the plasticity in their nature. In shape, they are elongated-cylindrical or slightly narrowed one way, and frequently are subtruncate at one end. Peck first gave the length as $10-12\frac{1}{2}$ micr. (32d report, p. 29, 1879); later in the monograph he increased this to $10-15$ micr. In an examination of over seventy-five collections from all parts of the country, I found considerable variation. Evidence points to the age of the plants at time of collection, restrictive effect of sudden dry weather, and perhaps other influences, as the causes of a shorter spore-size in some collections. Ten to 13 micr. is the most common length; $10-15$ micr. is frequently met with, and in frequent observations, even longer spores are scattered in the mount, ranging up to 20 micr. in length. The size of the spores of *I. infelix* can then be indicated thus: $10-13$ (15, 18, 20) $\times 4-5\frac{1}{2}$ (6). A collection of *I. lacera* Fr. from Sweden, yielded spores of the same shape, measuring $12-15$ (20) $\times 5-6$ micr. and Bresadola (Fungi of Poland, Ann. Myc., 1: 70) gives the spores of *I. lacera* Fr. as $11-16 \times 4-5$ micr. The cystidia of both European and American plants are of the thin-walled type. Bresadola (l. c.) would refer *I. lacera* Fr. to *I. cristata* Scop.

22 *Inocybe violaceifolia* Peck. One of the rare species. Its limitations are not yet known, but it is without doubt distinct from *I. cincinnata* Fr. and *I. obscura* Fr. of Europe. Only a

few plants of these violet-gilled species are usually found, and they all appear to be very rare.

23 *Inocybe subochracea* (Peck) Masee. I would include in this, var. *burtii* Peck, since the greater or lesser development of the veil is the only difference between them and depends on conditions for growth. This species is sharply characterized among the ochraceous or yellowish species by the abundant thick-walled, slender cystidia, especially numerous over the whole surfaces and edges of the gills. These cystidia are tinged yellow, and in dried specimens this characteristic is brought out still more, especially by the use of potash solution. In nearly all other species, the cystidia are hyaline. The subcuneate shape of the spores is also a helpful character, although not so sharply marked.

24 *Inocybe serotina* Peck. This is a large whitish or yellowish-white species of sandy regions. The spores are elliptical. The cystidia are few and hard to find, short, 45-55 x 18-22 micr. Peck does not mention them. The species is closely related to the genus *Hebeloma*, but no viscosity was reported on the pileus.

25 *Inocybe minima* Peck. The type was collected by Simon Davis in Massachusetts. Peck found it also in New York State. The pileus is minutely fibrillose or lanuginose, recalling the kind of covering present on the pileus of *I. infelix*, but the spores and cystidia are quite different. The spores measure slightly longer than given by Peck.

26 *Inocybe comatella* (Peck) Masee. Quite small and occurring on rotten wood. The spores measure 6-7 (8) x 3-4 micr., as given by Masee; this is smaller than noted by Peck. The cystidia are abundant and thick-walled. The hairs of the pileus appear as hyaline bundles of hyphae under the microscope.

27, 28, 29 *Inocybe eutheloides* Peck; *I. pallidipes* E. & E.; and *I. dstricta* var. *minor* Kauff., are closely related and kept apart with difficulty in the dried condition. The pileus of all three are more or less rimose, the extent of rimosity depending on weather conditions. This series of closely similar species includes *I. eutheloides* Berk., which apparently has thin-walled cystidia. *I. dstricta* var. *minor* has both the thin-walled and thick-walled type, the former predominating on and near the edge of the gills, but mixed with the other type. *I. eutheloides* and *I. pallidipes* have thick-walled cystidia of the usual appearance; when growing, *I. eutheloides* has a fawn colored cap, while that of *I. pallidipes* varies from light brown to darker

brown or umber; the stems of both are persistently white or whitish. The spores are the same in the two species. On the other hand the stem of *I. d e s t r i c t a* var. *m i n o r* is rufous-tinged at maturity, the pileus becomes normally more lacerated-scaly and usually there is a shade of reddish in the brown color. The plants of the three species average the same size.

30 *Inocybe excoriata* Peck. A fairly large plant, with pileus 3-5 cm broad. Other species which have the general appearance of it, differ in not possessing any cystidia. The pileus is not always excoriate and not too much stress must be placed on this character. The cystidia are thick-walled, fairly abundant and stout, and it is possible that it is *I. e u t h e l e s* B. & Br. of Masee's monograph, although not like specimens referred to *I. e u t h e l e s* by Bresadola.

34 *Inocybe maritimoides* Peck. There seems to be no other collection in existence except the type. It is clearly distinguished by its angular, non-nodulose spores and thin-walled, scattered cystidia. When the spores are rolled over under the microscope the surface is obscurely uneven; they are subrectangular to subquadrate in outline when at rest.

36 *Inocybe umboninota* (Peck) Masee. In the monograph, Peck amends the original description in the 38th report, page 87, by citing it as only "in part" the new conception. I shall therefore use the specimens referred to in the monograph as the type. By doing so, a number of difficulties connected with the identity of this species disappear. An examination of several collections which must be referred here, showed that the plants of this species vary larger than the size given by Peck. The pileus is 1.5-5 cm broad, often only a few of the large size in a collection. Nevertheless it must be considered a medium to large size *Inocybe*. The spores have the same characteristics as those of *I. u m b r i n a* Bres. but the latter is a small plant, with very rimose caps, while the caps of *I. u m b o n i n o t a* are scarcely rimose as a rule although tending occasionally to become more so. The spores measure 6-8 x 4-6 micr., are angular-tuberculate, the tubercles not very distinct. In stature it simulates *I. a s t e r o s p o r a* Quel.

38 *Inocybe radiata* Peck. This is apparently our nearest American relative of *I. c a r p t a* Bres., but the pileus and stem of *I. r a d i a t a* do not possess the lanuginose covering of Bresadola's plants, and the spores of *I. r a d i a t a* are "generally narrowed toward one end" (Peck), while those of specimens from Bresadola which I examined are more rectangular in outline. The size of the

spores is about the same in the two species, 7-11 (12) x 5-6 (7) micr., and both have the scattered, thin-walled type of cystidia. The tubercles of the angular spores are not very distinct and often far apart, and in undeveloped plants the spores may appear as if non-nodulose.

39 *Inocybe decipientoides* Peck. As in *I. radiata* the spores of this species are angular-nodulose, generally narrower toward one end, and variable in shape and especially in size; they measure 9-11 (13) x 5-7 micr. with very manifest, obtuse, but scattered nodules. The size, as given by Peck, is unsatisfactory. *I. decipiens* Bres. has angular spores without nodules. Peck tried to refer some specimens received by him to *I. decipiens*, but all these collections have distinct nodules on the spores and are to be considered *I. decipientoides*. This species was discovered by Simon Davis in Massachusetts, and through his kindness I have examined a number of collections. In one lot the spores exceeded the size I have given, measuring up to 15 micr. long. This great variability must be considered an innate character of this species. The pileus is somewhat squamulose, especially on the umbo.

42 *Inocybe subexilis* Peck. A small species of good standing.

43 *Inocybe paludinella* Peck. This was referred by Massee to *I. trechispora* Berk. The type material, as Peck has already pointed out in the monograph, shows that there is no basis for this synonymy except the similarity of the spores. The stature of *I. paludinella* is entirely different, the stems are long and slender, the pileus is not viscid and the cystidia are lanceolate, rather long, while in *I. trechispora* they are short and obese.

44 *Inocybe fallax* Peck. The size of the plants varies considerably. Usually only a few specimens occur in a place, and often they run smaller than is typical. Peck gives the size of the pileus 2.5-5 cm but I have seen collections where the pileus measured up to 7 cm. The spores of the smaller, mostly poorly developed plants do not surpass 7-9 x 5-7 micr., but in luxuriant and well-developed plants they are 7-10 (11) x 5-8 (9) micr., subsphaeroid to subrectangular in outline, with distinct irregular nodules; the figures of the spores, given by Peck (Plate O, N. Y. State Mus. Bul. 75) are unsatisfactory and do not show the variation in shape. The plants dry whitish, while *I. infida* Peck becomes brown. The cystidia are very obese. Its nearest European relative seems to be *I. umbratica* Quel. (*I. commixta* Bres.), which apparently differs only in its solid stem and perhaps the cystidia. The nature of the stem should always be noted in the fresh plants.

45 *Inocybe infida* (Peck) Masee. This has been a much misunderstood species. When dried the pileus becomes pale brown, the stem dark fuscous; this characteristic, along with the angular-nodulose spores, separates it from *I. geophylla*. I suspect, from this, that too much emphasis has been placed on its color when fresh, when it is said to imitate *I. geophylla* almost perfectly. Masee referred *I. umbratica* to it as a synonym, but the stem of the European species has a subturbinate, subemarginate bulblet, which is not present in our plant, and the stem of *I. umbratica* is solid. The gills of *I. commixta* Bres., which is synonymous with *I. umbratica*, are described as "very crowded," while in *I. infida*, although narrow, they are merely close. Specimens from Bresadola, marked *I. commixta*, had retained the whitish color on drying.

47 *Inocybe castanea* Peck. The size of the plants and the spores are similar to *I. umbrina* Bres., but the pileus is not markedly rimose as in that species, has reddish tints and the cystidia are definitely thick-walled. I have not collected it, and other differences doubtless occur.

48 *Inocybe albidisca* Peck. This is a clear-cut species.

50 *Inocybe intricata* Peck. This deserves its name, because of the confusion in the type collection, although Peck named it for a different reason. It was first collected in Massachusetts. The type collection contains two species: one with thin-walled cystidia which is probably *I. hiulca* Bres., the other the genuine type with thick-walled cystidia and large, broadly elliptical spores, not angular, densely and coarsely nodulose, 10-12.5 x 7-8 (9) micr. It is a well-marked species. It differs from *I. asterospora*, according to Peck, "by its smaller size, pale shining pileus, stuffed or hollow stem and larger spores." That Peck was dealing with selected plants, of the type only, is shown by the agreement of the spores and cystidia with his description.

53 *Inocybe nigrodisca* Peck. The small spores, subsphaeroid to subrectangular in outline, irregularly angular-nodulose, the nodules indistinct, are similar to those of *I. umbrina*, *I. umbonota* and *I. castanea*. The surface of the pileus is very minutely lanuginose as in *I. minima* and of the same small size, but that species has smooth spores. The cystidia are slender, lanceolate and thick-walled.

55 *Inocybe stellatospora* (Peck) Masee. This rather large plant with a pileus 2-5 cm broad, is unique among the Squarrosae,

by its small, nodulose-angular spores, variable in shape, and by its change of color on drying when it becomes dark, smoky umber or fuliginous. Dried specimens are easily recognized by this blackening, although Peck makes no remark about it. It seems to be a rare and solitary-growing species.

58 *Inocybe subfulva* Peck. This species and *I. echinocarpa* E. & E. are considered synonyms by Masee of *I. gaillardii* Gill. I can not bring myself to believe that the spines on the spores of our species are as bristle-like, or as long, as illustrated for *I. gaillardii* by Masee (*Am. Bot.*, XVIII, 504, pl. 32, fig. 11) and by Patouillard (*Tab. Analyt.*, pl. 11, fig. 8). An examination of Ellis's plants in two sets of N. Am. F. No. 1904, shows that *I. echinocarpa* is identical microscopically with *I. subfulva* Peck, and, although apparently differing in stature, must be considered a synonym of Peck's species. The hymenium lacks typical cystidia of either kind, but there are present, widely scattered, cystlike sterile cells which surpass the basidia slightly in length. The absence of cystidia separates it from *I. calospora* and *I. asterospora*. The spines on the spores are broader at the base, while in *I. calospora* they are cylindrical rod-shape. The stature is that of *I. calospora*.

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THE GENUS GOMPHIDIUS IN THE
UNITED STATES

C. H. KAUFFMAN

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THE GENUS GOMPHIDIUS IN THE UNITED STATES¹

C. H. KAUFFMAN

(WITH PLATES 12-14)

I reviewed the salient characteristics of the genus *Gomphidius* in the introduction to the genus in the Agaricaceae of Michigan, 1: 170 (8). At that time only a few species had come to my notice in the field in this country, although I had seen *G. viscidus* Fr. and *G. glutinosus* Fr. growing in abundance in northern Europe. In European countries only four species of this genus are usually recognized in floras: *G. viscidus* Fr., *G. glutinosus* Fr., *G. roseus* Fr. and *G. maculatus* Fr. The British mycologists, however, report, in addition to these species, also *G. gracilis* Berk., and Rea (12) says the latter is "common" in fir woods and heaths. Recent accounts of the American species of this genus have been published by Murrill (9 and 10).

The species of this genus usually possess a viscid or glutinous, and hyaline, universal veil; in some species, however, this veil is dry or merely moist, developing a slight viscidness only in very wet weather. The glutinous veil surrounds the young button, in the same manner as in the subgenus *Limacium* of the genus *Hygrophorus*; in the subgenus *Myxacium* of the genus *Cortinarius*; and in certain other genera of the Agaricaceae. In a few species, this veil is scarcely or not at all evident, although it is possible that even in these a blematogen is present in the early stages. In most species this veil forms a definite teleoblema as is shown by the fact that it is separable from the pileus as a distinct, thick pellicle. Confusion may easily arise concerning the color of the universal veil, because of its tendency to become black in a number of the species. Berkeley says (2) the pileus of *G. gracilis* Berk. "is covered with a smoke-colored gluten." However, the veil of this species, like that of a number of others,

¹ Papers from the Department of Botany of the University of Michigan, No. 221.

doubtless blackens easily when touched or in age, and in the fresh condition it is likely that the gluten is hyaline. Dr. Peck kept this distinction in mind when he described *G. nigricans* Peck (11) with its sensitive gluten. After giving the color of the pileus as "pale brownish-red," and that of the stem as "whitish," he says: "The species is usually known by the blackening gluten which smears both pileus and stem. . . . In the dried state the whole plant is black." The degree of blackening of the surface of the pileus and stem is much used in the descriptions of the species of this genus, but it is often difficult in an examination of dried plants to apply statements concerning it, because of the extreme blackening that may occur due to overheating. On the other hand, this character is of great help in discriminating between certain species when they are properly dried. Since the blackening of cap and stem is due to the veil, it is at once evident that rain-washed plants may not show this reaction after the specimens have been dried. Certain species, however, when in growing condition, do not dry black when properly dried. Such are *G. tomentosus*, *G. furcatus*, *G. subroseus* and *G. viscidus* forma *columbiana*; others like *G. ochraceus*, *G. maculatus* and *G. glutinosus* show this characteristic in greater or less degree, while *G. nigricans* shows it to an extreme extent.

A cortina-like partial veil, more or less continuous on the inside of the universal veil where the latter passes over the gill area, is present in most and perhaps in all species in the young condition; it is never copious and is soon evanescent.

The *gills* are decurrent, subdistant or distant; in only one species, viz., *G. vinicolor* Peck, can the gills be said to be close. The type of this species at Albany clearly has closer gills than is usual, but whether this character is consistent in the fresh plant is not too certain. Poor, small or undeveloped specimens of the other species sometimes give the effect of "close" gills.

The color of the gills changes markedly during the development of the spores. If one could make a color chart of these changes for each species, I am convinced that the shades of color represented would be quite specific for each species. I have taken down these shades of color at the time of collecting the fruit-bodies and found that even in the same region and with the

same undoubted species, I would get such a variety of Ridgway color names as to be more confusing than helpful. This is due to the fact that one necessarily collects the plants at different stages of maturity. Giving a general color description seems to be the only useful procedure, but even thus, the specific differences can be brought out. It is desirable to obtain the color of the gills before the fruit-body is overmature, because the very mature gills of the different species may be much alike. For example, the gills of *G. furcatus* Peck are "testaceous" (Ridg.) at a certain stage, and those of the new form, *G. viscidus* described in this paper, are "tawny" and later "sepia" in color. The European species *G. glutinosus* and *G. viscidus* should be distinguishable by their gill-color according to the emphasis (in italics) usually placed on the colors given, but unfortunately there is no exact agreement among European mycologists; and as explained above, this is not surprising when not all the stages are given. Reading between the lines, it seems evident that the prevailing color of the gills of *G. glutinosus* is some shade of gray, while those of *G. viscidus* tend to have tawny shades which become clouded with olivaceous or purplish hues.

The gill-trama is said by Fayod (4) to be divergent ("bilaterale"). My own records are not complete for all of the species, but in my collection of *G. glutinosus* in Idaho, the gill-trama was composed of interwoven floccose hyphae of large cells. The texture of the gill-trama is quite mucilaginous and tends to disintegrate.

The spores of all the species of *Gomphidius* known are elongated, fusiform or subfusiform to subcylindrical, and generally large in size. The largest spores were reported by Dr. Peck for his species *G. flavipes*; the maximum length recorded by him was 30 μ . In examining the type, which was dried too hard and is not very satisfactory, I found enough spores measuring 25 μ in length to make it very probable that the extremes are 30 μ . The color of the epispore as seen under the microscope can best be called sooty varying in intensity in different species or during different stages in the maturity of the spores. In some species the epispore appears punctate under high magnification.

In Fayod's account (4) of the generic characteristics of *Gomphidius*, due attention was given to the *cystidia*, which other authors since then have all too often neglected. These remarkable structures, cylindrical, large, and protruding markedly above the hymenium, Fayod considered as a unique means of distinction, separating this genus from all the others. As seen from the synopsis following, he was nearly correct; only *G. oregonensis* Peck and *G. nigricans* Peck have so far been examined by me in which the hymenium either lacks these characteristic cystidia or relatively few occur. Atkinson (1), in his account of *G. nigricans*, does not mention any cystidia although I was able to locate a few in my own examination of his material. There is little doubt that Atkinson had the true *G. nigricans*. In all my mounts of Peck's type material, I was unable to locate any cystidia.

Fayod, in his description of the cystidia (l.c.), mentions a crust-like covering over the main body of the cystidium, and illustrates this characteristic in his figure of the cystidia of *G. viscidus* (Pl. 6, fig. 7b). In the figure referred to, this crust appears to be of a crystalline nature. Neither Ricken (13) nor Rea (12) mention this peculiarity of the cystidia in the European species, although the cystidia are described by these authors. In all the material which I have examined, which included most of the species in the fresh condition as well as all of the American type collections, I have rarely seen anything approaching Fayod's figure. The cystidia are extremely abundant in some species and hence such a character should be easily seen. However, occasionally one does find a sort of sheath, of a somewhat roughened or crystalline character, but normally the wall is entirely smooth. Therefore I am inclined to consider this encrusted condition a fleeting or developmental condition, not to be used as a specific character.

The relationship of the genus *Gomphidius* is not very clear. In the opinion of Fries (Monographia 1: 149) "they have the stature of *Limacium*, but seem to hold closest relationship with *Cortinarius*, from which, nevertheless, they are far removed by the nature and color of their spores" (7). In *Hymenomycetes Europaei* (6), p. 399, he placed the group between *Cortinarius* and *Paxillus*.

Fayod (4) argues for a relationship between *Gomphidius* and *Paxillus* and includes both these genera in his tribe Paxillés. He, as well as others, laid a foundation for his argument by keeping Schweinitz's American species "*Agaricus rhodoxanthus*" (14) in the genus *Gomphidius*. This plant has been fully discussed by Atkinson (1) who places it in *Paxillus*, where I have hitherto kept it. In passing, it may be well to point out that it has a much closer relationship to some of the American species of *Boletinus*, and might well be put into that genus, disregarding its gill characters (the gills sometimes anastomose), and taking into account its habit, texture, spores and cystidia as of more relationship value than the gills. Such a situation has arisen with regard to the species of *Lenzites*, and a number of mycologists now agree to attach the latter genus to the Polyporaceae, a procedure which seems to me thoroughly scientific. Fayod (l.c.) pointed out the similarities of the Schweinitz plant with species of *Boletus*, especially with *B. subtomentosus* Fr., but as far as I know no one except Battaille (Les Bolets, p. 24, 1908) has definitely placed it in that group. The plant should be called *Phylloporus rhodoxanthus* (Schw.) Bres. (3), and placed next to the genus *Boletinus* in the Boletaceae.

Ricken has grouped *Gomphidius* with *Hygrophorus*, indicating its relationship with the subgenus *Limacium* of that genus, a disposition which I have followed (8), and which seems to me to have much in its favor. The structure of the veils, pileus, stem and gills are practically alike in certain species of *Hygrophorus* and of *Gomphidius*, the outstanding difficulties being the necessity of accounting for the characteristic cystidia and spores of the latter. But I can see no other connection where the difficulties are not more numerous. Rea (12) has placed it next to and presumably "above" the genus *Flammula*, but this arrangement seems to me entirely unsupportable.

Our species are found practically always in the neighborhood of coniferous trees, often in sphagnum bogs or in deep moss in the forest. Collections are made infrequently except in the northwestern Pacific coast states, where several species are quite abundant.

I wish to express my obligations to the authorities of the

New York Botanical Garden and to Dr. House of the New York State Museum for the privilege of access to the types of Dr. Murrill and Dr. Peck; also to the Department of Plant Pathology of Cornell University for allowing me to examine all of the specimens in the Atkinson herbarium.

SYNOPSIS OF THE SPECIES OF GOMPHIDIUS OCCURRING IN THE NORTH
TEMPERATE REGIONS

1. Cystidia few or lacking; plants becoming black when dried. (*G. glutinosus* may be sought here) 2
1. Cystidia present and more or less abundant, long and cylindrical. 3
2. Spores 15–22 x 5.5–6.5 μ ; pileus 2–7 cm. broad, not umbonate, glutinous, pale brownish-red when fresh; eastern U. S. (See figs. 50 and 51, Atkinson 1) *G. nigricans*.
2. Spores 10–13 x 3.5–4.5 μ ; pileus 5–10 cm. broad, not umbonate, viscid, livid flesh-colored when fresh, becoming black-spotted; stem citron-yellow below *G. oregonensis*.
3. Pileus with ochraceous shades, at least when young and fresh; western U. S. 4
3. Pileus not noticeably of these colors. 5
4. Pileus glabrous and glutinous; spores 15–19 (22) x 6–7 μ . (See description) *G. ochraceus*.
4. Pileus densely floccose-tomentose, dry or nearly so; spores 17–21 (24) x 6–9 μ *G. tomentosus*.
5. Pileus 5–10 (12) cm. broad 6
5. Pileus 2.5–5 (6) cm. broad 7
6. Pileus convex to plane, not umbonate, glutinous, livid purplish-brown; gills at first whitish, becoming gray to blackish at maturity; cystidia few to scattered; spores 17–22 x 6–7 μ *G. glutinosus*.
6. Pileus with subconic umbo, only slightly viscid, dark vinaceous-red to dark reddish-brown; gills at length olivaceous to purplish-umber; cystidia abundant; spores 17–20 (21) x 6–7.5 μ *G. viscidus*.
7. Stem with yellow base or yellow more or less throughout, concolorous within 8
7. Stem not yellow 12
8. Pileus 2.5–6 (7) cm. broad 9
8. Pileus 1–2.5 cm. broad, convex-plane, pink, with white flesh; gills distant; spores 22–25 (30) x 6–7.5 (8) μ *G. flavipes*.
9. Gills more or less forked 10
9. Gills not forked or very rarely; stem remaining dull red and pileus sooty-red when dried; pileus with subconic umbo; spores 16–21 (23) x 6–7 (7.5) μ . (See description) *G. viscidus* forma *columbiana*.
10. Pileus not umbonate; stem 6–12 mm. thick 11
10. Pileus umbonate, pale vinaceous-brown when fresh, gluten becoming smoky; stem 3–6 mm. thick; spores 16–19 x 5–7 μ (Rea) . . *G. gracilis*.
11. Stem sheathed by the viscid veil, white upwards and remaining whitish when dried; pileus salmon-colored to vinaceous-pink; spores 14–17 (20) x 5–6 μ . (See description) *G. subroseus*.

11. Stem not sheathed, at length becoming black-stained or blackish when dried; veil lacking or obsolete; pileus brownish-incarnate, at length black-stained; spores 15–23 x 6–7.5 μ *G. maculatus*.
12. Gills distinctly forked; stem attenuate downwards or pointed at base. . 13
12. Gills not forked, close; pileus dark red; stem vinaceous-reddish, not pointed at base; spores 17–22 x 5.5–6.5 μ . (Type). *G. vinicolor*.
13. Spores 15–17 x 4–5 μ (Rea); pileus rose-colored; stem whitish, tinged rosy at base; gills whitish-cinereous, finally olivaceous. *G. roseus*.
13. Spores 16–21 (24) x 5–6.5 (7) μ ; pileus at first whitish, then “testaceous” (R.); stem white, becoming pinkish; gills whitish, becoming testaceous, at length variegated with sooty-brown. *G. furcatus*.

UNDESCRIBED AND EMENDED SPECIES

Gomphidius ochraceus sp. nov.

Pileus 3–6 cm. broad, convex-expanded then plane, *glabrous*, *glutinous*, “ochraceous-salmon” to “apricot-orange” (Ridg.) when fresh, soon clouded with “olive-brown” and gradually becoming tinged with vinaceous shades, even or soon rugose-wrinkled from the drying gluten, margin at first incurved, at length spreading; flesh thick, abruptly thin on margin, whitish to “pinkish-buff.” Gills decurrent, subdistant to distant, rather broad, 7–8 mm., “tawny” (Ridg.), thick, edge entire. Stem 8–10 cm. long, tapering downwards, 6–10 mm. thick at apex, variously curved, subviscid, solid, “orange-buff” to “zinc-orange” (Ridg.), more or less floccose upwards to an obsolete annulus, concolorous within. Spores ellipsoid-fusiform, 15–19 (22) x 6–7 (8) μ , smooth, pale smoky. Cystidia abundant, cylindrical, hyaline, rounded-obtuse at apex, 150–180 x 12–15 μ . Odor none. Taste mild. Closely gregarious.

On deep moss under conifers, near Welch’s Post Office, Oregon National Forest, Mt. Hood, Oregon. September 29, 1922. Collected by C. H. Kauffman. Type in the herbarium of the University of Michigan.

This species has such a superficial similarity to *G. tomentosus* Murrill that it is easily passed by as that species. It differs definitely, however, in its glabrous and glutinous pileus, and in its somewhat broader and more distant gills. *G. tomentosus*, which was abundant in this region, and was carefully studied, does not have what I should call “distant” gills as given in Murrill’s description; rather the gills are close to subdistant. The color is not very sharply different, but a difference does show whenever the fresh plants are compared. The subviscid stem indicates a thin and evanescent universal veil.

Gomphidius subroseus sp. nov. (Plate 13).

Pileus 3–6 (7) cm. broad, convex-expanded then plane, very obtuse to broadly depressed, with a viscid separable pellicle, glutinous only in rainy weather, varying "salmon-color" to "vinaceous-pink" (Ridg.), disk "ochre-red" to "testaceous," usually fading, becoming slightly blackish on drying, glabrous, even or slightly wrinkled when dry; flesh thick on disk, abruptly thin on margin, white or tinged vinaceous. Gills decurrent, close to subdistant, attenuate at ends, 6–7 (8) mm. broad at middle, soon "pale smoke-gray" to "pale mouse-gray," finally darker and variegated, some forked near margin or towards stem, thickish, edge entire. Stem 3–6 cm. long, 6–12 (15) mm. thick, tapering downwards or subequal, straight or curved, solid, base or lower half "lemon-yellow," "empire-yellow" or "citron-yellow" (Ridg.), apex or upper portion white and silky, covered when fresh up to near the apex by the hyaline, viscid, thin, appressed sheath of the universal veil, at length glabrous and dry, rarely becoming sordid or blackish in age. Spores 14–17 (20) x 5–6 μ , subfusiform-ellipsoid, obtuse at ends, smooth, dark sooty. Cystidia rather abundant, cylindrical above the slender pedicel, hyaline (in fresh plants), 100–140 x 8–15 μ , apex rounded. Odor and taste none.

Type on humus and moss under conifers, near Welch's Post Office, Oregon National Forest, Mt. Hood, Oregon. September 22, 1922. Frequent in this region. Also under pines, Tolland, Colorado, September 14, 1920; and near Copeland, Idaho, September 2, 1922. Collected by C. H. Kauffman. Deposited in the herbarium of the University of Michigan.

This species differs from *G. roseus* (Fr.) Quél. by the distinct yellow base of the stem, by the less rosy-red color of the pileus attributed to the European plant, and perhaps by the cystidia. We apparently have no account of the cystidia of *G. roseus*. Ricken, to be sure, gives cystidia for the plant he places under that name, but Ricken's description departs from the conception of other mycologists, and his plant may be the species here described, or perhaps it is *G. gracilis*. Rea (12) unaccountably copies Ricken's remarks on the cystidia, but Rea's description otherwise applies to the plant with a rosy stem-base, and is therefore to be considered the correct traditional conception of *G. roseus*.

G. gracilis Berk., although it has a yellow stem-base, is described by Berkeley as having a conic-hemispherical pileus and

others agree that it is more or less umbonate; *G. subroseus* has a rounded pileus from the beginning and later becomes plane to depressed. After the specimens were dried they turned somewhat blackish, but when fresh this tendency to blacken—so noticeable a characteristic in some species—is very slight in this western species. From *G. flavipes* it is readily distinguished by its smaller spores, and from *G. maculatus* by the veil on the stem.

GOMPHIDIUS OREGONENSIS Peck (emended).

Pileus 5–10 cm. broad, at first convex, obtuse, becoming plane, glutinous from the universal veil, livid flesh-colored when fresh, becoming black-spotted in age and blackish when dried, glabrous, even; margin at first incurved. Gills short-decurrent, close to subdistant, gray when partly mature, then blackish. Stem 3–8 cm. long, subequal or tapering downwards, rather stout, 8–15 (25) mm. thick, floccose-fibrillose, citron-yellow almost to the apex, sheathed in part by the glutinous veil which sometimes terminates in a glutinous ring near the apex, yellow within at the base, surface becoming black-spotted when handled. Odor and taste mild. Spores narrow, elongated-ellipsoid, 10–13 x 3.5–4.5 μ , smooth, tinged smoky. Cystidia few, subcylindrical, 100–125 x 15–18 μ .

Description drawn from fresh plants collected at Lake Cushman, Washington, 1915, by C. H. Kauffman.

This has much the habit and stature of *G. glutinosus*, but is definitely distinct by its relatively small spores, and the somewhat different colors when fresh. The glutinous veil is quite thick on the pileus and especially so on the incurved margin of the young fruit-body. It is reported from all the Pacific coast states.

This species was incompletely described by Dr. Peck, who apparently drew his description from dried plants. Few collections are in the eastern herbaria that I examined. The specimens from California, distributed under this name by C. F. Baker in "Pacific Coast Fungi, No. 155," is not a *Gomphidius*, but probably a *Paxillus* with globose spores—at least this is true of the copy in the Atkinson herbarium. On the printed label of this number, Baker states that the gills are phosphorescent, a statement which is therefore not dependable in its application to *G. oregonensis* (9).

Dr. Lane of Portland, who sent the specimens from which Dr. Peck drew his description, wrote Dr. Peck that this species "grows there by the wagon load." Murrill (l.c.) says he "found it common both in Washington and Oregon." Zeller (15) also reports it as "one of the very common Agarics" around Corvallis, Oregon. My experience differs for the localities I visited in Washington and Oregon. At the base of Mt. Hood, *G. tomentosus* was very abundant, and rarely one could pick up also a few specimens of *G. ochraceus* and *G. subroseus*. In the Cascade range east of Seattle, only *G. tomentosus* was found. In northern Idaho the latter species also occurred. In the Olympic Mountains, however, in addition to the frequent *G. tomentosus*, I obtained two solitary-growing specimens of *G. oregonensis*. The questions then arise, is it *G. tomentosus*, instead of *G. oregonensis*, which is so common in these regions, or is each common only in certain localities? The simple process of determining the spore-size will doubtless be sufficient in the future to decide these points.

GOMPHIDIUS VISCIDUS Fr. **columbiana** form. nov.

Pileus 2-6 cm. broad, at first subconic-campanulate then expanded-umbonate, subviscid, or viscid in wet weather, color when fresh "auburn," "bay" or "Hay's russet" (Ridg.), sometimes with purplish tints, very glabrous, even, shining when dry; margin at first incurved, and cortinate with an evanescent, "apricot-buff" cortina; flesh thick on disk, abruptly thin on margin, tinged pinkish. Gills decurrent, broad in middle, narrowed towards ends, close to subdistant, distinct, none or very few forked, thick, soon "ochraceous-tawny" to "tawny," at length "sepia" or "Prout's brown" (Ridg.). Stem 3-7 (8) cm. long, 4-12 (15) mm. thick, subequal or ventricose downwards, or somewhat pointed at base, solid, varying when young from "capucine-buff," or "flesh-ochre" to "apricot-orange," at length sordid brown, concolorous within, when fresh covered with delicate, appressed fibrillose shreds, glabrescent except at the obsolete cortinate zone at apex, which is colored by the spores. Spores 16-21 (23) x 6-7 (7.5) μ , subfusiform, smooth, tinged smoky. Cystidia very abundant, cylindrical, with slender pedicel, hyaline, 120-150 x 15-18 μ . Odor and taste none.

Description from studies in the field. Collected in the Rocky mountains of Wyoming and Colorado. August and September. The American form of *G. viscidus* differs from the European plants

in the much smaller average size, somewhat different colors, and a tendency to form longer and more truly fusiform spores. Exsiccati from Europe which I examined came from Sweden, France, and the mountains of Italy; some are in the Atkinson herbarium and some at the New York Botanical Garden. When properly dried, the stems of the European form are regularly and conspicuously "ochraceous-tawny" to "cinnamon-brown" (Ridg.). The dried stems of the American form, when not darkened by overheating, are always dull reddish; the caps also become this color but tend to assume darker shades of it. Well-dried plants of the two forms do not "match." This American form occurs definitely throughout the Rocky Mountain and Pacific coast states. Specimens from California slightly larger than usual are in the herbaria mentioned. Whether any of the collections from the eastern United States usually referred to *G. viscidus* actually belong here, I am unable to say.

COMMENTS

GOMPHIDIUS FLAVIPES Peck.—This must be a rare species. The type specimens, as Murrill (*Mycologia* 14: 125) has already pointed out, are of no value for comparison. The unusually long spores are its principal claim to recognition.

GOMPHIDIUS FURCATUS Peck.—Apparently a species of the eastern United States only. It is probable that collections referred at times to *G. viscidus* Fr. belong here. The spores of the type material at Albany vary slightly longer than the length given by Peck. (See synopsis in this paper.) I have found this twice in Maryland, under pines; the pileus of these was 2–7 cm. broad, the stem up to 10 cm. long by 3–10 (12) mm. thick. Peck's plants had more slender stems. The color of the fresh pileus is "testaceous" (Ridg.), of the stem "congo-pink": after drying the color of both is pale reddish. Small specimens do not always have the gills forked. This species differs from all forms of *G. viscidus* in the absence of yellow in the stem. At Albany, there is a collection by Earle from Alabama, marked "*G. alabamensis* Earle." This is very probably *G. furcatus*. It grew "among needles under pine," has forked gills and the notes say that it was "pale reddish-brown throughout."

GOMPHIDIUS GLUTINOSUS Fr. (Plate 12).—There are good specimens from Bresadola at the New York Botanical Garden, and typical plants from Sweden in the Atkinson Herbarium. The principal point to be brought out here is that the cystidia are not abundant. In fact in some mounts it is difficult to locate them. In overmature and dried plants they are frequently shriveled, so that observations must be carefully checked. The cystidia of this species also appear to be less cylindrical than in many of the others. The caps are usually quite large, and the stems stout and long. It may be said to be the largest species.

GOMPHIDIUS GRACILIS Berk.—I have a few collections from the mountains of Washington which are referable to this species. There are, however, slight differences and further notes are needed. I have seen no European specimens. Our western plants have longer and stouter although rather more slender stems than described for the European species. The spores of the western plants measure $15-18 \times 5-6 \mu$, and the cystidia are abundant.

GOMPHIDIUS MACULATUS Fr.—I have found no facts which make it necessary to change my account of this (8, p. 170). The comments given with that description on other species (l.c.) are, however, revised in this paper.

GOMPHIDIUS NIGRICANS Peck.—This is an eastern species, seldom collected. (See remarks on p. 114.)

GOMPHIDIUS ROSEUS (Fr.) Quél.—(See remarks under *G. subroseus*.)

GOMPHIDIUS TOMENTOSUS Murrill (Plate 14).—(See remarks under *G. oregonensis*.) The following descriptive data may be added to Murrill's account (Mycologia 4: 307. 1912). Pileus 3-7 cm. broad, obtuse, sometimes actually subumbonate, the thick pellicle separable and slightly viscid in wet weather, "ochraceous-buff" (Ridg.), darker when wet and then "vinaceous-tawny" to "wood-brown" (Ridg.), deeper ochraceous when dry; flesh thick on disk, abruptly thin on margin, whitish to ochraceous, shot through with "pinkish-buff" hues. Gills close to sub-distant, 6-8 mm. broad in the middle, "ochraceous-buff" to "ochraceous-salmon" (Ridg.), at length sooty-brown. Stem 6-12 cm. long, 8-15 (20) mm. thick, rather firm and rigid, con-

color, at first floccose, then lacerate-fibrillose or denuded, sometimes slightly viscid; flesh compact, concolorous, "empire-yellow" (Ridg.) towards base. Taste often tardily but slightly disagreeable. Cystidia abundant, cylindrical, with slender pedicel which extends below the hymenium, hyaline, rounded at apex, 150-180 x 10-15 (18) μ , variable in length and thickness. In dense coniferous forests of fir and hemlock.

The unique tomentose-hairy surface is due to the thick universal veil which surrounds the young unopened plant. On the stem as it elongates the veil is lacerated, broken into fibrillose shreds or washed off in some cases. Sometimes the portion of it encircling the apex of the stem persists as a floccose-hairy annulus. The inferior veil is fibrillose-silky and concolorous, soon disappearing. The base of the stem is often deeply imbedded in conifer-needle beds or in moss cushions. The spores are as given by Murrill.

GOMPHIDIUS VINICOLOR Peck.—The dried type specimens at Albany are distinctly red-brown. A collection in the Atkinson herbarium from Dr. Herbst and collected in Lehigh Co., Pennsylvania, is very probably the same, although the spores average quite a little shorter. The spores of this species are notable for their more ventricose shape and appear much more fusiform under the microscope than most, especially those of *G. viscidus* forma *columbiana* which also dries reddish-brown and of which the spores tend to be subcylindric in shape. I have spoken before (8, p. 171) of the tendency for small or late-growing plants of this genus to have shorter spores than in "normal" plants. Considering that Peck describes the gluten of the pileus as turning black on drying, it is surprising to find the type specimens of this species unblackened, which indicates that the gluten or viscosity is thin and disappears. The species is rare. I should hesitate to refer here the plants from around San Francisco, California, some of which I examined at the New York Botanical Garden. (See *Mycologia* 4: 307.) The form mentioned by me in *Agaricaceae* of Michigan I, p. 171, as form "minor," is a slender little plant and cannot be placed here.

GOMPHIDIUS VISCIDUS Fr.—European specimens are well represented in American herbaria. The cystidia are abundant but

perhaps less so than in the American form "*columbiana*." (See remarks under the latter.)

GOMPHIDIUS spp.—One finds occasionally a few specimens rather small and slender, which are hard to place. Whether some of these are undescribed or are abnormal cannot be determined with the material and notes on hand. Two such forms are mentioned in Agaricaceae of Michigan I, p. 171–2. I have others from the Adirondack Mountains, and from North Carolina. The rarity of these, if they are autonomous species, and the chances of finding them when developed under favorable weather conditions or when not too old makes it difficult to "get a line on them."

LITERATURE CITED

1. Atkinson, G. F. Mushrooms. Ed. 3. 1911.
2. Berkeley, M. J. Outlines of British fungology 196. 1860.
3. Bresadola, G. Fungi tridentini 2: 95. 1892.
4. Fayod, V. Ann. Sci. Nat. VII. 9: 386–388. 1889.
5. Fries, E. M. Systema Mycologicum. 1821.
6. ——. Hymenomyces Europaei. 1874.
7. ——. Monographia Hymenomycetum sueciae. 1863.
8. Kauffman, C. H. Agaricaceae of Michigan 1: 169. 1918.
9. Murrill, W. A. Mycologia 4: 306. 1912.
10. ——. Mycologia 14: 121–125. 1922.
11. Peck, C. H. Ann. Rep. N. Y. State Mus. 48: 110. 1897.
12. Rea, C. British Basidiomycetes 324–326. 1922.
13. Ricken, A. Die Blätterpilze Deutschlands 1: 8–9. 1914.
14. Schweinitz, L. D. von. Schr. Nat. Ges. Leipzig 1: 19–131. 1822.
15. Zeller, S. M. Mycologia 14: 191. 1922.

UNIVERSITY OF MICHIGAN,
ANN ARBOR, MICHIGAN



GOMPHIDIUS GLUTINOSUS



GOMPHIDIUS SUBROSEUS



GOMPHIDIUS TOMENTOSUS



THE MYCOLOGICAL FLORA OF THE HIGHER ROCKIES
OF COLORADO

C. H. KAUFFMAN

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THE MYCOLOGICAL FLORA OF THE HIGHER ROCKIES OF COLORADO

C. H. KAUFFMAN

In 1917 the writer, accompanied by his wife, spent the month of August at Leal, Grand County, collecting and studying the fungi of that vicinity.¹ Leal Post-Office is the last ranch at the upper end of the valley through which runs Williams Fork Creek. This station is within the shadow of Ute Peak and of the Williams Fork Mountain range on one side, and the slopes leading to the Continental Divide on the other. At this point the stream is forked, with the two tributaries forming moist, narrow valleys up which much of the collecting was done. The elevations covered varied between 9,000 to 10,000 feet. The surrounding forest is a part of the Arapahoe National Forest. It consists principally of lodge-pole pine, sparsely interspersed with Engelmann spruce, while the higher portions are characterized by thick stands of subalpine fir. Aspen is scattered over the lower openings.

In 1920 a second trip was undertaken, this time to the eastern slope of the Continental Divide, in the region around Tolland, Gilpin County. On this occasion, Mr. Frank B. Cotner and Mr. Dow Vawter Baxter, two students from our laboratory, offered their services, and assisted in a survey of this area during the month of September. Mr. Baxter paid special attention to the rust flora, while Mr. Cotner collected Discomycetes. Unfortunately, Mr. Cotner was called home in the middle of the month, thus reducing the party to two.

A cabin was rented about a mile east of Tolland and excursions made up the streams in all directions. The region is well

¹ A grant of one hundred dollars was given the writer by the American Association for the Advancement of Science, to help defray the expenses of this trip.

known to botanists as the location of the mountain laboratory of the state university of Colorado.

This station was barely twenty-five miles, as the crow flies, from the one at Leal on the west side of the Divide. Its topography and flora have been discussed by a number of writers. (See Literature: 1, 4, 5, 6, 7, 10.)

The forests present and the elevations covered were about the same as at Leal. The rains had been abundant during August, and a copious crop of fungi, especially agarics, had fruited and many of these apparently did not again appear during September. The August crop was still in evidence when the party arrived, but was largely gone before it could be studied. This was especially true of the *Cortinarii*, which must have been very plentiful in August, but were comparatively rare in September. At Leal, the *Cortinarii* were astonishingly plentiful in August. In other parts of the United States, no such general fruiting of *Cortinarii* was observed until later in the season, although fruiting varies more or less with the weather conditions of any season.

Two papers have recently appeared, listing fungi from Colorado. Seaver (8) gives an account of the *Discomycetes*, many of which were collected at Tolland by Professor Bethel and himself, during August and September, 1910. Overholts (3) spent portions of the two seasons of 1913 and 1914 at Tolland; his lists include all the principal groups of fungi. It was the initial intention of the writer to explore a different portion of Colorado, but circumstances interfered, and Tolland was selected instead. Duplication has, therefore, resulted, but on the other hand, new material was obtained to justify the time spent in this region.

The identifications were made largely by the writer. He is under obligations to Dr. E. B. Mains for an examination of all the *Rusts*; to C. G. Lloyd for opinions on some specimens sent him; and to Dr. L. O. Overholts for information on the identity of some *Porias*. The *Myxomycetes* were identified by May V. Cannon of our Herbarium. In some cases, the writer of this paper has, nevertheless, followed his own judgment, and

all errors of identification should be laid at his door. Many unusual collections were made by those who accompanied us on these trips, and a large share of the success of the ventures is due to them.

The material is or soon will be accessible in the mycological collections of the Herbarium of the University of Michigan.

MYXOMYCETES

From Tolland, Colorado. (See Literature: 2, 9.)

- ARCYRIA INCARNATA Pers. On dead wood.
 ARCYRIA NUTANS (Bull.) On Merulius.
 ARCYRIA OERSTEDTII Rost. On conifer log.
 BADHAMIA DECIPIENS. (Curt.) Berk. On bark of spruce.
 BADHAMIA MACROCARPA (Ces.) Rost. On dead wood.
 COMATRICHA STEMONITIS (Seop.) Sheld. On log.
 COMATRICHA SUKSDORFII E. & E. On coniferous log.
 DIDYMIUM SQUAMULOSUM (A & S.) Fr. On spruce log.
 FULIGO OVATA (Schaeff.) Macbr. On conifer stump.
 FULIGO VIOLACEA Pers. On wood.
 LEOCARPUS FRAGILIS (Dicks) Rex. On wood of *Populus tremu-
loides*.
 LYCOGALA EPIDENDRON (Buxb.) Fr. On pine log.
 MUCILAGO SPONGIOSA (Ley.) Morg. On grasses.
 PHYSARUM NEFROIDEUM Rost. On Abies log.
 STEMONITIS FUSCA (Roth) Rost. On coniferous log.
 TILMADOCHÉ ALBA (Bull.) Macbr. On old wood.
 TRICHIA DECIPIENS (Pers.) Macbr. On log of Picea.
 TRICHIA INCONSPICUA Rost. On mossy wood.
 TRICHIA PERSIMILIS Karst. On conifer wood.
 TRICHIA VARIA (Pers.) Rost. On sticks.
 TUBIFERA FERRUGINOSA (Batsch.) Macbr. On dead wood.

ASCOMYCETES

DISCOMYCETES²

GEOGLOSSACEAE

CUDONIA CIRCINANS (Pers.) Fr. In moist places under spruce and pine. Tolland.

MITRULA CUCULLATA (Batsch) Fr. Rare, on fallen needles of *Picea Engelmanni*. Tolland.

MITRULA IRREGULARIS (Pk.) Durand. Infrequent, Tolland. Low ground under pine and spruce.

MITRULA MUSCICOLA P. Henn. Infrequent, Tolland.

One collection on moss at Tolland, 9500-ft. elevation, and one collection on moss in swampy ground at Leal, 8600-ft. elevation, the latter under poplars, the former on a steep, moist mountain side. Seaver (*l.c.*) reports it as *M. gracilis* Karst.

HELVELLACEAE

HELVELLA ALBIPES F'k'l. (See Plate XXX.) Frequent, Tolland.

Under *Alnus* and conifers. It seems best to keep this distinct from *H. elastica*, as the latter is known throughout the Eastern United States. The blackish-brown, bilobed deflexed cap and white to snow-white stem are too striking to be neglected. All our collections except one are, unfortunately, rather immature, but experience with this group indicates that the spore size at maturity would doubtless average well up to the size given for *H. albipes* by Rehm. In one collection the plants are shorter-stemmed, but the spores are more mature and measure up to 21 μ long by 13.5 μ wide.

HELVELLA INFULA Fr. (See Plate XXXI.) Leal and Tolland.

Scattered and usually solitary. Aug.-Sept. This cannot as yet be considered as identical with *Gyromitra esculenta* Fr., although Seaver (*Mycologia* Vol. III) has brought together argu-

² Discomycetes are noted for the most part according to Rehm, Rabenhorst, *Kryptogamen Flora*, I. 3.

ments in favor of such identity. *Gyromitra esculenta* is a highly gregarious plant, occurring in early spring and nearly always under pines. Its form, to be sure, varies in different individuals and some approach *H. infula* in surface form and lobing. *H. infula*, on the other hand, occurs throughout the summer and fall, in coniferous forests of any kind, singly for the most part, or at least few and scattered in a locality. I have found it, without much variation and not at all suggesting the gyrose cap of the other, in conifer forests from the Atlantic to the Pacific. For the sake of comparison, a photograph of *Gyromitra esculenta*, as it grows abundantly under pines in Michigan, is included. (See Plate XXXII.)

HELVELLA LACUNOSA Afzel. form MINOR. Infrequent, Tolland.

On the ground under conifers. Except for size and a tendency for the stem to be slender and taper upwards, it is not sufficiently distinct. Ascospores 15–17 x 10–12 μ .

PEZIZACEAE

ACETABULA SULCATA (Pers.) F'k'l. Somewhat frequent, Tolland.

On moist, sandy, or swampy soil, along streams, etc., under willows, alders, pine and spruce. A very variable plant in size and stem characters, but the ribs scarcely extend into the lower surface of cap. Ascospores 18–23 x 10–13 μ at maturity. The small forms approach *Helvella pezizoides* Afz. The *minor* form of *H. lacunosa*, mentioned above, had very noticeable ribs extending to the margin of the cap.

GEOPYXIS CUPULARIS (L.) Sacc. Infrequent, Tolland. On the ground under conifers.

LACHNEA HIRTA^{*} (Schum.) Gill. Infrequent, Tolland. On wet humus and moss.

LACHNEA SCUTELLATA Gill. Infrequent, Tolland. On rotten wood. Apothecia over a centimeter broad.

OTIDEA LEPORINA (Batsch) F'k'l. Infrequent, Tolland. On low ground under conifers. The spores are only 12–13.5 x 7–8 μ , but in other respects, the plants are typical.

OTIDEA UMBRINA (Pers.) Bres. Rare, Tolland. On and among moss in low ground under conifers. This is certainly Bresadola's species (See *Fung. Trid.*, II. 68), although our plants were only half-size. Iodine does not color the asci blue. Spores 15–17.5 x 8–9.5 μ .

PLICARIA BADIA (Pers.) F'k'l. Leal and Tolland. On sandy or mossy soil under pine and spruce.

PLICARIA REPANDA (Wahlb.) Rehm. Infrequent, Leal. On very decayed wood and humus, under spruce and pine.

PUSTULARIA CORONARIA (Jacq.) Rehm. Infrequent, Tolland. Only two collections of one specimen each; apparently, it was too late in the season. Along streams in soil and humus.

SARCOSCYPHA MELASTOMA (Sow.) Cooke. Rare, Tolland. On much decayed wood imbedded in mossy ground.

SEPULTARIA ARENICOLA (Lev.) Rehm. Infrequent, Tolland. On sandy soil under pine. Spores 20–24 x 10–13 (14) μ .

HELOTIACEAE

CHLOROSPENIUM AERUGINASCENS (Nyl.) Karst. On decorticated wood, probably *Salix*. Well developed apothecia were obtained. The other species was not found.

CORYNE URNALIS Sacc. Rare, Tolland. On much decayed wood.

DASYCHYPHA PULVERULENTUM (Lib.) Sacc. var. **fruticicola** var. nov.

On old fallen cones of *Pinus contorta*. Agrees well with Rehm's description and some European Exsiccati, except in slightly larger average size of the apothecia, which are white externally. Apothecia 1–1.5 (2) mm. broad; asci 55 x 6 μ ; spores 7–9 x 1.5–2 μ . The paraphyses are sublanceolate upwards and ally it closely to the genus *Lachnum* Retz.

Helotium alnicola sp. nov.

Apothecia 1.5–3 mm. broad, 1–4 mm. high, with a pale ochraceous hymenium, later pallid, at first closed, margin incurved on drying, externally white and glabrous, sessile to stalked, caespitose in small groups on small cankers at base of *Alnus* trunks recently dead; asci about 225 x 10–12 μ , cylin-

dricul, rounded above; paraphyses hyaline, filiform, non-clavate above, 3–4 μ diam.; ascospores 20–25 x 5.5–6.5 μ , subfusiform, smooth, minutely granular within or with one central oil-globule; none were seen septate.

On small cankers at base of dead trunks of *Alnus tenuifolia*, along streams, frequent. Whether this acts parasitically could not be determined, but some of the circumstantial evidence obtained seemed to indicate that it does.

HELOTIUM BOUDIERI Sacc. et Trott. On bark and wood of *Alnus tenuifolia*. When fresh, the apothecia are cream-buff, which changes to fulvous-yellow on drying and with age.

HELOTIUM CITRINUM (Hedw.) Fr. Common, Tolland. On rotten wood of deciduous trees.

HELOTIUM SULPHURATUM (Schum.) Phil. var. **Piceae** var. nov.

Gregarious on decaying needles of *Picea Engelmanni*. Apothecia 1–3.5 mm. broad, disk pale-yellowish, glabrous externally, on short, thick, darker stipe; asci cylindrical, about 150 x 12 μ , paraphyses equal, filamentous, straight or frequently somewhat coiled above, projecting above asci; spores hyaline, smooth, continuous, without oil-drop, 10–12 x 5–6 μ . This probably deserves more than varietal rank.

HYMENOSCYPHA SCUTULA (Pers.) Phillips. var. **Grossulariae**, var. nov.

Apothecia 1–3 mm. broad, slightly tough, externally white and minutely tomentulose, disk when fresh "antimony yellow" (Ridg.), stipe short, 1–2 mm. long, slender, "cinnamon" (Ridg.). Asci 100–110 x 8–9 μ , subcylindrical, slightly thick-walled not blue with iodine; ascospores 16–19 x 3–4 μ , hyaline, 1-septate at the last, subfusiform, more acute at one end, paraphyses filamentous, equal throughout in width.

On dead stems of *Grossularia* sp. 9500-ft. elevation. There are no definite hairs externally, such as occur in apothecia of *Dasychypha*.

HYMENOSCYPHA SUBLENTICULARE var. CONSCRIPTUM Karst. On decaying wood of *Salix*. Disk dingy pale-ochraceous. Ascospores 14–16 x 4–4.5 (5) μ .

HYMENOSCYPHA VIRGULTORUM Phill. On old wood, probably

of *Alnus*. Apothecia chrome-yellow when fresh, then dull red. Spores 12–18 x 3.5–4.5 μ .

LACHNELLULA CHRYSOPHTHALMA (Pers.) Phillips. On timbers of coniferous wood in interior of mines. See note by Seaver (*l.c.*).

LACHNELLA FLAMMEA (A. & S.) Fr. Common, Tolland. On decorticated sticks of *Salix* sp., *Alnus tenuifolia*, and *Populus tremuloides*.

LACHNUM BICOLOR (Bull.) Karst. Infrequent, Tolland. On decayed log of *Salix*. Disk of apothecium yellow when fresh, fading.

OMBROPHILA JANTHINA (Karst.) Rehm. Infrequent, Tolland. On decaying cones and cone debris of *Picea Engelmanni*.

PHIALEA LUTESCENS (Hedw.) Gill. Infrequent, Tolland. On rotten hard wood of conifers.

PHIALEA SUBTILIS (Fr.) Rehm. Frequent locally.

On needles of *Picea Engelmanni* in brush-piles, partly covered by debris from high water. The slender stipes are longer than are typical in the sense of Rehm, being 0.5–2.5 mm. long, and the spores are very narrow, scarcely over .5 μ wide. The plant is entirely pure white when fresh.

TAPESIA EVILESCENS Karst.

Apothecia .5–1 mm. broad, cupulate when fresh and then disk is whitish, cinerescent, externally with whitish margin, elsewhere brownish-fuscous, glabrous except where immersed at base in the fuscous, adnate, rather thin, interwoven subiculum; context thin, whitish above, brownish-filamentose downward, with a thin excipulum of subpolygonal, dark brown and thick-walled cells; asci 50–65 x 3–4 μ , subcylindric-subfusiform, subacute at apex; paraphyses filiform, equal, 1–1.5 μ thick, hyaline. Spores cylindrical, straight, subequal, 8–9 (10) x .5–1 μ , biseriate in upper part of ascus. Hyphae of subiculum dark brown, brittle, thick-walled, septate, 3–3.5 μ diam.

Closely gregarious on subiculum, on decorticated fallen branches of *Alnus tenuifolia*. Tolland. Elevation 9000 ft.

Although *T. evilescens* is reported on dead stems of Gramineae, this species is closely allied to it, by its very narrow spores, and by this character is removed from the

ordinary wood-inhabiting species. On drying, the margins of the apothecia become incurved and remain whitish; elsewhere the apothecia become blackish-cinereous.

MOLLISIACEAE

MOLLISIA CINEREA (Batsch.) Karst. Common, Tolland. On old logs, etc., of *Salix*, etc.

MOLLISIA MELALEUCA (Fr.) Sacc. Rare, Tolland. On decayed wood of *Alnus tenuifolia*.

MOLLISIA TRABINCOLA Rehm. Rare, Tolland.

This curious species dries up and is hard to find unless the substratum is moistened. It gives the appearance when wet of belonging to the Stictidaceae, and on drying takes on an elongated form at times. Spores 6–8 x 1.5–3 μ . Iodine does not affect the asci.

CENANGIACEAE

CENANGIUM ABIETIS (Pers.) Rehm. Infrequently seen, Tolland. On dead twigs of *Pinus contorta*.

CENANGIUM ALPINUM E. & E. Common, Tolland and Leal.

On dead branches of *Picea Engelmanni* and *Pinus contorta*, 9000-ft. elevation. Although no authentic material was examined, the plant is unique by the fimbriate margin of the apothecia, which are folded lengthwise and measure 1–2.5 mm. along the incurved fold. The fimbriate condition is due to dark yellow-brown hairs about 100–120 μ long, 4–5 μ thick, septate, hyaline toward apex and minutely granular. The apothecia occur singly or in groups of few individuals. The asci measure 45–55 x 5–6 μ . The paraphyses are filiform and equal. The spores in the specimens examined averaged slightly different from those given by Ellis, being 8–12 x 2.5–4 μ in size.

GODRONIA BETHELI Seaver. Common, Tolland. On dead branches of *Alnus tenuifolia*.

STICTIDACEAE

OCELLARIA AUREA Tul. Frequent, Tolland. On dead branches of *Salix* sp.

PROPOLIDIUM AMBIGUUM Starb.

On old, decorticated wood of some deciduous tree. This interesting fungus was obtained in too small quantity for one to be sure of its identity. However, the negative iodine test, the pale ochraceous to fulvous-tinged disk, as well as the spores and asci agree so well with this ambiguous species, that it may probably be it.

PROPOLIS FAGINEA (Schrad.) Karst. Infrequent and in old condition. On wood. Tolland.

TRYBLIDIACEAE

ODONTOTREMA MINUS Nyl. Form *salicella* forma nov.

On sticks of *Salix* sp. Differs apparently only in its host. Asci measure 30–40 x 7–9 μ , spores 9–11 x 3.5 μ , fusoid, 1–3 septate, hyaline. Paraphyses rarely branched at apex and not enlarged above.

HYPODERMATACEAE

LOPHODERMIIUM ARUNDINACEUM (Schrad.) Chev. forma *apiculatum* (Fr.) Duby.

LOPHODERMIIUM PINASTRI (Schrad.) Chev. Tolland.

Causing yellowing of young trees of *Pinus contorta*, especially along wet places, with accompanying leaf-cast. Effect was seen only in scattered places.

HYSTERIACEAE

LOPHIUM DOLABRIFORME Walbr. Common, Tolland.

On sticks of *Salix* in wet situations. (See *Mycologia*, XII., 180. 1920.) Patouillard's Fig., No. 294, *Tab. Analyt.*, and his description under *L. elatum* Grev., seem to me to refer to the same species.

PYRENOMYCETES

HYPOCREALES

NECTRIA SANGUINEA Fr. Common, Tolland. On an old valsaceous stroma; on *Salix*.

DOTHIDEALES

PHYLLACHORA TRIFOLII (Pers.) Fkl. Tolland. On *Trifolium repens*. Associated with it is *Polythrincium trifolii* Kze. and a *Phyllosticta*.

PERISPORIALES

SPHOEROTHECA HUMULI var. FULIGINEA (Schlecht.) Salmon. On *Castilleja* sp. Tolland.

SPHAERIALES

BERTIA MORIFORMIS (Tode.) De Not. Tolland. On decaying log of poplar or alder.

CRYPTOSPHAERIA VICINULA (Nyl.) Karst. Tolland. On dead branches of *Alnus tenuifolia*. Easily recognized from Saccardo's description. The spores are quite brown at maturity, being $11-15 \times 3-3.5 \mu$.

DIAPORTHE NIVOSA Ell. & Holw. Tolland.

On branch of *Alnus tenuifolia*. This is in much better condition than Ellis's specimens distributed in *N. A. F.*, which is somewhat immature. The spores are given too small in Ellis, *N. A. Pyren.*, p. 436, as shown both by an examination of our copy of Ellis's No. 2535, and by the present collection. The ascospores are $16-19 \times 5-5.5 \mu$, oblong-subfusoid, pointed at ends, 1-septate, hyaline.

DIATRYPELLA DISCOIDEA var. ALNI Cke. Frequent, Tolland. On dead branches of *Alnus tenuifolia*.

EUTYPELLA ALNIFRAGA (Wahl.) Fr. Tolland. On dead branches of *Alnus tenuifolia*.

HYPOXYLON MORSEI B. & C. Tolland. On dead branches of *Alnus tenuifolia*. The spores in old perithecia run up to 27μ in length, but ordinarily they are $19-24 \times 8-9$ (10) μ . Single perithecia are often 1.5 mm. in diameter, or even larger.

LOPHIOSTOMA MACROSTOMOIDES (De Not.) Ces. & De Not. Tolland. On decorticated sticks of *Alnus* or poplar. This species blackens the surface of the wood.

LOPHIOTREMA HYSTERIOIDES Ell. & Langlois. Tolland. On decorticated wood of poplar or willow. As I did not have

access to a specimen of this, my identification is based entirely on the description with which it agrees well.

ROSELLINIA ALBOLANATA E. & E. Tolland.

On decorticated sticks of *Salix*. Ascospores 25–27 x 5–8 μ . In the early condition it has a thin “cartridge-buff” (Ridg.) subiculum which extends considerably beyond the fertile portion, much as in *R. subiculata*. The perithecia are for quite a time covered by it, but gradually denuded as they approach maturity. In age, the subiculum becomes “ecru-drab” to cinerescence. Ellis, in *N. A. Pyrenomycetes*, places it in the wrong section.

ROSELLINIA THELENA Rabenh. Rare, Tolland. On dead bark of *Picea Engelmanni*. Known by the distinct appendages at each end of spore.

Strickeria megastega (E. & E.) comb. nov. Tolland. (*Teichospora megastega* E. & E., *Proc. Acad. Nat. Sci.*, Phila., 1890, p. 243.) Common, Tolland. On decorticated sticks of *Salix*, *Alnus* and poplars.

TREMATOSPHERA CORTICOLA Fkl. Tolland.

On decorticated wood of *Alnus tenuifolia*. The perithecia at first break through, but at length appear entirely superficial; the asci have very thick walls; the spores measure 35–40 x 7.5 μ .

VALSA ABIETIS Fr. Tolland. On dead branches of *Abies lasiocarpa*.

VALSA NIVEA Fr. Tolland. On dead branches of *Populus tremuloides*. The material is overripe and few spores were seen. Associated with *Cytospora nivea*. Ascospores 9–12 x 1.5–2 μ .

VALSA SALICINA (Pers.) Fr. Tolland. On dead branches of *Salix*.

VALSA SORDIDA Nitschke. Tolland. On dead branches of *Populus tremuloides*.

VALSARIA MOROIDES (C. & P.) Sacc. Tolland. On dead branches of *Alnus tenuifolia*.

BASIDIOMYCETES

UREDINALES

- AECIDIUM ASTERUM Schw. Infrequent. Tolland. On *Aster* sp.
- CALYPTROSPORA COLUMNARIS (A. & S.) Kühn. On *Vaccinium oreophilum* Rydb. Common, Tolland. Leal.
- COLEOSPORIUM SOLIDAGINIS (Schw.) Thüm. On *Solidago*. Common. Tolland. Leal.
- GYMNOSPORANGIUM JUNIPERINUM (L.) Mart. On *Sorbus scopulina*. Infrequent. Tolland.
- MELAMPSORA ALBERTENSIS Arth. On *Populus tremuloides*. Common, Tolland.
- MELAMPSORA BIGLOWII Thüm. On *Salix* sp. Common. Tolland.
- MELAMPSOROPSIS PYROLAE (D. C.) Arth. On *Pyrola secunda*. Frequent, Leal, Tolland.
- PERIDERMIIUM COLORADENSE (Diet.) Arth. & Kern. Forming witches brooms on *Picea Engelmanni*. Frequent. Leal and Tolland.
- PERIDERMIIUM COLUMNARE (A. & S.) Kunz. & Schum. On needles of *Abies lasiocarpa*. Frequent. Tolland.
- PERIDERMIIUM CONORUM-PICEA (Rees) Arth. & Kern. On cones of *Picea Engelmanni*. Common, Tolland.
- PERIDERMIIUM FILAMENTOSUM PK. On branches of *Pinus contorta*, scarcely hypertrophied. Leal, infrequent.
- PHRAGMIDIUM MONTIVAGUM Arth. On leaves of *Rosa* sp. Common, Tolland.
- PHRAGMIDIUM SPECIOSUM Fr. On *Rosa melina*. Infrequent. Leal.
- PUCCINIA ATROPUNCTA Pk. & Clint. On *Veratrum speciosum*. Leal.
- PUCCINIA CIRSIII Lasch. On *Cirsium griseum*. Infrequent, Tolland. On *Carduus Hookerianus*. Infrequent, Leal.
- PUCCINIA CLEMATIDIS (D C) Lagerh. (I) On *Thalictrum* sp. Tolland.
- PUCCINIA CLINTONI Pk. On *Pedicularis*. sp. Frequent. Tolland.

Puccinia HEUCHERAE (Schw.) Diet. On *Heuchera Hallii*. Tolland.

Puccinia MONOICA Arth. (I) On *Arabis* sp. Leal.

Puccinia PATRUELI Arth. (I) On *Agoseris glauca*. Leal.

Puccinia PIMPINELLAE (Str.) Lk. On *Osmorhiza* sp. Tolland.

Puccinia POLYGONI-VIVIPARI Dietr. On *Polygonum bistortoides*. Leal.

Puccinia TARAXICI (Reb.) Plow. On *Taraxacum officinale*. Frequent, Leal and Tolland.

Puccinia TROXIMONTIS Pk. II, III. On *Agoseris glauca*. Leal.

Pucciniastrum MYRTILLI (Schum.) Arth. On *Vaccinium* sp. Infrequent, Leal and Tolland.

Pucciniastrum PUSTULATUM (Pers.) Diet. On *Epilobium adenocaulon*. Infrequent, Tolland.

Pucciniastrum PYROLAE (Pers.) Diet. On *Pyrola secunda*. Infrequent, Leal, Tolland.

Uromyces TRIFOLII Lev. On *Trifolium repens*. Frequent. Leal, Tolland.

Uropyxis SANGUINEA (Pk.) Arth. On *Berberis aquifolium*. Rare. Tolland.

TREMELLALES

DACRYOMCETACEAE

Guepinia MONTICOLA Tracy & Earle. Rare. Tolland. On bark of *Picea Engelmanni*.

AURICULARIACEAE

Auricularia AURICULA-JUDAE L. Frequent, Leal and Tolland. On logs and branches of *Abies*, etc.

TREMELLACEAE

Exidia GLANDULOSA Fr. Common. Tolland, Leal. On *Salix* branches etc.

Hormomyces FRAGIFORMIS Cke. Infrequent. Tolland, Leal. On old logs.

TREMELLODON GELATINOSUM (Scop.) Schroet. Rare. Leal. On wet logs under *Abies*.

AGARICALES

THELEPHORACEAE

CONIOPHORA BYSSOIDEA Fr. Sept. Rare. Tolland. On fallen decaying trunk of *Abies lasiocarpa*.

CONIOPHORA OLIVACEA (Fr.) Karst. Sept. Infrequent. Tolland. On coniferous log.

CONIOPHORA POLYPOROIDEA (B. & C.) Burt. Sept. Rare. Tolland. Hanging, loosely attached, over mossy rocks along stream.

CORTICIUM ALBULUM Atk. & Burt. Rare. Tolland. On much decayed wood of pine and spruce.

CORTICIUM GALACTINUM (Fr.) Burt. Sept. Tolland. On log of *Abies lasiocarpa*.

CORTICIUM INVESTIENS (Schw.) Bres. Infrequent. Tolland. On much-decayed wood of pine or spruce.

HYMENOCHAETE TABACINA Fr. Sept. Infrequent. Leal. Tolland. On dead fallen branches of *Salix*.

PENIOPHORA ALLESCHERI Bres. Sept. Tolland. On log of *Abies lasiocarpa*.

STEREUM ABIETINUM Pers. Rare. Tolland. On coniferous log.

STEREUM PURPUREUM Fr. Sept. Rare. Tolland. On *Salix*.

STEREUM RAMEALE Schw. Sept. Common. Tolland. On dead *Alnus*.

STEREUM RUFUM Fr. (*Corticium pezizoideum* (Schw.) Schrenk.). Sept. Frequent. Tolland. On *Populus tremuloides*.

STEREUM RUGISPORA (E. & E.) Burt. Sept. Infrequent. Tolland. On logs of *Picea Engelmanni*.

STEREUM SANGUINOLENTUM Fr. Sept. Rare. Tolland. On bark of a log of *Picea Engelmanni*.

STEREUM SULCATUM Burt. Sept. Rare. Tolland. On coniferous log.

THELEPHORA CARYOPHYLLEA Fr. Frequent. Tolland. On the ground under conifers.

HYDNACEAE

HYDNUM AURANTIACUM Pk. Sept. Infrequent. Tolland, Leal. Under Abies.

HYDNUM IMBRICATUM Fr. Infrequent. Leal.

Under pine and spruce. This agrees well both microscopically and macroscopically with material I obtained near Stockholm, Sweden. It is futile to refer this species to Linnaeus. We have, therefore, the northern European plant in this country. It is necessary, however, to use the highest magnifications in examining the spores and basidia in order safely to segregate the species which are somewhat similar externally, and to possess good field-notes.

HYDNUM GRAVEOLENS Dolastre var. Sept. Rare. Tolland. Under conifers (pine and spruce).

HYDNUM REPANDUM Fr. Sept. Infrequent. Tolland, Leal. Under conifers (pine and spruce).

HYDNUM SCROBICULATUM Fr. Sept. Infrequent. Tolland. Under conifers (pine and spruce).

HYDNUM SUAVEOLENS Fr. (See Plate XXXIII.) Sept. Infrequent. Tolland. Under conifers (pine and spruce).

HYDNUM UNDERWOODII (Banker) Coker. Sept. Frequent. Leal, Tolland.

Under spruce and fir. Three collections were brought. Its superficial characters were not sufficiently striking in the older and larger plants to indicate that we had something interesting and doubtless we usually passed it by as *H. imbricatum*. When it is younger and smaller in size, the teeth are short and the description of Banker and Coker applies well. When it is larger and more luxuriantly developed, the teeth are as much as 5 or 6 mm. long, and the surface of the pileus may become cracked-scaly and imitate *H. imbricatum*. But the crowded, slender and fragile teeth, and, to a smaller degree, the color of the plant, separate it quickly from *H. imbricatum*. Our larger specimens compare well with Ellis, *N. A. F.*, No. 926 (*H. imbricatum*), and although Banker included this in his account of *H. Underwoodii* (*Mem. Torr. Bot. Club*, XII: 148. 1906), his formal

description does not take into account the longer teeth of Ellis' specimens. Our smaller specimens, although possessing mature spores, are evidently not full size and are well indicated by Coker's illustrations of the species. (*Jour. Elisha Mitchell Sci. Soc.*, 34: Plate 7, facing p. 172. 1919.)

ODONTIA SETIGERA Fr. Sept. Infrequent. Tolland. On coniferous wood.

PHLEBIA ALBIDA Fr. Sept. Rare. Tolland. On log of *Abies lasiocarpa*.

BOLETACEAE

BOLETUS AMERICANUS Pk. Under spruce and pine. Tolland.

BOLETUS PUNCTIPES Pk.

Under spruce and pine. Tolland. This species which some have included with *B. granulatus* Fr., was very abundant and is entirely the Peck conception. Only in age or when dried, does it show the characteristics of its sister species. Typical *B. granulatus* was not seen.

BOLETUS SCABER Fr. Under spruce and pine.

Boletus tomentosus sp. nov.

Pileus 5-8 cm. broad, convex-subexpanded, obtuse, dry, becoming subviscid in wet weather, ground color "antimony yellow" (Ridg.), covered with "yellow-ochre" to "buckthorn brown" tomentose, rather small scales, which are disposed in an areolate manner; flesh white, changing slowly to "pale sky-blue" (Ridg.), amber-yellow under the cuticle. Tubes depressed around stem, almost free, convex, 4-6 mm. long, 1-2 to a mm., angular, radiately subelongate, "yellow-ochre" at first, soon changing to "tawny-olive" or "buckthorn-brown," dissepiments thick; mouths concolor, uneven. Stem 3-5 cm. long, 1.5-2 cm. thick, solid soon cavernous or grubby, subcompressed, even, obscurely subtomentose, "amber-yellow," dotted by scattered, minute, reddish-brown points; flesh white changing to pale sky-blue. Spores narrowly subfusiform, 8-9 x 3 μ , subhyaline or scarcely tinged straw color. Taste mild. Odor slight.

Under fir and pine. Leal and Tolland, Colorado, Aug.-Sept.

This is doubtless the plant referred to *B. hirtellus* Pk. by Overholts. If it is that species, the descriptions of it so far pub-

lished must be considerably emended. *B. tomentosus* has characters showing it to be intermediate between the "gyroporus" group and the "Roskovites" group. The flesh of the stem tends to break down as in *B. castaneus* and the pileus is not truly viscid. On the other hand, the tubes are almost free from the stem and do not blacken on drying. The colors are not golden as given by Peck for *B. hirtellus*; the flesh changes to sky-blue and the spores are almost hyaline.

Boletus versipellis Fr. Under poplars. Common. Leal. Tolland. It is surprising that this was not reported by Overholts. It has some similarity to *B. scaber*, and may have been confused with it.

POLYPORACEAE

FOMES APPLANATUS Fr. September. Tolland. Rare. On *Populus tremuloides*.

FOMES IGNIARIUS Fr. (Poplar form). Sept. Infrequent. Tolland. On living trunk of *Populus tremuloides*.

FOMES PINICOLA Fr. September. Leal, Tolland. Frequent. On *Pinus contorta*.

FOMES ROSEUS Fr. Sept. Rare. Tolland. On logs of *Picea Engelmanni*.

IRPEX DEFORMIS Fr. Sept. Rare. Tolland. On log of *Pinus contorta*. Unusual in its occurrence on coniferous wood.

IRPEX FUSCOVIOLACEUS Fr. (f. RESUPINATA). Sept. Infrequent. Tolland. On log of *Pinus contorta*. (See Overholts, *Ann. Mo. Bot. Gard.*, 22. 686. 1915.)

LENZITES ABIETINELLUS (Murr.) Sacc. Sept. Rare. Tolland. On dead *Alnus* branches.

LENZITES SEPIARIA Fr. Sept. Common. Leal. Tolland. On old or charred logs of *Pinus contorta*. There are no good intermediate forms between this and *Trametes protracta* when observed in their development in this region.

MERULIUS GYROSA Burt. Sept. Rare. Tolland. On coniferous wood.

MERULIUS SORORIA Burt. Sept. Rare. Tolland. On coniferous wood.

POLYPORUS ALBOLUTEUS E. & E. Sept. Infrequent. Tolland. On mine timbers of coniferous wood.

POLYPORUS CAESIUS Fr. Sept. Infrequent. Tolland. On very rotten coniferous wood.

POLYPORUS CINNAMOMEUS Fr. Sept. Frequent. Leal. Tolland. On low or sandy ground under pine and poplar, etc.

POLYPORUS CIRCINATUS Fr. Sept. Frequent. Leal. Tolland. Under spruce and fir.

POLYPORUS CONFLUENS Fr. (See Plate XXXIV.)

(A) Tolland. Sept. Common, but scattered-gregarious.

About a dozen collections were made on succeeding days; special attention was paid to get the possible variations due to age, habit, color, amount of stem-confluence, etc. Although occurring in widely scattered localities on the slopes of the ranges under lodge-pole pine and Engelmann spruce, a day's trip would yield easily a peck or more. A large amount was thus obtained and the facts noted. It seems desirable to record this study in the following description.

Pilei fleshy, firm, somewhat fragile, either simple and then up to 10 cm. broad, or on branching stems with few pilei, or on confluent to connate stems with several pilei 5-10 cm. broad, orbicular, eccentric or irregularly compressed, sometimes wavy-lobed, convex, obtuse; surface dull white when perfectly fresh, i.e., "ivory-white" (Ridg.), soon "cinnamon-buff" to "clay-color" (Ridg.) when rubbed, in age, or after being exposed to wind or sun, provided with a more or less differentiated cuticle which becomes either minutely rimose, areolate-rimose, or diffracted-sealy according to weather conditions, showing whitish context between the cracks, glabrous; margin thin almost membranous, persistently incurved, substerile to fertile. Context when fresh quite thick, 1-3 cm.+ in thickness, white, fleshy, homogeneous, compact but rather soft when fresh, fragile, but becoming harder and firm in dry weather, slowly assuming a "cinnamon-buff" color when broken or attacked by larvae.

Hymenophore composed of very short tubes, 1-2 mm. long, varying subdecurrent to long-decurrent and somewhat oblique from the oblique position of most stems; mouths not at first

stuffed, white, but soon "straw-yellow" (Ridg.) or lutescent, 2-3 to a millimeter, at first angular with thick dissepiments which become thin and lacerate-serrate or frequently break down in age so as to yield pores of larger size.

Stem 4-10 cm. long, ventricose-irregular, pointed at base, single, subconfluent or confluent-connate, often compressed or subsulcate, frequently irregular and ascending, sometimes covered above for half the length with abortive pores, white when fresh, becoming "cinnamon-buff" or lutescent when handled or in age, covered with a thin floccosity, flesh spongy and white at first, then compact and sublutescent. Cystidia none. Spores minute, oval, smooth, hyaline, apiculate, 4-5.5 x 3.5-4 μ , usually with an oil-drop. Odor slight and then pleasant, or none. Taste mild.

The herbarium specimens of these collections, now a little over a year in the dried condition, scarcely show tendencies to take on a tinge of reddish. The pilei and stems are now generally sordid "cinnamon-buff, clay-color to tawny-olive" (Ridg.), verging here and there into "pecan-brown" where the rufescent tendency occurs, while the pores vary between "buffy-brown" and "mikado-brown," the extremes matching poorly. My collections from Elkmont, Tenn., also under pines, which I referred to *P. confluens*, although colored when fresh like the Colorado plants, show now, after five years in the herbarium, their rufescent character strongly. Indeed, the Colorado plants might perhaps be confused with *P. ovinus* in the dried condition.

P. ovinus, however, becomes, when dried, blackish-stained as if scorched, and the tubes are not strongly decurrent, the plants are more regular and more truly white when fresh, and the stems are simple. The tubes of the dried specimens of individuals of *P. confluens*, which were picked in a fresh growing condition, have a paler, a pinkish-buff color, while those specimens which had matured and were slightly weathered when picked, have the tubes now as described above.

A comparison of the figures by Fries (*Sverig ätl Svamp.*, Pl. 24) and by Barla (Pl. 29, Figs. 2 and 3) shows that the habit of the Colorado plants is much less complex; the majority have

few branches or a small number of confluent stems. Only occasional plants possess the large number of pilei shown in these figures. The color in the figures cited cannot be taken too seriously, in view of the variations in the plants of the terrestrial group to which *P. confluens* belongs. I have no doubt that the Tennessee plants are the true *P. confluens*, and although the Colorado plants do not match at all at present, I think they must be considered the same thing.

(B) Leal. Aug. Rare.

These collections were at first referred to *P. confluens*, but further study makes this reference doubtful. Only one collection was made. The tubes when dried are "Saccardo's umber" to "sepia," very regular even in the mature plant, angular, and the mouths do not become lacerate-dentate. Stems simple or sparsely branched, distinctly "orange-rufous" (Ridg.), probably with an orange-rufous mycelium. The pileus is rather thin, with a membranous incurved margin, whitish-lutescent when fresh, glabrous, and with a cuticle; the pileus dries much thinner than those under (A). Spores, etc., like *P. confluens*.

It is not unlikely that this is the long-lost *Polyporus politus* Fr. It is true the pileus does not show the red color except as a tint. In *Icones*, Fries states that his figures were made from dried specimens, and doubtless the drawings were somewhat conventionalized. On the other hand, it would be easy to see in Fries's figure of *Polyporus subsquamosus* our diffracted-scaly specimens of *P. confluens* described above.

As to *P. fractipes* Murr. and *P. peckianus* Sacc., one cannot be very positive. A specimen of what is apparently a good *P. peckianus* is in my herbarium; it differs at once from the Colorado species by its smaller pores, and according to Peek's original description, as *P. flavidus* (*N. Y. Mus. Rep.*, 26: 68), the pileus is depressed-funnel form, and its pores are yellow, while according to Lloyd (Vol. V., letter 62, note 429), its spores are smaller, $3.5 \times 2.5 \mu$. *P. fractipes* Murr. is said to have small pores also, 4-5 to a mm., and the pileus is much thinner than that of the Colorado plants; other characters agree rather well with form (A). There remains *P. Whitei* (Murr.).

This is only separable from the Colorado form (A), following Murrill's description, by the rose color which the tubes and flesh assume on bruising or drying, unless the character of a pruinose pileus be important.

POLYPORUS ELEGANS Fr. Sept. Infrequent. Leal. Tolland. (*Polyporus varius*.) On dead branches of *Populus tremuloides*.

POLYPORUS FRAGILIS Fr. Sept. Rare. Tolland. On coniferous log. Spores 4-5 x 1.5 μ .

POLYPORUS HIRTUS Fr. Rare. Leal. On old stump of *Pinus contorta*.

POLYPORUS LEUCOSPONGIA Ell. & Hark. Sept. Frequent. Leal. Tolland. On old or charred logs of *Pinus contorta* in forest burns where logs are under dry conditions.

POLYPORUS OSSEUS Fr. Rare. Leal. At base of living trunk of *Picea Engelmanni* on the exposed dead part of a root.

POLYPORUS PERENNIS Fr. Sept. Infrequent. Tolland. On the ground under conifers.

POLYPORUS RESINOSUS Fr. Sept. Apparently rare. (*P. benzoinus*, sense Lloyd.) On *Abies lasiocarpa*. In good condition with surface of pileus hispid-reticulate, with metallic-bluish zones.

POLYPORUS URSINUS Lloyd. Sept. Infrequent. Tolland. Leal. On old logs of pine and fir. Spores 8-10 x 2.5-3.5 μ . Hymenium provided with short hyaline cystidia, often encrusted at apex.

POLYSTICTUS ABIETINUS Fr. Sept. Frequent. Leal. Tolland. On logs, etc., of pine, *Abies* and spruce.

POLYSTICTUS SUBCHARTACEUS Murr. Sept. Infrequent. Tolland. On dead *Populus tremuloides*.

PORIA MEDULLAE-PANIS Fr. Sept. Frequent. Tolland. On coniferous logs.

PORIA OBUDCENS Fr. Sept. Tolland. On coniferous log.

PORIA SALMONICOLOR B. & C. Sept. Rare. Tolland. On coniferous wood.

TRAMETES CARNEA Nees. Sept. Tolland. Infrequent. On bark of *Pinus contorta* and *Picea Engelmanni*.

TRAMETES MOLLIS Fr. Sept. Frequent. Tolland. On log of *Abies lasiocarpa*. Reported only on deciduous trees by Overholts.

TRAMETES PICEINA Pk. Sept. Infrequent. Tolland.

Forming low, narrow, strips on decorticated fallen logs of *Picea*. Markedly distinct from the *Trametes pini* fruit-bodies on the same host and in same region, by its smaller pores and its resupinate-reflexed habit. (See, however, Overholts, *Ann. Mo. Bot. Gard.*, 22: 722. 1915.)

TRAMETES PINI Fr. Sept. Very common. Leal. Tolland. On *Pinus contorta*, *Picea Engelmanni*, *Abies lasiocarpa*. On living or dead trunks. Large percentage of pines had heart rot.

TRAMETES PROTRACTA Fr. Sept. Common. Leal. Tolland. Common on old and charred logs of *Pinus contorta*. This is distinct from *T. vialis* Pk.

TRAMETES SERIALIS Fr. Sept. Rare. Tolland. On dead branches of *Salix* sp.

TRAMETES TENUIS Karst. Sept. Frequent. Leal. Tolland. fide Overholts. On charred logs of *Abies lasiocarpa*, forming extensive patches up to 20 cm. long.

TRAMETES VARIIFORMIS Pk. Sept. Frequent. Tolland. Leal. On coniferous wood.

CLAVARIACEAE

CLAVARIA AUREA Fr. Infrequent. Tolland, Leal.

On the ground under pine, spruce and fir. Spores subhyaline, 9–12 x 4–4.5 μ , rarely up to 15 μ long. Size and habit similar to *C. flava*. Color of branches "apricot-yellow" to "buff-yellow" (Ridg.), with "lemon-yellow" tips. Base of stem white, 10–12 cm. thick.

CLAVARIA BOTRYTIS Fr. Infrequent. Tolland.

Under spruce and pines. The spores in some specimens measure shorter, and indicate slow maturity. The striations on the spore wall are faint and must be looked for under magnifications of about 1500 diam. Spores of the Colorado form measure 10–13 (15) x 4–5 μ . The spores of some of my Michigan specimens measure 10–15 (16) x 5–6 μ , all striate. I am

inclined, however, to think the Colorado plant is merely a form; at least it is not *Clavaria botrytoides* Pk. (*N. Y. State Mus. Bull.*, 94: 49. 1905.)

CLAVARIA CORNICULATA Fr. (*C. muscoides* L.) Frequent. Tolland. Under conifers.

CLAVARIA CRISTATA Fr. Frequent, Tolland. Under pines.

CLAVARIA FLAVA Fr. Occasionally abundant, Leal and Tolland. Under pines. Spores 10–14 x 3.5–4.5 μ , slightly yellowish, or subhyaline in microscope, the spore wall practically smooth under very high magnification.

CLAVARIA FUMOSA Fr. Rare. Leal, Tolland.

On moss and humus under spruce and fir. The color is smoky-brown with tint of purple. It forms dense clusters of usually simple clubs 5–8 cm. high, 2–5 mm. thick; the hymenium is provided with cylindrical hyaline cystidia; spores oblong, 9–10 x 5 μ hyaline.

CLAVARIA LIGULA Fr. Uncommon. Tolland. Under pines.

CLAVARIA PISTILLARIS Fr. forma TRUNCATA. (See Atkinson, *Mushrooms*, p. 203. 1900, and E. T. Harper, *Mycologia*, V. 263. 1913.) Typical plants occur also. Infrequent. Tolland, Leal. Under pines.

CLAVARIA PYXIDATA Fr. Infrequent. Leal. On poplar log.

AGARICACEAE

AMANITA MUSCARIA Fr. Infrequent. Tolland.

In groves of pine and poplar. American authors nearly always include "red" in giving the colors of the pileus, but no one, to my knowledge, has clearly stated that the brilliant-red European color form had been observed in this country.

I saw this form in Sweden, but until I came across the collection at Tolland, assumed that it did not occur in the United States. These specimens had a uniform "scarlet" to "scarlet-red" (Ridg.) pileus, just like those of Europe; the volva was "light-buff" to "naples-yellow" (Ridg.) and the thick outer edge of the annulus was also decorated by "naples-yellow" floccose tufts which had been torn from the volva. The spores measure 9–12 x 6–8 (9) μ , with a very large oil globule.

If we consider the well-known orange-yellow to yellow form as the center of the color shading, we get as one extreme this brilliant red form in the Rocky Mountains, and as we go east and south to Virginia, I have noted that the colors tend to be much paler, even when in a favorable growing condition. The tendency to fade rapidly to dingy white after maturity is much more common there than in the North.

ARMILLARIA MACROSPORA Pk. Rare. Tolland.

Mossy or moist ground under spruce and fir; solitary, rarely two or more. Because of the inadequate description published by Peck, it seems desirable to give an emended account of this species, especially because another large-spored plant, *A. evanescens* (Lovejoy) Murrill, has been described from the Rocky Mountains:

Pileus fleshy, 8–12 (20) cm. broad, convex, obtuse, then expanded-plane, becoming turbinate in age, with a gelatinous pellicle which is viscid when moist, even, glabrous, shining when dry, "cinnamon-buff" to "pinkish-buff" (Ridg.); sometimes tinged brownish-yellowish; margin acute, sometimes subappendiculate from the veil; flesh very thick in centre, abruptly quite thin at margin, white; gills acuminate-long-decurrent, narrow, crowded, a few forked toward margin of pileus, white to "light buff" (R.), edge entire; stem 4–7 (9) cm. long, 1.5–3 cm. thick, subequal or tapering downwards, stout, solid, white within; veil thick, persistent, rather membranous, at first sheathing the stem to middle or above, terminating in a flaring, membranous portion which becomes the annulus, at length torn and forming subconcentric patches colored like pileus, the thin outer layer of the veil composed of gelatinous hyphae and viscid when wet; odor subfarinaceous when flesh is crushed, taste like rancid meal or somewhat disagreeable; spores 13–16 (17) x 5–6 (rarely 7) μ , subcylindric-subfusiform, hyaline, granular within; cystidia none; basidia 85–90 x 9–11 μ .

ARMILLARIA MELLEA Fr. Rare in the conifer forests, but then attached to coniferous wood.

ARMILLARIA VISCIDIPES Pk. Solitary. Not infrequent. Tolland, Leal.

Solitary on the slopes of the mountain ridges under pine and spruce. The stem, whose enclosing veil is viscid when young and fresh, is subequal or usually tapering downwards; the spores are minute, 5-6 (7) x 3-4 (5) μ , so that Peck (*Ann. Rep. N. Y. State Mus.*, 44: 128) seems to have noted only the extreme larger size; furthermore, a mount of the gills usually shows a large number of immature, subspheroid spores. The odor is subalkaline, penetrating and distinguishing.

CANTHERELLUS CIBARIUS Fr. Frequent in August, not seen later.

CANTHERELLUS LUTESCENS Fr. (Epicrisis). Infrequent. Tolland, Leal.

On rotten coniferous wood. The stature is that of *C. infundibuliformis*. Pileus "fawn color" (Ridg.); gills "ochraceous-salmon," stem "pinkish-cinnamon"; the spores measure 10-12 (13, 15) x 4-5.5 μ , subcylindrical, hyaline.

CLAUDOPUS NIDULANS Fr. Rare. Tolland. On conifer log.

CLITOCYBE CANDICANS Fr. Infrequent, Tolland, Leal. In fir and spruce forests.

CLITOCYBE CANDIDA Bres. Rare. Under fir and spruce in high mountains.

CLITOCYBE CONNATA Schum.-Bres. (*Fung. Trid.*, I. Pl. XXXIII.) Infrequent, Tolland.

On rotten coniferous wood and debris. *Clitocybe overholtsii*, Murrill (*North American Flora*, 9. Part 6, p. 403), is doubtless the same thing. It varies in its habit, and the connate character is not always dependable.

CLITOCYBE FRITILLIFORMIS Fr. Rare. Tolland. On moss under fir.

CLITOCYBE GEOTROPA Fr. Rare. Leal. On conifer log.

CLITOCYBE LACCATA Fr. Frequent. Tolland, Leal. On low ground.

CLITOCYBE MAXIMA Fr. Infrequent. Tolland. Under spruce and pine.

CLITOCYBE PICEINA Pk. Infrequent. Leal. Under conifers.

CLITOCYBE PITHYOPHILA Fr. Infrequent. Tolland. Under fir.

CLITOCYBE SORDARIUS (Fr.) (*Paxillus sordarius* Fr.). Rare. Tolland. On banks, attached to very rotten wood. Spores narrow, subfusiform, hyaline, 8-9 x 3.5-4 μ .

CLITOCYBE TORNATA Fr. Infrequent, Tolland. On decayed wood.

COLLYBIA ACERVATA Fr. Infrequent, Leal, Tolland.

On much-decayed wood of conifers, forming dense subconfluent, caespitose clusters of many individuals. The conception of this species as described in *Agaricaceae of Michigan*, I. 759, is entirely erroneous, by the fact of its very incompleteness. The species would not be recognizable by that description, or indeed by that of many other books. Even Fries did not put sufficient emphasis on the densely caespitose character of the stems, with which many of the other characters are correlated.

COLLYBIA ALBIFLAVIDA (Pk.) Kauff. var. **montana** var. nov. Rare. Tolland. Among grass in meadow, edge of coniferous forest.

This departs from the species in its somewhat broader gills, 6-10 mm. broad, which become "pale ochraceous-orange" (Ridg.), and the spores measure 8-9 (10) x 5-6 (6.5) μ . In stature, habit and the presence of cystidia, and the other characters, it corresponds to the well-known eastern species.

COLLYBIA BUTYRACEA Fr. Not seen after August, Tolland.

COLLYBIA CIRRATA Fr. Infrequent. Leal. On debris of conifer needles.

COLLYBIA COLOREA Pk. Rare. Leal. On conifer log.

COLLYBIA CONFLUENS Fr. Frequent, Leal. On ground in woods.

COLLYBIA DRYOPHILA Fr. Frequent. Leal. Under spruce and fir.

COLLYBIA TUBEROSA Fr. Frequent, Tolland. On decaying fungi.

COLLYBIA TENUIPES (Schw.) Sacc. Infrequent. Tolland. Attached to wood.

COLLYBIA VELUTIPES Fr. Infrequent, Tolland. On wood of *Salix*, etc.

COPRINUS ATRAMENTARIUS Fr. Infrequent, Tolland. On the ground.

CORTINARIUS ALBOVIOLACEUS Fr. (Inoloma). Frequent. Leal. In alluvial soil along streams.

CORTINARIUS ALUTACEOFULVUS Britz. (Telamonia). Infrequent. Leal, Tolland. On moist, mossy ground, or on mosses under spruce.

This is to be considered as a segregate of *C. bivelus* Fr. It differs from its nearest relatives like *C. bivelus*, *C. rusticus* Karst., and *C. laniger* Fr. because of its almost spherical spores, which measure 6-7.5 x 5-6 μ . Furthermore, *C. bivelus* and *C. laniger* have a distinct odor according to Fries. This quartet of species has presented considerable difficulty, but an accumulation of data makes it possible to distinguish three of them as occurring in this country. *C. alutaceofulvus* occurs also in the Adirondack Mountains under spruce. In Overholts's list I referred a collection of what is probably this species, to *C. rusticus*.

CORTINARIUS ANOMALUS Fr. (Dermocybe). Frequent, Leal. In moist debris and leaves; under pine and spruce.

CORTINARIUS ANGULOSUS Fr. (Hydrocybe). Infrequent. Leal. Under conifers. This is a firm plant, which, like its nearest relatives *C. isabellinus* and *C. renidens*, becomes ochraceous on losing moisture; from both of these it differs in its spore characters and habit.

CORTINARIUS ARQUATUS Fr. (Bulbopodium). Rare. Leal. Under spruce and fir.

This is apparently distinguished from the larger *C. atkinsonianus* by the weak violaceous colors, the broad gills, and the peculiar violaceous base of the stem, which, as Fries remarks, is not itself bulbous or marginate, but is surrounded and enlarged by the volva-like remnant of the veil. Our Colorado specimens were not strikingly volvate, but agree well with Ricken's account and his spore-size, 12-15 x 7-8 μ . Other European notices agree in giving the spore-size 10-12 μ long. But no one except Ricken has given us a critical study of it since the time of Fries. It is of course possible that two species occur in Europe.

CORTINARIUS ATKINSONIANUS Kauff. (Bulbopodium). Infrequent. Leal. Under conifers.

CORTINARIUS BALTEATUS Fr. (Phlegmacium) form *pallidus*. Rare. Leal.

These specimens lacked the violaceous-purplish tinge on the margin of the pileus; but Fries noted forms of this kind in Sweden. The broad, obtuse pileus is out of proportion to the short stem. The gills are very broad and distinguish this species from its relatives. Ricken says the stem is peronate, but on what authority, I am unable to determine; at all events, he does not depend on Fries.

Cortinarius bistreoides sp. nov. (Telamonia).

Pileus 2-4 cm. broad, submembranaceous, fragile, at first conic-campulate, then expanded-plane or repand on margin, usually with a subacute umbo, *glabrous*, silky-shining when dry, even, "mummy brown" (Ridg.) when moist, "ochraceous-buff" on drying, *umbo at length "bistre,"* and finally bistre elsewhere, with a very thin margin, which is at first delicately white-silky, at length incised or crenate-plicate; flesh concolor, hygrophaneous, quite thin. Gills adnate, often sinuate, strongly ventricose, *broad*, definitely subdistant, at first pallid-brownish, then "tawny," edge white-flocculose. Stem *slender*, 4-6 cm. long, 2-4 mm. thick, equal, somewhat rigid-elastic, straight or flexuous, solid, innately silky-fibrillose and shining when dry, slowly fuscous, incarnate-tinged within, scarcely marked by zones of the evanescent, whitish universal veil. Odor slight, radishy-earthy, taste slight or none. Spores elliptical, 10-12 x 5-6 (7) μ , tuberculate at maturity, dark rusty brown in microscope.

Gregarious or subcaespitose, in moist places under spruce and fir. Leal, Colorado. August.

Distinguished from its allies by its large spores, and the prevailing bistre shades of the pileus. The flesh of the stem is solid and tinged by a shade of incarnate-brown, then slowly fuscous. The cap becomes blackish-streaked or stained in age. The scanty cortina is white. *C. badius* Pk., which has large spores, is entirely different in the smaller size of the plant and in its colors, etc. It must not be confused with *C.*

nigro-cuspidatus or *C. paleaceus*, whose spores are much smaller.

CORTINARIUS BIVELUS Fr. (Telamonia). Infrequent. Leal. Tolland. Under spruce and pine. See remarks under *C. alutaceofulvus*.

CORTINARIUS BRUNNEOFULVUS Fr. (Telamonia). Infrequent. Leal. In mixed woods.

CORTINARIUS CAESIOCYANEUS Britz. (Bulbopodium). Infrequent. Leal. Alluvial soil, forest.

CORTINARIUS CALLISTEUS Fr. (Inoloma). Rare. Leal. Alluvial soil, under spruce, fir and alder.

This is the second time I have collected this fine species. Fifteen years ago, I obtained a few plants in hemlock and pine woods at Ithaca, N.Y. It is quite distinct and entirely like the European plant.

CORTINARIUS CINNAMOMEUS Fr. (Dermocybe). Common. Leal. Tolland. On moss and debris under pine, spruce or fir.

Cortinarius citrinellus sp. nov. (Bulbopodium).

Pileus up to 10 cm. broad, fleshy, convex-expanded, very viscid, then somewhat floccose-dotted from the drying gluten, at first "olive-lake" to "buff-citrine" (Ridg.), finally "clay-color" to "honey-yellow," the margin at first incurved and tomentose; flesh thick, except on margin, at first tinged "primrose-yellow" (Ridg.), then whitish. Gills adnate and rounded behind, then sinuate, moderately broad, 8-10 mm., ventricose, close, becoming slightly subdistant, at first "primrose-yellow" (Ridg.), finally "tawny." Stem 5-7 (8) cm. long, apex 1.5-2 cm. thick, at first marginate-bulbous, becoming oval-bulbous, abruptly short-obtusely-pointed below bulb, which is densely fibrillose-tomentose from the "primrose-yellow" veil, elsewhere veil is evanescent and surface of stem concolorous with that of the pileus. Cortina yellowish, odor and taste slight. Spores broadly ellipsoid to globose, 8-9 x 6-8 μ , rough, brownish under microscope.

Solitary or scattered. Leal, Colorado. Under pine and spruce. August.

This differs from its allies in the subglobose spores. It ap-

proaches *C. prasinus* in its colors, but with less green. It differs from *C. virentophyllus* in spores, colors and habitat. When quite young, the green shades are more manifest. In wet weather, the bulb is viscid from the veil-remnants. The cortina is at first attached to the margin of the bulb, thus indicating its position in the subgenus *Bulbopodium*.

CORTINARIUS COLYMBADINUS Fr. (Dermocybe). Very common in a restricted area of spruce and fir forest. Leal.

This is form (B) of Fries's *Monographia*, which he collected under pines. When it is moist and drying, the subhygrophanous character is apt to lead one into the hygrophanous groups. The "tawny-olive" to "old-gold" (Ridg.) color of the moist cap, the tendency of the margin to become geniculate, the rather broad, almost subdistant gills and spores which measure 7-8 (9) x 6-6.5 μ , separate it from its allies. This form had only a slight radish odor, while form (A) of *Monographia*, which occurred under beech, is said to have had a very strong odor of radish.

CORTINARIUS CROCEOCONUS Fr. Rare. Leal. Mossy ground under conifers.

CORTINARIUS CYANOPUS Fr. Rare, Leal. Under spruce and fir.

This seems to agree well enough with the conception handed down to us. The spores measure 10-12 x 8-9 μ . It is Ricken's plant, except that both he and Fries limit it to frondose woods. Since its violet-stemmed allies are already numerous, I refrain from segregating it on such slight grounds. *C. aggregatus* Kauff. has much smaller spores. Further study of these violet species may bring out additional useful characters. The gills of the Colorado plant were "deep vinaceous-lavender" (Ridg.) at first, and their edge noticeably crenulate. The upper part of the stem within and without had the color of the young gills. The pileus was "cinnamon-buff" to "clay color" (Ridg.).

CORTINARIUS CYLINDRIPES Kauff. (Myxacium). Infrequent. Tolland. In moist places under conifers.

CORTINARIUS DECUMBENS Fr. (Dermocybe). Rare. Leal. Under spruce and fir.

The whole plant is at first "ivory white" (Ridg.), later the gills become "Sayal-brown" from the spores. The specimens

were larger than the typical size found by Fries, but he notes that such extremes do occur. The rather stout and decumbent stems soon become spongy-hollow and split easily in the longitudinal direction. Spores measure 7–8.5 x 5–6 μ . This is my first collection.

CORTINARIUS DELIBUTUS Fr. (Myxacium). Infrequent, Leal. On mosses under conifers.

This differs from *C. sphaerosporus* Pk., which is similar and occurs in Eastern United States, by its somewhat larger spores, the white flesh of the pileus and in the gills which are not truly violaceous in the young stage. Its gills are more crowded than in the typical form, a form which is also reported by Fries. The color of the pileus varies from "mustard-yellow" (Ridg.) to "cream-buff."

CORTINARIUS DIBAPHUS Fr. Rare. Tolland. Under spruce.

CORTINARIUS DILUTUS Fr. (Hydrocybe). Infrequent, Leal. Tolland. On mosses under conifers.

By reason of its strongly hygrophanous character, the pileus, which is almost "chestnut-brown" when young and moist, fades to a pale "cinnamon-buff" (R) as it develops and loses moisture. The spores are spheroid, 6–7 x 6 μ . Its nearest relative is probably *C. rubricosus* Fr.

CORTINARIUS ELEGANTIOR Fr. Rare. Leal. Under alpine fir.

This fine species was described by Fries from the mountains, under fir. Our plants agree exactly with his account. Ricken says the gills are broad, but such is not the Friesian description. The spores measure 12–15 (16) x 8–9 μ . The variety from frondose woods described in *Agaricaceae of Michigan, I.* 355, probably belongs elsewhere. The Colorado plants have slightly larger spores than any recorded by European authors, but misinterpretation of Friesian plants in the middle and south of Europe, is to be expected. We have already in this country three or four superficially similar, but really quite distinct species.

CORTINARIUS EVERNIUS Fr. (Telamonia). Infrequent, Leal. On mosses under conifers.

Quite typical; but variations in size, and changes due to the

fading of the intense violet color of the stems, are frequently very confusing.

CORTINARIUS GENTILIS Fr. (Telamonia). Frequent, Leal, Tolland. In deep mosses, under conifers, etc.

Sharply marked by its broad and distant gills, which often become very distant as the plant matures and the drying cap pulls up on the margin. Except for its longer stems and habitat, it has somewhat the appearance of *C. distans* Pk. But in the latter the stem is cingulate by the faded whitish remnants of a brownish veil, while in *C. gentilis* the zone in the middle is "yellow-ochre" and due to a yellow veil. The spores of *C. gentilis* are also slightly larger than in *C. distans*, and measure 8-9 (10) x 5.5-6 (7) μ .

CORTINARIUS GLANDICOLOR Fr. (Telamonia). Rather frequent. Leal. Tolland. In debris under conifers, especially fir.

This is most easily confused with *C. punctatus* Fr. and stout forms of *C. uraceus* Fr. It has about the stature and shape of *C. distans* Pk., but that species never has a fuscous tendency, while in *C. glandicolor* the whole plant when it reaches maturity becomes fuscous and in age even blackish. I have found the latter in this country only in the mountain forests, in the Adirondacks, the Rockies, and the Olympics. Its spores are very slightly longer than in *C. distans*, but smaller than in *C. punctata*. Its gills vary from close to subdistant, in some forms distant in age. The stem is at first whitish, but in age only the annular zones of the veil remain whitish. In *Agaricaceae of Michigan*, p. 422, it is compared with its relatives, but at that time I had not become definitely acquainted with it. The pileus is campanulate, its umbo quite variable from small and pointed to broadly mammillate and obtuse, and small plants often have the shape of *C. rigidus*, but differently colored.

Cortinarius glaucopoides sp. nov. (Bulbopodium).

Pileus 5-10 cm. broad, fleshy, convex, obtuse, then expanded-plane, often irregular from crowding, with a viscid, separable pellicle, glabrous, even, "antimony-yellow" (Ridg.) to "pale orange-yellow," unicolorous, deeper lutescent with age, not streaked, the thin margin at first incurved; flesh thick, abruptly

thinner on margin, *white or whitish at first, distinctly lutescent*. Gills adnate-emarginate with tooth, somewhat narrow to medium broad, up to 5-8 (9) mm., close to crowded, at first "pale vinaceous-drab" (Ridg.) becoming "ochraceous-tawny," edge suberose. Stem 4-7 cm. long, 10-15 mm. thick, straight or curved, subequal above the *small, abrupt, oblique, marginate bulb*, solid, at first slightly superficially fibrillose, cortina white, at length glabrescent and innately silky, white or whitish, sometimes tinged "drab" at apex, *lutescent toward base within and without*, bulb flattened below. Odor slight but penetrating, taste mild. Spores narrowly elliptical, almost smooth under high powers, 8-9 x 4-5 μ , pale rusty brown in microscope. Caespitose or in gregarious clusters. Leal, Colorado. August. Under conifers in mountain forests.

This has the habit and spores of *C. glaucopus*, but the colors are sharply different, and the pileus is never streaked. The remark of Fries (*Monographia*, I. p. 18), that "it (*C. glaucopus*) is changeable as it is variable," has doubtless led later mycologists to take the easy road of putting a number of species under this name, especially when the lutescent character of flesh and stem was well marked and other characteristics seemed to fit. I should not like to attempt the solution of the question as to which of the segregates is to be considered the type. The species before us could be so considered, except that Fries does not report *C. glaucopus* in mountainous coniferous forests.

***Cortinarius griseoluridus* sp. nov. (Myxacium).**

Pileus 5-8 (10) cm. broad, fleshy, broadly convex then expanded, obtuse, rarely subumbonate, with a distinct glutinous pellicle, at first "light quaker drab" (Ridg.), especially on margin, elsewhere becoming "olive-ochre" on a "smoky-gray" ground color, even, glabrous at first, at length scaly-spotted or variegate-virgate from the drying gluten, margin at first incurved, sometimes more purplish-tinted; flesh very thick on disk, abruptly thin on margin, soft, moist, at first tinted violaceous-gray, then watery-whitish, with a tint of "ochre-olive" (Ridg.) under pellicle. Gills adnate-subdecurrent, then emarginate with tooth, *close to crowded*, medium broad, at first "pale vinaceous-drab,"

soon "avellaneous," finally rusty-brown, *edge minutely crenulate*. Stem 4–9 cm. long, 10–20 mm. thick at apex, stout, often tapering upward from a clavate base, sometimes subequal and longer, sometimes with a large oval bulb and shorter, bulb up to 30 mm. thick and often abruptly short-pointed below, firmly stuffed to hollow, terete or compressed, at first tinged violaceous within and without, apex at first flocculose-furfuraceous and soon white, elsewhere *covered by the thin, viscid, appressed, subconcentric, grayish-lutescent patches* from the glutinous universal veil. Odor and taste mild. Spores broadly oval to subglobose, subacute at one end, thick walled, under oil-immersion with interrupted ridges on surface so as to appear subreticulate, pale rusty in microscope, 8–10 x 7–8.5 μ .

Gregarious. Leal, Colorado. Under conifers in mountain forests. August.

This differs from *C. salor* Fr., to which it is related, by its dull or sordid hues, by its close gills, stuffed to hollow stem and its habitat under conifers. It is also apparently related to *C. emunctus* Fr., but no reliable microscopic data are at hand for that species. Britzelmayr's species *C. griseolilacinus* and *C. subflexuosus* are not sufficiently described. This species was very abundant over a small flat at the base of the slopes, under spruce and fir. When very young, the stem is violet within and without, but quickly changes. A few hours after it is picked, the pileus changes entirely to "buffy-olive" (Ridg.), and in large specimens its surface is covered with numerous spot-like floccose scales.

CORTINARIUS ILLUMINUS Fr. (Hydrocybe). Infrequent, Leal. Gregarious under spruce and fir.

Fries notes that this is difficult to distinguish because its characteristics are not prominent. He reports it from both frondose and conifer woods. The plants I have referred here possess gills with an unusual shade of color, soon "cinnamon-rufous" to "terra cotta" (Ridg.). Its stems are rather long-attenuate upwards and subventricose downwards, with a short abruptly attenuate base which is often decumbent, soon hollow. It is related to *C. armeniacus* Fr., but the stems become sordid to

dingy rusty brown in age. Its habit is that of a stout-stemmed *C. rigens*. The colors of the pileus when moist are "chestnut-brown" to "cinnamon-rufous," and fade slowly; its texture is rigid and brittle. The spores are small, $7-8 \times 5 \mu$.

CORTINARIUS INJUCUNDUS (Weinm.) Fr. (Telamonia). Rare, Leal. Under conifers.

This belongs to the *C. brunneus* group and is about the same stature and colors, but differs from *C. brunneus* in that the apex of the stem, both within and without, as well as the young gills, are violaceous; the gills are similar, but are attached with a decurrent tooth; and the pileus is markedly variegated-streaked in two shades of brown; the spores are about the same. Barbier (*Bull. Soc. Myc.*, 27: 183) considers it merely a form of *C. brunneus*. Cooke's illustration, Plate 823, shows spores which manifestly do not fit our plant. The spores of the Colorado plants are broadly elliptical, $8-9 (10) \times 6-7 \mu$.

CORTINARIUS ISABELLINUS Fr. (Hydrocybe). Frequent, Leal, Tolland. In hard soil under pines.

Characterized by its rigid-brittle stem and cap, with broadly umbonate and usually gibbous pileus, which is umber when moist, "olive-ochre" (Ridg.) when dry, and with thick and rigid, rather broad gills. Pileus 3-5 cm. broad; stem 4-6 cm. x 6-7 mm. thick and nearly equal. All parts on losing moisture begin to show the "olive-ochre" color, including the cortina. The spores measure $8-9 (10) \times 4.5-5 \mu$.

CORTINARIUS LANIGER Fr. Not infrequent. Tolland. Under conifers.

Its near relative, *C. bivellus* has a glabrous pileus, while in this, the surface is at first and for a while hoary-canescens, or with appressed superficial silky-white fibrils, becoming glabrous in time. Its spores are rather variable, $8-11 \times 5-6 \mu$. The enlarged base of the clavate stem is quite tomentose-mycelioid and sometimes quite villose upwards.

CORTINARIUS LILACINIPES Britz. (Bulbopodium). Infrequent, Leal. Under spruce and fir.

The narrow, crowded gills, at first "vinaceous-fawn" (Ridg.) in color, the lutescent bulb attached to an ochraceous mycelium,

and the pale yellow, "antimony-yellow" (Ridg.) color of the pileus, are the main features of this good-sized plant. I refer it here with some hesitancy, as the Britzelmayr species are hard to recognize. The spores when examined under the oil-immersion are reticulate-rough and measure 11–13 (14) x 6–7 (8) μ . The gill-color of the young plant persists to maturity, so that they appear incarnate-tinged even in age. The apex of the young stem is at first tinged with lilac or vinaceous.

CORTINARIUS MALICORIUS Fr. (Dermocybe). Infrequent. Leal, Tolland. Under conifers.

Cortinarius metarius sp. nov. (Bulbopodium).

Pileus 4–7 (8) cm. broad; fleshy, convex-expanded, then plane, with a viscid pellicle which is at the very first pale bluish-violaceous, *quickly lutescent*, then "mustard-yellow," "naples-yellow" or "apricot-yellow" (Ridg.), glabrous, even, the thin margin at first incurved and minutely tomentose; flesh medium thick on disk, tinged at first with violaceous-incarnate tints, soon whitish then *lutescent*. Gills adnexed, rounded behind, then sinuate-uncinate, *narrow*, 4–6 (7) mm. broad, crowded, at first incarnate or amethystine, "heliotrope gray" (Ridg.), soon pale "clay-color." Stem 4–6 cm. long, 10–18 mm. thick, subequal above the *shallow and broad, marginate-depressed bulb*, sometimes compressed-subturbinate, solid, at first more or less violet within and without, soon white then lutescent, bulb covered by remnants of a yellow universal veil, superficially fibrillose above bulb. Odor and taste mild or slight. Spores narrowly ellipsoid, inequilateral, almost smooth, pale yellowish-rusty under microscope, 9–12 (13) x 5–6 μ .

Solitary, on the ground in mountain forests of spruce and fir. Leal, Grand Co., Colorado. August.

This is exactly halfway between *C. calochrous* and *C. caerulescens*, and these three species offer good material for the "lumpers" in taxonomy. It differs from *C. calochrous*, in the distinctly larger spores, and the color changes in the plant; from *C. caerulescens*, in its smaller spores, the presence of a yellow universal veil, and the narrow gills. The name refers to the limitations imposed by this separation.

CORTINARIUS MUCIFLUUS Fr. (Myxacium). Infrequent, Tolland. Moist places under bushes.

CORTINARIUS MULTIFORMIS Fr. Frequent, Leal. In troops, under conifers.

Cortinarius nigrocupidatus sp. nov. (Telamonia).

Pileus 2-3.5 (4.5) cm. broad, submembranous or slightly fleshy, at first conic-campanulate, then campanulate-expanded with an obtusely conical, black, prominent umbo, sometimes mammillate, innately silky-fibrillose, silky-shining when dry, glabrous, even, hygrophanous, "sepia" or "army brown" (Ridg.) fading to "wood-brown" or paler, except umbo, the margin at first decorated by narrow shreds of the white universal veil; flesh thin, concolor, hygrophanous, fading. Gills adnate, then emarginate with decurrent tooth, *subdistant*, rather broad, ventricose, somewhat wrinkled on sides, at first pallid-brownish, then "cinnamon" to "tawny-cinnamon." Stem slender, 4-6 cm. long, 3-5 mm. thick, elastic, equal, flexuous, stuffed, then hollow, "sepia" within and without, scarcely fuscescent, unequally zoned downwards by the silky white remnants of the delicate universal veil, sometimes with only a median zone. Odor and taste slightly of radish. Spores short ellipsoid to suboval, 8-9 (10) x 5-6 μ , obtuse, minutely and indistinctly rough, rusty-brownish under microscope.

Subcaespitose or gregarious. Leal, Colorado. Under spruce and fir in mountain forests.

Related to *C. stemmatus* Fr., from which it differs in its subdistant, broad gills, and somewhat larger spores. It has to some extent the appearance of *C. paleaceus*, but the pileus is glabrous, and the spores larger. Sepia is the prevailing color in fresh specimens; it is deeper and darker on the umbo of the pileus.

CORTINARIUS OBTUSUS Fr. Frequent, Leal, Tolland. Caespitose or gregarious, under fir and spruce.

CORTINARIUS ORICALCHIUS Fr. (Bulbopodium). Infrequent, Leal, Tolland. Under spruce and fir.

This species seems to be sufficiently well known in Europe. My Colorado collections were excellent examples of the species.

In the mountains of northwestern United States, the darker form, which is probably *C. atrovirens* Kalkb., occurs. It is surprising that these are not known in the eastern part of the country.

CORTINARIUS PERCOMIS Fr. (Phlegmacium). Infrequent, Leal. Under spruce and fir.

The distinct, penetrating, sweet-aromatic odor is one of its characteristics. It is related to *C. cliduchus* Fr., and Ricken has apparently confused the two species as they were conceived by Fries. Unfortunately, Fries did not mention the odor for either species, but he limits *C. percomis* to pine and fir forests, and *C. cliduchus* to beech and oak. He also makes it clear that in *C. percomis*, the color of the flesh and gills is pale yellow, citrin- or sulphur-yellow, and that the other parts of the plant are flavescent; in *C. cliduchus* the colors are darker, "luteus" to "fulvous." My collections, placed under *C. percomis*, all tended to the paler group of colors. The spores measure 10-12 (13) x 5-6.5 (7) μ .

Cortinarius pinetorum (Fr.) comb. nov. (Inoloma).

Cortinarius argentatus var. *pinetorum* Fr., *Monogr. Hymen. Suec.*, I. 46. 1851. Leal. Under conifers.

This appears to be the Fresian form of *C. argentatus* occurring under conifers. It is quite close to the form described in *Agaricaceae of Michigan*, I. 381, under *C. argentatus*. There is a peculiar lack of constancy in the width of the gills; sometimes they are distinctly narrow, sometimes medium broad; likewise the spacing varies, the narrow gills are crowded, the others tend to be subdistant. Forms under pines in Michigan showed the same variation. The typical *C. argentatus* is larger and occurs in oak woods.

CORTINARIUS PUNCTATUS Fr. (Telamonia). Rare, Leal. Under conifers.

This I consider form (B) of the *Monographia* of Fries. The series of species and forms to which *C. punctatus*, *C. glandicolor* and *C. uraceus* (stout form) belong, is a difficult *Cortinarius* problem, fully recognized by Fries, who, however, did not hand down to us the spore records. Had he been able to do this, a good deal of the puzzle might be open to solution. *C. punctatus*

as here recognized, has spores 10–12 (13) x 6–8 (9) μ , with occasional spores up to 16 μ long. No sign of a veil could be observed. The pileus is “vandyke brown” when fresh and moist, but both it and the stem are markedly fuscous, so that the plants become quite dark or blackish in age. The gills are distant, broadly adnate and rather broad.

CORTINARIUS PURPURASCENS Fr. (Bulbopodium). Infrequent, but typical. Leal. Under conifers.

CORTINARIUS RIGENS Fr. (Hydrocybe). Infrequent, Tolland. Under fir.

This has the habit of *C. scandens*, but becomes much larger. The spores measure 7–9 x 4–5 μ .

CORTINARIUS RIGIDUS Fr. (Telamonia). Frequent, Leal, Tolland. On mosses under conifers.

Its markedly broad gills, and the concentric white zones on the fuscous-brown stem, distinguish it from its relatives. The pileus is conic-campanulate, but umbo is subobtuse.

CORTINARIUS SCANDENS Fr. (Hydrocybe). Frequent, Leal, Tolland. Under conifers.

CORTINARIUS SPLENDIDUS Pk. (Myxacium). Rare, Leal. In moss, under pine and spruce.

CORTINARIUS SUILLUS Fr. (Telamonia). Infrequent, Leal. Under conifers.

This fine large plant was met for the first time; the “ochraceous-salmon” to “apricot-buff” colors of its pileus make it fairly easily recognizable. The stem is stout, clavate-bulbous and white, pileus and gills turn slowly blackish when bruised. The spores measure 9–10 (11) x 5–6 (7) μ . The veil is rather evanescent.

CORTINARIUS URACEUS Fr. (Hydrocybe). Rare, Leal. Under conifers.

CORTINARIUS VIBRATILIS Fr. (Myxacium). Infrequent, Leal, Tolland. Mixed and conifer woods.

CORTINARIUS VIOLACEUS Fr. Infrequent, Leal. On moss under fir.

CREPIDOTUS VERSUTUS Pk. Uncommon, Tolland. On decayed wood.

ENTOLOMA SERICEUM Fr. Rare, Tolland. Mixed woods.

FLAMMULA ALNICOLA Fr. (sense Ricken). Rare, Tolland.
On end of fir log.

FLAMMULA HIGHLANDENSIS Pk. Infrequent, Leal. On decayed coniferous wood.

FLAMMULA INOPODA Fr. Rare, Tolland. On end of a fir log.

FLAMMULA LUBRICA Fr. Rare, Tolland. On very rotten coniferous wood, under fir.

FLAMMULA LUPINA Fr. Rare, Leal. On decaying coniferous log.

FLAMMULA MIXTA Fr. (sense of Ricken). Rare, Leal.

FLAMMULA PENETRANS Fr. Frequent, Leal, Tolland. On coniferous logs and stumps.

FLAMMULA SPUMOSA Fr. Infrequent, Tolland.

One lot was studied during its development on rotten pine timber lying in a dark shed next to our cabin. On the day when these were picked, another lot was brought in from outdoors, also on a very rotten pine log. Careful comparison showed that the gills of the former had remained paler than in the typical plant showing scarcely any yellow at maturity. The gill-colors of the two lots of dried herbarium specimens do not match, and a word of caution is necessary when comparing dried specimens for shades of color. Both were microscopically alike when mature.

GALERA HYPNORUM Fr. Infrequent. Leal. On moss, under conifers.

GOMPHIDIUS ROSEUS Fr. Infrequent, solitary. Leal, Tolland. On moss, etc., under conifers.

Differs from *G. viscidus*, in the smaller size, upper part of stem white, "vinaceous-pink" to "pinkish-buff" pileus, and smaller spores. Both have a viscid, but not truly glutinous cap and veil. The spores measure 15-18 (20) x 5-6 μ , although in both collections an occasional larger one may be found. Base of stem is "empire yellow."

GOMPHIDIUS VISCIDUS Fr. Infrequent, solitary. Leal, Tolland. Under pines, spruce or fir.

Although not common, nor as luxuriantly developed as in

the conifer forests of Europe, this is doubtless the same as the European species. Stem becoming "apricot-orange" (Ridg.) within and without; spores 18-24 x 6-7 μ .

HYGROPHORUS AGATHOSMUS Fr. Rare, Leal. Under pines.

HYGROPHORUS CALOPHYLLUS Bres. Rare. Under pine and spruce.

This is my first collection of this beautiful gilled plant. It is a good species. The "sea-shell pink" (Ridg.) color of the gills is lost in the dried specimens.

HYGROPHORUS CHRYSODON Fr. Tolland. Infrequent, but copious where it occurs; in gregarious or caespitose clusters. Under conifers, low ground.

HYGROPHORUS CONICUS Fr. Rare, Tolland. In low ground.

HYGROPHORUS DISCOIDEUS Fr. Rare, Tolland. Under spruce.

HYGROPHORUS EBERNEUS Fr. (form *flavescens*). Infrequent, Leal. Under pines.

HYGROPHORUS FUSCOALBUM Fr. Common during September, Tolland. Under conifers.

HYGROPHORUS HYPOTHEJUS Fr. Common, Tolland. Under pines.

Most often the gills do not become as deep yellow as in the typical form.

HYGROPHORUS PUDORINUS Fr. Common during September, on the slopes of the mountains under pine, spruce or fir. Tolland.

HYGROPHORUS VIRGINEUS Fr. Rare, Tolland, Leal. On beds of spruce needles; in open meadow.

INOCYBE ALBODISCA Pk. (form). Infrequent. Leal. In open meadow.

INOCYBE CAESARIATA Fr. Infrequent. Tolland. Under pines.

INOCYBE EUTHELOIDES Pk. Frequent. Leal. Under mixed poplars and conifers.

INOCYBE FLOCCULOSA Berk. Infrequent. Leal. Low ground.

INOCYBE GEOPHYLLA Fr. Frequent. Tolland. Leal. Under conifers and in open meadow.

INOCYBE LANUGINOSA Fr. Infrequent. Tolland. Leal. On mossy bank among debris.

INOCYBE SUBDECURRENS E. & E. Infrequent. Leal. Under mixed poplars and conifers.

LACTARIUS CAMPHORATUS Fr. Common, Tolland, Leal. Moist forest flats along streams.

LACTARIUS DELICIOSUS Fr. Common, Tolland, Leal. Under conifers.

In this region the plants frequently have the gills colored "Hellebore green" (R) as they become old.

LACTARIUS INSULSUS Fr. Infrequent, Tolland, Leal. Under spruce on banks.

LACTARIUS MACULATUS Pk. Infrequent. Moist places under spruce.

LACTARIUS SCROBICULATUS Fr. Infrequent. Tolland, Leal. Under spruce and fir and pine.

LACTARIUS SUBDULCIS Fr. Frequent, Tolland. Under pine, etc., moist places.

LACTARIUS THEIOGALUS Fr. Frequent, Tolland. Under pine and poplar.

LACTARIUS TORMINOSUS Fr. Infrequent. Under spruce on moist ground.

LACTARIUS TRIVIALIS Fr. Frequent. Low forests.

LACTARIUS UVIDUS Fr. Infrequent, Tolland, Leal. Low ground, under shrubs, etc.

LENTINUS UMBILICATUS Pk. Infrequent. Tolland. On very rotten pine logs.

LEPIOTA AMIANTHINA Fr. Frequent, Tolland, Leal. On debris, under conifers.

LEPTONIA GRISEA Pk. Rare, Tolland. Moist places under fir.

MARASMIUS ANDROSACEUS Fr. Common. Tolland. On beds of pine needles.

***Marasmius piceina* sp. nov.**

Pileus 2-3 mm. broad, membranous, reviving, convex-sub-expanded, radiately and widely rugoso-striate, umbilicate, glabrous, "pinkish-buff" (Ridg.). Gills adnate, slightly broad, ventricose, distant, whitish. Stem filiform, equal, short, 1-2

cm. long, pallid with a slight yellowish-buff tint downwards, glabrous, with scarcely any pruina, even, not horny, instititious on half-decayed needles of *Picea Engelmanni*. Odor distinct, penetrating, suballiateous or somewhat disagreeable. Spores ellipsoid-sublanceolate, acute at one end, hyaline, smooth, 8-10 x 3.5-4 μ . Basidia 4-spored, 30 x 5-6 μ . No cystidia seen.

Tolland, Colorado. Sept. 8. Very abundant on spruce needle beds after rains in the mountain forests. Stem scarcely thicker than a hair.

Marasmius pinastris sp. nov.

Pileus slightly fleshy to submembranous, 1-3 cm. broad, at first campanulate and margin incurved, then expanded-plane, umbonate or papillate, umbo often irregular-uneven, margin at length radiately rugulose-striate to subplicate, surface uneven elsewhere, subtomentose, "snuff-brown" on center to "clay-color" toward margin; flesh thin, equal, whitish. Gills subdecurrent, arcuate, narrow, subdistant, intervenose, crisped, pallid, edge entire. Stem 2.5-4 cm. long, 1-2.5 mm. thick, dilated and pallid at the apex, solid, equal, sometimes striate-lined above, white within, subglabrous above, covered downwards by a distinct roughish "chestnut-brown" tomentum, which is paler on drying, strigose-attached at the base. Odor rather strong, suballiateous, penetrating. Taste slowly disagreeable or subastrigent. Spores 8-9 (10) x 4-4.5 (5) μ , narrowly ovate and pointed at one end, hyaline, smooth. Cystidia absent.

Among needles and debris under pine and spruce. Tolland, Colorado. Sept. 8.

MARASMIUS PRASIOSMUS Fr. Rare. Leal. On decaying twigs of spruce.

MYCENA ALKALINA Fr. Infrequent. Leal. On mosses under spruce and pine.

MYCENA DEBILIS Fr. Frequent. Leal. On mosses under conifers.

MYCENA GALERICULATA Fr. Infrequent. Tolland. On decayed wood.

MYCENA IMMACULATA Pk. Rare. Tolland. On bed of spruce needles.

MYCENA PARABOLICA Fr. Infrequent. Tolland. On very rotten and moist coniferous logs.

MYCENA PURA Fr. Not seen after August. Tolland. On very rotten logs.

MYCENA VULGARIS Fr. Frequent. Leal. On beds of decaying spruce needles.

NAUCORIA MELINOIDES Fr. Common. Tolland. Under willows and alders along streams.

OMPHALIA CAMPANELLA Fr. Frequent. Tolland. On coniferous logs, etc.

OMPHALIA EPICHYSIUM Fr. Infrequent. Tolland. On mossy log of Salix.

PANOEOLUS CAMPANULATUS Fr. Infrequent. Tolland. On horse dung.

PANOEOLUS RETIRUGIS Fr. Common. Tolland. Leal. On dung.

PAXILLUS INVOLUTUS Fr. Infrequent. Tolland. On banks.

PAXILLUS PANUOIDES Fr. Rare. Tolland. On old timbers in the interior of abandoned mines.

PHOLIOTA sp. Rare. Tolland. Growing caespitose in groups of three from the top of a spruce stump; too much dried to permit obtaining a full account of it. Has spores of *P. limonella*, but gills are broader, and it was growing on conifers.

PHOLIOTA DISCOLOR Pk. Infrequent. Tolland. On conifer logs.

PHOLIOTA FLAMMANS Fr. Infrequent. Tolland. On decayed conifer logs.

Pholiota platyphylla sp. nov.

Pileus submembranous, 1-3 (4) cm. broad, convex, obtuse or obsoletely subumbonate, hygrophorous, "tawny" (Ridg.), disk "mars brown," fading to "antimony-yellow" or "warm-buff," obscurely striatulate on margin when moist, glabrous; flesh very thin on the incurved margin, concolor. Gills broadly adnate, decurrent by tooth, very broad, ventricose, close to almost subdistant, thin, at the very first pallid, soon "clay color" to "buckthorn-brown" (Ridg.). Stem 3-5 (6) cm. long, 2-4.5 mm. thick, equal, or slightly tapering upwards, subflexuous in age,

stuffed, concentrically white-zoned from the delicate veil, zones terminating above middle of stem in a flaring, membranous, whitish annulus, white-scurfy above annulus, becoming at length silky or glabrous below, brownish within and without under the veil remnants, fuscous. Spores subellipsoid, but narrower toward one end, inequilateral in one view, smooth, 10–12 x 5–6.5 μ , pale rusty brown, cystidia scattered on sides of gills, 60–70 x 9–11 μ , narrowly lanceolate above the slender pedicel, hyaline; sterile cells similar but narrower and crowded.

On wet moss under pine and spruce along stream. Tolland, Colorado. Sept. 5.

PHOLIOTA UNICOLOR (Fl. D.) Fr. Infrequent. Tolland. On decayed wood.

PLEUROTUS BETULINUS (Pk.) (*Panus betulinus* Pk.). Rare. Tolland. Near the ground on the dead limb of a willow.

PLEUROTUS OSTREATUS Fr. Infrequent. Tolland. On stumps or dead trunks of *Abies lasiocarpa*. Spores are white in the mass. There is no doubt that this grows on conifers in this region.

PLUTEUS NANUS Fr. var. LUTESCENS Fr. Not uncommon. Leal. On decayed wood.

PSALLIOTA RUTILESCENS (Pk) emend. (*Bull. Torr. Bot. Club*, 31: 180. 1904.)

Pileus fleshy, 10–15 cm. broad, dry, convex-expanded, firm, whitish when young and fresh, soon becoming "vinaceous-cinnamon" (Ridg.) to drab, with a thick cuticle, the upper thin portion of which at length breaks into small fibrillose cuneate scales; flesh thick, abruptly thin at margin, white at first but slowly changing when cut or bruised to *rufescent-ochraceous*. Gills free, becoming remote, rather narrow, 5–7 mm. broad, narrower behind, crowded, thin, at first "purplish-vinaceous" to "light russet-vinaceous" (Ridg.), rufescent when bruised, finally "burnt umber" or blackish-brown. Stem stout, 8–12 cm. long, 1.5–3 cm. thick, firm, equal above the rather abrupt, often oblique and spongy bulb, bulb sometimes almost obsolete, sometimes large, elsewhere silky or subfibrillose, glabrescent, *solid*, white at first in and out, *rufescent* where cut or bruised. An-

nulus simple, thin, narrow, persistent, subfragile, white becoming brownish-tinged. Odor aromatic almost of anise or bitter almonds. Spores small, short elliptical-oblong, dark purple-brown, with oil drop, $5-6 \times 4-4.5 \mu$.

Under spruce and fir, often at the base of a tree in humus. Aug. Frequent. Leal. Tolland.

The incomplete description and error in spore size, and the extension of its habitat seem sufficient reasons for a full revised description. As Dr. Peck has remarked, the plants at first appear to fit well to the description so far accessible of the seaside *Psalliota maritimus* Pk., but a more detailed study of the latter in the developing state would doubtless bring out definite discrepancies. It differs from *P. silvatica* Fr. in its solid stem, slightly smaller spores and the narrow annulus.

PSALLIOTA SEMOTA Fr. (sense Ricken). Rare. Tolland. Under fir.

RUSSULA ADUSTA Fr. Infrequent. Leal. Under pine.

RUSSULA ATROVIOLACEA Burl. Infrequent. Tolland. Under willows. There seems to be a form also in which the stem has a tinge of the same color as the cap.

RUSSULA CYANOXANTHA Fr. (Form). Rare. Tolland. Under conifers.

RUSSULA DELICA Fr. Frequent. Tolland. Leal. Under pine in sandy soil.

RUSSULA EMETICA Fr. Frequent. Leal. Tolland. In mixed forest on very rotten wood.

RUSSULA FALLAX Cke. Infrequent. Tolland. Mossy places.

RUSSULA FLAVA Romell. Common. Tolland. Under pine and spruce.

RUSSULA GRAMINICOLOR Quel. Infrequent. Tolland. Leal. Under pine and spruce.

RUSSULA MAXIMA Burl. Rare. Tolland. Under spruce.

RUSSULA MODESTA Pk. Rare. Tolland. Under *Abies lasiocarpa* at an elevation of 9800 feet, growing on the bare ground.

RUSSULA NIGRODISCA Pk. Frequent. Tolland. On moist places under spruce.

RUSSULA NIGRICANS Fr. Infrequent. Tolland. Under conifers.

RUSSULA PUELLARIS Fr. Infrequent. Leal. Under thickets in open moist places.

RUSSULA ROSEIPES Secr.-Bres. Infrequent. Tolland. Leal. On moist ground under conifers.

RUSSULA RUGULOSA Pk. Infrequent. Leal. On mosses under conifers.

RUSSULA SANGUINEA Fr. Frequent. Tolland. Under spruce.

RUSSULA SERISSIMA Pk. Infrequent. Tolland. Under conifers on high slopes.

RUSSULA SUBALUTACEA Burl. Rather frequent. Tolland. Under spruce.

RUSSULA VIRESCENS Fr. Infrequent. Tolland. Mixed woods.

STROPHARIA DEPILATA Fr. Scattered. Tolland. Leal. Under conifers.

STROPHARIA SEMIGLOBATA Fr. Frequent. Tolland. On dung.

STROPHARIA SQUAMOSA var. *subalpina* var. nov. Infrequent. Tolland. On forest debris or humous soil in coniferous forests.

With the data on its variability incomplete, this is retained here as a variety, although it is definitely distinct from the foregoing species and its several varieties. The spores are elongated-elliptical, smooth, obtuse, 12-15 (16) x 5.5-6.5 (7) μ , pale-purplish in microscope. Pileus 3-7 cm. broad, "yellow-ochre" to "ochraceous-orange" (Ridg.), becoming tawny in age, glabrescent, viscid, soon dry. Gills broad, at first "drab-gray" then "storm-gray" (Ridg.); stem 4-10 cm. long, 4-8 mm. thick, white at first, as are the lacerate, spreading or recurved scales, but lutescent to fuscous.

It differs, then, according to the notices of the European authors as to spore size, from *S. squamosa* by its large spores, from the var. *thrausta* by lack of the hygrophanous flesh and probably by its spores. Masee, who must have had access to Cooke's var. *aurantiacus*, gives its spores like that of *S. squamosa*.

TRICHOLOMA BUFONIUM Fr. Rare. Tolland. Under spruce, alder, etc.

TRICHOLOMA CONGLOBATUM Fr. Rare. Tolland. Under pine.

TRICHOLOMA EQUESTRE Fr. Infrequent. Under pine.

TRICHOLOMA FALLAX Pk. Infrequent. Tolland. On conifer needles.

TRICHOLOMA IMBRICATUM Fr. Frequent. Under pines.

TRICHOLOMA MURINACEUM Fr. Infrequent. Leal. Under spruce and fir.

TRICHOLOMA PANOEOLOM var. CAESPITOSUM Bres. Infrequent. Under conifers. Tolland.

TRICHOLOMA PERSONATUM Fr. Infrequent. Tolland. Under poplars.

TRICHOLOMA PESSUNDATUM Fr. Common. Under pines.

This is the first American collection I have seen of this species, but I have no doubt of its identity.

TRICHOLOMA PORTENTOSUM Fr. Infrequent. Under pine.

TRICHOLOMA RUTILANS Fr. Infrequent. Tolland. Leal. On pine stumps and logs.

TRICHOLOMA SAPONACEUM Fr. Infrequent. Tolland. Under spruce and pine.

Tricholoma tristiforme sp. nov.

Pileus fleshy, 1-2 cm. broad, convex, then expanded-plane, obtuse, sometimes papillate, dry, covered with floccose-fibrillose, pointed or recurved, minute, fuscous to blackish scales, denser on disk, ground color "tileul-buff" (Ridg.), margin not striate; flesh white, unchanged. Gills emarginate-adnate, broad, broader in front, ventricose, close, white, scarcely cinerous, edge entire. Stem 2-3 cm. long, 1.5-3 mm. thick, equal, solid, innately and longitudinally silky-fibrillose, white scarcely changing, subshining when dry. Cortina slight and evanescent, perhaps lacking. Odor and taste subfarinaceous. Spores 7-9 x 4-5 μ , narrowly elliptic to oblong, hyaline, smooth, granular within. Basidia 48-50 x 5 μ , 4-spored, cystidia none. Sterile cells on edge of gills subfiliform, short and indistinct.

On the ground under lodge-pole pine. Tolland. Aug. 24.

In size, habit and appearance this resembles an *Inocybe*. It differs from *T. triste* Fr. in its solid stem and indistinct cortina, and probably in its spores.

GASTEROMYCETES

GEASTER CORONATUS (Schaeff.) Schroet. Tolland.

GEASTER SCHMIDELII Vitt. Tolland.

CALVATIA FONTANESII Mont. Tolland.

LYCOPERDON GEMMATUM Fr. Leal. Tolland.

LYCOPERDON GLABELLUM Pk. Leal. Tolland.

LYCOPERDON NIGRESCENS Pers. Tolland.

LYCOPERDON PYRIFORME Fr. Leal. Tolland.

BOVISTA PLUMBEA Fr. Leal.

CRUCIBULUM VULGARE Tul. Leal. Tolland.

Common on wood and debris. One collection was found on cow dung.

SPHAEROBOLUS CARPOBOLUS L. Leal. Tolland.

Common on debris of wood, etc. One collection on cow dung, and one on a spruce cone lying on the ground.

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REFERENCES TO LITERATURE

1. BRUDERLIN, KATHARINE. 1911. A Study of the Lodgepole-Pine Forests of Boulder Park (Tolland, Colorado), Univ. Colo. Studies, 8: 265-275.
2. COCKERELL, T. D. A. 1911. The Fauna of Boulder, Colorado. Univ. Colo. Studies, 8: 227-256. (Mycetozoa, pp. 231-235.)
3. OVERHOLTS, L. O. 1919. Some Colorado Fungi. Mycologia, 11: 245.
4. RAMALEY, FRANCIS, and Robbins, W. W. 1909. A Summer Laboratory for Mountain Botany. Plant World, 12: 105.
5. RAMALEY, FRANCIS. 1910. Remarks on Some Northern Colorado Plant Communities with Special Reference to Boulder Park (Tolland, Colorado), Univ. Colo. Studies, 7: 223-236.
6. RAMALEY, FRANCIS, and Mitchell, Louis A. 1911. Ecological Cross-Section of Boulder Park (Tolland, Colorado), Univ. Colo. Studies, 8: 277-287.
7. RAMALEY, FRANCIS, and Elder, Mary Esther. 1912. The Grass-Flora of Tolland, Colorado, and Vicinity. Univ. Colo. Studies, 9: 121-141.
8. SEAVER, FRED J. 1911. Studies in Colorado Fungi — I, Discomycetes. Mycologia, 3: 57.
9. STURGIS, W. C. The Myxomycetes of Colorado I and II. Colorado College Pub. Sci. Ser., No. 1, 1907, and No. 12, 1913.
10. YOUNG, ROBERT J. Forest Formations of Boulder County, Colorado. Bot. Gaz., 46: 351.

PLATE XXX



HELVELLA ALBIPES FKL.

Tolland, Colorado, Sept. 20, 1920
Elevation 9,000 feet. (Photo. Baxter)

PLATE XXXI



HELVELLA INFULA FR.

Tolland, Colorado, Sept., 1921. (Photo. Baxter)





CYTRMITRA ESCULETA Fr.

Port Huron, Michigan, May 1, 1921.
Collected under pine by Mr. Howe. Contributed by Dr. O. E. Fisher.



HYDNIUM SUAVEOLENS FR.

Tolland, Colorado, Sept. 4, 1920. (Photo. Baxter)



POLYPORUS CONFLUENS Fr.

Tolland, Colorado, Sept. 2, 1920. (Photo. Baxter)

THE FUNGUS FLORA OF MOUNT HOOD,
WITH SOME NEW SPECIES

C. H. KAUFFMAN

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THE FUNGUS FLORA OF MT. HOOD, WITH SOME NEW SPECIES*

C. H. KAUFFMAN

DURING the autumn of 1922, the writer, accompanied by Mr. L. E. Wehmeyer, collected and studied the fungi in a small area at the western base of Mt. Hood. By the advice and through the kindness of the men of the Portland Office of the United States Forest Service, accommodations were obtained at the ranch-house of Mr. and Mrs. W. J. Faubian, just inside the western entrance to the Oregon National Forest, and on the first lap of the Mt. Hood Highway. For numerous courtesies extended by the men of the Portland Forestry Office, the writer wishes to make grateful acknowledgment.

The foothills rise in abrupt ridges at this point, and represent a portion of radiating outposts of the great mountain peak visible beyond. Near by two of the valleys are well watered by the Zigzag River and the Sandy River, with their sources in the glaciers and snow-fields about twelve miles from our station. Smaller streams also abound. Some of the valleys and ridges are still covered by forests of Douglas fir, western hemlock, white fir, some scattered cedars, and in low places two species of maple and one of alder. The topography and water-relations are such as to produce a variety of habitats favorable to fungi of all sorts, and as the rainy season was well started when we arrived, it was not surprising that within the single month of our stay a large mass of material came to hand. The collecting was started on September 21 and terminated October 24. The area covered was scarcely more than a two- to three-mile radius from the ranch.

* Paper from the Department of Botany of the University of Michigan, No. 228.

In order to take complete notes and obtain the photographs, little time was left for longer excursions, and in any case, a small area well covered is likely to yield a high percentage of the possibilities of a larger area.

Aside from collections of parasite fungi, our knowledge of Oregon fungi in the past has been brought about in three ways. Occasionally a local amateur sent specimens to Dr. Peck at Albany, Professor Atkinson at Cornell University or to Dr. Burt at St. Louis. In this way certain basidiomycetes and rarely species of the other groups received names; the more common fungi of interest to forest pathology were also occasionally gathered and studied by the pathologists at Washington or elsewhere. Secondly, Dr. Murrill of the New York Botanical Garden, on an exploring expedition for material for the *North American Flora*, gathered a considerable number of Oregon fungi which he later described and named. The latest additions to the flora of the State were compiled by Zeller (21) and it is to be hoped that this author will find opportunity to continue his research in this, an almost unstudied part of our country.

Two mycological features impress an eastern mycologist when he enters the Pacific states west of the Cascade Range. In the first place, many species, if one is at all familiar with northern European plants, are found to be old Friesian species. In the second place he is astonished — nay, somewhat alarmed at his own ignorance — to find so many that appear to be undescribed. Such meager information as we have of that fatal trip to the state of Washington, by the late Professor Atkinson, indicates that he, too, was impressed by the multitude of new forms, and his anxiety to waste no second in this fascinating country is believed to have lured him to overtax his strength and to overlook the signs of physical exhaustion.

It has been the author's policy to refrain as much as possible from the business of describing species. During 1915, with two assistants, the writer spent two months in the mountains of Washington, and obtained a large number of (new) species. After ten years of contemplation about a considerable number of forms then seen, and in frequent cases again collected in 1922, it

seemed highly desirable in the interests of the future of Pacific Coast mycology, that these species should be described. The more outstanding forms have, therefore, been selected and are given below. In order to keep this paper within bounds, only the basidiomycetes are included; if possible the other groups will be presented later.

All material and type-specimens are deposited in the Herbarium of the University of Michigan.

BASIDIOMYCETES

AGARICALES

THELEPHORACEAE

HYMENOCHAETE BADIO-FERRUGINEA (Mart.) Lév. — On dead stems of *Vaccinium parviflorum*.

HYMENOCHAETE FULIGINOSA (Pers.) Bres. — On decorticated wood of some frondose tree.

HYMENOCHAETE SPRETA Pk. — On decayed wood. Only the first setigerous layer is present.

SEBACINA DENDROIDEA (Pk. & Cke.) Lloyd. — On *Fomes applanatus*.

STEREUM HIRSUTUM Fr. — On dead branches of *Alnus oregona*.

THELEPHORA CARYOPHYLLEA Fr. — On decayed wood remnants and humus.

THELEPHORA INTYBACEA Fr. — On debris on the ground in conifer woods.

HYDNACEAE

CALDESIELLA CRINALIS (Fr.) Bourd. & Galatz. — On very rotten wood.

HYDNUM AURISCALPIUM Fr. — On cones of Douglas fir. Frequent.

HYDNUM CAPUT-URSAE Fr. — On alder log.

HYDNUM COMPLICATUM Banker. — On debris under conifers. The odor is definitely and agreeably aromatic when the fresh plants are bruised. Young or growing plants are white on and

near the margin, "cinnamon-rufous" (R.¹) or darker on disk, all parts becoming dark-brown to reddish-blackish-brown after bruising or in age, so that the colors vary considerably in different plants. The texture is hard and tough in the interior portions. The spores are as given by Banker (3).

HYDNUM GRAVEOLENS Delast. var. — The same species as that reported from Colorado by Kauffman (13, p. 116).

HYDNUM FULIGINEO-VIOLACEUM Kalchbr.-Bres. — This is without doubt the species described and figured by Bresadola (6).

MUCRONELLA AGGREGATA Fr. — On bark of decaying birch sticks. Spores short, ellipsoid, $4-5 \times 3 \mu$, smooth, hyaline.

PHLEBIA CINNABARINA Schw. — On decayed wood.

PHLEBIA RADIATA Fr. — On decayed wood.

CLAVARIACEAE

CLAVARIA CINEREA Fr.

CLAVARIA Densa Pk.

CLAVARIA FLAVULOIDES Burt.

CLAVARIA FUSIFORMIS Fr.

CLAVARIA LIGULA Fr.

Clavaria nebulosoides, sp. nov. — FRUIT BODY simple, fleshy, cylindrical, stipitate, fertile portion 3-5 cm. long, 1.5-2 mm. thick, "wood brown" to "fawn color." STIPE slender 1.5-3 cm. long, minutely pruinose. SPORES oblong, $5-6 \times 2.5 \mu$, hyaline, smooth; cystidia $65-70 \times 7-12 \mu$, fairly abundant, hyaline, thin-walled, lanceolate, pedicel long and slender; basidia 4-spored, $30 \times 5 \mu$.

On mosses in conifer forest. Mt. Hood, Oregon. October 15. Collected by L. E. Wehmeyer.

Distinguished by its habit, color and the presence of cystidia.

LACHNOCLADIUM ORNATIPES (Pk.) Burt. (See Plate II, Fig. 1.) — The synonymy of this species is given by Burt (8, p. 66). Both because the descriptions have been meager, and because Burt finds the spores of the type-specimens quite a little smaller

¹ "R." as used in this paper refers to Ridgway's *Color Standards and Nomenclature*, 1912.

than in our specimens and as given by Peck, I include here a more complete description: FRUIT BODY 4–8 cm. tall, dichotomously branched, with few to several main branches. FERTILE BRANCHES occupying mostly only the upper half of the plant, subfleshy, smooth, “avellaneous” (R.), or paler towards the tips, dilated and compressed-subrugose upwards, terminal branches attenuated-acute, with pointed apices in two’s or three’s. STEM and sterile branches 3–4 cm. long, 3–8 mm. thick, rather tough, clothed by a strigose-hairy thick covering, “army-brown” (R.) to “avellaneous,” subterete or compressed upwards; context solid, subspongy, similar to, but of a deeper color than, the hymenium. SPORES spherical, with abrupt slender apiculus, hyaline, smooth, granular within, 9–10 μ (11.5 with apiculus); basidia 1–2-spored, rarely 3-spored, on long subcurved sterigmata; cystidia none. ODOR none; taste mild or slowly somewhat bitter.

Growing on mossy humus or very rotten debris under conifers. October.

Pistillaria fusiformis, sp. nov. (See Plate II, Fig. 2.) — FRUIT BODY fleshy, white, subfusiform-acuminate, 3–5 mm. tall, somewhat curved, fertile portion subcompressed, sometimes furrowed on the flattened side. STEM slender, scarcely more than 1 mm. long, terete, minutely hairy, white; sclerotium none. SPORES oval-elliptical to subglobose, $7.5 \times 6 \mu$, hyaline, smooth; basidia $45 \times 8\text{--}9 \mu$, 2- to 3-spored with prominent, slender sterigmata; cystidia none.

On decayed coniferous wood. Gregarious. Mt. Hood, Oregon. October 7. Collected by L. E. Wehmeyer.

The body is entirely fleshy, spongy and homogeneous within. The general shape and appearance are like that shown by Patouillard (18) for *P. rosellae* var. *ramosa*, Fig. 53, but otherwise different.

TYPHULA PHACORRHIZA Fr. — In alder thickets.

Typhula cystidiophora, sp. nov. — FRUIT BODY simple; fertile portion cylindrical, 2–5 cm. long, 1–1.5 mm. thick, obtuse, subpruinose or almost glabrous under a lens, white or tinted pale yellowish; context soft, fleshy, subfragile. STEM filiform, 2–2.5

cm. long, .5–1 mm. in diameter, tough, concolor, minutely hirsute. SPORES narrowly elliptic-subovate, guttate, smooth, subhyaline and tinged ochraceous, $5-6.5 \times 2.5-3 \mu$; basidia 4-spored, slender, $45-50 \times 4-5 \mu$; cystidia abundant, lanceolate to subcylindric below, subacute to subcapitate above, hyaline, thin-walled; pedicel slender, $50-75 \times 8-12 \mu$. SCLEROTIUM fuscous, depressed-subglobose, 4–6 mm. diameter.

On moist soil among mosses in conifer forest. Subgregarious. Mt. Hood, Oregon. October 12. Collected by C. H. Kauffman.

This differs from *T. gyrans* Fr. and other related species in the presence of cystidia throughout the hymenium and by the elongated fertile portion of the plant.

TYPHULA MUCOR Pat. — FRUIT BODY white, 1–1.5 cm. tall; fertile portion oblong, 2–3 mm. long, 2–3 mm. thick, glabrous. STEM very slender, filiform, .1–.3 mm. thick, glabrous, composed of parallel hyaline hyphae, 2.5μ diam. SCLEROTIUM minute, subglobose, dark brown. SPORES subcylindric, hyaline, smooth, $7-9.5 \times 2.5-3 \mu$; cystidia none; basidia 4-spored, $24-26 \times 4-5 \mu$.

On decaying leaves of frondose trees. October.

This minute species is so close to that figured and described by Patouillard (18) that it must be considered at most merely a taller form.

POLYPORACEAE

FOMES IGNIARIUS Fr. — On trunks of alder and willow. This is the form usually found on poplar.

MERULIUS FUGAX Fr. — On conifer wood.

MERULIUS HEXAGONOIDES Burt. — On decayed wood and bark. Fertile portion when fresh "tawny" to "Saccardo-umber" (R.), sterile margin white.

MERULIUS PINASTRI (Fr.) Burt. — On rotten wood in conifer forest.

MERULIUS TREMELLOSUS Fr. — On decayed sticks and branches.

POLYPORUS AURANTIACUS Pk. — On hemlock log.

POLYPORUS ELEGANS Fr. — On dead branches.

POLYPORUS CINNAMOMEUS Fr. — On sandy ground.

POLYPORUS FRAGILIS Fr. — On logs of Douglas fir.

POLYPORUS GALACTINUS Fr. — On very rotten wood, among alder and maple.

POLYPORUS GUTTULATUS Pk. — On conifer log.

POLYPORUS (GANODERMA) OREGONENSIS Murrill. — On conifer log.

POLYPORUS HIRTUS Fr. — On the base of a dead Douglas fir stub.

POLYPORUS PERENNIS Fr. — On the ground, conifer forest.

POLYPORUS PICIPES Fr. — On conifer logs.

POLYPORUS RADIATUS Fr. — On dead alder trunk.

POLYPORUS BENSOINUS Fr.-Lloyd. — On decayed log of Douglas fir.

POLYPORUS SCHWEINITZII Fr. — On roots of Douglas fir.

POLYPORUS SULPHUREUS Fr. — On Douglas fir logs.

POLYSTICTUS HIRSUTUS Fr. — On alder branches.

PORIA FERRUGINOSA Fr. — On fallen branches of *Acer circinatum* and *Acer macrophyllum*.

PORIA MEDULLA-PANIS Fr. var. COLORATA Overh. — On decayed wood of Douglas fir.

PORIA MOLLUSCA Fr. — On much decayed wood, probably of frondose trees.

TRAMETES CARNEA Nees. — On Douglas fir logs.

BOLETACEAE

BOLETINUS PICTUS Pk.

BOLETUS GRANULATUS Fr. — Whitish form.

BOLETUS LUTEUS Fr.

BOLETUS SUBTOMENTOSUS Fr.

BOLETUS TOMENTOSUS Kauff.

BOLETUS MIRABILIS Murrill. (See Plate III.) — PILEUS fleshy, firm, 5–12 cm. broad, “maroon” (R.) colored, dry, densely velvety tomentose, with an incurved, sterile, narrow, membranous margin; flesh compact, pale yellowish, becoming reddish-tinted or shot through with red streaks when cut or bruised. TUBES “citron-yellow” (R.) when young, becoming “olive-yellow” when bruised or in age, 10–15 mm. long, adnate, narrowly depressed around the stem, not stuffed, regular;

mouthing angular, 1–1.5 per millimeter, dissepiments thick, entire. STEM stout and often rather long, 10–12(15) cm. long, tapering upwards from the clavate base, very abruptly short-pointed at base, subviscid, pale yellow and more or less reticulate at apex, conspicuously and longitudinally streaked by “maroon” color, white at the very base, 1–2.5 cm. thick above, 2–5.5 cm. thick below, solid; flesh yellowish upwards, at length tinged with reddish, whitish downwards. SPORES 18–24(27) \times 6–9 μ , ventricose-fusiform, smooth and even, yellowish-ochraceous, exospore tinted reddish; basidia 4-spored, 48–50 \times 12–15 μ ; cystidia fairly abundant, ventricose-lanceolate, hyaline, 90 \times 15–24 μ , obtuse at apex, pedicel slender. ODOR and taste mild.

On the ground in fir forests. Mt. Hood, Oregon. September 28 and 30. Collected by L. E. Wehmeyer.

Only *B. russelli* and *B. Betula* have spores approaching in size those of this species. By the stem characters, however, its relationship is elsewhere. In the fresh condition the stem is covered by a delicate hoariness, of cobweb-like texture, which is responsible for the slight viscidness in wet weather, and which is continuous at first with the incurved delicate membranous margin of the pileus. Occasionally the tubes verge into the reticulations at the apex of the stem, so as to appear slightly decurrent. The flesh and tubes do not turn blue when wounded. Under the arrangement of Dr. Peck, the species inclines towards the *Calopodes*, although the stems in the specimens seen were reticulate only at the apex. It departs from the characters assumed for the *Edules* in the tubes not being at first stuffed, although it approaches such large species as *B. eximius* and *B. edulis* in color and size. Murrill (*Mycologia*, 4:98, 217) named and described this species, but evidently under other weather conditions, as its pileus is said to be bay color and its surface composed of floccose, but rigid, conic persistent papillae.

AGARICACEAE

AMANITA JUNQUILLEA Quél. — This is reported from North Carolina by Beardslee (4), also as *A. gemmata* (Fr.) Gill. by Coker (9). I have collected the North Carolina plant a number

of times in Virginia and Maryland. The collections from that region have spores which tend to average below $9\ \mu$ long, while in the European plant the spores are given $10\text{--}12 \times 7\text{--}8\ \mu$ by Ricken (20) and $11\text{--}13 \times 7\text{--}9\ \mu$ by Boudier (5). In the West, a very similar species is found, with the spores measuring $10\text{--}12 \times 7\text{--}8\ \mu$. The latter I believe to be the genuine *A. junquillea* as described in Europe. I do not feel sure that the plant from the Eastern United States can properly be referred here, although it is certainly close to *A. junquillea* in most of its characters. One can of course find occasional longer spores in the Eastern plant, but to record such merely confuses the record. In this connection, I should like to reiterate (12, p. 617) that *A. russuloides* Pk. is a different and distinct species, and should not be included in any synonymy under *A. junquillea* or *A. gemmata*. Some of my collections in the East are very probably genuine *A. gemmata* (Fr.) Gill.

AMANITA MUSCARIA Fr. — The scarlet-capped form of Europe. Frequent.

Amanita silvicola sp. nov. (See Plate IV.) — PILEUS 6–10(12) cm. broad, at first broadly convex, then plane to subrepand, white, subviscid, when young covered by a soft, floccose, continuous white universal veil which later is irregularly disposed in flat patches or masses, not warty, margin persistently incurved, even, and at maturity crenate from the appendiculate veil-remnants; flesh abruptly thin on margin, scarcely over a centimeter thick near stem, soft. GILLS reaching stem, free except by decurrent lines, or obscurely and very narrowly adnate, white, crowded, medium broad, 6–7 mm., edge distinctly flocculose. STEM 6–10 cm. long, at first with the pileus seated on a subnapiform bulb and surrounded by the smooth, floccose universal veil, at length elongated and subequal, 15–25 mm. thick, bulb up to 3 cm. thick, white, surface at maturity covered by obscure floccose-silky remains of the veil, at times terminating in a narrow, quickly evanescent floccose annulus, bulb edged by a circular indistinct line which is the edge of the separated veil, solid, rather compact and firm. ODOR and taste none. SPORES $9\text{--}10(12) \times 5\text{--}5.5(6)\ \mu$, elliptical, smooth, white, obliquely apiculate; basidia

clavate, $48-50 \times 8-9 \mu$. 4-spored; sterile cells on edge of gills large, globose-pyriform, $24-30 \mu$ wide.

In thick forests of hemlock and cedar. Mt. Hood, Oregon. September 30. Collected by C. H. Kauffman.

The whole plant is pure white. The volva, although about a millimeter thick on the young pileus, because of its soft texture leaves only thin remnants on the stem; it is circumscissile. Because of the napiform bulb, one might think of it as belonging to the *A. solitaria* group. However, the universal veil is very different from those of that group; the bulb is not rooting, the pileus is without warty scales, and the spores are distinctly narrower than those of *A. solitaria*, while the absence of any odor separates it from *A. chlorinosma*.

AMANITA TOMENTELLA Kromb. — In forests of hemlock and cedar. See Kauffman (12, p. 607).

AMANITOPSIS STRANGULATA Fr. — On mosses in hemlock forest. Stout and massive specimens.

ARMILLARIA ALBOLANARIPES Atk. — In hemlock and fir forest.

ARMILLARIA VISCIDIPES Pk. — For a full discussion of this species see Kauffman (14, p. 62). It may reach a huge size; pileus up to 20 cm. broad; stem up to 12 cm. long and 4 cm. thick at apex; gills up to 15-18 mm. broad.

ARMILLARIA CINNABARINA (Fr.) Kauff. — (See 14, p. 60.)

CANTHERELLUS AURANTIACUS Fr.

CANTHERELLUS CIBARIUS Fr.

CANTHERELLUS FLOCCOSUS Schw.

CANTHERELLUS INFUNDIBULIFORMIS Fr.

CANTHERELLUS MULTIPLEX Underw. (See Plate V.) — I have collected and studied this curious species several times. It occurs in the Rocky Mountains of Wyoming and Colorado, in the Olympic Mountains of Washington and in the Cascade Mountains of Washington and Oregon, including Mt. Hood. It was originally collected at Mt. Desert, Maine. It may be looked for in coniferous forests of the higher latitudes of North America or in the mountains southward. Murrill (17) erected the genus Polyzellus for it. It is, however, only a very extreme growth-condition of *C. clavatus*, and typical individuals of the latter spe-

cies are to be found with the — often abundant — “multiplex” plants. The photograph is of the intermediate type. E. T. Harper in *Mycologia*, Volume 5, Plate 94, has illustrated what is undoubtedly the same plant, and properly referred it to *C. clavatus*.

CANTHERELLUS PRUINOSUS Pk. — On debris under coniferous trees. Although this determination may be open to question, yet in the absence of any recorded microscopic characters for Peck's species, it seems to me more than probable that we have here the species so briefly described by him (*N. Y. State Mus. Rep.*, 28:51. 1876). Patouillard (18), in *Tabulae Analyticae*, figured (No. 651) a species from Guinea, South America, of which the slender specimens there shown well illustrate the size and shape of our plant. That species, however, has different spores and grows in the tropics. The western plant is white throughout, 2.5 cm. tall, shaped like the slightly curved horn of a cow, flaring slightly at the top, depressed-subinfundibuliform, and externally with narrow, longitudinal ridges; a few of these may be forked. The spores are spherical, hyaline and smooth; the basidia are 4-spored, elongated, subclavate $90-100 \times 4 \mu$.

COLLYBIA ACERVATA Fr.

COLLYBIA ALBIFLAVIDA (Pk.) Kauff. var. MONTANUM Kauff.

COLLYBIA ALBIPILATA Pk. — On cones of Douglas fir. Common. This is without doubt Peck's species. However, it is very likely to turn out to be only a somewhat smaller American form of one of the European species. The idea of the spore-size for *C. esculenta* and *C. conigena* as given by Bresadola (6), $6-8 \times 3-4 \mu$, has not been followed by later European authors, e.g. Ricken (20), Rea (19) and Lange (16). The spores of my collection measure $3.5-4 \times 2 \mu$, and the cystidia are “fusoid-ventricose,” capitate. In this latter respect it agrees with Bresadola's conception of *C. esculenta*. The pileus, however, is “pale cinnamon-pink” when fresh, becoming “pinkish-cinnamon” in age, and is pruinose; this pruinosity is due to erect cystidia-like cells projecting from the corticate surface layer of the pileus. All this is distinctly a character of the American species. The

European species, *C. esculenta* and *C. conigena*, have entirely glabrous caps. Lange (16) recognizes only *C. tenecella* and *C. conigena*, and gives the larger spore-size to the former, the small spore-size to the latter. Evidently Murrill is right in saying that no typical material of these European species has as yet turned up in America. *C. albopilata* occurs on various cones, although usually reported only on pine cones. The other similar thing in the United States is *C. conigenoides* Ell. on magnolia cones. See Kauffman (11).

COLLYBIA CONFLUENS Fr.

Collybia cylindrospora, sp. nov. — PILEUS subpliant, 4–6(7) cm. broad, convex-expanded and soon irregularly repand, obsoletely umbonate or obtuse, glabrous, even, moist, with a tough cuticle, dull “antimony yellow” (R.), disk tinged “cinnamon rufous”; flesh of equal thickness, 1–1.5 mm., white. GILLS broadly adnate, rather broad, narrowed in front to a point and not reaching the edge of the pileus, subarid, slightly tough, close, occasionally interveined, whitish. STEM 8–10(12) cm. long, 4–6(8) mm. thick, irregularly twisted, striate to furrowed-compressed, hollow, glabrous, “cinnamon” (R.), sometimes darker downwards, subrooting at base. ODOR and taste slightly disagreeable, earthy. SPORES subcylindric, smooth, hyaline, 5–6 × 1.5–2 μ ; cystidia none; sterile cells on edge of gills filiform, about 2 μ wide; basidia 4-spored, 30 × 5–6 μ .

On debris and very rotten wood in conifer forest. Mt. Hood, Oregon. October 5. Collected by C. H. Kauffman.

It is distinguished from its near relatives, like *C. fusipes*, *C. lancipes* and *C. distorta*, especially by its narrow, cylindrical spores. The stems are sometimes connate part way. Its general appearance is like that of *C. rugulosiceps*.

COLLYBIA PLATYPHYLLA Fr.

COLLYBIA PROLIXA Fr.—Ricken

COLLYBIA PROTRACTA Fr.—Ricken

Collybia rugulosiceps, sp. nov. (See Plate VI.) — PILEUS 3–5 cm. broad, very pliant, convex-plane, with a distinct obtuse umbo, at length depressed around umbo, moist, hygrophaneous, glabrous, radiately and finely rugulose to umbo, “cinnamon

drab" to "avellaneous" (R.), umbo "sayal-brown" (R.), becoming somewhat paler when dry, margin thin, substriate, splitting radially in age, acute, soon spreading; flesh thin, concolor. GILLS narrowly adnate, soon sinuate and decurrent, rather narrow, and narrowed in front to a point, 3-6 mm. broad, whitish with indistinct gray tints, close to subdistant, here and there intervenose. STEM 4-8(10) cm. long, 3-5 mm. thick, slender, equal, abruptly dilated at apex, sometimes twisted, hollow, terete or compressed-furrowed, glabrous and naked, entirely even, tough-cartilaginous, almost horny, "wood-brown" to "avellaneous" or darker, white-substrigose at the very base. ODOR and taste entirely lacking. SPORES broadly elliptical, smooth, hyaline, 8-9(12) \times 5-7(8) μ , variable; basidia 4-spored, 32-34 \times 5-6 μ ; cystidia none; sterile cells on edge of gills oval, short and indistinct.

Always on decayed logs or wood remains of conifers, caespitose or subcaespitose. Common. Mt. Hood, Oregon. October 3. Collected by C. H. Kauffman.

It belongs to the section Tephrophanae, although neither the hygrophanous character, nor the gray tints of the gills are strongly marked. In its relationship, it verges towards *C. lanicipes* Fr., but the stem is not atriate and the gills are not broad. From *C. rugosiceps* Atk. and *C. subrugosa* Murrill it differs in the character of its gills and spores as well as in its colors and habitat. It has much the appearance of some of the *Tricholoma melanaleuca* group, but lacks cystidia, has different colors and the stem is truly cartilaginous. The surface layer of the pileus is corticate, composed of one or two series of globose-pyriform, brown cells.

CLAUDOPUS BYSSISSEDUS Fr.

CLITOCYBE AMARA Fr.

CLITOCYBE ATRIALBA Murrill

CLITOCYBE CLAVIPES Pk.

CLITOCYBE DECORA Fr.

CLITOCYBE ECTYPOIDES Pk.

CLITOCYBE GALLINACEA Fr.

CLITOCYBE LACCATA Fr.

CLITOCYBE MEDIA Pk.

CLITOCYBE NEBULARIS Fr.

CLITOCYBE OCHROPURPUREA

Berk.

CLITOCYBE PITHYOPHILUS Fr.

CLITOCYBE SUAVEOLENS Fr.

CLITOPILUS NOVABORACENSIS Pk.

CLITOPILUS WOODIANUS Pk.

COPRINUS ATRAMENTARIUS Fr.	Cortinarius montanus , sp. nov.
COPRINUS FIMETARIUS var.	(Bulbopodium). (In press,
MACRORHIZA Fr.	<i>North American Flora</i> , Vol. 10)
CORTINARIUS AMARUS Fr.	CORTINARIUS MUCIFLUUS Fr.
CORTINARIUS ANOMALUS Fr.	CORTINARIUS OBTUSUS Fr.
CORTINARIUS BADIUS Pk.	CORTINARIUS PALEACEUS Fr.
CORTINARIUS BULBOSUS Fr.	Cortinarius pyriodorus , sp. nov.
Cortinarius clandestinus , sp.	(Inoloma). (In press, <i>North</i>
nov. (Dermocybe). (In press,	<i>American Flora</i> , Vol. 10)
<i>North American Flora</i> , Vol. 10)	CORTINARIUS RENIDENS Fr.
CORTINARIUS DILUTUS Fr.	CORTINARIUS RIGIDUS Fr.
CORTINARIUS EVERNIUS Fr.	CORTINARIUS SATURNINUS Fr.
CORTINARIUS FUCATOPHYLLUS	CORTINARIUS SUBSIMILIS Fr.—
Lasch—Ricken	Ricken
CORTINARIUS LANIGER Fr.	CORTINARIUS VIOLACEUS Fr.
CORTINARIUS LONGIPES Pk.	CORTINARIUS WHITEI Pk.

DICTYOLUS RETIRUGIS (Fr.) Quél. — On species of Hypnum mosses. SPORES elliptical, smooth, hyaline, $7-8 \times 4-4.5 \mu$; cystidia none; basidia clavate, 4-spored, $40 \times 6 \mu$. The hymenial surface may be provided with radiating vein-like ridges which do not reach the margin of the pileus, or it may be even without any sign of gill development. FRUIT BODY 4–6 mm. wide, sessile, convex-subreniform to orbicular, surface of pileus “cartridge-buff” (R.) when fresh, tinged grayish on drying, indistinctly pruinose under a lens. Although departing slightly from the species to which it is here referred, it seems too close to it to be considered a distinct species.

Eccilia bispora, sp. nov. — PILEUS 1–2.5 cm. broad, convex-depressed or umbilicate, sometimes subumbonate, rather elastic but somewhat brittle, glabrous, with a separable gelatinous pellicle and slightly viscid in wet weather, “avellaneous” (R.), indistinctly striatulate on margin, which is at first incurved rather than decurved; flesh concolor, rather thin, tapering to margin. GILLS broadly adnate, sometimes with decurrent tooth, broad, close to almost subdistant, becoming deep flesh-color, edge entire. STEM 4–5(8) cm. long, 3–6(8) mm. thick, equal or tapering downwards, often compressed-furrowed, dilated at apex, cartilaginous, brittle, almost glassy, hyaline-white, hollow, even,

white-mycelioid at base. ODOR and taste rancid-farinaceous. SPORES obtusely angular, broadly ellipsoid, $10-12 \times 8-10 \mu$, deep flesh-color under the microscope; basidia 2-spored $45 \times 8-9 \mu$; hymenium with abundant, sterile, cystidia-like cells which are acutely pointed, but scarcely project beyond the basidia; true cystidia none.

On wood debris. Mt. Hood, Oregon. October 5. Collected by C. H. Kauffman.

Nearly all of the cartilaginous-stemmed species of *Leptonia*, *Nolanea* and *Eccilia* have slender and equal stems. In this species the stem has a tendency to be irregularly undulate and subcompressed, in the larger specimens quite thick, while in contrast to its length, the caps are narrow. The pellicle of the pileus, the stem features and the microscopic characters set it off from other species. The slight tooth of the gills may induce one to look for it under *Leptonia*, and the stem character at first sight suggests an *Entoloma* or *Clitopilus*. The two-spored basidia and other microscopic characters were a constant feature in two different collections.

ENTOLOMA NIDOROSUM Fr.

FLAMMULA LIQUIRITIAE Fr.

ENTOLOMA NITIDUM QuéL.

FLAMMULA SAPINEA Fr.

ENTOLOMA SPECULUM Fr.

FLAMMULA SPUMOSA Fr.

FLAMMULA ASTRAGALINA Fr.

GALERA HYPNORUM Fr.

Galera martipes, sp. nov. — PILEUS 5–8 mm. high and wide, conical, obtuse, hygrophanous “clay color” (R.) and long-striate (moist), “pinkish buff,” even and atomate (dry); flesh very thin, concolorous. GILLS adnate, ascending, ventricose but rather narrow, subdistant. STEM 8–10 cm. long, 1 mm. thick, slender, equal, “mars-brown” (R.), clay-color at apex, minutely pruinose throughout, pruinosity due to minute, spreading hairs, fistulose, mars-brown within, cartilaginous, flexuous. ODOR and taste none. SPORES oval-subventricose, smooth, ochraceous, $8-9 \times 4-5 \mu$; cystidia abundant on edge of gills and near, scattered on sides, rounded-ventricose above the slender pedicel, neck abruptly narrow, lance-shaped to aciculate, hyaline, $60-75 \times 12-18 \mu$.

Attached to mosses and decayed needles, in forest of hemlock and Douglas fir. Mt. Hood, Oregon, September 2. Collected by C. H. Kauffman.

The pileus is homogeneous in structure, not corticate. The species is closely related to *G. hypnorum*, but differs constantly in its longer and pruinose stems, smaller spores and the character and distribution of the cystidia. See Atkinson (2) for relationships of the species of Galera.

Gomphidius ochraceus, sp. nov. (*Mycologia*, 17: 119. 1925)

Gomphidius subroseus, sp. nov. (*Op. cit.*, 17: 120. 1925)

GOMPHIDIUS TOMENTOSUS Murrill (*Op. cit.*, 17: 124. 1925)

HEBELOMA ELATUM Fr.

HEBELOMA PUNCTATUM Fr.

HYGROPHORUS CERACEUS Fr.

HYGROPHORUS COCCINEUS Fr.

HYGROPHORUS CONICUS Fr.

HYGROPHORUS PARVULUS Pk.

Hygrophorus mollis (B. & Br.), comb. nov. — PILEUS 5–12 mm. broad, at first discoid, then broadly convex, obtuse, moist, “mikado orange” (R.), decorated by fine, pointed, concolorous fascicles of fibrils which suggest a minutely echinulate appearance, margin at first incurved, even; flesh relatively thick, thinner on margin, concolor. GILLS adnate, rather narrow, of equal width, subdistant, waxy, “light orange-yellow.” STEM 1–2.5 cm. long, 1.5–2 mm. thick, “light orange-yellow” (R.), equal, glabrous, hollow, toughish, concolorous within, apex naked but attached at base by delicate radiating, pure white hairs; cortina none. SPORES elliptical, smooth, hyaline, $8-9 \times 4-4.5(5)$; basidia $48-50 \times 7-8 \mu$; cystidia none; gill-trama of interwoven hyphae; trama of pileus floccose, homogeneous, composed of concolorous hyphae; sterile cells inconspicuous.

On a very decayed log under Douglas fir. Subcespitate. Mt. Hood, Oregon. October 16. Collected by L. E. Wehmeyer.

This species departs in such minor particulars from the European form which goes under the name of *H. turundus* var. *mollis*, that it seems clearly to be the same. I have here raised the variety to specific rank on microscopical grounds. The whole plant has a waxy lustre. No cortina was visible even in the youngest specimen. The decoration of the cap gives a white

sheen when reflecting the light. It belongs to the subgenus *Camarophyllus*.

Hygrophorus fimbriatophyllus, sp. nov. — PILEUS 2-3 cm. broad, at first oval-hemispherical then broadly convex, obtuse, uniformly "apricot-yellow" (R.), fibrillose-floecose or broken into soft and small scales, margin even, at first incurved and silky from the cortina; flesh moist, concolor, 2 mm. thick near stem, narrowed to the margin of the pileus. GILLS broadly adnate or at length spuriously subdecurrent, rather narrow, 2-4 mm., "apricot-yellow," waxy, edge concolorous and fimbriate. STEM 4-7 cm. long tapering upwards, 2-3.5 mm. thick at apex, 3-6 mm. at base, concolor, even, flexuous, at first silky-fibrillose, glabrescent. ODOR and taste none. SPORES subglobose to broadly elliptical, smooth, hyaline, $7-8(9) \times 6-7 \mu$; cystidia none; sterile cells on the edge of the gills prominent, cylindrical, obtuse, $100-120 \times 4-5 \mu$, hyaline; gill-trama interwoven.

On very rotten wood in conifer forest. Mt. Hood, Oregon. October 13. Collected by L. E. Wehmeyer.

The pileus although fleshy is thin and somewhat pliant, but the waxy gills preclude the genus *Clitocybe*. The young plant is surrounded by the continuation of the pileus covering, thus indicating a universal veil. *H. intermedium* Pass.-Ricken has a similar covering. Our plant belongs to the subgenus *Camarophyllus*.

Hygrophorus multifolius, sp. nov. (See Plate VII.) — PILEUS 1.5-4 cm. broad, pliant, at first broadly convex and discoid, at length plane to depressed with a small unbo and a decurved margin, *viscous*, with a thin, separable pellicle, soon dry and subtomentose, putty-colored to "drab" (R.), margin at first incurved and persistently translucent-striatulate, incurved portion subtomentose; flesh rather thin, 1.5 mm. near stem, tapering gradually to margin, concolor, fading. GILLS adnate-subdecurrent, at length decurrent by elevation of cap-margin, narrow, 3-4 mm., almost linear, close or subcrowded, "echru-drab" (R.) or paler, waxy, edge entire. STEM 3-5 cm. long, 2-3.5 mm. thick, equal, terete or compressed, hollow, slightly viscid when fresh from the thin hyaline evanescent universal veil, sometimes white-silky or lacerate-silky in upper portion, "light drab" within and without,

fading, toughish. ODOR strongly farinaceous, taste similar. SPORES suboblong, smooth, hyaline, $6-6.5(7) \times 3-3.5 \mu$; cystidia none; basidia 4-spored $45-50 \times 4-5 \mu$; sterile cells on edge of gills inconspicuous; gill-trama with parallel-diverging hyphae, those in axis parallel.

On deep moss and on needle beds in hemlock, cedar and fir forest. Gregarious to subcespitose. Mt. Hood, Oregon. October 1 to 15. Collected by L. E. Wehmeyer.

This species has much the appearance and habit of *Clitocybe*. It is, however, a true *Hygrophorus*, as shown by its viscid veil and by its gill structure. It belongs to the subgenus *Limacium*. Its near relatives all have distant gills. When artificially dried after collecting, those growing in wet weather dry dark while those already wind-dried retain their colors.

HYPHOLOMA FASCICULARE Fr.

HYPHOLOMA OLIVAESPORA Ellis. — See *H. vinosum* Kauff. (12, p. 261), which is a synonym.

***Hypholoma canocephs*, sp. nov.** — PILEUS 1-2 cm. broad, about 1 cm. high, fragile, conical-campanulate to broadly conical, hygrophanous, "cinnamon-drab" (R.) when moist, but this ground-color almost hidden except on umbo by an appressed radially disposed, white-villose innate silkiness, slowly fading, at length subglabrescent, margin at first straight, appressed silky, not striate; flesh thin, concolor. GILLS adnate, rounded behind, seceding, narrow, 2 mm., crowded, "cinnamon-drab," white-flocculose on edge. STEM 4-6 cm. long, 2.5-3 mm. thick, equal, white, fragile, straight or curved at base, hollow, even, at first covered by a rather persistent white-silky floccosity, at length glabrescent, whitish within, rather cartilaginous. ODOR and taste none. SPORES elliptic-oblong, subobtuse, smooth, purplish-brown, $8-9.5 \times 3.5-4.5 \mu$; cystidia on sides of gills are lacking; sterile cells on edge short cystidia-like, ventricose-subglobose above pedicel, with abruptly narrowed, cylindric neck, thin-walled, hyaline, $40-50 \times 8-12 \mu$, neck 4μ diameter.

On very rotten pieces of wood mixed with black alluvial moist soil in conifer forest. Mt. Hood, Oregon. October 14. Collected by C. H. Kauffman.

This species has two characters which might lead one to place it in the genus *Psathyra*, viz. the cartilaginous stem and straight margin of the young pileus. The innate character of the pileus covering which represents a universal veil is, however, a *Hypholoma* character. The universal veil in the indusiate *Psathyras* is deterrent and usually only scattered loose flecks of it are found on the young pileus. This species is to be placed in the section of *Hypholoma* to which *H. velutinum* and *H. melanthinum* belong, in spite of the fact that the spore characters are different from those species. It forms a connecting link between *Hypholoma* and *Psathyra*.

Hypholoma tsugaecola, sp. nov. (See Plate VIII.) — PILEUS 3–7 cm. broad, thin and pliant, convex then subexpanded-discoid, finally depressed on disk and margin elevated, *subviscid*, with a separable subgelatinous pellicle, *hygrophanous*, “buckthorn brown” to “ochraceous-tawny” (R.) when moist, “yellow ochre” to “antimony-yellow” when dry, *glabrous*, but margin narrowly appendiculate from the veil, margin at first incurved, very thin and acute, pellucid-long-striatulate; flesh about 1 mm. thick, thicker on disk, concolor, fading. GILLS adnate-subdecurrent, close, narrow, almost linear, 5–7 mm., soon “ochraceous-tawny” (R.) with a darker sheen by reflected light, edge entire. STEM curved-ascending, 5–8 cm. long, subequal, 5–8(10) mm. thick, apex conspicuously dilated in the region of gill-attachment, “*snuff-brown*” (R.) within and without, surface at first with scattered, scurf-like deterrent scales up to the obsolete annulus, then longitudinally fibrillose, rigid, fibrous with subcartilaginous cortex, solid below, firmly stuffed, finally hollow at the apex. ODOR none; taste bitterish. SPORES 6–7.5 × 4–4.5 (5) μ , short ellipsoid, smooth, purplish-brown under the microscope, dark purplish in mass; cystidia none; sterile cells indistinct; basidia 4-spored, 32 × 4–5 μ .

Cespitose on dead hemlock stub. Mt. Hood, Oregon. October 9. Collected by C. H. Kauffman.

There are relatively few viscid or pelliculose species of *Hypholoma*; two rare British species have been described. *H. incomptum* Masee is similar to ours, but differs in the much

more ferruginous colors, different gill-attachment and narrower spores. Its detailed microscopic characters are not sufficiently known.

INOCYBE ALBODISCA Pk.

INOCYBE CALAMISTRATA Fr.

INOCYBE DECIPIENTOIDES Pk.

INOCYBE FALLAX Pk.

INOCYBE FASTIGIATA Fr.

INOCYBE GEOPHYLLA Fr.

INOCYBE LACERA Fr.

INOCYBE LANUGINOSA Fr.—Bres.

INOCYBE LILACINA (Boud.) Kauff.

INOCYBE PALLIDIPES E. & E.

INOCYBE PRETERVISA QuéL.

INOCYBE PROMINENS Kauff. forma *longistriata*, f. nov. — The rimosity is more extensive than in the typical form.

INOCYBE RADIATA Pk.

INOCYBE SCABELLA Fr.

INOCYBE SORORIA Kauff.

INOCYBE VIRGATA Atk.

INOCYBE GEOPHYLLA Fr. forma *perplexa*, f. nov. — This form has the stature and all the other characters of *I. geophylla*, except that the pileus, gills, stem and flesh become slowly — finally entirely — diffused with an “apricot buff” or pinkish color after picking, and this color is retained in the dried specimens. This form occurs throughout the eastern Rocky Mountain region and thence westward to the Pacific Coast. When fresh or in a growing condition it is white like *I. geophylla*.

LACTARIUS ALPINUS Pk.

LACTARIUS AURANTIACUS Pers.

—Ricken

LACTARIUS LIGNYOTUS Fr.

LACTARIUS MUCIDA Burl.

LACTARIUS PARVUS Pk.

LACTARIUS SUBDULCIS Fr.

LACTARIUS SUBPURPUREUS Pk.

LACTARIUS TORMINOSUS Fr.

LACTARIUS TURPIS Fr.

LACTARIUS UVIDUS Fr.

LEPIOTA ACUTAESQUAMOSA Fr.

LEPIOTA CLYPEOLARIA Fr.

LEPIOTA CRISTATA Fr.

LEPIOTA FLAMMEOTINCTA Kauff.

See Kauffman (15)

LEPIOTA GLOIODERMA Fr.

LEPIOTA PETASIFORMIS Murrill

LEPIOTA PULCHERRIMA Graff.

See Kauffman (15)

LEPIOTA RUBROTINCTA Pk.

LEPTONIA ASPRELLA Fr.

LEPTONIA FORMOSA Fr.

LEPTONIA OCCIDENTALIS Mur-

rill

LEPTONIA SERRULATA Fr.

Leptonia subeuchroa, sp. nov. — PILEUS 1.5–2 cm. broad, subpliant, convex, subumbonate, “dark purple-drab” (R.), densely hairy-sealy, even on margin which is at first incurved; flesh thin, concolor towards cap surface, whitish towards gills. GILLS adnate, subventricose, rather broad, close (or subdistant in age), pure white at first, becoming “seashell pink” (R.), edge concolor, entire. STEM 2–3 cm. long, 1.5–2.5 mm. thick, straight or curved, equal, “dark madder blue” (R.), glabrous and even, naked at apex, stuffed to hollow, whitish within. ODOR not noted. SPORES almost even, obscurely angled, ellipsoid-almond-shaped, bright pink under microscope, $8-9(11) \times 5.5-7 \mu$; basidia 4-spored, about $45 \times 7 \mu$; cystidia none; sterile cells on edge of gills indistinct.

On mossy log, in forest of cedar, hemlock and maple. Gregarious. Mt. Hood, Oregon. October 16. Collected by C. H. Kauffman.

This species stands apart from all its relatives by its obscurely angular spores. As to individual species, it differs from *L. placida* by the absence of black squammules at apex of stem; from *L. subplacida* and many others, in spore-size and color; from *L. euchroa* in the white young gills; from *L. chalybea* by its habitat and color; and from *L. chloropolia* and *L. lazulina* by the non-striate margin of the pileus.

Leptonia trivalis, sp. nov. — PILEUS 2–4 cm. broad, subpliant, flattened-convex, finally plane and margin elevated, obscurely depressed-papillate, subviscid from a subgelatinous, subseparable pellicle, glabrous, pellucid-striatulate when fresh, “sayal brown” (R.), slowly fading; flesh concolor, fading, subhygrophanous, margin at first incurved. GILLS adnate-seceding, rarely with decurrent tooth, close, rather narrow, 2–4(5) mm., white at first, “light pinkish cinnamon” at maturity, edge entire or suberose. STEM 4–8 cm. long, 2–4 mm. thick, equal, elastic, cortex cartilaginous, toughish, hollow, flexuous, even, very glabrous, easily splitting lengthwise, hyaline-white. ODOR and taste none. SPORES globose, obscurely angular, pale under microscope, 7–8 μ diameter; basidia 4-spored, $25 \times 8-9 \mu$; cystidia none; sterile cells on edge of gills indistinct.

On decayed wood in a cedar swamp. Mt. Hood, Oregon. October 9. Collected by C. H. Kauffman.

It seems to be nearest to *L. glabra* Murrill, a species from Maine, but differs from it by the gelatinous surface of the pileus, the adnate gills, the much thicker stem and its generally larger size. *L. semiglobata* Murrill also from Maine, a species with a slightly viscid pileus, has squammules on the pileus, a yellowish-gray stem and ellipsoid, angular spores. Our species has a general nondescript appearance that allies it to many species of this genus.

Marasmius limonispora, sp. nov. — PILEUS 1–2 cm. broad, submembranous, pliant, “light grayish olive” to “pale smoke gray” (R.) when growing, dingy “pinkish-buff” after reviving in rains, at first even, obscurely radiate-wrinkled in age, the glabrous margin at first incurved; flesh thin, concolor. GILLS broadly adnate, relatively rather broad, close, subdistant when pileus expands, whitish, pruinose. STEM 7–10 cm. long, about 2–2.5 mm. thick, equal, flexuous below but rather strict otherwise, entirely “natal brown” at maturity, or with white apex, pruinose throughout, tubular, concolor within, with a subfibrous cortex, white-myceloid at the base where it is intergrown with moss and humus. ODOR and taste none. SPORES limoniform in one view, subplano-convex in other view, $9\text{--}12 \times 6\text{--}7 \mu$, hyaline, smooth; cystidia scattered on sides and edge of gills, lanceolate-subventricose, capitate, hyaline, $65\text{--}75 \times 12\text{--}15 \mu$; basidia 4-spored, $40 \times 6\text{--}7 \mu$.

On mosses and humus on the ground in conifer forest. Gregarious. Mt. Hood, Oregon. October 16. Collected by C. H. Kauffman.

Marasmius subnauseosus, sp. nov. — PILEUS 5–15 mm. broad, submembranous, broadly convex to flattened, obtuse, “mars yellow” (R.) on margin, “sudan brown” on disk, glabrous, dry, even, margin at first incurved; flesh concolor, of uniform thickness. GILLS broadly adnate, occasionally with a tooth, color “warm buff,” crowded, rather broad behind, narrow in front, edge entire. STEM 2–4 cm. long, 1–1.5 mm. thick, tapering down from a somewhat dilated apex, instititious, soon

tubular, "raw umber" (R.) except the yellowish apex, covered with a ferruginous pruinosity which is denser at base, even, "mars yellow" within. ODOR none; taste tardily nauseous, at length definitely so. SPORES minute, narrow, subcylindric, 5-6 (7) \times 1-1.5 μ , smooth and hyaline; cystidia none; basidia 24 \times 5-6 μ ; pileus corticate, the surface layer of thick-walled brown cells.

On decayed wood in conifer forest. Gregarious or scattered. Mt. Hood, Oregon. September 28. Collected by C. H. Kauffman.

Marasmius umbilicatus, sp. nov. — PILEUS 2-4 cm. broad, slightly fleshy, at very first pale pinkish buff, soon milk-white, *deeply umbilicate*, radiately rugose-wrinkled, glabrous, margin membranous, at first incurved and white pruinose on edge, then repand; flesh concolor. GILLS subdecurrent, arcuate, narrow, acuminate at ends, close to subdistant, intervenose, becoming crisped, whitish. STEM 3-5 cm. long, 2-3 mm. subequal, dilated at apex, tough-cartilaginous, hollow, irregularly compressed and longitudinally furrowed, dark fuscous, darker at base, pallid at apex, glabrous except the scurfy apex, with brownish tomentum at base. ODOR and taste none. SPORES narrow, elongated-pointed at one end, 9-10 \times 3-3.5 μ ; cystidia scattered on sides and edge of gills, subfusiform-acicular, about 60 \times 7 μ .

Attached to fir needles and debris in fir and hemlock forests. Rather frequent in the mountains of Oregon and Washington. October 5. Collected by C. H. Kauffman.

This has the general appearance of *M. delectans* of the Eastern United States, but the pileus is deeply umbilicate, the gills are subdecurrent, the spores of a different shape and it grows in a different habitat.

MYCENA ACICULA Fr.

MYCENA AMICTA Fr.—Ricken

MYCENA AMMONIACA Fr.

MYCENA CLAVICULARIS Fr.

MYCENA EPIPTERYGIA Fr.

MYCENA HAEMATOPODA Fr.

MYCENA INCLINATA Fr.—Ricken

MYCENA LUDEA Fr.—Ricken

MYCENA PELIANTHINA Fr.

MYCENA PURA Fr.

MYCENA ROSELLA Fr.

MYCENA RUBROMARGINATA Fr.

MYCENA VITILIS Fr.

MYCENA VULGARIS Fr.

MYCENA STROBILINOIDES Pk. — This was a most satisfactory find, and made it possible to record the character of this species in detail. Peck described it from the Olympic Mountains, Washington. It is a striking little plant, about 3–4 cm. tall, with a “flame-scarlet” (R.) pileus, and an “orange” stem; the gills are colored “light salmon-orange” with a flame-scarlet edge. The spores are elliptical, smooth, hyaline, and measure $7-8 \times 5-5.5 \mu$. The sterile cells on the edge of the gills are broadly clavate, not very much larger than the basidia, but are colored fiery-orange, and their surface is echinulate-dotted; similarly decorated sterile cells, less highly colored, are scattered through the hymenium elsewhere, and although they have the size of basidia they are clearly differentiated by these markings. This is a case, entirely apart from other findings, which supports Buller (7, p. 279) in his contention that paraphyses are always paraphyses and here these sterile cells are surely of the nature assumed by him, i. e. they are “paraphyses” and never become basidia. No types of cystidia are present. This collection grew on needle beds of the Douglas fir.

MYCENA PTERIGENA Fr. — This dainty little plant, beautifully illustrated in Fries, *Icones*, Plate 85, Fig. 4, occurs in this country in the Eastern mountains as well as in the West. I have collected it in the Adirondacks and then again at Mt. Hood. It was attached to dead fern fronds lying on the ground. The pileus is only 2–5 mm. broad, scarcely higher, and at first delicately rose-tinted. At maturity or in age the pileus becomes grayish-brown either entirely or only on the umbo; it is at first subcylindric-subconic, then subhemispherical, and the margin is pellucid-striatulate when fresh. The gills are distant, ascending, rather narrow, whitish. The stem is 3–4 cm. long, half a millimeter or less in thickness, filiform, tough, flaccid, becoming grayish-brown after the rosy tints fade, and is attached by small hairs at the base. The spores measure $8-10 \times 4-4.5 \mu$, and are oblong or oblong-subfusiform and hyaline. The surface layer of the pileus is composed of large horizontal hyphae.

Mycena tinctura, sp. nov. (See Plate IX.) — PILEUS 1–2.5 cm. broad, subfleshy, conic-campanulate, obtusely umbonate, “pale

pinkish buff" to "drab gray" (R.), umbo "fuscous," at length tinged avellaneous, striate-subplicate, striae subdistant, subhygrophanous, scarcely fading, glabrous, margin at first straight; flesh submembranous, equal, concolor. GILLS ascending, adnate-seceding, rather narrow, without decurrent tooth, *subdistant*, distinct, white, at length gray-tinted, edge entire. STEM 4-7 cm. long, 1-2 mm. thick, equal, even, glabrous, naked at the apex, pale "echru-drab" to "wood brown" (R.), terete or twisted, sometimes compressed-sulcate, cartilaginous, *tough*, strict and elastic, *with a watery juice, becoming dark vinaceous when crushed*. ODOR and taste none. SPORES 9-11(12) \times 5-6(7) μ , ellipsoid, acute at apiculate end, hyaline, smooth; cystidia none; sterile cells on edge of gills saccate but indistinct; surface layer of pileus corticate, composed of 3 to 4 rows of subglobose, vesiculose, rather large cells.

On decayed wood and needle beds of hemlock. Cespitose to solitary. Mt. Hood, Oregon. October 7 and 16. Collected by C. H. Kauffman.

It belongs to the section Lactipedes by virtue of the rather copious watery juice of the stem, which stains the crushed flesh wine color. In other respects, it could be referred to the Filopedes. In age the drab and fuscous colors of the cap may fade. In addition to the juicy stem it is distinguishable from its relatives by the lack of odor, the narrow, subdistant gills, the spore characters and the absence of cystidia. When growing on wood, the stems may be dwarfed.

NAUCORIA MELINOIDES Fr.—Ricken

NAUCORIA SIDEROIDES Fr.—Ricken

Naucoria belluloides, sp. nov. — PILEUS 8-20 mm. broad, convex, obtuse, dry, glabrous, "chestnut" to "hays russet" (R.), not hygrophanous, margin at first involute, then spreading, even when moist; flesh thin, concolor to ochraceous. GILLS *adnexed*, rounded behind, not broad, 3 mm., crowded, "chamois" to "honey-yellow" (R.), edge entire. STEM 2-3 cm. long, 2-3 mm. thick, equal or tapering slightly upwards, "cinnamon-rufous" within and without, stuffed axis paler, apex pruinose, glabrous elsewhere, even. ODOR none; taste distinctly bitter. SPORES broadly

ellipsoid to oval, rough, dark rusty under the microscope, $7-8 \times 5-5.5(6) \mu$; cystidia none, or few to scattered, short subcylindrical and subcapitate, hyaline; sterile cells on edge of gills nine-pin-shaped, hyaline, obtuse; basidia $32-34 \times 6-7 \mu$; surface of pileus corticate, composed of pyriform, brown cells.

On decayed coniferous wood. Mt. Hood, Oregon, October 10. Collected by L. E. Wehmeyer.

Very similar in size and coloring to our eastern species, *N. bellula* Pk., but differs by its larger spores, adnexed gills, etc.

NOLANEA PASCUA Fr.—Ricken. — This is a rare species, at once distinguished microscopically by its cruciate-angled spores.

Nolanea latifolia, sp. nov. — PILEUS 2-3 cm. broad, campanulate-hemispherical, apex truncate-depressed, in age sometimes markedly umbonate but umbo truncate, glabrous, hygrophorous, striatulate to subeven and "hair-brown" when moist, quickly fading to "drab-gray" or ashy on losing moisture, then even, margin at first straight; flesh submembranous, concolor. GILLS broadly adnate-seceding, broad, ventricose, abruptly sinuate near stem, *close*, at first gray-tinted, then "vinaceous-fawn" (R.), somewhat crisp. STEM 5-6 cm. long, 2-3 mm. thick, strict, equal, elastic, cartilaginous, stuffed to hollow, fragile, persistently grayish-brown to "hair-brown," variegated with silky-white innate fibrils, white-myceloid at the slightly enlarged base. ODOR and taste none or slightly subnauseous. SPORES spherical, obtusely angular, tinged flesh-color, $8-9 \mu$ diameter, (10μ with apiculus); cystidia none; basidia 4-spored, $40-42 \times 11-12 \mu$.

Among moss and debris in forest of fir and hemlock. Solitary or subgregarious. Mt. Hood, Oregon. October 7 and 25. Collected by C. H. Kauffman.

I am not at all sure that this may not be *N. occidentalis* Murrill, but if so, that species is very imperfectly described. It differs from Murrill's account by the definitely adnate gills which are closely spaced, not at all distant, and by the fact that they are at first grayish.

OMPHALIA CAMPANELLA Fr.

OMPHALIA MAURA Fr.—Ricken

OMPHALIA DUMOSA Fr.—Ricken

OMPHALIA ONISCA Fr.

OMPHALIA GRACILLIMA Fr.

OMPHALIA UMBELLIFERA Fr. forma *ochraleuca*, f. nov. — Plant “cream-color” (R.) in all parts. SPORES ovoid-elliptical, smooth, hyaline, $6-8 \times 4-5 \mu$; cystidia none. GILLS distant, broadly decurrent, broadest in middle, few forked. STEM sloid, more or less pruinose. PILEUS convex-umbilicate to subinfundibuliform, striate-plicate, with a white-appressed pruinosity. Collected several times with the characters constant. It differs from the other forms of this variable species mostly in color.

PANUS STIPTICUS Fr.	PLEUROTUS SEROTINUS Fr.
PAXILLUS ATROTOMENTOSUS Fr.	PLUTEUS GRANULATUS Fr.
PHOLIOTA ADIPOSA Fr.	PLUTEUS CERVINUS Fr.
PHOLIOTA EREBIA Fr.	PLUTEUS LEONINUS Fr.
PHOLIOTA DISCOLOR Pk.	PLUTEUS NANUS Fr.
PHOLIOTA MARGINATA Fr.	PLUTEUS TOMENTOSULUS Pk.
PLEUROTUS ALBOLANATUS Fr.	PSALLIOTA ARVENSIS Fr.

Psalliota subrutilescens, sp. nov. (See Plate X.) — PILEUS 7–12(15) cm. broad, oftener 7–9 cm., fleshy, firm, at first hemispheric-oval, at length broadly convex, obtuse or obsolete subumbonate, at first uniformly covered by a continuous, appressed, fibrillose-hairy cuticle which is “hays brown” to “sorghum brown”; during expansion this cuticle is broken up into very numerous, small and appressed, hairy areolae, scarcely in form of scales, and the color changes slowly to shades of vinaceous, e. g. “light russet vinaceous,” “brownish-vinaceous,” “vinaceous-brown” (R.), etc., remaining darker on disk, the whitish flesh scarcely showing between the areolae, margin even, indistinctly virgate. GILLS free, at first reaching the stem, becoming subremote, narrow, 4–5 mm., sublinear, crowded, “safrano pink” (R.) when immature, later “vinaceous fawn,” finally “sorghum-brown” (R.) or darker, glistening, edge entire. STEM 8–12 (15) cm. long, oftener 8–10 cm., tapering upwards from a subclavate base, 7–10(12) mm. thick at apex, 12–18 mm. at base, often subdecurrent at base, at first peronate by a rather thick, densely silky-interwoven, snow-white sheath, which becomes lacerate-torn forming pointed or squarrose scales, and terminating above in the annulus, apex of stem even, silky or minutely

sublacerate, stuffed to hollow, tinged vinaceous or subrufescent within, soon soft and putrescent at base. ANNULUS at first erect-flaring and white, then deflexed, thick, interwoven-silky, smooth above, densely floccose-scaly and vinescent beneath, with a broad floccose rim when normal, double, persistent, superior. ODOR none, taste tardily bitterish-subnauseous. SPORES oval-oblong, 5-6(6.5) \times 3(3.5) μ , obtuse, smooth, purplish-brown; cystidia none; basidia 4-spored, 30-34 \times 5-6 μ .

In low moist conifer forests or near alders, usually in humus. More frequently solitary or few. Not uncommon. Mt. Hood, Oregon. October 11. Collected by C. H. Kauffman.

This was the only forest Psalliota seen, and although not abundant it occurred singly with some frequency. It is superficially similar to *P. rutilescens* Pk.-Kauff. (13), but fundamentally is quite distinct. It differs from that species by its double annulus, stuffed to hollow, non-bulbous stem, the narrower spores and the highly developed blematogen. The differentiation of the concrete surface layer of the pileus and of the sheath and annulus take the same course during development as in the case of *P. rodmani* Pk. studied by Atkinson (1). The sheath on the young stem, along with the portion up to the margin of the pileus, includes the partial veil as an interior layer — thin along the stem — and this composite sheath can be easily peeled off from the stem at this stage.

PSATHYRA PENNATA Fr.-Ricken

PSATHYRA PERSIMPLEX Britz.-Kauff. (12, p. 270)

Psathyra fragilissima, sp. nov. (See Plate XI.) — PILEUS 2-5 cm. broad, 1.5-3 cm. high, very fragile, at first broadly conic and obtuse, conic-campanulate at maturity, hygrophanous, "light cinnamon drab" (R.) and even when young and moist, later "benzo brown," at first covered by snow-white evanescent floccose-fibrillose, small and superficial scales, "pale pinkish buff" and even when dry, soon glabrous, margin at times evanescently appendiculate; flesh thin, equal, fragile, concolor. GILLS ascending, adnate-seceding, relatively narrow, 3-5 mm., crowded, soon "hair-brown" then "fuscous" (R.), edge at first minutely white-flocculose. STEM long and slender, extremely fragile, 10-15(18)

cm. by 3-5(6) mm., equal or tapering slightly upwards, pure white, glabrous, scurfy and substriate at apex, hollow, even, strict but becoming flexuous, cartilaginous, easily splitting. ODOR and taste mild or slightly nutty. SPORES elliptical, regular, obtuse, smooth, $13-15 \times 6-7 \mu$, purple brown; *cystidia none*; sterile cells on edge of gills short and broadly nine-pin-shaped, i.e. capitate, $45 \times 12-15 \mu$; basidia 4-spored, $30-32 \times 12 \mu$; upper layer of pileus slightly differentiated, composed of 3-4 rows of vesiculose, hyaline cells, forming a subseparable pellicle, interior trama slightly tinged with drab.

On decayed leaves, needles and humus in mixed forest. Gregarious. Mt. Hood, Oregon, October 12. Collected by C. H. Kauffman.

This differs from both of the preceding by lacking cystidia on the sides of the gills. It is distinguished in general, by the pure white universal veil, long white stems, non-striate pileus, large spores and by the shape of the sterile cells on the edge of the gills. It belongs to the section *Fibrillosae*.

Psilocybe ochraiceps, sp. nov. — PILEUS 1-3 cm. broad, at first broadly oval, at length subhemispherical, obtuse or obscurely short-pointed on centre, unexpanded, about 1 cm. high at maturity, pelliculose, lubricous, subhygrophanous, at first "yellow-ochre" (R.) to "antimony-yellow," glabrous and even, margin at first incurved and white-cortinate; flesh concolor (moist), whitish (dry), easily split radially, toughish across radial section. GILLS adnate-seceding, ascending, ventricose, rather broad, 3-5 mm., closely spaced at margin of pileus, subdistant near stem, white at first, then "hair-brown," sprinkled by the spores, edge entire. STEM 4-9 cm. long, 1-2.5 mm. thick, equal above the tomentose-enlarged base, reddish-fuscous within, pale-fuscous beneath a distinct cortinate white coating of fibrils, narrowly white-stuffed in the axis, very slightly viscid. ODOR and taste slight, subnauseous. SPORES $8-9 \times 4-5 \mu$, elliptic-oblong, smooth, obtuse, purple-brown; *cystidia none*; sterile cells inconspicuous.

Base of stems imbedded in humus or rotten wood. Gregarious. Mt. Hood, Oregon, September 28 and October 7. Collected by C. H. Kauffman.

It belongs to the section Tenaces. A very distinct plant, whose pileus remains unexpanded and on drying *in situ* becomes radially undulate-plicate, its margin closing in on the stem. The stem is distinctly sticky to the tongue, indicating an outer veil continuous with the pellicle of the pileus. At first and for a time, the cortinate covering gives the stem the appearance of being white.

Psilocybe olivaceotincta, sp. nov. — PILEUS 1.5–3 cm. broad, fragile, at first obtusely campanulate, then expanded to plane, hygrophamous, “citrine-drab” (R.) and faintly striatulate when moist, “olive-buff” or “pinkish-buff” and atomate when dry, glabrous, margin at first incurved, flesh thin, .5–1 mm., concolor. GILLS broadly adnate, close to subdistant, thin, rather broad, at first “pale olive buff,” then “citrine drab” (R.), edge very entire. STEM 3–5 cm. long, 1.5–2.5 mm. thick, equal or tapering downwards, toughish, becoming rigid-brittle, “cinnamon-rufous” upwards, “chestnut brown” downwards, glabrous except the minutely scurfy apex, concolor and minutely tubular within. ODOR and taste none. SPORES elliptical, smooth, 10–12 \times 5–6 μ , distinctly purple-brown under the microscope; cystidia none; sterile cells on edge of gills, filiform, cylindrical, hyaline, 3–4 μ diameter; trama of pileus homogeneous.

On moist thick humus and rotten debris in conifer forest. Mt. Hood, Oregon, October 6. Collected by C. H. Kauffman.

Sharply distinct by the contrasting colors of pileus and stem.

RUSSULA BOREALIS Kauff.

RUSSULA DELICA Fr.

RUSSULA EMETICA Fr.

RUSSULA EXPALLENS Gill.

RUSSULA FALLAX Cke.

RUSSULA FLAVA Romell

RUSSULA MURRILLII Burl.

RUSSULA PECTINATOIDES Pk.

RUSSULA RAULTII Burl.

RUSSULA SUBOLIVASCENS Burl.

RUSSULA XERAMPELINA Fr.

STROPHARIA AMBIGUA (Pk.) Zeller

STROPHARIA STERCORARIA Fr.

Stropharia fragilis, sp. nov. (See Plate XII.) — PILEUS very fragile, 3–7 cm. broad, at first subhemispherical then campanulate-expanded, obtuse, at length plane-subrepand, very hygrophamous, “army-brown” to “wood brown” (R.) and striatulate on

margin when moist, fading to "pinkish buff" and even when dry, finally becoming finely radiately wrinkled, at very first with concentrically disposed, superficial, hairy-silky to subfloccose, white, evanescent scales, soon denuded, disk brownish in age, margin at first incurved; flesh thin, 1-1.5 mm. thick, concolor. GILLS adnate-seceding, medium broad, 4-6 mm., nearly plane, close, soon "drab"-colored, then "hair-brown" or darker, edge white-flocculose. STEM very fragile, 7-10 cm. long, 4-5 mm. thick, thicker at base, tapering slightly upwards, from the subclavate base, white, lacerate floccose-silky up to the annulus, apex pruinose, silky above ring, stuffed to hollow, with cartilaginous cortex, white within. ANNULUS membranous, soon deflexed, white, coronillate on upper surface, densely silky or floccose below, distant about one third from apex of stem, derived from the universal veil, partial veil very scanty. SPORES elliptic-oblong, $6.5-8 \times 3.5-4(4.5)$, smooth, dark purplish-brown under the microscope; cystidia on sides and edge of gills, ventricose-sublanceolate, obtuse, hyaline, thin-walled, pedicel rather stout. ODOR and taste mild or slight.

On the ground in a swampy cedar and hemlock forest. Cespitose or subcespitose. Mt. Hood, Oregon, October 16. Collected by C. H. Kauffman.

It belongs to the group *Spintrigeri*. Without a knowledge of the detailed characters, it could easily be identified with *S. spintrigera* Fr. It has not at all the habit of *Hypholoma appendiculatum* with which Fries (10) compares his species. Our species differs from *S. spintrigera* in its striatulate, scaly pileus, the longer stems, broader gills, and, as far as is known, by the presence of cystidia on the sides of the gills. The spores are of the same size as given by Rea (19) for *S. spintrigera*, but Rea departs from the sizes of the plant given by Fries and others by including here a long-stemmed plant. According to Fries (*l. c.*) the gills are very narrow, 2-4 mm. wide, although this conception has also been varied by later authors. Lange (16) describes a variety of *S. spintrigera* and has kept close to the Friesian conception with respect to the habit assigned to it by Fries.

STROPHARIA SQUAMOSA Fr. (See Plate XIII.) — Reading between the lines one soon realizes that mycologists are continually beset with the query: What is the typical *S. squamosa*? The method pursued in the past, of attaching several varieties under this name, has but complicated the situation, for it seems easier to collect the varieties than to get clear the correct idea of the Friesian species, at least in this country. In support of these statements is the uncertainty shown in the works of various authors concerning the microscopic characters of this plant and its varieties. Persoon is still given credit for naming it — in fact he named it twice — but no descriptions can be found which are at all complete, which do not practically copy that of Fries from *Monographia*. Ricken (20) publishes a figure that gives the general appearance of the plant, but since it is difficult to reproduce the changing colors during the development or under different weather conditions, one does not get a very clear idea from such a figure.

The plants shown in our photograph agree well with the Friesian description and that of Ricken. The stems are slender, 10–15 cm. long and 3–6 mm. thick, at first strict, tough, and lacerate floccose-scaly up to the annulus. The pileus is at first hemispherical with a subconic umbo, viscid when wet, and covered by scattered, superficial, evanescent, silky-white scales, beneath which it is colored “echru-olive” (R.), darker towards the “chestnut”-colored umbo; the umbo later becomes much less prominent, or the pileus may be merely obtuse. It is 3–5 (6) cm. broad, and when it loses moisture, by drying *in situ*, it becomes “ochraceous-buff” and finally, “yellow-ochre.” The gills are broadly adnate, 6–10 mm. broad, at first “pale mouse-gray” (R.), then finally “fuscous”-colored. The odor is slight, but occasional penetrating whiffs of it can be easily noticed. The taste is mild. These plants have spores measuring $12\text{--}14 \times 6\text{--}7.5 \mu$, elliptical, smooth and purple-umber under the microscope. Cystidia are lacking on the sides of the gills, while the edge is provided with filiform obtuse sterile cells, $50\text{--}60 \mu$ long, and $3\text{--}4(5) \mu$ thick. The annulus is somewhat distant from the pileus, at first erect-flaring, then deflexed, rather narrow, and

strongly coronillate on its upper surface; at first it is white-lutescent, then stained above by the spores, and floccose-silky on the under side. The plants grow loosely gregarious on humus or very rotten wood in open coniferous forests. They were my first collection of the species which seemed to me to be typical, rather than varieties.

TRICHOLOMA EQUESTRE Fr.	TRICHOLOMA ROSEIBRUNNEA
TRICHOLOMA FARINACEA Murrill	Murrill
TRICHOLOMA PANOEOLOM Fr.	TRICHOLOMA RUTILANS Fr.
var. CESPITOSUM Bres.	TRICHOLOMA SUBPESSUNDATUM
TRICHOLOMA PERSONATUM Fr.	Murrill
TRICHOLOMA PESSUNDATUM Fr.	TRICHOLOMA SYLVATICA Pk.

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LITERATURE CITED

1. ATKINSON, G. F. 1915. Morphology and Development of *Agaricus Rodmani*. Proc. Amer. Phil. Soc., 54: 309-342.
2. ——— 1918. The Genus *Galerula* in North America. Proc. Amer. Phil. Soc., 57: 357-374.
3. BANKER, H. J. 1906. A Contribution to a Revision of the North American *Hydnaceae*. Mem. Torr. Bot. Club, 12: 99-194.
4. BEARDSLEE, H. E. 1908. The *Amanitas* of North Carolina. Journ. E. Mitch. Soc., 24: 124.
5. BOUDIER, E. 1902. Observations sur Quelques-unes des Principales Espèces d'*Amanites*. Myc. Soc. Fr. Bull., 18: 253.
6. BRESADOLA, G. 1892. *Fungi Tridentini*, 2: 32, 85 and 86.
7. BULLER, A. H. REGINALD. 1909. *Researches on Fungi*, Vol. II. London and New York.
8. BURT, E. A. 1922. The North American Species of *Clavaria*. Ann. Mo. Bot. Gard., 9: 1-78.
9. COKER, W. C. 1917. The *Amanitas* of the Eastern United States. Journ. E. Mitch. Soc., 33: 42.
10. FRIES, ELIAS MAGNUS. 1852. *Monographia*, Vol. I.
11. KAUFFMAN, C. H. 1917. Tennessee and Kentucky Fungi. *Mycologia*, 9: 159-166.
12. ——— 1918. *Agaricaceae of Michigan*, Vol. I.

13. ——— 1921 (appeared in 1923). The Mycological Flora of the Higher Rockies of Colorado. Papers Mich. Acad. Sci., Arts and Letters, 1: 100-150.
14. ——— 1922. The Genus *Armillaria* in the United States and Its Relationships. *Ibid.*, 2: 62.
15. ——— 1924. The Genus *Lepiota* in the United States. *Ibid.*, 4: 311-344.
16. LANGE, JAKOB E. 1917. Studies in the Agarics of Denmark, Part III. Dansk Botanisk Arkiv., 2: 18.
17. MURRILL, W. A. 1910. North American Flora, 9: 171.
18. PATOUILLARD, N. 1883-1886. *Tabulae Analyticae Fungorum*.
19. REA, CARLTON. 1922. British Basidiomycetes.
20. RICKEN, A. 1910-1915. *Die Blätterpilze Deutschlands*, Vols. I, II.
21. ZELLER, S. M. 1922. Contributions to our Knowledge of Oregon Fungi. *Mycologia*, 14: 173-199.



FIG. 1. LACHNOCLADIUM ORNATIPES



FIG. 2. PISTILLARIA FUSIFORMIS



BOLETUS MIRABILIS

PLATE IV



AMANITA SILVICOLA



CANTHARELLUS MULTIPLIX



COLLYBIA RUGULOSICEPS



HYGROPHORUS MULTIFOLIUS



HYPHOLOMA TSUGAEFCOLA



MYCENA TINCTORIA

PLATE X

0



PSALLIOTA SUBRUTILESCENS

PLATE XI



PSATHYRA FRAGILISSIMA



STROPHARIA FRAGILIS

PLATE XIII



STROPHARIA SQUAMOSA

46
THE GENUS LEPIOTA IN THE UNITED
STATES

C. H. KAUFFMAN

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THE GENUS *LEPIOTA* IN THE UNITED STATES *

C. H. KAUFFMAN

A CAREFUL business man takes an inventory of stock on hand at certain intervals in the development of his business. It would appear that this common-sense procedure could be applied equally to systematic mycology, and that if the knowledge on hand were put together in compact form, and the species no longer known or names no longer tenable could be thrown on the rubbish heap, a large amount of confusion and error in our accounts of existing plants would be eliminated. It is with the hope of bringing about some such result that the present paper has been prepared. Various sections of the United States have been visited during the last ten years, and although comparatively few new species were discovered and not nearly all of the supposedly native or described species were collected, yet a sufficient number of studies have been made to make a review of the genus possible.

The genus *Lepiota* comprises many species, and the monographic accounts that have appeared from time to time indicate that the genus has special attractions for the mycologist. Dr. Peck, in the *35th Report of the New York State Museum*, as long ago as 1884, gave a detailed account of eighteen species then known to him from that state. C. G. Lloyd in one of his first numbers of *Mycological Notes*, published in 1898, gives an account of seven of the larger species. Since Mr. Lloyd knows how to photograph fungi, it is to be regretted that he did not follow up his first output of agaric pictures. Then came A. P. Morgan's monograph of the genus, appearing in Volumes 12 and

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13 of the *Journal of Mycology*, 1906-1907. I doubt whether mycologists have studied Mr. Morgan's arrangement of species as carefully as it deserves. We have here an effort to lay a firm foundation for the American species within this genus, and Mr. Morgan, by careful choosing of terms, tried to bring all related species together under headings which would indicate their morphological development. Finally, a comprehensive account of all the known North American species appeared in 1914, in the *North American Flora*, Vol. 10, Part I. Here Dr. Murrill recognises ninety-seven species, of which nine are segregated and placed in the genus *Limacella*, proposed in 1909 by F. S. Earle.

Since Peck's first list, the number of species recognized in the United States has increased fivefold. Peck himself described a large number, and Professor Atkinson added some from time to time; Morgan himself named fifteen of those enumerated in his monograph, while Dr. Murrill added a goodly number, especially from the poorly explored regions of the West and South.

Many of the ninety odd species now on record for the United States are too incompletely known and described. The difficulty which Morgan encountered in properly placing species can be easily read between his lines. Those which he himself collected and studied, he had no difficulty in placing under the appropriate section to which, by their structure and development, they naturally belonged; but when he was compelled to place a species described by someone else, he frequently had to guess at the possible structure of such plants, and sometimes he vacillated as regards the section into which the plant should be placed. The present writer has experienced these same difficulties, and some of the points involved will be discussed under "Comments" later in the paper.

The name *Lepiota* was used for the first time by Persoon. He applied it to those white-spored Agarics with an annulus on the stem and with innate scales on the pileus. Lange (9) in transferring *Armillaria mellea* to the genus *Lepiota* seems to have gone back to Persoon's broad characterization of the group. Lange, however, uses other arguments to support his attitude.

Fries (4) limited the group, as a tribe under *Agaricus*, much as we have it at present. Quélet (11) raised it to generic rank. The important European works dealing with the genus *Lepiota* since the time of Fries and Quélet are those by Quélet and Battaille (12), Ricken (14), Lange (9) and Rea (13). Further discussion of the views of European authors will be limited to the sections below under "Comments."

The genus *Lepiota* is here kept intact except for the removal of those species of the old group "granulosae," which have adnate or adnexed gills, and which are therefore more properly *Armillarias* (8). A list of these is given below. The genus has been divided into sections by various authors in different ways. That these sections do not remain static in their content, merely shows once more the need of more accurate and complete knowledge of the species already described, and more care in describing new ones. In this paper the species are grouped in seven sections: *Lubricae*, *Viscidae*, *Pruinosae*, *Subclypeolariae*, *Clypeolariae*, *Asperae*, *Procerae-annulosae*.

If the morphological development from the initial button stage were already worked out for most of the species, then the grouping within these sections could be made permanent. Only a few species, however, have been studied from this point of view. Atkinson (1, 3) published an account of *Lepiota clypeolaria*, *Lepiota cristata* and *Lepiota seminuda*. From his studies on these and other species of agarics which possess partial veils or universal veils, he was able to point out the essential nature of these veils (2). In these papers he shows that a differentiated universal veil can be detected around the young buttons of certain species. This enveloping zone Atkinson calls the *blematogen* and it may take one of two possible courses during the further development of the button or fruit-body; in the one case, the developing veil becomes intergrown with the primary tissue of the pileus, and is therefore at length concrete with it, as in *Lepiota clypeolaria*; in the other case, there is a gelatinizing of an inner layer of hyphae of this outer enveloping zone of tissue in such a way that it causes a loosening of the outer portion to form the volva; the latter then separates at maturity as in *Amanita*

or Amanitopsis. This differentiated tissue, which forms a true volva, Atkinson called the *teleoblema*. The genus *Lepiota* is, then, definitely and generically distinct from *Amanita* and *Amanitopsis*, without reference to the other differences in development. The variations in the character of the cap-covering, in different species of *Lepiota*, is doubtless due to the amount and texture of the tissue derived originally from the blematogen.

If we turn now to the stem characters, we find that the facts concerning the development of the annulus and stem-covering are not as clearly worked out as those of the pileus. In separating the genus into sections, the characters of the annulus and stem-covering play a rather important part. These characters also are generally poorly studied or recorded by those who describe new species, and it is here that difficulties arise when monographic arrangements of the species are attempted. Atkinson has given us a clear picture of the layers of tissue of the stem-covering in *Lepiota clypeolaria*. Here the rather dense tissue in the gill cavity — later to become the partial veil and annulus — extends downward thinly to the base of the stem. Enveloping this thin layer is the tissue of the universal veil, which is concrete with the inner layer and which breaks up into cottony scales. It may be said, in passing, that these parts can be made out in the field with a good hand lens, and it is essential that all species collected and described should be studied in this way when collected. *L. clypeolaria* is an example of the kind of species which should go into the section *Clypeolariae* as given below.

Atkinson gave some attention to the details of development of annulus and stem-covering in *Lepiota cristata*. The blematogen on the stem is composed of hyphae parallel to the stem and is poorly developed, i.e., there is so little of it that the thin, almost unnoticeable, peronate sheath which terminates in the annulus when the plant is partly grown or expanded, cannot be accounted for by this layer. Atkinson pointed out, however, that the thin, descending tissue connected with the tissue of the gill cavity later becomes much thicker. In the section *Subclypeolariae*, given below, there is probably this type of development through-

out the section, at least it may be assumed that only this type of species should be included in this section. As constituted in the present paper, it will be seen that the presence of a definite annulus of the truly membranous type is the fundamental basis of the section referred to.

The species which come under the section *Pruinosae*, as limited in this paper, should have a pulverulent, flocculose or obsolete covering on the surface of the pileus and on the stem, and this covering is assumed to be derived from the blematogen. In addition, the annulus is not truly membranous, or at least it is delicate and poorly developed. Here again, one can not at present be consistent, because of the incomplete data for quite a number of species. Atkinson studied the development of *Lepiota seminuda*, as a representative of this group. He found the mealiness due to the breaking down of the blematogen tissue, its hyphal cells separating into turgid cells. Of course, not all the species included below in this section have this type of cap- and stem-covering, and doubtless a number of groupings can be made when more developmental studies give us the details. There is, however, a reasonable limit to the subdividing that may be done, and relations will have to be worked out with some degree of conservatism.

No studies of any consequence have yet been made of the development from the early stages, for the species belonging to our other sections. In the *Lubricae*, with a gelatinizing and therefore viscid or glutinous outer layer on both pileus and stem, it seems clear that a universal veil of the blematogen type is present. There is reason to suspect that such a layer is well developed in the sections *Asperae* and most of the *Procerae-annulosae*. The last group has usually been placed under two sections, but the structures, during development, in spite of the size of the plants, have not been sufficiently studied in many cases, so that no acceptable line of separation seems possible at present.

Many of the species of *Lepiota* are quite peculiar in their fruiting habits. There are, in a broad sense, two types with reference to habitat; those which appear on cultivated land,

among grass or in ploughed fields, or on similar ground; and those which grow in forests, thickets or other shady and moist places. Many, if not most of them, fruit under much drier conditions than other agarics. When collecting is good for many genera, i.e., during continuous wet weather, the fruit-bodies of *Lepiota* are apt to be rare or scattered; after the wet weather ceases, and other forms no longer appear, then it is frequently possible to find *Lepiotas*, often an unusual number of the smaller species.

In the following synopsis of species it has seemed best to eliminate in the beginning those species reported from the tropics or scarcely extending into our southern states, as well as those which have apparently been introduced from the tropics and appear sporadically in hothouses or conservatories. These two sets of species will be merely listed, except for brief comments on a few of them given elsewhere.

LIST OF *LEPIOTAS* RECENTLY DESCRIBED FROM THE
TROPICS OR SUBTROPICS

- Lepiota abruptibulba* Murrill; Cuba
agricola Murrill (as *Limacella*); Jamaica
aspratella Murrill; Jamaica
Broadwayi Murrill; West Indies, Granada
candida Copeland (non Morgan); Philippines
chlorospora Copeland; Philippines
colimensis Murrill; Mexico
dryophila Murrill; Louisiana (New Orleans)
elata Copeland; Philippines
ferruginea Bres.; Africa
flavodisca Murrill; Cuba
hemisclara (B. & C.) Sacc.; Cuba
jamaicensis Murrill; Cuba
lactea Murrill; Cuba
longistriata Pk.; Cuba, Jamaica, Alabama
manilensis Copeland; Philippines
mississippiensis Murrill; Mississippi
rimosa Murrill; Cuba
subclypeolaria (B. & C.) Sacc.; Cuba
subgrisea Murrill; Jamaica
subcristata Murrill; Jamaica
subflavescens Murrill; Louisiana
subgranulosa Murrill; Mexico
subrivelata Murrill; Louisiana

subphopenita Graff; Philippines
 tepeitensis Murrill; Mexico
 testacea Murrill; Mexico
 xylophilus Pk.; Hawaii

LIST OF LEPIOTAS OCCURRING IN HOTHOUSES, ETC.,
 APPARENTLY INTRODUCED FROM THE TROPICS

Lepiota *Allenae* Pk. (Massachusetts; greenhouses)
amantiformis Murrill (New York City; conservatories)
avellanea Clements (Nebraska; greenhouses)
biornata B. & Br. (England; melon and cucumber frames)
cepaestipes Fr. (Europe and North America; also native)
denudata Fr. (Europe; in tanneries, flowerbeds; also native?)
farinosa Pk. (Massachusetts; mushroom bed in hothouse)
Georginae W. J. Smith (England; fern houses)
licmophora B. & Br. (England; greenhouses)
lilacina-granulosa P. Hennings (Europe; greenhouses)
lutea (Bolt.) Quél. (Syn. *L. citrina* Pass. per Bres.) (Europe; hot-
 houses)
magnusiana P. Hennings (Germany; hothouses)
martialis Cke. & Massee (England; on trunk of tree fern, greenhouse)
medioflava Boudier-Rea (Europe; hothouses)
meleagris Fr. (Europe and America; hothouses, etc.; also native)
micropholis B. & Br. — Lange (Europe; hothouses)
pseudolicmophora Rea (England; greenhouses)
spectabilis Clements (Nebraska; greenhouse)

LIST OF SPECIES OF LEPIOTA TRANSFERRED
 TO THE GENUS ARMILLARIA

Lepiota constricta (Fr.) Quél. = *Rea* = *Armillaria constricta* Fr.
adnatifolia Pk. = *Armillaria adnatifolia* (Pk.) Kauff. (8)
amianthina Fr. = *Armillaria amianthina* (Fr.) Kauff. (8)
carcharia Fr. = *Armillaria carcharia* (Fr.), comb. nov.
cinnabarina Fr. = *Armillaria cinnabarina* (Fr.) Kauff. (8)
granosa Morg. = *Armillaria granosa* (Morg.) Kauff. (8)
granulosa S. E. Gray = Fr. = *Armillaria granulosa* (Fr.) Kauff. (8)
pulveracea Pk. = *Armillaria pulveracea* (Pk.), comb. nov.
rhombospora Atk. = *Armillaria rhombospora* (Atk.), comb. nov.
haematites Berk. = Bres. = *Armillaria haematites* (Bres.), comb. nov.

SYNOPSIS OF THE SPECIES OF LEPIOTA OF THE NORTH
TEMPERATE REGIONS OF EUROPE AND AMERICA

(Compiled in part from the literature*)

- Young plant enclosed in a glutinous universal veil I. LUBRICAE
Surface of pileus viscid, because of a gelatinizing, more or less separable pellicle; stem dry II. VISCIDAE
Pileus and stem covered when in good growing condition, by mealy, flocculose or granular particles; sometimes subscaly; veil and annulus delicate, of the same texture or substance as the covering on the pileus; hence the annulus is evanescent. III. PRUINOSAE
Annulus membranous, thin but distinct, often persistent, frequently terminating a thin, smooth, peronate (i.e. external) layer of the stem, or stem entirely naked; cuticle of the pileus at first continuous, then diffracted-scaly except on disk IV. SUBCLYPEOLARIAE
Universal veil well developed, but concrete, breaking up into colored fibrillose or floccose-fibrillose scales or masses on the pileus and stem; on the latter, terminating the sheath in the form of a floccose or fibrillose, soon evanescent annulus. V. CLYPEOLARIAE
Universal veil composed of a thick loose fibrillose layer covering the pileus and stem from the first; when drawn apart by the expansion of the pileus or by the elongation of the stem, its fibers converge into conspicuous erect, or squarrose scales; the partial veil tends to be fine-fibrillose or subarachnoid, often copious. VI. ASPERAE
Plants mostly rather large; annulus well developed, membranous, sometimes thick and appearing double, sometimes mobile on the stem. Pileus diffracted-scaly, sometimes fibrillose, rarely glabrous
VII. PROCERAE-ANNULOSAE

I. LUBRICAE

- | | |
|--|---|
| 1. Taste of pellicle not bitter | 2 |
| 1. Taste of pellicle very bitter; plant white. (See description)
(<i>L. candida</i> Morgan) <i>L. pulcherrima</i> Graff | |
| 2. Spores ovoid-ellipsoid | 3 |
| 2. Spores globose or subglobose | 5 |
| 3. Pileus 5-8 cm. broad | 4 |
| 3. Pileus 2-5 cm. broad, white with fulvous umbo; gills narrow; stem long, slender, hollow, abruptly bulbous; spores 7.5-10 × 4-5 μ; annulus membranous; in woods <i>L. fulvodicca</i> Pk. | |

* The microscopic characters, e.g. size and shape of spores, have been reported for the older species by various students of Agarics. In order to show whose account of these characters is followed in the ensuing synopsis, the names of such authors are added, where necessary, after the older author's name.

4. Spores 9-11 × 5-6 μ ; pileus whitish to pale alutaceous; gills narrow; stem rather stout, stuffed, subbulbous. *L. bentista* Morgan
4. Spores 5-6 × 3-4 μ ; pileus alutaceous to subfulvous, with darker umbo; stem equal or subequal, hollow or stuffed, floccose below
L. oblita Pk.
5. Viscid layer of pileus and stem hyaline. 6
5. Viscid layer thick, brown; pileus 3-4 cm. obtuse; stem 4-6 cm. × 3-4 mm, solid, tapering upward; gills broad; spores 4-5 μ diameter. *L. glischra* Morgan
6. Pileus cream-color, tinged rosy, 6 cm. broad, with broad umbo; stem 5-10 cm. × 8-12 mm, solid, enlarged at base; odor farinaceous; spores unknown. *L. roseicrema* Murrill
6. Pileus white, 4-7 cm. broad, glutinous; gills soft, subvenose-connected; stem 5-8 cm. × 4-6 mm., equal, soon hollow, glabrous; spores 4-6 μ diameter. *L. illinita* Fr.

II. VISCIDAE

1. Pileus rather large, 5-10 (14) cm. broad; annulus ample, membranous, pendant. (Transition to *Amanita*). 2
1. Pileus smaller; annulus usually narrow, median or superior. 4
2. Taste distinctly farinaceous; apex of stem dotted with dark green drops when developing; pileus 7-10 cm. broad, pinkish-tan; stem spongy-soft, more or less scaly; spores globose, 5-6 μ (Ricken). (*L. guttata* (Pers.) Quél.) (*Amanita lenticularis* Fr.)
L. lenticularis Lasch-Ricken.
2. Taste not farinaceous; apex of stem without green watery drops. . . . 3
3. Pileus 8-14 cm. broad, whitish with brownish disk, thick and firm, glabrous; gills white; stem equal, 8-15 cm. × 15-25 mm, solid; odor none; spores unknown. *L. Persoonii* Fr.-Ricken
3. Pileus 4-9 cm. broad, white to pale alutaceous, rather soft, glabrous; gills crowded, white, edge entire; stem 4-10 cm. × 4-10 mm., subbulbous; odor becoming strong and disagreeable; spores oval 3-4 × 2-3 μ *L. Fischeri* Kauff.
4. Odor of radish; pileus, etc., white, 3-6 cm., umbonate; flesh soft, watery; stem hollow; annulus lacerate, usually appendiculate on edge of pileus; spores unknown. *L. medullata* Fr.
4. Odor not of radish. 5
5. Spores globose or subglobose. 6
5. Spores elliptical; stem stuffed or hollow. 8
6. Taste not farinaceous; pileus yellowish, 2.5-5 cm., covered like the stem with dew-like transparent drops; stem white above, with yellow or brownish squamules below; spores 4-5 μ diam.; in pastures. *L. irrorata* Quél.-Rea
6. Taste farinaceous; pileus 2-5 cm., convex, glabrous, even; gills ventricose, close, white; stem 4-7 cm. × 4-10 mm., solid; spores globose, 4-5 μ 7
7. Pileus "burnt sienna" to "mars-orange" (Ridg.), fading; stem with reddish, floccose scales up to the slight annulus. . . . *L. gloioderma* Fr.

7. Pileus pinkish-cream color; stem subglabrous; annulus ample, superior, persistent. *L. McMurphyi* Murrill
8. Pileus, etc., white, 1-3.5 cm. subumbonate, glabrous, even; gills crowded, narrow; stem slender, 5-8 cm. \times 3-5 mm; annulus apical, membranous, at first erect; spores short-ellipsoid 5-7.5 \times 3-3.5 μ (*L. candida* Morg.) (*L. albissima* Murrill) . . . *L. pulcherrima* Graff
8. Pileus not white. 9
9. Pileus delicately pink, 2-4 cm. subviscid, even; gills narrow; flesh white, unchanged; stem 5-9 cm. \times 3-5 mm., glabrous, soft, stuffed, annulus median; spores subacute at ends, ellipsoid, 5-6 \times 3-4 μ (*L. delicata* var. Kauff., *Agar. Mich.*, 1. 631) *L. rubida*, sp. nov.
9. Pileus ochraceous-fulvous, 4-5 cm., radiate-wrinkled; gills broad; flesh whitish, blackening at base of stem; stem equal, 8 cm. \times 5-7 mm.; annulus oblique, black-sealy; blackish fibrils appendiculate on margin of pileus; spores 5-6 \times 3-4 μ . . . *L. demisannula* Secr.-Ricken

III. PRUINOSAE

1. Spores averaging 9 μ or more in length. 2
1. Spores averaging less than 8 μ , often minute. 9
2. Spores subfusiform, 12 μ or more in length. 3
2. Spores elliptical, oblong or oval. 5
3. Pileus 1.5-2.5 (3) cm. broad. 4
3. Pileus 6-12 mm. broad, with minute, whitish or cinereous, granular scales, substriate; gills broad, distant; stem 1.5-2.5 cm. long, slender, glabrous, whitish; spores 12-15 \times 5-6 μ *L. arenicola* Pk.
4. Gills white, becoming fumose on drying, broad; pileus 2-3 cm., with isabelline, powdery scales; stem 5-6 cm. \times 4-6 mm., furfuraecous, pale drab below; spores 12 \times 7 μ *L. fumosifolia* Murrill
4. Gills white with gilvous tint; pileus 1.5-2.5 cm., gilvous or fulvous-ochraceous on disk, margin pale; stem about 3 cm. \times 3 mm., with floccose scales; spores 11.5-13.5 \times 4.5 μ (*L. gracilis* Quél. var. *laevigata* Lange) *L. laevigata* Lange, comb. nov.
5. Pileus not over 3.5 cm. broad. 6
5. Pileus rather large, 4-8 (10) cm., striate-plicate on margin, densely flocculose-sealy, yellowish-brown, brown on disk; stem subventricose or tapering upward, 4-12 (15) cm. \times 4-6 mm. at apex, up to 15 mm. at thickest part, subglabrous; annulus subpersistent; spores 9-10 \times 5-7 μ , oval-elliptical. *L. cepaestipes* Fr.
6. Pileus with lilac or purple color present. 7
6. Pileus white, disk changing to brown on drying, 2-3.5 cm., disk subscabrous; stem 2-3 cm. \times 2-4 mm.; spores 8-10 \times 5-6 μ
L. mutata Pk.
7. Pileus or flocculose scales lavender or lilac-tinged. 8
7. Pileus and stem covered with a heliotrope-purple pulverulence, 1-2 cm.; flesh white tinged-yellow; gills broad, rather distant; spores 8-10 \times 3-4 μ *L. purpureoconia* Atk.
8. Odor fetid; gills rather narrow; pileus 1-2 cm. minutely scaly; stem toughish, dark brown to blackish below, 4-5 cm. \times 2-2.5 mm.; spores 9-11 \times 2-2.5 μ *L. ecitidora* Atk.

8. Odor none; gills broad, subdistant; pileus 1.5–2.5 cm., floccose-scaly, brownish, tinged with lilac; stem concolor below, 1.5–2.5 cm. \times 2–4 mm.; spores $10 \times 5 \mu$ *L. sublilacea* Pk.
9. Spores minute, scarcely reaching 5μ in length..... 10
9. Spores 6μ or more in length..... 16
10. Stem rufous-tinted, rufescent or rosy-tinted beneath the superficial fibrils or pulverulence..... 11
10. Stem whitish, 2–3 cm. long, 1 mm. thick, glabrous; pileus oval to convex, obtuse, pink-tinged when young, granular-mealy; gills subdistant; spores $4-5 \times 3 \mu$ *L. cristatella* Pk.
11. Pileus 2–3.5 cm. broad..... 12
11. Pileus averaging less than 2 cm..... 13
12. Pileus white, disk rufescent, very minutely flocculose; gills rather broad; stem 4–6 cm. \times 2–3 mm.; spores ovoid-oblong, $3.5-4.5 \times 3 \mu$ *L. noscitata* Britz-Morgan
12. Pileus bright rose color, densely granular, convex; gills at length ochraceous; flesh rufescent; stem 5–6 cm. \times 3–5 mm.; spores $5 \times 3 \mu$, elliptical..... *L. rosea* Rea
13. Pileus and stem covered with mealy, white particles..... 14
13. Pileus and stem glabrous; pileus 8–10 mm., white; stem 2–3 cm. \times 1–2 mm., rufescent; gills broad; spores oblong, $4-5 \times 2-3 \mu$ *L. rufipes* Morgan
14. Pileus umbonate, 8–20 mm. broad; gills broad..... 15
14. Pileus convex, obtuse, white or nearly so, 4–8 mm. broad; gills broad; spores elliptic-oblong, $4-5 \times 2.5-3 \mu$ *L. pusillomyces* Pk.
15. Pileus milk-white; spores $4 \times 2 \mu$ *L. hemisphaerica* Murrill
15. Pileus whitish, tinged flesh-color; spores $4 \times 2 \mu$ (Rea); $4 \times 2.5 \mu$ (Lange); 5μ long (Quél.)..... *L. seminuda* (Lasch) Quél.
16. Spores subglobose..... 17
16. Spores ellipsoid; pileus between 1.5 cm. and 3 cm. broad..... 18
17. Pileus incarnate-ochraceous, umbonate, with minute granular scales; stem granular, 2–3 cm. \times 1–1.5 mm., equal; spores $5-7 \mu$ diameter..... *L. repanda* (Clements) Sacc.
17. Pileus incarnate-ochraceous, with zone of blue on margin, umbonate, subfibrillose; stem scaly downwards, equal; spores 6–8 μ diameter..... *L. cyanozonata* Longyear
18. Gills white or whitish..... 19
18. Gills lemon-yellow, edge serrulate; pileus lemon-yellow, with rufous scales, 1.5–2 cm.; stem concolor, 2–4 cm. \times 2–4 mm., scaly; spores $7-8 \times 4 \mu$ *L. citrophylla* B. & Br.-Boudier
19. Pileus or scales becoming tinged with vinaceous, or with lilac, rosy or rufous colors..... 20
19. Pileus or scales becoming tinged with yellowish or brown colors..... 24
20. Odor none or slight..... 21
20. Odor strong, of coal tar; pileus white becoming lilac-tinted, minutely mealy; stem 5–7 cm. \times 3–5 mm. changing to deep lilac when bruised; spores boat-shaped, $7-8 \times 3 \mu$ *L. Bucknallii* B. & Br.-Rea
21. Gills broad to very broad..... 22
21. Gills narrow; stem tapering upward..... 23

22. Spores 8-9 × 3.5 μ, oblong-ellipsoid; pileus umbonate, umbo reddish-tan, with few delicate floccose scales, 2.5-3.5 cm.; stem equal, 7-9 cm. × 2-4 mm. *L. amplifolia* Murrill
22. Spores 6 × 3 μ, oblong (Kauff); pileus umbonate, vinaceous-buff, 1.5-2.5 cm., umbo obtusely conic, densely flocculose; stem 2-5 (6) cm. × 1.5-3 mm. (Spores 3.5 × 2 μ Murrill) . . . *L. petasiformis* Murrill
23. Gills crowded; stem clavate, 8 mm. thick below, fibrillose, up to 7 cm. long; pileus 3 cm. broad, white with rosy tint, subumbonate; spores 6-7 × 4 μ *L. roseicinerea* Murrill
23. Gills not crowded; stem slender, 2-4 mm. thick, 5-9 cm. long; pileus 1.5-3 cm., umbonate, snow-white or rose-tinted; spores 7-8 × 3.5 μ *L. subnivosa* Murrill
24. Stem 2-3 mm. thick; pileus yellow-tinged 25
24. Stem very slender, scarcely 1 mm. thick, 2-4 cm. long, brownish below; pileus 1-2 cm., umbonate, minutely brownish-scaly, umbo dark brown; spores 5-6 × 3-4 μ *L. nudipes* Pk.
25. Spores 6-8 × 4 μ 26
25. Spores 4-5 × 3 μ, elliptical; pileus 1-2 cm., white, becoming yellowish when dry, pruinose; stem 1-2 cm. × 2-3 mm., equal, fibrillose below the median annulus; on mosses and among grass in woods
L. parvannulata Lasch-Rea
26. Pileus pubescent-glabrescent, whitish or tinged yellowish-incarnate, umbo deeper yellowish; 1.5-2.5 cm.; stem 5-7.5 cm. long; subequal; annulus superior *L. mesomorpha* Fr.-Rea
26. Pileus at length with minute, pale yellow scales, not umbonate, 1.5-2.5 cm.; stem 3-5 cm. long, base slightly enlarged; annulus median. (In drying the whole plant assumes a rich yellow hue.)
L. alluvina Pk.

IV. SUBCLYPEOLARIAE

1. Spores fusiform or subtruncate-cuneate 2
1. Spores oblong, elliptical or ovoid 5
2. Taste slight or none 3
2. Taste strong of radish; pileus 3-6 cm., disk pale-yellowish, margin whitish and lacerate-scaly; stem 4-8 cm. × 3-6 mm., bulb thicker; annulus at length lacerate and fugacious; spores fusiform 15-19 × 5-6 μ; among grass in fields *L. crminea* Fr.-Ricken
3. Spores not up to 12 μ long, subtruncate-cuneate 4
3. Spores 12-15 × 5-6 μ, subtruncate at one end; pileus small, 10-15 mm. broad, scales chestnut-brown; stem 3-4 cm. × 2-2.5 mm., clothed with chestnut-brown scales up to the annulus; flesh turning to brown when bruised; in woods *L. geniculospora* Atk.
4. Odor somewhat disagreeable; pileus 1-3 cm., scales reddish-brown; stem 4-5 cm. × 2-4 mm., cortex tinged pinkish; spores 6-8 × 3-4 μ *L. cristata* Fr.
4. Odor none; pileus 3-5 cm., scales dark tawny; gills becoming ochraceous at maturity; stem 3-6 cm. × 3-6 mm., equal, concolor; spores 9-10 × 3.5-4 μ *L. fulvella* Rea
5. Flesh or surface of plant changing color when bruised or in age 6

5. Flesh white, unchanging. 15
6. Stem distinctly clavate or subbulbous. 7
6. Stem equal, or tapering gently upward. 10
7. Plant showing red, green and blue tints when handled; pileus 1-3 cm; at first rufous-umber, then with minute, reflexed scales; at length rimose; stem 3-5 cm. long, at first white; gills broad, subdistant, spores $7-9 \times 4-5 \mu$ *L. virescens* Morgan
7. Plant not exhibiting this reaction. 8
8. Plant when young vinaceous-drab; scales of pileus, the stem and the edge of gills becoming blackish-brown in age. (See emended description.) *L. brunnescens* Pk.
8. Plant at first whitish, or brownish only on the disk of the pileus, becoming reddish-brown when handled, or blackish-brown when dried 9
9. Spores $8-9 \times 6-7 \mu$; pileus 2.5-4 cm., with numerous, minute, scales; stem 3-5 cm. long, 2-3 mm. thick at apex, subbulbous
L. multicolor Murrill
9. Spores $6-8 \times 4-5 \mu$; pileus 3-5 cm., cuticle not soon broken into scales; stem 5-7 cm. long, 4-6. mm. thick at apex, clavate
(*L. rufescens* Morgan) *L. brunnescens* Pk.
10. Spores not more than 9μ long. 11
10. Spores $9-12 \times 5-6 \mu$, pointed at the ends; pileus 1-2 cm., yellowish rubescent, minutely, densely scaly; stem 3-5 cm. \times 2-3 mm.; all parts becoming red or reddish in age. *L. maculans* Pk.
11. Pileus even, or at most short substriate. 12
11. Pileus sulcate on margin, scales at first pale yellow, umbo fulvescent, 2-4 cm.; gills narrow, subdistant; stem 3-5 cm. \times 2-4 mm., rufescent; spores $5-6 \times 3-4 \mu$ *L. flavescens* Morgan
12. Stem up to 17 cm. long, drab color; in forest of Sequoia, California; pileus 3-4 cm.; chestnut-brown, rufescent, glabrous to fibrillose; gills white, becoming rose-colored when bruised. . . *L. roseifolia* Murrill
12. Stem much shorter. 13
13. Plant in all parts assuming blue tints when bruised or on drying; pileus 1-2 cm., scales brownish; stem 3-5 cm. \times 1.5-2 mm.; annulus persistent; spores $7 \times 5 \mu$, elliptic. *L. caeruleascens* Pk.
13. Plant not assuming blue tints. 14
14. Fibrillose covering of pileus and stem changing very quickly, in the fresh plant, to flame-scarlet, when the plant is touched or disturbed; flesh and gills white, unchanging (See description.) (*L. subfelina*?) *L. flammeotincta*, sp. nov.
14. Fibrillose scales, etc., of the pileus and stem, as well as the flesh, changing to reddish-brown then brown 12-24 hours after bruising; pileus 2-3 cm., granular or scaly; stem 3-5 cm. \times 4-5 mm.; annulus median; spores $6-8 \times 4-5 \mu$ *L. brunnescens* Pk.
15. Stem peronately appressed-fibrillose or fibrillose-subscaly below the membranous annulus. 16
15. Stem glabrous below the annulus. 21
16. Pileus 3-6 cm. broad; stem 4-6 (7) cm long. 17
16. Pileus 2-3 cm. broad, or smaller; stem 2-4 cm. long. 19

17. Edge of gills dark umber; scales of pileus small, umber-colored; stem peronate up to the annulus, median; gills narrow; spores $6-7 \times 4 \mu$; among grass..... *L. nigromarginata* Massee
17. Edge of gills concolor.....18
18. Gills flavescent at maturity; pileus mouse-gray at first, scales bistre-colored; annulus superior; stem with appressed, white scales, later becoming bistre-colored; spores $6-7 \times 3-4 \mu$
L. scabinella Fr.-Rea
18. Gills remaining white; pileus varying brown, purplish-brown to blackish-brown, at length squarrose-scaly; annulus large; stem fibrillose, thickened at base, 2-5 (6) mm. thick; spores $6-7.5 \times 4-5 \mu$*L. felinoides* Pk.
19. Pileus very small, scales blackish-brown, 5-10 mm. broad; stem 1 mm. thick, floccose-fibrillose; annulus conspicuous, under surface blackish-brown; spores $6-7 \times 4 \mu$; in woods.....*L. gracilis* Pk.
19. Pileus 2-3 cm. broad.....20
20. Pileus when young purplish-lilac, scales at length fuscous; annulus median; stem 2.5-3 mm. thick, its cortex rubellus; spores $4-5 \times 2-2.5 \mu$*L. lilacea* Bres.
20. Pileus with continuous cuticle, rarely subscaly, pale umber to dark brown; gills broad; all parts tough; spores $4-5 \times 3 \mu$
L. neophana Morgan
21. Pileus quite small, 5-20 (25) mm. broad.....22
21. Pileus 2-4 (5) cm. broad.....24
22. Stem solid, growing from wood; pileus 10-15 mm. broad; with minute blackish scales; gills remote; annulus persistent; spores $5-6 \times 3-3.5 \mu$*L. phaesticta* Morgan
22. Stem hollow; not on wood.....23
23. Stem clavate, 5-7.5 cm. long, 3-6 mm. thick; pileus 1-2.5 cm. broad, whitish, tinged isabelline, fibrillose-pubescent; spores $6-7 \times 4 \mu$; in woods.....*L. juniperina* Murrill
23. Stem equal, 2.5 cm. long, 2 mm. thick; pileus 1-2 cm. broad, whitish, becoming rugulose, striate; gills narrow; spores $6-8 \times 4-5 \mu$ (Morgan).....*L. rugulosa* Pk.
24. Spores $5-6 (7) \times 3 \mu$25
24. Spores $6-8 \times 4-5 \mu$; pileus subrimose, not scaly, gray or grayish-brown, disk purple-tinged; stem 4-5 cm. \times 2-4 mm. subequal
L. Glatfelteri Pk.
25. Umbo of pileus conspicuous, black, scales deep flesh-color, margin striate; gills subdistant; stem 3-6 cm. \times 2-5 mm., equal
L. incarnata (Clements) Sacc.
25. Umbo whitish, brownish or chestnut color.....26
26. Pileus white, rarely brownish on umbo, fibrillose-subscaly; stem slender, 2-4 mm. thick; annulus median.....*L. miamensis* Morgan
26. Pileus covered with small, avellaneous to chestnut-colored scales; stem 3-10 mm. thick, brown-tinted; annulus superior
L. castaneidisca Murrill

V. CLYPEOLARIAE

1. Spores fusiform or subfusiform 2
1. Spores not fusiform 6
2. Pileus (2) 3-5 cm. broad 3
2. Pileus 1-2 (3) cm. broad 5
3. Spores 21-26 (30) \times 5-6 (7) μ ; gills narrow; pileus or scales cinnamon-brown (See description.) *L. fusispora*, sp. nov.
3. Spores rarely 20 μ long 4
4. Pileus subglobose, yellowish-tawny; stem stout, 6-10 mm. thick, yellowish, densely clothed with erect white flocci up to the floccose annulus; spores 12-14 \times 4-5 μ *L. pratensis* Fr.-Rea
4. Pileus floccose-scaly, creamy-yellowish; stem 3-6 mm. thick, sheathed with a dense floccose tomentum up to the floccose annulus; spores 10-16 (18) \times 4-6 μ *L. clypeolaria* Fr.-Kauff.
5. Pileus brownish, floccose-scaly, 1-2 cm.; gills broad, rather distant; stem 1 mm. thick; spores 11-13 \times 4-5 μ
L. floralis Berk. & Rav.-Beardslee
5. Pileus or scales black, 2-3 cm.; spores 8-10 \times 3-4 μ ; in conifer forest *L. felina* Pers.-Ricken
6. Spores projectile-shaped (i.e., rounded-enlarged at one end, narrowed and pointed at the other) 7
6. Spores not projectile-shaped 9
7. Pileus 5-8 cm. broad, silky, glabrescent; whole plant white; gills broad; stem 6-8 mm. thick; annulus submedian, floccose-membranous, reflexed, striate above; spores 12-14 \times 6-7 μ , apiculus recurved *L. alba* (Bres.) Sacc.
7. Pileus 1-2 (3) cm. broad 8
8. Spores 9-11.5 (13) \times 4-5 μ ; gills or flesh turning brownish-red with age; pileus subglabrous to somewhat felty, 1-2 cm., brown to reddish-brown *L. castanea* Quél.-Lange
8. Spores 7-8 \times 3-4 μ ; pileus and stem white to rose-tinted, changing to chestnut-brown on drying; stem 2-5 mm. thick; collected in Washington state *L. castanescens* Murrill
9. Spores truncate at one end 10
9. Spores ellipsoid to oblong 13
10. Spores truncate at apiculate end, so as to be minutely bicornate, 8-9 μ long 11
10. Spores truncate at broader end, narrowed to subeuncate at the other end 12
11. Edge of gills purple-pruinose; pileus 3-4 cm., fawn-color, densely and minutely scaly; annulus cottony; in conifer forests; subcaespitose *L. Boudieri* Bres.
11. Edge of gills concolor; pileus 1-2 cm., mammillate, finely tomentose or with fine reddish-brown scales; odor of balsam
L. castanea Quél.-Bres.
12. Spores 8-11 \times 3-4 μ ; pileus 1-2.5 cm., cinnamon-rufous to tawny. See ("Comments.") *L. acerina* Pk.
12. Spores 6-8 \times 2.5-3 μ ; pileus 4-8 cm., brown to tawny-olive, dif-

- fractured-scaly; gills rather broad; stem 4-6 cm. \times 5-8 mm., equal, subbulbous, scales concolor..... *L. caloceps* Atk.
13. Pileus 3-5 cm. broad..... 14
13. Pileus usually less or up to 3 cm. broad..... 15
14. Spores 8-11 \times 5 μ ; pileus alutaceous to brown; stem 4-6 cm. \times 5-8 mm.; annulus lacerate and appendiculate..... *L. spanista* Morgan
14. Spores 6-8 \times 3-4 μ ; pileus covered with small reddish brown scales and fibrils; stem 7-10 cm. \times 4-8 mm.; annulus narrow, distant
L. clypeolarioides Rea
15. Spores 8-10 μ long..... 16
15. Spores 5-6 or 7-8 μ long..... 17
16. Stem about 1 mm. thick; pileus flame-red, conic-campanulate, 1-1.5 cm., subscaly-fibrillose; annulus subcortinate; spores 8-10 \times 4.5-5 μ *L. ignicolor* Bres.
16. Stem 3-4 mm. thick; pileus flesh-color, scaly, convex, subumbonate, 1.5-3 cm.; annulus inferior, fugacious..... *L. helveola* Bres.
17. Pileus or scales black, striate-sulcate on margin, 2-3 cm.; stem slender, farinaceous-scaly; annulus median, band-like; spores oblong, 5 \times ?..... *L. noctiphila* (Ell.) Sacc.
17. Pileus not black..... 18
18. In conifer forests; pileus 2-3 cm., covered with small, squarrose, rusty-brown scales; stem equal, 2-3.5 cm. \times 3-4 mm., floccose up to the floccose annulus; spores 7-8 \times 3-4 μ
L. forquignoni Quél.-Ricken
18. In frondose woods; pileus 1.5-2.5 cm., tawny-brown; stem 4-5 cm. \times 2-4 mm., with mycelial bulb, floccose-fibrillose, rufescent; annulus flocculose-subappendiculate; spores 5-6 \times 3' μ
L. umbrosa Morgan

VI. ASPERAE

1. Spores minute, 4-5 (6) \times 2.5-3 μ 2
1. Spores longer, 6-8 (9) \times 2.5-3.5 μ 6
2. Stem bulbous, or tapering upward, 4-6 (10) mm. thick..... 3
2. Stem equal, slender, 2-3 mm. thick..... 5
3. Pileus or warty scales white, faintly dusky in age, 2-4 cm.; gills broad; stem tapering upward, 3-5 cm. \times 3-5 mm., flocculose-scaly, white; veil appendiculate..... *L. gemmata* Morgan
3. Pileus or scales brown, fuscous or unber..... 4
4. Pileus 5-7 cm. broad, tomentose then torn into papillate scales, which may disappear; gills reaching stem, forming a prominent collar, not forked; stem 5-7 cm. \times 6-10 mm., densely woolly-scaly, fuscous; odor of radish; in frondose woods. Spores oval, 5-6 \times 2.5-3 μ *L. hispida* Lasch-Lange
4. Pileus 2-4 cm. broad, hair-brown to olive-brown, with small, erect, pointed scales; gills narrow, sometimes bifurcate at stem; stem concolor, bulbous; spores 4-5 \times 2-3 μ *L. asperula* Atk.
5. Odor of radish; pileus campanulate, mammillate, bay-brown, 1.5-2 cm., at length with fine hairy erect scales; flesh rosy-colored; veil silky-cobwebby; spores 4-5 \times 2.5-2.8 μ (Lange); 6-7 \times 3-3.5 μ (Quélet & Bernard)..... *L. echinella* Quél. & Bern.

5. Odor not of radish; gills narrow; pileus convex-plane, dark brown, covered by a copious brown tomentum and then by very dense and wooly, pointed scales, 1.5-2.5 cm.; stem very tomentose, brown; spores $4 \times 2-2.5 \mu$*L. eriophora* Pk.
6. Stem glabrous or nearly so; veil arachnoid, very fugacious; pileus 5-7.5 cm. broad, pale crust-brown, soon cracked into minute scales; spores subtruncate-oblong, $8 \times 3.5 \mu$
L. Cortinarius Lange
6. Stem adorned downwards by fibrils of veil and scattered dark, floccose scales..... 7
7. Pileus 6-12 (15) cm. broad, covered with brown or rufous-brown, erect, pyramidal soft warts or scales..... 8
7. Pileus 2-5 cm. broad, its cuticle breaking up into small, pointed, blackish-brown scales; gills ventricose-broad, simple, crowded; spores $6-8.5 \times 3.5-4 \mu$*L. fusc squamea* Pk.
8. Gills forked, rather narrow; spores $6-9 \times 2 \mu$*L. Friesii* Lasch
8. Gills not forked, crowded; spores $6-9 \times 2.5-3 \mu$...*L. acutaesquamosa* Fr.

VII. PROCERAE-ANNULOSAE

1. Spores large, (12) 14-18 μ or more in length..... 2
1. Spores not reaching 14 μ in length..... 9
2. Flesh white, unchanging..... 3
2. Flesh becoming pink or reddish when bruised; annulus erect-flaring, externally brown at margin, probably fixed; pileus 5-7.5 cm., dark-brown, diffracted-scaly; stem 7.5 cm. \times 10-15 mm., subequal, not bulbous; spores $18-20 \times 10-12 \mu$
L. emplastrum Cke. & Massee
3. Stem markedly bulbous at base; annulus mobile..... 4
3. Stem tapering upward, scarcely subbulbous; annulus thin, erect-flaring, narrow; pileus pallid brown, disk reddish-brown, 8-15 cm., abruptly umbonate; spores $14-18 \times 9-10 \mu$...*L. gracilentia* Fr.-Ricken
4. Pileus quite large, between 8-18 (20) cm.; cuticle diffracted into large, irregular scales..... 5
4. Pileus averaging smaller..... 7
5. Cuticle of pileus brown to tawny-brown..... 6
5. Cuticle of pileus whitish or tinged alutaceous; stem 20-30 cm. long, bulb 3-4 cm. thick; spores $12-16 \times 9-10 \mu$...*L. porrigens* Viv.-Morgan
6. Pileus not umbonate, brown, scales shaggy-imbricate, 15-20 cm.; stem 20-30 cm. long; gills whitish; spores $12-17 \times 8-10 \mu$
L. rachodioides P. Henn.-Morgan
6. Pileus umbonate, rufous-brown to tawny-brown, 8-12 (15) cm. broad; annulus thick, firm, its underside brown-scaly; stem with furfuraceous or small brown scales, 15-25 cm. long; spores $14-18 (20) \times 9-12 \mu$*L. procera* Fr.
7. Pileus obtuse or obtusely subumbonate..... 8
7. Pileus acutely umbonate, fuscous, diffracted-scaly, 3-6 cm.; gills very remote; stem 7-10 cm. \times 3-4 mm., obsolete scaly; spores $15 \times 9-10 \mu$*L. mastoidea* Fr.-Ree
8. Pileus glabrous or minutely floccose, margin excoriate, whitish with

- brown disk, 7-10 cm.; annulus fringed on margin, flaring; stem 8-12 cm. \times 6-12 mm., mealy-floccose; spores 12-16 \times 8-10 (11) μ
L. excoriata Fr.-Lange
8. Pileus delicately floccose-sealy, white with ochraceous disk, 5-8 cm., annulus narrow, entire; spores 12-18 \times 7-8 μ*L. puellaris* Fr.-Rea
9. Flesh changing color when bruised, usually to reddish or yellowish; annulus fixed..... 10
9. Flesh white, unchanging..... 17
10. Stem ventricose-fusiform, varying to bulbous with short pointed base 11
10. Stem either truly bulbous at base or tapering upward from base.... 13
11. Cuticle of pileus diffracted into rather large concentric scales, fuscous to brown with rufous tints which become more pronounced in age; gills flavescens, or tinged rufous; annulus apical, membranous, erect-flaring, then collapsing..... 12
11. Cuticle of pileus fawn-color, with minute blackish scales; gills becoming rose-color, rarely lemon-color, rubescent when bruised; annulus lacerate, very fugacious, with blackish scales on its lower surface; pileus 2-5 cm.; spores elliptical, 6-7 \times 4 μ (Masseé)
L. meleagris Fr.-Rea (non Rieken)
12. Pileus 5-20 cm. broad; spores 8-11 \times 6-8 μ , straw-colored to reddish or purplish.....*L. haematosperma* Bres.
12. Pileus 4-8 (10) cm. broad; spores 8-10 (10.5) \times 5-7 (7.5) μ , white
L. americana Pk.
13. Spores elliptical..... 14
13. Spores subglobose, 6-7 (10) μ in diameter; pileus and concentric squarrose scales white, 3-10 cm., disk ochraceous; gills white, connected at inner end by a cartilaginous collar; flesh becoming pinkish under cuticle and at base of stem; stem attenuate upward from bulbous base.....*L. nympharum* Kalchbr.-Rea
14. Pileus robust, hemispherical, diffracted-sealy; scales large, shaggy, often revolute, gray-brown or bay-brown, 10-15 cm.; gills very remote; annulus with lacerate margin, adhering for a long time to margin of pileus; stem 10-15 mm. thick, bulb large; spores 9-11 (12) \times 6-7 μ*L. rachodes* Fr.-Lange
14. Pileus thinner, scales minute..... 15
15. Spores small, 6-7 \times 3-4 μ 16
15. Spores 10-12.5 \times 6-7.5 μ ; pileus 5-7.5 cm., umbonate, with minute scurfy, brown scales, striate on margin; stem tapering upward from enlarged base, 5-7.5 \times 4-6 mm.....*L. Earlei* Pk.
16. Flesh or surface of pileus and stem becoming fuliginous on drying; pileus 8 cm., white with rosy tints, finely floccose scaly; stem long, twisted, tapering upward; gills distant.....*L. fuliginescens* Murrill
16. Flesh turning saffron-red, finally black; pileus 5-12 cm., minutely scaly or hispid; stem bulbous; annulus sometimes submobile; spores straw-colored.....*L. Badhami* B. & Br.-Rea
17. Spores white in mass..... 18
17. Spores green in mass; annulus mobile; pileus white, buff or brown, 10-20 cm. broad, scaly, subexcoriate; stem hard, clavate below, 2-4 cm. thick; spores 9-12 \times 6-8 μ*L. Morgani* Pk.

18. Stem solid; pileus 6–10 cm. broad 19
18. Stem stuffed with fibrils or hollow 21
19. Pileus pallid clay-color; *annulus ample* 20
19. Pileus white, glabrous, margin even; stem subequal or subbulbous, 5–10 cm. \times 8–12 mm.; taste and odor farinaceous, annulus large then subevanescent, spores globose, 4–5 μ *L. solidipes* Pk.
20. Pileus diffracted-scaly, scales rather large; stem 5–7 cm. \times 7–10 mm.; spores 8–9 \times 6–7 μ ; in cultivated gardens; southern states
L. hortensis Murrill
20. Pileus floccose-silky, glabrescent; stem 5–10 cm. \times 10–12 mm., bulbous; spores 7–8 \times 4–5 μ ; in frondose woods
L. holosericea Fr.-Ricken
21. Pileus colored rosy, pink, red or olive 22
21. Pileus white or slightly isabelline on disk 25
22. Pileus 4–7 cm. or 6–12 cm. broad 23
22. Pileus 2–4 cm. broad, rose-lilac, livid on disk, minutely fibrillose-scaly; gills narrow; annulus sometimes mobile, ample; stem 7–10 cm. \times 2.5 mm., slender; spores 8–9 \times 4–5 μ *L. roseilivida* Murrill
23. Pileus olive; spores 5–6 \times 3–3.5 μ (See description.) *L. olivacea*, sp. nov.
23. Pileus pinkish to red, subglabrous, *radially rimose*, annulus ample; fixed, membranous; stem equal or attenuate upward 24
24. Spores 8–10 \times 4–5 μ ; stem 4–9 cm. \times 4–6 (8) mm. *L. rubrotincta* Pk.
24. Spores 7 \times 3.5 μ ; stem 10–15 cm. \times 5–10 mm. *L. rubrotinctoides* Murrill
24. Spores 5–7.5 \times 3–4.5 μ ; pileus 6–12 cm. broad; stem peronate by a red, glabrous sheath up to the ample, flaring, thickish annulus. (*L. pulcherrima* Zeller) *L. decorata* Zeller (non *L. pulcherrima* Graff)
25. Pileus 4–8 (9) cm. broad 26
25. Pileus 2–4 cm. broad, finely fibrillose-scaly; gills narrow; stem 5–10 cm. long, 3–5 mm. thick; annulus persistent; spores 7–9 \times 3.5–4 μ *L. Sequoiarum* Murrill
26. Pileus abruptly umbonate, plicate-sulcate on margin; gills narrow, remote; stem 7–10 cm. long, tapering upward from a bulbous base, 5–8 mm. at base; annulus thin, spores 7–9 \times 5–6 μ
L. "mastoidea" Morgan
26. Pileus convex, not umbonate, white, glabrous; gills changing slowly to dingy pinkish at maturity; stem 5–10 cm. \times 6–12 mm., tapering upwards from a thickened base; annulus in form of a rounded collar; spores 7–9 \times 5–6 μ *L. naucina* Fr.

NEW AND EMENDED SPECIES OF LEPIOTA *

***Lepiota olivacea*, sp. nov. (Plate XV)**

Pileus fleshy, fragile, 4–7 cm. broad, campanulate-expanded, soon plane or depressed, sometimes subumbonate, dry, cuticle

* The type specimens are deposited in the Herbarium of the University of Michigan.

innately and radially fibrillose, subpulverulent, even, "light grayish-olive" to "olive-gray" (Ridg.), "dark olive" on disk, opaque; flesh thin, soft, white, unchanging; gills free, becoming remote, ventricose, 5-6 (7) mm. broad, edge obscurely fimbriate, stem 5-6 (7) cm. long, 3-5 mm. thick at apex, equal or tapering slightly upwards, scarcely subbulbous, up to 10 mm. thick at base, silky-stuffed then hollow, glabrous, even, white, silky-shining upwards; annulus median, terminating a thin evanescent sheath, membranous, at first erect-flaring; odor and taste none or slight; spores 5-6 \times 3-3.5 μ . elliptic-ovate, acute at one end, smooth, subhyaline and with a delicate incarnate tint under the microscope, uniguttate; basidia short, stout, 4-spored, 25-27 \times 8 μ ; cystidia none; sterile cells on edge of gills, ventricose above, 27-30 \times 7-10 μ , often crystallate at apex.

Growing scattered on low, alluvial soil under thickets of *Sambucus* and *Impatiens*. Ann Arbor, Michigan. August 14, 1921. Collected by C. H. Kauffman.

Green or olive *Lepiotas* are rarely mentioned in the literature; *L. virescens* Morgan and *L. caerulescens* Pk. are entirely different both by their color and spores. Although I have received reports that *L. Morgani* Pk. is sometimes entirely green, that species is far removed from the one here described.

***Lepiota fuispora*, sp. nov. (Plate XVI)**

Pileus fleshy, 2-5 (7) cm. broad, subcampanulate-expanded, subumbonate, at length plane or depressed around the umbo, dry, at first with a rather thick, soft, fibrillose, "cinnamon-brown" (Ridg.) cuticle, which becomes broken into numerous, floccose, erect or recurved scales, arranged concentrically and showing the pale buff flesh between, not striate on the margin which is lacerate-floccose; flesh rather thin, soft, "warm-buff" towards surface, whitish near gills; gills free, reaching the stem by a point, rather narrow, 3-4 mm. broad, subventricose, close, thin, white or with creamy tint, edge entire or nearly so; stem 4-6 cm. long, 5-6 mm. thick at apex, equal or incrassate downwards, up to 12 mm. thick below, stuffed, cortex rather rigid and

hard, covered at first up to the annulus by the thick, floccose-fibrillose cinnamon-brown universal veil, which is then broken into thick, wedge-shaped scaly masses, which often disappear in part; annulus at first manifest, recurved, thick, plicate-striate from the gill-pressure, becoming evanescent; odor and taste none or slight; spores long, fusiform, acuminate-pointed at both ends, 18–25 (30) \times 5–6 (7) μ , smooth, hyaline; cystidia none; basidia clavate, 4-spored, 55–60 \times 10–12 μ ; sterile cells on edge of gills indistinct, saccate.

On very decayed wood or debris. Type collected by Prof. F. C. Stewart at Seventh Lake, Adirondaek Mts., New York, September 1, 1921. Also in the Medicine Bow Mts., near Centennial, Wyoming, September 5, 1923. Collected by C. H. Kauffman.

This is apparently a rare species, or perhaps usually confused with related ones. The spores are surprisingly large, and are unique; one end is often drawn out to a needle-like prolongation. It probably occurs in mountainous regions throughout the northern part of our country.

***Lepiota flammeatincta*, sp. nov.**

Pileus fleshy, 2–3 cm. broad, campanulate-expanded, at length almost plane, obtuse or obsoletely umbonate, dry or nearly so, cuticle at first continuous and “tawny” (Ridg.) or disk chestnut color, soon breaking up into numerous, small, appressed, fibrillose, tawny scales, sometimes subexcoriate, margin not striate, cuticle changing quickly to “flame-scarlet” when plant is picked or touched; flesh thin, about 1.5 mm., submembranous on margin, white, unchanging, except adjacent to cuticle; gills free, subremote, narrow, crowded, white, unchanging; stem 6–8 (10) cm. long, 2.5–5 mm. thick, tapering gently upwards, peronate at first by a somewhat tawny, fibrillose, often reticulate sheath, up to the annulus, fibrillose covering changing quickly to “flame-scarlet” (Ridg.) when handled, whitish within, delicately stuffed by white fibrils then hollow, apex white and naked and unchanging; annulus membranous,

narrow, at first flaring then collapsing, tawny below, whitish above, tinged flame-scarlet when disturbed; odor none; taste slightly bitterish; spores $8-9 \times 4-4.5 \mu$, subellipsoid-oblong, smooth, hyaline; cystidia none; basidia clavate, about $30 \times 6-7 \mu$; sterile cells on edge of gills saccate.

Oregon National Forest, Mt. Hood, near Welch's, Oregon. October 5, 1922. Collected by C. H. Kauffman.

Whether this is *L. subfelina* Murrill can not be definitely known. After picking, the plants were laid exposed on a table, when the flame-scarlet tints disappeared and the tawny colors became again noticeable. The flesh and gills do not possess the substance causing the change to red; only the cuticular covering (i.e., the universal veil) of the cap and stem seem to possess this property.

Lepiota cuneatospora, sp. nov.

Pileus 1.5-3 cm. broad, dry, at first obtusely oval, even and uniformly flesh-pink, at length campanulate-expanded, broadly mammillate, umbo pinkish, elsewhere paler to dull cream color, the cuticle glabrous, even or becoming rimulose, sometimes excoriate on margin; flesh white, thin, thickened at umbo, unchanging; gills free, approximate, somewhat truncate-rounded behind, rather narrow or of medium width, crowded, thin, whitish; stem 4-5 (6) cm. long, 2-4 mm. thick, equal, glabrous above and below the annulus, even, hollow, silky-shining, white, flesh-tinted or white within; annulus membranous, erect-flaring, superior or at least above middle of stem, distinct and often with thick edge, white or tinged pink on lower side, fixed or submobile; odor and taste slight or none; spores $7-9 \times 3 \mu$, narrowly wedge-shaped, subtruncate at broad end, with scattered, obscure papillae, hyaline; cystidia none; sterile cells on edge of gills obscure; basidia clavate, about $28 \times 6 \mu$. Gregarious, or forming loose arcs like parts of fairy rings; on grassy ground in a grove of pine. Takoma Park, Maryland. July 22, 1919. Collected by C. H. Kauffman.

The annulus at the time of its formation is continuous below with a very thin evanescent outer layer on the stem. The non-

scaly cap and stem, the peculiar spores, and the distinct but delicate annulus are some of the distinguishing characters. It is related to *L. Boudieri* Bres. and *L. castanea* Quél. Both of these have a scaly cap and stem; the first has a cottony annulus, the latter emits a fragrance of balsam. From *L. fulvella* Rea it differs in stature, color and its smaller spores.

***Lepiota brunnescens* Pk. (Emended)**

Torrey Club Bull., 31: 177. 1904.

Syn. *Lepiota rufescens* Morgan. Journ. Myc., 12: 246. 1906.

Pileus 2–4 cm. broad, fleshy, thin, campanulate-expanded, nearly plane, subumbonate, cuticle at first “pallid vinaceous drab” (Ridg.), soon breaking into concentrically arranged, vinaceous drab, subsquarrose, small, fibrillose scales, which soon become “blackish-brown” (Ridg.), and alternate with the slightly colored flesh between, disk remaining even, glabrous and becoming blackish-brown, margin not striate; flesh thin, soft, whitish or tinged vinaceous, becoming blackened towards the margin of pileus; gills free, thin, crowded, “pallid-vinaceous drab,” rather broad, ventricose, edge white-fimbriate but becoming blackish-brown, or stained blackish; stem 4–6 (7) cm. long, 4–5 mm. thick above, tapering upward from a subelavate base up to 9 mm. thick, stuffed then hollow, cortex rather soft in texture, surface silky, “pallid-vinaceous drab” becoming blackish-stained in age or from handling; annulus median, membranous, at first erect-flaring, subpersistent, concolor, blackening in age; odor fungoid; spores 6–8 × 3.5–4.5 μ ellipsoid, subacute at one end, smooth, hyaline; cystidia none; sterile cells on edge of gills slender, sublanceolate.

On leaf-mold in swamps and grassy woods, Great Falls of the Potomac, Virginia. August 20, 1918.

Originally described from St. Louis, Missouri. *L. rufescens* Morgan, from Ohio, is referred to it by Murrill as a synonym, and this is undoubtedly correct. Murrill reports it also from New York, New Jersey, and California. To quote Dr. Peck, “This singular species when fresh resembles *Lepiota cristata*, but

on drying the whole plant changes color." Since the colors and their changes have not been very accurately described, it seemed best to give a revised description here.

Lepiota pulcherrima Graff (Emended) (Plate XVII)

Philippine Basidiomycetes II. Philip. Journ. Sci. Bot., 9: —. 1914.
 Syn: *Lepiota candida* Morgan (non Copeland). Journ. Myc., 12: 202. 1906.
Limacella albissima Murrill, North Amer. Flora, 10: 40. 1914.

Entire plant white. Pileus fleshy, 1–4 cm. broad, at first subconic-campanulate, expanded-plane, obtuse, subviscid, pellicle thin and very bitter to taste, cuticle on drying sometimes becoming fine silky-sealy or minutely diffracted-sealy, margin not striate; flesh thin, white, unchanging; gills free, approximate, narrow, crowded, edge concolor and entire; stem 5–8 cm. long, tapering gently upward, slightly subfusiform or subclavate, 2–4 mm. thick at apex, 4–8 mm. below, innately silky or fibrillose-seurfy below annulus, pruinose to glabrous at apex, stuffed with silky fibrils then hollow; annulus membranous, erect-flaring, narrow, superior, subpersistent, terminating a thin, evanescent sheath which is subviscid and bitter to the taste; odor none; spores small, 5–6 (7.5) \times 3–3.5 μ , oval-elliptical, smooth, hyaline, often uniguttate; cystidia none; basidia clavate, 30 \times 5–6 μ ; hymenium sharply differentiated from gill-trama.

Among forest debris on the ground, under mixed trees of maple, alder and conifers, Oregon National Forest, Mt. Hood, near Welch's, Oregon. September and October. Collected by C. H. Kauffman and L. E. Wehmeyer.

These plants had the color and other characters of *L. pulcherrima* Graff (= *L. candida* Morg). The very bitter taste of the surface of the pileus and stem in the growing condition, is, however, not known to be present in that species and I have omitted testing for it in collecting *L. pulcherrima* at Ann Arbor. The slightly shorter spores of the Oregon form is the only other difference I know of; those measure 5–6 μ long, while the spores of the Ann Arbor collection are up to 7.5 μ long. It is, however, too close to the latter, and future observations may show that

the eastern plant is also provided with a bitter pellicle. It is known to me from Ohio, Michigan and Oregon.

The naming of this plant has become a slightly involved matter. Morgan found it in Ohio and published it in 1906 as *L. candida*. Meanwhile Copeland had already used this name for a Philippine species in 1905. In the *North American Flora*, Murrill segregated it under *Limacella albissima* in 1914. Finally, the same year, Graff, in his account of Philippine fungi, renamed the plant, calling it *L. pulcherrima*. Since then, Zeller has named a red-capped *Lepiota* from Oregon *L. pulcherrima*, but discovering the error, now suggests *Lepiota decorata* for his plant.

***Volvaria avellanea* (Clem.), comb. nov. (Emended)**

Syn: *Lepiota avellanca* Clem., Bot. Surv. Nebr., 2: 41. 1893.

Volvaria concinna Clem., Bot. Surv. Nebr., 5: 91. 1901.

Volvariopsis concinna (Clem.) Murrill, North Amer. Flora, 10: 142. 1917.

Pileus thin, fleshy, 1-3 (5) cm. broad, at first oval to obtusely subconic and then uniformly "vinaceous-brown" (Ridg.), minutely flocculose-fibrillose, with incurved margin, at length broadly campanulate, subumbonate, dry, with long subdistant striae on margin, the thin cuticle broken into numerous, radiating, appressed, delicate scales, "vinaceous-brown" on disk, scales concolor or paler; flesh white, submembranous, unchanging; gills free, rather broad, subdistant, white, becoming crisped on drying, edge minutely white-flocculose; stem 2-4 cm. long, 1-3 (5) mm. thick, at first conic then tapering slightly upward or equal, stuffed then hollow, slightly mealy or glabrous at apex, white above the inferior, sheathing, thinly membranous and closely appressed, "vinaceous-brown" volva, which frequently disappears early leaving its upper portion on the stem as a low-hung narrow annulus; odor none; spores oval or elliptic-oval, 9-11 (12) \times 5-6 (7) μ , smooth, with rosy tints; cystidia none; sterile cells on edge of gills broadly saccate, obtuse, about 45 \times 12 μ .

In warm greenhouse, Washington, D. C., growing on coconut fiber used as soil, or on soil itself; as *V. concinna*, collected

on moist soil along a river in Nebraska; as *Lepiota avellanea*, on soil in a greenhouse in Nebraska.

This plant, as it appears from time to time in a hothouse, is quite variable. Sometimes the veil is more delicate and the lower part of the volva is not seen and only a slight, vinaceous-tinged annulus occurs. The volva when present is long, cylindrical and sheathes the stem closely, and is easily overlooked; it is a unique volva. The rosy tint of the spores is also easily overlooked. The size of the plant varies quite a little under different conditions for its development. I do not doubt that both the plants described by Prof. Clements belong to the same species. I frequently observed and studied it at Washington. An error in the citation of the date of publication of *Lepiota avellanea*, as given in the *North American Flora*, Vol. 10, page 58, would lead one to the wrong specific name to be applied.

COMMENTS ON CERTAIN SPECIES OF THE SYNOPSIS

LEPIOTA ACERINA PK. (Plate XVIII). — The slender habit of this plant is well shown in the photograph. The veil covering is floccose; on the pileus it breaks into minute, soft scales which are "cinnamon-rufous" to "tawny" (Ridg.); the stem is more or less reticulate from the veil, the minute flocculose scales occupying the connecting points of the reticulum. The photograph was made from plants collected at Ann Arbor, August 14, 1921.

LEPIOTA AMERICANA, *L. BADHAMI*, *L. HAEMATOSPERMA* and *L. MELEAGRIS*. — The general confusion concerning the identities of these four species seems to be promoted by each successive writer. Bresadola (*Fung. Trid.*, 2: 83.) combined the first three species. It now appears that *L. americana* is distinguishable from *L. haematosperma* by its white spores and smaller size. If Rea's description of *L. Badhami* is conclusive, then that species is mainly separable from *L. haematosperma* by the flesh at length becoming black, by its truly bulbous instead of ventricose stem, and by its smaller size. It is to be noted that *L. haematosperma* Bull.-Bres. appears under the name *L. meleagris* in Ricken's book; *L. Badhami* is considered a synonym. But

L. meleagris, the specific name of which was applied by Sowerby, ought to be known in England, if anywhere. Rea's account (13) of the plant therefore deserves attention. It appears to be relatively a much smaller plant than any of the others; the scales on the cap are minute and black, and the annulus is "very fugacious." It has no relationship to such species as *L. brunnescens* Pk. or *Psalliota echinata* Fr.

LEPIOTA ACUTAESQUAMOSA, *L. ASPERA*, *L. FRIESII* and *L. HISPIDA*. — What one is to believe among the conflicting opinions concerning the identity of these four species, is difficult to decide. Fries gives his mature opinion in *Hymen. Europ.*, 1874, where he recognizes the specific distinction of *L. acutaesquamosa* Weinm., *L. hispida* Lasch and *L. Friesii* Lasch. In a note under *Amanita aspera*, he refers to the Persoon species "*Agaricus asper*" as one involved in confusion. In *Monographia*, Vol. I (1857), p. 23, he says *L. Friesii* has not yet been collected in Sweden. Quélet and Battaille (12), on the other hand, recognize *Lepiota aspera* of Persoon, and practically make *L. acutaesquamosa* Weinm.-Fr. a synonym of it. They also recognize *L. hispida* Lasch, but do not mention *L. Friesii*. According to their descriptions, *L. aspera* has forked gills, while the gills of *L. hispida* are simple. Gillet, in *Champignons de France*, 1874, includes *L. acutaesquamosa* Weinm. and *L. hispida* Lasch and assigns to them simple gills, recognizing *L. Friesii* Lasch as a species with forked gills. Ricken (14) considers *L. acutaesquamosa* Weinm. as a synonym of *L. Friesii* Lasch, including only the latter and *L. hispida*. He gently brushes away certain difficulties by including in the description of each of these species the words "bisweilen gabelig." C. G. Lloyd (*l. c.*) also combines *L. Friesii* and *L. acutaesquamosa* by the use of the magic words: "sometimes gills are not forked, sometimes few forked, and often many forked." Morgan (*l. c.*) recognizes Persoon's name, *L. aspera*, and reduces *L. acutaesquamosa* and *L. Friesii* to synonymy. Morgan's method of side-stepping the gill-character in question is to omit stating whether they are simple, forked or either. Rea (13) italicizes the word "branched" in describing the gills of *L. acutaesquamosa* and omits italics for it in *L. Friesii*.

In the account of *L. hispida* no mention is made of the matter. Finally, Murrill, in the *North American Flora*, tries to solve the puzzle by including all these names except *L. hispida* in the doubtful species of Persoon, viz., *L. aspera*. The gills are said by him to be "sometimes forked."

What would you! I have selected this detail out of the history of systematic mycology in order to illustrate the psychology of the taxonomist when he is confronted with the question of the identity of some of the older species. I must admit that I have no final answer to the questions involved above. However, certain points stand out from the summary.

Apparently *L. hispida* is unknown in the United States. There seems to be no question that the gills are always simple in this case. It is known, if at all, to the French mycologists and those of southern Europe. It is, therefore, to be looked for in the southern half of our country. Lange (9) suggests that *L. fusc squamea* Pk. corresponds to it, but see remarks on that species below.

As to *L. aspera* Pers., it would seem that the conclusion of Fries, mentioned before, is the only tenable one. The name should be deleted.

With regard to the gill-forking of the two species, *L. acutae-squamosa* and *L. Friesii*, I can only cite my own observations, namely, that collections show gills either abundantly branched or that they show no branching except very scantily, and not at all in the normal manner. Whichever name may be selected for the forked-gill type of plant, I feel convinced that this is a genetic characteristic that holds, and that we have these two species in this country.

LEPIOTA ARENICOLA Pk. — This name is given in Quélet & Battaille's monograph as *L. arenicola* Mén., but I have been unable to locate the original description or its authorship.

LEPIOTA ASPERULA Atk. and L. ERIOPHORA Pk. — The former was described in 1901, the latter in 1903. Morgan in 1906 reduced *L. eriophora* to synonymy under Atkinson's species. Peck (*N.Y. State Mus. Bull.*, 116: 25, 1907) objects to the procedure of Morgan by pointing out the differences between the two spe-

cies. He says *L. eriophora* "differs from *L. asperula* Atk., by its smaller size, darker brown color, the denser crowded scales of the pileus and especially by the copious brown tomentum of cap and stem, a character suggestive of the specific name." The spores of both are minute and measure about $4-5 \times 2-3 \mu$. Murrill has reduced both species to synonymy under *L. aspera*, which includes *L. acutaesquamosa*, an opinion which in my judgment is unsupportable. The spore sizes of these two species make any such synonymy untenable.

LEPIOTA CAERULESCENS Pk. — *L. Bucknallii* differs from this chiefly by the fugacious annulus, strong odor of gas tar and perhaps more narrow spores. Morgan puts it under *L. virescens* Speg.

LEPIOTA CLYPEOLARIA Fr. — The supposed variability of this species is still a complex problem. Some have lumped all the forms described into one species, while others have just as assiduously segregated the group into many species. The present tendency is conservative, and the elimination of *L. metulaespora* B. & Br., an Indian species, will save much speculation.

LEPIOTA ERMINEA Fr. — According to Bresadola (*Fung. Trid.*, I: 15.) this species has been largely misunderstood in Europe, and he points out that the figures hitherto referred to *L. erminea* Fr. belong to *L. clypeolaria* var. *alba* Bres. (in this paper given as *L. alba* (Bres.) Sacc.) and that the genuine *L. erminea* Fr. can be known easily by its very campanulate pileus and pungent radishy taste.

LEPIOTA FELINA Pers.-Ricken. — The erroneous idea which many American students have had, that this species is about the same size as *L. clypeolaria*, *L. fuscusquamea*, etc., is probably responsible for the fact that it is practically unknown in this country. It has been reported frequently but as Murrill suggests (10), such reports likely had to do with *L. fuscusquamea* or other species. That it is even poorly known in Europe is shown by the conflicting accounts of spore size and shape given by different authors. The account given by Ricken (14) appears to fit Persoon's plant the best of any of them. The scales of the cap are appressed, minute, and black, and its spores are fusiform.

LEPIOTA FUSCOSQUAMEA (Pk.) Sacc. — In *Agaricaceae of Michigan*, p. 633., I reported a plant collected in northern Michigan, as *L. felina* Fr. This I now consider to be *L. fuscossquamea* Pk. I have since collected the latter species in the Adirondack Mountains, and am convinced that the spore size given by Peck is misleading, and should be $6-8.5 \times 3.5-4 \mu$. In the *North American Flora*, Murrill assigns spores to it, smaller even than the size given by Peck. Lange (9) tried to unite this species with one he collected in Europe and which he considered to be *L. hispida* Laseh. The spore size of Lange's plant is given as $5-6 \times 2.75-3 \mu$, and the shape oval, hence the two species cannot be combined. Although it may be thought a fine distinction, it may be worth while to point out that the spores of *L. acutae-squamosa* and *L. Friesii* in this country, are constantly at least one micron less in width than in *L. fuscossquamea*. Its gills are simple. The floccose covering on the stem is dense and breaks up into erect, conical, blackish scales. This blackish color is distinguishing.

LEPIOTA GRACILIS Pk. and "LEPIOTA GRACILIS" Quélet. — Peck's name apparently antedates the use of the name by Quélet for his variety of *L. clypeolaria*. Both Lange (9) and Rea (13) seem to have missed this use as a varietal name, since they have raised Quélet's variety to the rank of a species, crediting Quélet with it. (See *Flore Monographique des Amanites et des Lépiotes*, p. 66.) Peck's species is remarkable for the small size of the plant which is said to have a conspicuous, persistent, membranous annulus. Lange (9, p. 24) has described a plant which he calls *L. gracilis* Quélet. var. *laevigata*. As indicated in the synopsis earlier in this paper, this deserves specific rank and is therefore renamed **L. laevigata** Lange, comb. nov.

LEPIOTA MASTOIDEA Fr. — This is another Fresien species not very well understood in Europe. Since Rea gives the spore characters of the plant which he places here, we can look for it more confidently. The plant described by Morgan (*Jour. Myc.*, 13: 2, 1907) is at least not that of Rea, and probably is a distinct American species. Bresadola (*Ann. Myc.*, 18: 65. 1920) considers *L. porrigens* Viv. a synonym of it. Ricken (14) in-

tinates that *L. mastoidea* may be only a small form of *L. gracilentia*. The fact of the matter is, that various European writers pass along suggestions about a number of species of the *Procerae* group, but rarely make an exhaustive study of any of them.

LEPIOTA PARVANNULATA (Lasch) Fr. — A species scarcely if at all understood in this country. According to Fries, "The only species with which it can be confused is *L. erminea*, which agrees in color and is found in similar places (i.e. in grassy fields), but which is much larger and differs in the superior, torn annulus, the glabrous pileus and its odor of radish."

LEPIOTA SEMINUDA (Lasch) Quél. — This is hardly ever referred to by modern American collectors. Bresadola makes the suggestion (*Ann. Myc.*, 18: 64. 1920) that *L. cristatella* Pk. is identical. By letter, he had given this opinion to Americans a long while before. Atkinson (3) reproduces excellent photographs of it, from both French and American collections. Murrill (*North American Flora*, 10: 48) includes it. In my opinion, it is nevertheless probable that two distinct forms occur. In Michigan we have the typical form described by Peck, but farther south, especially around Washington, D. C., I have collected a somewhat larger plant which fits the description and figures of *L. seminuda* much better than it does that of the little *L. cristatella*.

COMMENTS ON EXCLUDED OR DOUBTFUL SPECIES*

LEPIOTA ALBO-SERICEA P. Henn. — This name is used by Lange for a plant of which he gives a description. He says it is likely that it is the same species as *L. serena* Fr. and is identical with the larger form of *L. parvannulata* Fr.

LEPIOTA ANGUSTATA Britz.-Morg. — This is too close to *L. cristata* Fr.

LEPIOTA ASPRATA Berk. — Fries, in *Hymen. Europ.*, refers this to *Pholiota muricata* Fr.

* No complete list of possible synonyms or exclusions among the older names, such as are mentioned by Saccardo, can be given here. However, an attempt is made to include most of the names that have been used for discarded species in this country, as well as certain ones from Europe.

LEPIOTA ARIDA (Fr.) Gill. is *Amanita arida* of the *Icones* of Fries. Rea includes it among the Lepiotas, but it is surely a better *Amanita*.

LEPIOTA ATROCROCEA W. G. Smith. — No microscopic characters are reported for this species.

LEPIOTA CONCENTRICA Murrill. — Referred to *L. fuscosquamia* Pk. as a synonym by Murrill himself.

LEPIOTA CULTORUM B. & C. — This species was named in 1853 from South Carolina, but has remained unknown to mycologists since that time.

LEPIOTA DAUCIPES (B. & M.) Morg. is more likely an *Amanita*.

LEPIOTA DELICATA Fr. was referred to the genus *Armillaria* by Boudier. Rea reports it as having globose spores, 5–6 μ in diameter. Schweinitz and Morgan reported the species from the United States.

LEPIOTA DRYMONIA Morg. — No specimens are in existence and its spore characters are unknown.

LEPIOTA ECHINATA (Roth.) Quél. — This little species, with red-tinted spores, I have kept in the genus *Psalliota*. (See *Agaricaceae of Michigan*, I. 245.)

LEPIOTA FRAGILLISSIMA (B. & Rav.) Morg. — It was originally described in the genus *Hiatula*. The spore characters are unknown.

LEPIOTA FULVA STRA (B. & C.) Sacc. — This species is too poorly known to be retained.

LEPIOTA HAEMATOSPERMA (Bull.) Boud. is another name for *Psalliota echinata* Fr.

LEPIOTA JANTHINA Cke. — Ricken considers this to be the same as *L. castanea* Quél.

LEPIOTA MAGNISPORA Murrill. — This was described by Murrill from the Northwest, in 1912; later he published it as a synonym of *L. clypeolaria*. Its spores were given as 15–18 \times 4–5 μ in size, oblong-fusiform in shape.

LEPIOTA MAMMAEFORMIS Underw. — The type collection of this came from Alabama. It is made a synonym of *L. cepae-tipes* by Murrill.

LEPIOTA METULAESPORA B. & Br. — A species described long ago from India. European and early American mycologists referred certain of their collections to it, and the name has persisted in the literature up to within a few years. It is now generally agreed that the name and the species have no place in the floras of Europe and North America. It is therefore surprising to see it emerge once more in Lange's recent paper on the genus.

LEPIOTA NARDOSMIOIDES Murrill. — This is an anomaly in the group. The umber tint to the spores indicates that it needs further study. It was found in a redwood forest in California.

LEPIOTA PELIDNA (B. & Mont.) Sacc. — This is not sufficiently understood. The original plants grew on fallen trunks. In spite of its habitat, it is very likely an *Amanita*.

LEPIOTA PERMIXTA Barla. — Rea who includes this in his book, gives its spore-size as $12-20 \times 8-12 \mu$. This spore-size is also given in Saccardo's *Sylloge*. The original description of the spores suggests that it is probably not white-spored. It is described from southern France.

LEPIOTA PINGUIS Fr. — The spore characters are unknown. It was probably introduced into Sweden, since Fries collected it from pine wood not native to that country.

LEPIOTA POLYPYRAMIS (B. & C.) Morg. — Presumably an *Amanita*.

LEPIOTA POLYSTICTA Berk. — The minute globose spores, along with some other characters, suggest a different genus.

LEPIOTA PROMINENS F. — Morgan and others consider this a synonym of *L. porrigens*.

LEPIOTA PYRENAEA Quél. is *Pholiota aurea* Fr., according to Maire.

LEPIOTA RADICATA (Pk.) Morg. is *Amanita radicata* Pk.

LEPIOTA SERENA Fr. — This is one of the Fresian species about which little has become known. Boudier suggests that it is *Armillaria subcava* Schum. Bresadola makes *L. brebissonii* Godey a synonym of *L. serena*.

LEPIOTA SISTRATA Fr. — Not recognized as a rule by modern mycologists.

LEPIOTA SORDESCENS B. & C. (as Agaricus). — Referred to *L. cepaestipes* by Murrill.

LEPIOTA SUBREMOTA B. & C. (as Agaricus). — This has apparently not been recognized since it was named. Murrill refers it to *L. cepaestipes*, while Morgan makes it a synonym of *L. mastoidea* Fr.

LEPIOTA SULPHURINA (Clements) Sacc. — This seems to me, from its description, to have the characters of an *Amanita* with pulverulent volva.

LEPIOTA VITTADINII Fr. — Intermediate between the genera *Lepiota* and *Amanita*, verging toward the latter.

LEPIOTA XYLOGENUS Mont. — As shown by Murrill (*Mycologia*, 6: 151. 1914), there is no dependence to be placed on the meaning of the specific name in this case. It was collected in Hawaii.

UNIVERSITY OF MICHIGAN

LITERATURE CITED

1. ATKINSON, G. F. 1914. The Development of *Lepiota clypeolaria*. *Ann. Myc.*, 12: 346-356.
2. ——— 1914. Homology of the "Universal Veil" in *Agaricus*. *Mycologisch. Centrallbl.*, 5: 13-19.
3. ——— 1916. The Development of *Lepiota cristata* and *L. seminuda*. *Mem. N. Y. Bot. Gard.*, 6: 209-228.
4. FRIES, ELIAS MAGNUS. 1821. *Syst. Myc.*, I: 19.
5. ——— 1857. *Monographia*, I: 17.
6. ——— 1874. *Hymen. Europ.*, p. 29.
7. KAUFFMAN, C. H. 1918. *Agaricaceae of Michigan*, I: 625.
8. ——— 1922. The Genus *Armillaria* in the United States and its Relationships. *Papers Mich. Acad. Sci. Arts and Letters*, II: 53-67.
9. LANGE, JAKOB E. 1915. Studies in the Agarics of Denmark, Part II. *Dansk Botanisk Arkiv.*, 2: 13.
10. MURRILL, W. A. 1914. *North American Flora*, 10: 40-64.
11. QUÉLET, LUCIEN. 1886. *Ench. Fung.*, p. 5.
12. QUÉLET, LUCIEN, ET BATAILLE, FRÉDÉRIC. 1902. *Flore Monographique des Amanites et des Lépiotes*, p. 44.
13. REA, CARLTON. 1922. *British Basidiomycetes*, p. 64.
14. RICKEN, A. 1914. *Die Blätterpilze Deutschlands*, I: 314.

LEPIOTA OLIVACEA, SP. NOV.



PLATE XVI



LEPIOTA FUISPORA, sp. nov.

PLATE XVII



LEPIOTA PULCHERRIMA

PLATE XVIII



LEPIOTA ACERINA

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QK605 .K35 gen
Kauffman, Calvin He/Russula, Gomphidius,



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