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# *North American Species of Gymnopilus*

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# NORTH AMERICAN SPECIES OF GYMNOPILUS

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## INTRODUCTION

### *Acknowledgments*

This study has been supported by a grant from the National Science Foundation, to which due acknowledgment is made for its encouragement through financial assistance.

For the many collections of *Gymnopilus,* including type specimens, made available on loan, the following institutions and officials are recognized with my gratitude: British Museum (Natural History), London, and Mr. R. Ross; Royal Botanic Gardens, Kew, and Sir George Taylor; Naturhistöriska Riksmuseet, Stockholm, and Dr. Sten Ahlner; Instituto de Botanica Spegazzini, La Plata, Argentina, and Dr. Juan C. Lindquist; The University of Florida, and Dr. James Kimbrough; Harvard University (Farlow Herbarium), and Dr. I. Mackenzie Lamb; The University of Massachusetts, and Dr. Howard E. Bigelow; The New York Botanical Garden, and Dr. Clark T. Rogerson; The New York State Museum, and Mr. Stanley Jay Smith; San Francisco State College, and Dr. Harry D. Thiers.

As always, the writer is especially indebted to Dr. Alexander H. Smith, The University of Michigan, for his encouragement and help throughout this study. All his collections and photographs of *Gymnopilus* were made available; and, he has taken time to read the manuscript critically.

Through the continued courtesies extended me by Superintendent George W. Fry, The Great Smoky Mountains National Park, and its Chief Naturalist, Mr. Vernon R. Bender, Jr., it has been my privilege to carry on essential field work in that rewarding preserve.

### *Explanations and Abbreviations*

Color names in quotation marks are from Ridgway, Color Standards and Color Nomenclature, Washington, D. C., 1912. This volume, now out of print, was published by its author.

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In many of the species studied, only the type collection was available. In these instances the descriptions were based on my study of the type.

The herbaria in which exsiccati are deposited are indicated by the abbreviations recommended in Index Herbariorum, except those of Smith, which are on deposit in The University of Michigan Herbarium, and those of Hesler, which are in The University of Tennessee Herbarium.

The photographs are reproduced natural size unless otherwise indicated; the drawings of cystidia at × 1000, and the spores at × 4000.

Some abbreviations used: GSMNP, Great Smoky Mountains National Park; SFSC, San Francisco State College; pl, pleurocystidia; ch, cheilocystidia; pileo, pileocystidia; caulo, caulocystidia.

## GENERAL CONSIDERATIONS

### HISTORY

The genus *Gymnopilus* embraces species most of which in the past half-century have been attached to *Flammula* and *Pholiota,* and a few to *Naucoria* and *Cortinarius.*

In a narration of events leading to the establishment of the genus *Gymnopilus,* it is relevant to begin with the work of Fries (**1821**). In Volume I of *Systema Mycologicum,* under the broad genus *Agaricus* (subgenus *Cortinarius,* tribe *Dermocybe*), Fries established subtribe 4, *Lignatiles.* Under this subtribe, he described two species: (1) *Agaricus sapineus,* to which he attached forma *penetrans* and forma *hybridus;* and (2) *A. picreus.* Both species are now placed in the genus *Gymnopilus.* Fries, in the same volume, established tribes *Pholiota* and *Flammula,* but nearly all of the species treated by him are now excluded from the genus *Gymnopilus.* From these facts, it is evident that Fries saw in the species *A. sapineus* and *A. picreus* an apparent affinity to *Cortinarius,* and he held these species to be more distantly related to *Flammula* than to *Cortinarius.*

However, in *Epicrisis Systematis Mycologici,* **1838,** Fries changed the status of *Flammula* from tribe to subgenus, and to it he transferred both *A. sapineus* and *A. picreus.* At the same time, he also described six additional species under the subg. *Flammula,* as follows: *A. stabilis, A. penetrans, A. hybridus, A. harmoge, A. liquiritiae,* and *A. limulatus.* Thus, by 1838, he had decided that *A. sapineus* and *A. picreus* (and some others) belonged, not to *Cortinarius,* but to *Flammula.*

Again, in *Systema Mycologicum,* Fries (**1821:** 240) characterized tribe *Pholiota* as having a membranous or floccose-radiate, annuliform veil; and in the same work (**1821:** 250), he distinguished tribe *Flammula* by a fibrillose, fugacious veil. Finally in *Hymenomycetes Europaei,* he (Fries, **1874**) described *Flammula* with some species lacking a veil, and in others having a fibrillose

veil. Shortly before, Kummer (**1871**) had given generic status to both *Pholiota* and *Flammula.*

Another arrangement was proposed by Quélet (**1886**) who established the genus *Dryophila,* with *Pholiota* and *Flammula* as subgenera. As Donk (**1962**) has stated, "*Dryophila* is merely a new name for the fusion product of two pre-existing genera of which Quélet retained the names as infrageneric epithets." Under subgenus *Flammula,* sect. III. *Sapineae,* Quélet lists and briefly describes six species which are now placed under *Gymnopilus.*

At last, the genus *Gymnopilus* was proposed by P. Karsten (**1879**), and was based on *Flammula liquiritiae* and *F. picrea.* In the past few years, the species assembled under *Gymnopilus* include those which Fries (**1838**) placed under his tribe *Sapinei* of *Flammula.* Today, *Gymnopilus* embraces those species in which the spores are ferruginous to yellowish brown, rough, and without a germ pore, and in which a veil is absent in some, or present and fibrillose-fugacious in others, or membranous and persistent (see fuller characterization on page 17).

In the *North American Flora* Murrill (**1917**) treated under *Gymnopilus* either viscid or dry species, with either smooth or rough spores. It is, therefore, understandable that, of the eighty-five species which he recognized, Murrill included many species which today are placed under several genera, to wit: *Gymnopilus* 26 species, *Pholiota* 39, *Galerina* 4, *Agrocybe* 3, *Cortinarius* 2, *Hebeloma* 2, *Conocybe* 1, *Paxillus* 1, and those of doubtful relationship 7 (see list beginning on page 83). Among Murrill's contributions to knowledge have been his descriptions of twenty valid new species of *Gymnopilus,* and his citations to other original descriptions (**1917,** and subsequently).

More recently, Romagnesi (**1942**) proposed the generic name *Fulvidula.* He further proposes infrageneric groups, namely *Annulatae,* embracing species with a membranous persistent annulus; and *Cortinatae,* including some species with a slight, fugacious cortina, or a cortina sometimes lacking. His description of *Fulvidula,* however, lacked a Latin diagnosis, and his proposal, therefore, is invalid.

Singer in his "Agaricales" (**1951a**) presented a broad compendium of *Gymnopilus*. In it, he gave a full statement of the characters of the genus, a discussion of relationships to other genera, and an enumeration of species of world-wide distribution. These species were assigned by Singer to one of two sections, namely, *Annulati* and *Sapinei* (the latter called *Gymnopilus* in his revised edition, **1962**). His treatment (**1951a**) of the genus concluded with a key to some twenty-seven entities.

The unpublished doctoral thesis of Harding (**1952**), The University of Michigan, under the guidance of Dr. Alexander H. Smith, is a worthy contribution to the systematics of *Gymnopilus.* He was moved to study American species of this genus because of a very present need: no critical studies on North American species were available. His thesis took the modern approach,

and it constituted the first work in which extensive use is made of micro-characters of the basidiocarp—the cuticle, context, hymenium, and the spores—in the delineation and recognition of species. Other features of Harding's thesis are summarized, as follows:

(1) His key to species makes primary use of habitat, the absence of, or the presence and the nature of cheilocystidia, taste of pileus, structure of the pileus cuticle, and the presence or absence of an annulus. (2) Because of a broad species-concept, he recognizes only twenty-one species. His descriptions of several species have been expanded to admit some entities which, in my studies, are recognized as distinct taxa. (3) From a study of types, Harding separated the species of *Gymnopilus* from other related genera, and he assigned a number of relevant species to their currently accepted genera.

Kühner and Romagnesi (**1953**) in a descriptive key presented twelve species for central and eastern Europe and northwestern Africa. It is a helpful treatise for the regions covered, and is also of value for comparisons with North American species.

Moser (**1955**) presented a key to nine species, those known to him from Central Europe. In his revised publication (**1967**), he expanded the key to include fifteen species.

## MATERIALS STUDIED

According to my records, eight-hundred fifty collections have been examined in this study. Materials available have come from several areas of the United States, and a more limited number from Canada, the West Indies, and Europe.

By far the greatest number of North American collections have been available from the Herbarium of The University of Michigan. Collections there, taken by Dr. Alexander H. Smith and scores of his students and correspondents, have provided an excellent representation from Michigan, the Rocky Mountains, the Pacific Northwest, and the Southwest.

From other geographic regions, collections have been available and studied, as follows: (1) from northeastern United States, especially Maine and Massachusetts, collections by Dr. H. E. Bigelow; (2) from New York, material collected by Peck and Murrill; (3) from Florida and the West Indies, again by Murrill, and by Earle; (4) from California, and the Gulf Coast states, nearly one hundred collections by Dr. H. D. Thiers; (5) from the Southern Appalachian region, especially North Carolina and Tennessee, including the Great Smoky Mountains National Park—my own collections.

From Sweden, a limited number of exsiccati, particularly those of Romell, Lundell, and Nannfeldt, have been studied and found helpful in formulating concepts of certain European species.

Finally, all available North American types of *Gymnopilus* and certain related genera have been examined; and also a few type collections from England and Argentina.

## THE BASIDIOCARP

### *Macroscopic Features*

### *The Pileus*

The size, shape, color, and surface characters of the pileus (compare FIGS. 109–125) provide assistance in distinguishing some species and groups. Likewise, color, odor, and taste of the pileus context may also be of value, particularly when coupled with other characters.

*Size.* In a large number of species, the pileus is 2–5 cm broad; in some other species it is smaller (0.6–1.5 cm); and in still others larger (5–10–15 cm). Emphasis placed on size in separating species depends on the numbers of collections observed, and the geographic range of these collections. The size of the pileus may be useful if joined with other characters.

*Shape.* The young pileus in *Gymnopilus* is convex, but in nearly all species, it expands during growth to maturity. In a few species, the pileus may be umbonate, especially at first; in others, characteristically it may become depressed to umbilicate (e.g., *G. hispidus*). In general, features of shape have been used only to a limited extent here in separating taxa.

*Color.* The range of pileus colors displayed by species is considerable, although in a majority the colors are in the yellowish and brownish series. More rarely the pileus is greenish when young, as in *G. aeruginosus* which changes colors with maturation; becoming greenish as it develops in *G. punctifolius;* staining green where handled, in *G. viridans;* or drying greenish, *G. luteoviridis.* In *G. luteofolius,* the young pileus is dark-red and later fades to pinkish then yellowish. In squamulose species, the scales may be concolorous to the pileus surface; or differently colored (reddish or purplish scales in *G. peliolepis* on a pale yellow base; red to orange scales on a buff to tawny base, in *G. rufosquamulosus*). The color may be uniform throughout the pileus surface, or the central portion may be different from that of the rest of the surface. Color is important in species diagnosis, and when used in contrasting extremes is most valuable (e.g. in *G. peliolepis* the scales are purplish, in contrast to those in *G. fulvosquamulosus* which are tawny).

*Other Features.* Among the species studied, the character of the pileus surface offers some basis for making distinctions at the species level or for higher taxa. The pileus in a number of species is glabrous, or it may become so during maturation. It is, therefore, desirable to observe, under a lens, young as well as mature pilei, to determine the condition characteristic for the species.

In a larger number of species, the surface may be fibrillose or it may be scaly. The scales may be generally distributed over the pileus surface, or localized on the central portion. Other conditions encountered vary according to hyphal arrangement: virgate (striped or streaked radially by repent, differently colored fibrils, as in *G. spectabilis* and *G. magnus*); pilose (as in *G. chryso-*

*trichus*); with flat or repent scales or erect and stiff (hispid, as in *G. dryophilus, G. praefloccosus, G. hispidus*). In an occasional species, short pileocystidia are clustered and macroscopically appear as mounds (*G. melleus*). In a few species, the surface becomes areolate (in *G. aeruginosus,* sometimes in *G. sapineus,* and on the pileus center in *G. areolatus*). In an occasional species the margin of the pileus is at times striate or even sulcate, especially in age or when dry (examples: *G. parvulus, G. fulgens, G. chrysopellus, G. chrysotrichioides*).

The extent to which species are hygrophanous is a problem which needs further attention. In some descriptions, this character is not mentioned by the authors; and apparently no author, including the writer, has given adequate attention to this character. For the present it may be said that typically the species of *Gymnopilus* are not hygrophanous.

The use of gross features (size, color, surface) of the pileus in distinguishing entities in *Gymnopilus* should be based on constant and contrasting conditions: very small or very large; noticeably different color-series; and obvious differences in surface-ornamentation (fibrils, mounds, scales). When species appear similar in their microscopic characters, they may still be separated on a basis of certain macroscopic features.

At times the pileus context offers characters of value in taxonomy, but these characters are usually used to supplement others. The color of the context is commonly similar to that of the pileus surface. The context color in *G. amarissimus* is pale-yellow, but darkens where bruised—a character of supplementary value. The odor in most *Gymnopilus* species is mild; but occasionally a distinctive odor is present. In *G. humicola,* it may be aromatic; in *G. praelaeticolor,* fragrant; in *G. flavidellus,* it is sometimes raphanoid. Odors may not be constant in a species, so that taxonomic use of them is limited. Taste, on the other hand, is bitter in many species of *Gymnopilus,* and is more constant for the species than is odor. In several species, the taste is mild; or farinaceous (*G. praelaeticolor*); or sweet (*G. fulgens*), and these characters have supplementary value in species recognition.

## *Lamellae*

In most species, the gills are adnate or adnexed; in some they are emarginate, and in a few they are decurrent. The typical color-pattern is at first some shade of yellow, then becoming ferruginous or tawny at maturity. In a very few species, the lamellae are at first white (*G. braendlei, G. pulchrifolius*), then darkening to yellowish or brownish with aging.

Color changes on bruising are observed in the gills of a few species: the yellowish gills of *G. melleus* and *G. humicola* become brown where bruised; the buff gills of *G. aurantiophyllus* become rusty orange; and the yellowish olive to "Isabella color" gills of *G. punctifolius* become dotted on the sides and edges with yellow to ferruginous stains. At times, without bruising, the lamellae of *G. penetrans* and *G. liquiritiae* become reddish brown spotted toward maturity.

All these features of colors and color-changes should be noted in the fresh state, and will be found useful in combination with other characters in identification.

The spacing and width of the lamellae are also worth noting. Gills may be close or crowded, distant or subdistant; extremes in spacing have value in the separation of otherwise related species. In most, the gills may be described as medium broad; in those with either narrow or broad lamellae, supplementary use of this character can be made.

### *The Stipe*

The *Gymnopilus* collections studied are usually centrally stipitate, rarely eccentric. The size of the stipe varies with the species, and generally is correlated with cap size. It is usually cylindric and equal, although in a few it may taper up, or in others, may taper down. In *G. ventricosus* the stipe is ventricose and radicating; and in *G. subtropicus* is clavate.

The stipe is usually concolorous or subconcolorous with the pileus—of yellowish to tawny tints. On the other hand, it is white in *G. abramsii* in contrast to its grayish brown pileus, and also white in *G. subsapineus,* in which the pileus is yellow. The stipe of *G. sordidostipes* darkens, the process taking place from the base up. In some other species color changes occur on bruising: the color of the stipe becomes ferruginous in *G. amarissimus;* it is buff, and becomes brown where bruised by handling in *G. humicola* and *G. sapineus,* and the yellow stipes of *G. melleus* and *G. flavidellus* become brown where bruised.

The stipe surface may be glabrous or glabrescent, or silky to fibrillose, or scaly—according to the species. The apex may be provided with mealy, pulverulent, or pruinose ornamentations—again according to species. Very often caulocystidia, but not always, are component elements in such ornamentations

The various features of the stipe summarized above are constant enough to offer uses, especially as supplementary characters, in separating species.

### *The Veil*

The presence and behavior of a partial veil (FIG. 116), or its absence, constitute important taxonomic characters in *Gymnopilus.* When present and membranous and more or less persistent, the species is here referred to the subgenus *Annulati;* and when fibrillose, cortinate, or arachnoid, and more or less fugacious, or even absent, the species is assigned to the subgenus *Gymnopilus* The majority of the species studied belongs to members of the latter subgenus, in several species of which a veil is absent.

One of the unresolved problems of the veil is its origin and persistence. Harding (**1952**), in his study of basidiocarp development in *G. fulvosquamulosus* (called *G. praefloccosus* by him), concluded that a universal veil is present and that, on rupturing, it leaves some of its remnants on the stipe as an annulus. Thus, under Harding's interpretation, the annulus is derived solely

from the universal veil rather than from a partial veil. An evaluation of his conclusions can best be made only after an extended study of this problem.

The persistence of the annulus is sometimes variable, and is a problem, at least for the novice, even in species in the subgenus *Annulati.* Thus, different descriptive terms are used, such as "usually persistent," "subpersistent," or "persistent at least when young." On the other hand, in a few species of the subgenus *Gymnopilus,* the veil, although fibrillose, may be heavy, and when it is laden with spores, one might mistake it for a persistent annulus. In several species, the veil is membranous, at times heavy, and persists as a conspicuous annulus (Figs. 109–111).

The nature and behavior of the veil, when present, is of great importance in identification, and a correct interpretation of it is essential.

### *Habitat*

One of the characteristics of *Gymnopilus* species is their lignicolous habitat (Figs. 109, 114, 125). A few are terrestrial (*G. abramsii, G. angustifolius, G. arenicola, G. fulgens, G. humicola, G. terrestris*). One of these, *G. fulgens,* usually grows on peaty or burned-over soil.

Some lignicolous species are found on both hardwood and coniferous wood (e.g. *G. aeruginosus, G. flavidellus, G. liquiritiae, G. penetrans, G. sapineus*); others are more specialized, and apparently are thus confined to one or the other habitat. A few tropical species are found on palms, and at least one is known on orchids (*G. palmicola*). When collecting, one should note whether the basidiocarps are lignicolous or terrestrial, since this feature is usually of value supplementary to other characters in species recognition.

### *Habit of Growth*

As in other agaric groups, the basidiocarps of *Gymnopilus* vary, according to species, in their growth habit. In many, the fruiting bodies are scattered, or even grow singly; or they may be gregarious. Finally, a few species grow in clusters. Included in a list of those which are cespitose are *G. aeruginosus, G. areolatus, G. chrysopellus, G. dryophilus, G. magnus, G. spectabilis, G. underwoodii.* The cespitose character, especially, is of some value in species-recognition, but must either be coupled with additional characters, or employed in contrast to a scattered habit of growth.

## *Microscopic Characters*

### *Spores*

Size, shape, and ornamentation of spores and their reaction to certain chemicals are important considerations in taxonomy.

*Size.* In the species of *Gymnopilus* studied, the spores range in size from small to medium large, from a minimum length of 3.5 $\mu$ to a maximum of 12.5 $\mu$.

In measuring spores, the length and diameter include the ornamentations. In the subgenus *Gymnopilus*, section *Microspori*, the spores of *G. bellulus*, *G. rufescens*, and *G. sub-bellulus* are small, 3.5–5.5 × 2.5–3.5 μ; and in *G. bryophilus* and some others they measure about 5.5–7(–7.5) × 3.5–4.5 μ. On the other hand, the spores of species in section *Gymnopilus* are larger, 6–8 or 7–9(–10) μ in length. Finally, the spores of *G. subspectabilis* in the subgenus *Annulati*, attain a length up to 12.5 μ. Spore dimensions are useful in taxonomy at the section level, and at times in the separation of species and groups of species.

*Shape*. In a majority of species the spores are ellipsoid in face view, but often noticeably inequilateral in profile (FIGS. 1–30). In a few species they are subglobose to ovoid (FIGS. 23–26), and more rarely amygdaliform, or nearly pip-shaped (*G. rufescens*). Typical of the genus, the spores lack a germ pore, and are not truncate; in contrast, a germ pore is present in *Pholiota*. Spore shape has not been found generally useful in distinguishing species nor groups, except as a supplementary character.

*Ornamentation*. The epispore in all *Gymnopilus* species is rough—a character which, together with the lack of a germ pore, aids in distinguishing *Gymnopilus* from *Pholiota* (compare FIGS. 1–30).

The epispore ornamentation in a majority of species consists of a wrinkling, without any loosening, as is found in some species of *Galerina*. In *Gymnopilus fulgens* and *G. imperialis* (FIGS. 29–30), however, the roughness is exaggerated and takes the form of large, conspicuous warts. Intermediate to these two conditions (wrinkles and coarse warts), in a great number of species, the spores are ornamented with less conspicuous warts with interconnecting wrinkles. In most species, the ornamentation is 0.25 μ or less in height, but in *G. fulgens*, it reaches a height of 1.0 μ and in *G. imperialis*, 1.5 μ. The warts are more or less blunt, except in *G. naucorioides*, *G. punctifolius* (FIGS. 20–21) and *G. rufosquamulosus*, in which the ornamentation is subasperulate to wrinkled-echinulate. The spore wall is double, and moderately thick. The apiculus varies in its prominence, and indeed at times appears short. A plage is absent, although at times there seems to be an obscure suggestion of such an area.

*Chemicals and Stains*. In these investigations, the spores of each collection studied have been examined in 2% potassium hydroxide, Melzer's reagent, and cotton blue.

Potassium Hydroxide. Spores mounted in 2% KOH are ferruginous (pale to deep-colored, depending on the species), somewhat the same color as when mounted in water. Usually, spores from exsiccati tend to assume their usual form in KOH—a fact which renders it a satisfactory medium for routine observations.

Melzer's reagent. The formula employed in the preparation of this reagent is that published by Singer (**1962:** 82), as follows: potassium iodide 1.5 g, iodine 0.5 g, chloral hydrate 22 g, water 20 g. With its use on spores, I was

able to determine whether spores are dextrinoid or non-dextrinoid. When the spores in Melzer's reagent become reddish, reddish brown, or purplish, they are said to be dextrinoid, a term proposed by Hora (**1960**), and preceded by the term pseudoamyloid (Singer, **1951a**); if the spores react negatively to Melzer's reagent, they are said to be non-dextrinoid. Accordingly, we have found that about three fourths of all species of *Gymnopilus* studied are dextrinoid, and the remainder non-dextrinoid. It has been learned that in some dextrinoid species, the spores must first be wetted in concentrated ammonium hydroxide ($NH_4OH$), then transferred to Melzer's reagent; otherwise, one may be misled to the conclusion that such species are non-dextrinoid.

In a few species (*G. melleus*, *G. aurantiacus*, and *G. hispidus*) the dextrinoid condition develops slowly, and may be observed only after 3–8 hours in Melzer's reagent. In other dextrinoid species, the reaction is more or less prompt. In some instances the delayed reaction seems correlated with age of the collection; the older the collection, the more slowly the spores stain reddish brown. In other instances, no such correlation was found. Further examination into this problem is desirable.

Finally, the positive or negative reaction of spores to Melzer's reagent is useful to separate groups of species.

Cotton blue. This reagent has been used in these studies to a limited extent as a stain for spores of *Gymnopilus* species. The formula employed in its preparation is that of Kotlaba and Pouzar (**1964**), as follows: cotton blue, 0.05 g, concentrated lactic acid 30 g. Their work serves as a guide in the use of cotton blue. Where the spore-wall or the ornamentation stains blue, these authors propose the term cyanophilic; when the spore wall or the ornamentation does not stain, acyanophilic. A summary of our methods and observations in the use of cotton blue follows:

(1) A gill fragment is placed on a slide in a few drops of cotton blue; (2) the slide is held over the flame of an alcohol lamp and boiled for about five seconds; (3) the gill fragment is transferred to a drop of water or 2% KOH for examination; (4) if some spores are bright greenish, additional heating effectuates cyanophily.

The spore wall and ornamentations are, in most species, stained blue or blackish in cotton blue. In *G. fulgens* and *G. naucorioides*, however, these structures do not stain in cotton blue, even after additional heating, and are thus acyanophilous.

In most of the species of higher basidiomycetes studied by Kotlaba and Pouzar (**1964**), it was learned that the dextrinoid reaction and cyanophily occur together; that is, for the species studied by them, if the spores of a species are cyanophilous, they are also dextrinoid. However, their studies did not include species of the genus *Gymnopilus*. In our experience with cotton blue and Melzer's reagent on the spores of this genus, four possible conditions were found to prevail: (1) species in which the spores were both cyanophilous

and dextrinoid number thirty-three; (2) those cyanophilous and non-dextrinoid, five (*G. armillatus, G. dryophilus, G. luteoviridis, G. rufescens,* and *G. sub-bellulus*); (3) species acyanophilous and dextrinoid, one (*G. fulgens*); (4) species acyanophilous and non-dextrinoid, one (*G. naucorioides*).

### *Basidia*

In most of the species of *Gymnopilus* studied, the basidia are small to moderately so (20–25 × 4–6 μ), but more rarely they are smaller (16–20 μ long), or in a few species larger (30–38 × 7–10 μ). Commonly, the basidia are 4-spored, although in some species they bear 2–4-spores. There is no consistent correlation between the size of the spores and that of the basidia. Although in *G. bellulus* the spores are small (3.5–5.5 μ long) and the basidia small (17–22 × 4–5 μ), in *G. sub-bellulus* the spores are 3.5–5 μ long, the basidia are 22–26 × 4–5 μ. It was noted that the basidia of *G. magnus* at times showed brown contents; and in *G. melleus,* the entire basidial layer stained dark-red in 2% KOH. In these studies, there seemed to be no character in the basidia which could reliably be used to separate species and larger groups.

### *Cystidia*

In all species of *Gymnopilus* thus far studied, one or more kinds of cystidia have been encountered. These are sterile bodies named according to their location on the basidiocarps. They may be found on the edges (cheilocystidia) or on the sides (pleurocystidia) of the lamellae; on the surface of the pileus (pileocystidia), and on the apex of the stipe (caulocystidia).

*Pleurocystidia* (Figs. 51, 54, 57, 59, 101, and others). These bodies, on the sides of the lamellae, interspersed among the basidia, are typically colorless, ventricose, and more or less nine-pin shaped. In a few species they tend to be fusoid, in others clavate, obclavate, or spathulate (Fig. 86), and are more rarely capitate. In size, they measure mostly 25–30 × 5–7 μ, but in a few species they are longer (25–47 × 6–10 μ). In some they were found to be rare and inconspicuous, so that it may become necessary to survey the hymenium of several gill-sections to determine their presence or absence. In most instances, they project only slightly. When present, they are always accompanied by cheilocystidia.

*Cheilocystidia* (Figs. 31, 33, 49, 60, 68, 72, 82, 84). Typically, these bodies, on the gill-edges, are flask-shaped, especially lecythiform, tibiiform, or lageniform, often capitate, and are at times referred to as gymnopiloid type of cheilocystidia. Not infrequently they are longer and more conspicuous than accompanying pleurocystidia. More rarely, in *G. aurantiacus,* they are filamentous-capitate. As stated above, they are often capitate; but in a given species, even in the same section, capitate cheilocystidia may be accompanied by subcapitate and even non-capitate kinds. Thus the presence or absence of

a capitellum on the cheilocystidia is not invariably a useful character in distinguishing entities in this genus. Finally, although cheilocystidia are present in most species of *Gymnopilus,* they are absent (as are pleurocystidia) in *G. terrestris, G. rufobrunneus,* and *G. parvisquamulosus.*

*Pileocystidia* (FIGS. 41, 47, 65, 69, 85, 95). These are morphologically specialized, hyphal-end structures on the pileus surface. They may be terminal to more or less erect hyphae, or they may arise directly from repent cuticular hyphae; in the latter instance, they may occur in mounds, rosettes or tufts, or scattered. As terminal elements, they may be scattered or in tufts. In some species they are colorless, but in others they are brownish, and clavate, subspathulate, or cylindric. The use of pileocystidia in separating entities should be limited. Their occurrence as scattered terminal elements is not constant. On the other hand, when pileocystidia occur in distinct tufts on the pileus surface, they may be of some taxonomic use, especially when employed in conjunction with other characters.

*Caulocystidia* (FIGS. 42, 53, 56, 66, 81, 89, 96). These structures, when present, are found on the surface of the stipe apex. Longitudinal sections reveal their presence or absence. Whenever stipe apices show a scaly or a pruinose condition, the presence of caulocystidia may be suspected. Caulocystidia, like pileocystidia, may arise directly from the stipe surface as tufts or even as a palisade, or they may occur as somewhat scattered elements terminal to surface hyphae. In form, they are ventricose, clavate, or cylindric, and colorless or brown. In some species they are similar in shape to the cheilocystidia. They have been found useful in separating species and groups, particularly when in tufts or palisades.

*Basidioles* (FIGS. 63, 77, 88). These are immature basidia on gill-sides, interspersed in the hymenium and are usually buried, clavate to cylindric, and with brown cell contents. They are erratic in occurrence, but when found we have recorded their presence. Further study may indicate limited taxonomic usefulness, but at present they are not employed to distinguish groups or species.

### *Gill Trama*

The hyphae forming the trama of the gill are typically subparallel in their arrangement. Rarely, if ever, are they either strictly parallel or intricately interwoven. These hyphae tend to be more or less uniform in diameter and cell-length. The rather uniform hyphal arrangement in the gill trama excludes the use of this character in taxonomy. Likewise, hyphal characters of the subhymenium are not sufficiently distinctive to serve in the separation of taxa. In no instance has a gelatinous subhymenium been observed in the species studied. Lactiferous hyphae, although often found in both the gill and pileus trama, offer no assistance in species identification because of their irregularity of occurrence.

### *Pileus Trama*

The hyphae composing the pileus trama are either radial or interwoven in their arrangement. In tangential sections the radially disposed hyphae show as cut-ends, and appear as pseudoparenchyma; a radial section of the pileus will confirm the true radial arrangement. In the interwoven type the hyphae appear interwoven in both radial and tangential sections. In several species of the interwoven type, the hyphae are very loosely arranged, and not infrequently are rather broad.

It is useful in species identification to determine the hyphal arrangement of the pileus trama. In *G. lepidotus,* for example, the trama is radial; in contrast, in the related species *G. subtropicus* the arrangement is interwoven. In *G. picreus* the trama is radial, a character which distinguishes it from some related species (*G. aurantiacus, G. lutescens,* and *G. subdryophilus*). Further study, particularly with fresh material, might indicate more clearly the extent to which pileus trama type is useful in taxonomy; meantime this character is used, judiciously it is hoped, to some extent in species separation.

### *Pileus Cuticle*

The term cuticle, or cutis, implies a distinct covering layer, or zone, on the pileus and stipe. But, the surface zone of the pileus of *Gymnopilus* species may not always be sharply differentiated. In the simplest form, the covering may be only scarcely differentiated from the subcuticular and trama areas, as in *G. mitis, G. lepidotus,* and *G. rufosquamulosus.*

In the more modified forms, the surface hyphae are differentiated to the extent that a well-defined cuticular zone is observed. Often these hyphae are brownish and their walls thickened, and at times incrusted. In many species, more or less erect hyphae develop on the pileus surface. These hyphae are usually brown, at times incrusted, and may be scattered or in tufts. These tufts constitute scales which are evident to the unaided eye. The terminal elements of these hyphae may, in certain species, become morphologically specialized to form pileocystidia. In other species (examples, *G. melleus, G. sapineus*), sections of the pileus cuticle reveal mounds of pileocystidia. In those species in which all surface elements are repent, the pileus is described as glabrous. In contrast to a condition characteristic of some species of *Pholiota,* the cuticular hyphae in *Gymnopilus* do not gelatinize; consequently, we have found no truly viscid or glutinous species in this genus.

The presence or absence of pileocystidia, or other less specialized ornamenting hyphae, have been recorded in these studies, but the nature of the pileus cuticle has not been found useful in critical determinations of species or larger entities.

### *Clamp Connections*

In most if not all species of *Gymnopilus,* clamp connections are present. They may be sought on the cuticular hyphae of the pileus and stipe apex. In

species with scales, clamp connections are frequently conspicuous on the component hyphae. In some species they are small or even rare, and in a very few were not found; in such instances, however, it is hazardous to conclude that they are entirely absent. At all events, their almost uniform presence prevents their use in distinguishing species and other groups.

## INTERGENERIC REATIONSHIPS

The genus *Gymnopilus* and its relatives are members of the family Cortinariaceae. Those distinctive structural features which unite these genera into a family include the brownish clay to ferruginous spore deposits, spores often without a germ pore (but present in all species of *Pholiota* and in some species of *Galerina*) and often with exosporial ornamentation, the usual presence of cheilocystidia and frequent occurrence of a partial veil.

A critical microscopic character of *Gymnopilus* is its rough exosporium; other features are the absence of a germ pore, and the nearly constant gymnopiloid cheilocystidia. Macroscopically, members of the genus are recognizable by their typical lignicolous habitat, and by the non-gelatinous character of all their hyphal systems. The stipitate-pileate habit of growth, the rough, ferruginous spores which lack a germ pore, the repent, filamentous pileus cuticle, and the partial veil—all are distinctive characteristics which mark the kinship of *Gymnopilus* with the genus *Cortinarius,* more particularly the infrageneric groups, *Dermocybe* and *Inoloma* (*sensu* Kauffman, **1932**).

Those generic characters which distinguish *Gymnopilus* from *Cortinarius* embrace, in the latter, the terrestrial habitat, the glutinous to viscid pileus in many species, the presence of a universal veil, frequently well-developed in many of its species, and the brownish to clay colored spores. On the other hand, in view of the number and importance of the structural characters common to both genera, a close natural relationship of one to the other is strongly indicated, as Fries (**1821**) evidently concluded. Finally, it is recalled that a few species of *Gymnopilus* still cling to the terrestrial or humicolous habitat (*G. abramsii, G. angustifolius, G. arenicola, G. fulgens, G. humicola,* and *G. terrestris*); and that in *G. fulgens* and *G. ventricosus* the spores are subamygdaliform and coarsely warty—characters strongly reminiscent of many species of *Cortinarius*. The mature spores, because of their ornamented exosporium, are of diagnostic value at the generic level in both *Gymnopilus* and *Cortinarius*. Likewise, the size of the spores, when extremes of dimensions are contrasted, is of high importance in separating species and groups.

The postulation that *Cortinarius* may be the nearest relative of *Gymnopilus* does not deny at least some relationship with other genera of the Cortinariaceae. Following a comparison of *Gymnopilus* with *Cortinarius,* then, it seems promising to examine the more critical structures in *Pyrrhoglossum, Phaecollybia,* and *Galerina,* and the smooth-spored genera *Pholiota, Phaeomarasmius,* and *Pleuroflammula.* The features of concern in this connection include habit

of growth, habitat, gelatinous or non-gelatinous surfaces, veil, spores, and cheilocystidia.

*Habit of Growth.* It is noted that the basidiocarp of most genera belonging to the Cortinariaceae are centrally stipitate and pileate. It is suggested that this habit of growth and development is, in general, more primitive than the pleurotoid habit found in *Pyrrhoglossum, Pleuroflammula,* and to some extent in *Phaeomarasmius.* The natural relationship between these pleurotoid types and *Gymnopilus* is indicated perhaps more strongly by their lignicolous habitat.

*Habitat.* The range of habitats of these related genera varies from the strictly terrestrial, as in *Cortinarius,* to the lignicolous habitat in *Pyrrhoglossum* and *Pleuroflammula.* In these two latter genera, there has been a reduction in development of the stipe: it is either absent or is very short, and then eccentric to lateral. Again, in the terrestrial genus *Cortinarius* the basidiocarp is stipitate-pileate. It is also of note that the partial veil reaches its strongest development in the stipitate-pileate forms, and on the other hand, is inconspicuous or absent in pleurotoid species of *Pyrrhoglossum.*

*Gelatinous and Non-Gelatinous Zones.* The evolutionary origin of gelatinous hyphae is not clear. But, at least in some species of *Cortinarius, Galerina, Pholiota,* and *Phaeocollybia,* zones of hyphal gelatinization are known. On this character alone, *Gymnopilus,* lacking any observed gelatinous hyphae, would seem less related to these genera than to the non-gelatinous genera (*Pleuroflammula, Phaeomarasmius,* and *Pyrrhoglossum*).

*The Partial Veil.* Among the genera in the Cortinariaceae, the inner veil displays a wide variation in the degree of presence of absence. It is absent in the species of *Phaeocollybia;* and it is either absent or inconspicuous in *Pyrrhoglossum.* In other genera, it may be absent in some species, although in a majority it is present, and then it exhibits one of two conditions: (1) it is membranous and persistent in a number of species of almost all genera; (2) in other species, it is arachnoid and fugacious. Through the partial veil, present in most species of *Gymnopilus,* there are evident relationships with *Cortinarius, Phaeomarasmius, Rozites* and perhaps more remotely with *Pholiota* and *Galerina.* In *Gymnopilus* there are three velar conditions: (1) an inner veil present, membranous and persistent; (2) an inner veil present, arachnoid and fugacious; (3) an inner veil absent, even in young buttons. In *Cortinarius,* the inner veil is usually arachnoid, copious to sparse and fugacious; on the other hand, in species such as *C. torvus,* a membranous, flaring, persistent annulus is formed, but its origin is in the universal veil rather than in the partial veil. Similarly, in other species (the group *Telamonia, sensu* Kauffman), the universal veil, according to the species, leaves annular shreds, bands, or zones variously distributed over the stipe. In *Rozites,* the veil is double and membranous. It consists of an inner veil which forms an apical annulus, and an outer veil which forms a volval band on the lower portion of the stipe.

In *Gymnopilus,* a universal veil seems to be absent or at least greatly

educed and inconspicuous (present, according to Harding, **1952**). Thus, if one postulates that *Gymnopilus* may have been derived from *Cortinarius* or a similar ancestor, the loss of he universal veil has been gradual, and that step could have been taken through *Hydrocybe* of *Cortinarius.*

*Spores.* It is largely through their episporial ornamentation and the lack of a germ pore that *Cortinarius* and *Gymnopilus* are related. In many species of *Cortinarius,* the ornamentation is composed of warts; in two species of *Gymnopilus* at least, *G. fulgens* and *G. imperialis,* the ornamentations are coarse (up to .7-1.5 $\mu$ high), and the spore shape is somewhat amygdaliform, both characters being suggestive of *Cortinarius*. Smooth-spored genera (*Pholiota, Pleuroflammula, Phaeomarasmius*) would, as here postulated on this character, occupy a position more remote from *Gymnopilus* than the rough-spored genera (*Cortinarius, Pyrrhoglossum,* and *Phaeocollybia*).

*Cheilocystidia.* On the data at hand, even though incomplete, cheilocystidia are present in many species of the Cortinariaceae. In *Gymnopilus,* they are present, with a few exceptions presently noted, and are almost invariably ampullaceous, lecythiform, or flask-shaped, and often capitate. Such cheilocystidia are characterized as gymnopiloid. In our observations, they are absent from only three species (*G. terrestris, G. parvisquamulosus,* and *G. rufobrunneus*). In other genera, the cheilocystidia, when present, may be clavate or filamentous, but sometimes capitate, and in some species of *Pyrrhoglossum* they are quite gymnopiloid (flask-shaped and capitate). In passing, it is noted that, except for their pleurotoid habits, those species of *Pyrrhoglossum* with gymnopiloid cheilocystidia are indeed very close to *Gymnopilus.*

## TAXONOMY—CLASSIFICATION

**GYMNOPILUS** Karsten, Bidr. Finl. Nat. Folk **32:** xxi. 1879
[*Fulvidula* Romagn., Rev. Mycol. II. **1:** 209. 1936. *nom. subnud.*]

*Basidiocarp* solitary, subcespitose, or cespitose. *Pileus* 0.5–12(–18) cm broad, usually convex then more or less expanding, rarely umbonate, rarely umbilicate or deeply depressed, colors bright: yellow, tawny, reddish, green, or more rarely brown, dry, or at least not viscid, in some species hygrophanous, glabrous to fibrillose or scaly (scales fibrillose, repent or erect, at times their color different from the pileus-cuticle), margin even, rarely striate to sulcate. *Context* thin to rather thick, whitish, pallid, or yellowish, rarely brown, color unchanging, or more rarely changing color where bruised; odor usually not distinctive, or more rarely aromatic, fragrant, raphanoid; taste usually bitter (slightly so, or very bitter), in several species mild or not distinctive. *Lamellae* adnate, varying to adnexed or slightly decurrent, or rarely long-decurrent, at first white or yellowish, rarely brownish, becoming ferruginous (or at least darker) at maturity, occasionally changing color where bruised, varying from close or crowded to subdistant, rarely distant, lamellulae in some species conspicuous, edges usually even, at times fimbriate. *Stip*e central, 2–10(–20) cm long, 2–10(–30) mm thick, equal or tapering up or down, rarely ventricose to clavate, glabrous or fibrillose, apex often pruinose. *Partial veil* absent, or present and then either sparse or ample, arachnoid and fugacious, or membranous to submembranous and present as a persistent, superior *annulus*. *Spores* in deposits ferruginous, mostly ellipsoid in face view, at times ovoid, rarely subamygdaliform, usually inequilateral in profile; the epispore rough-warty or wrinkled, germ pore none, wall double. *Basidia* more or less clavate, 4-spored, less commonly 2-spored, rarely 1-spored. *Pleurocystidia* absent, or more commonly present, ventricose to clavate; *cheilocystidia* present (absent in a small number of species), typically gymnopiloid (ampullaceous, with a neck, capitate or non-capitate). *Gill trama* usually subparallel, the hyphal elements varying from 3–20 $\mu$ in diameter; subhymenium not distinctive (not gelatinous in any species observed). Pileus trama of two general types, based on arrangement of its hyphal components: (1) hyphae disposed radially; (2) hyphae interwoven, often loosely so. Cuticle of repent hyphae which are more or less differentiated from the underlying elements, at times the surface hyphae bearing more or less erect hyphae, which, in some species, from bundles (observed as scales). *Pileocystidia* absent, or present. *Clamp connections* present. *Caulocystidia* absent, or present, and when present more rarely arranged in a palisade.

Summary: The constant generic characters of the genus *Gymnopilus* are its dry pileus, rough, ferruginous spores which lack a germ pore, and its centrally stipitate pileus. Other characters of less universal occurrence are the lignocolous habitat, bright colors of the basidiocarp, and ampullaceous cheilo-

/stidia. Remarks on relationship to other genera will be found beginning ›n page 14).

Lectotype species: *G. liquiritiae* (Pers. ex Fr.) Karst.

## Key to Subgenera

1. Veil forming a membranous to densely fibrillose, persistent annulus ..... subgenus *Annulati*
1. Veil absent, or present and fugacious, not forming a persistent annulus ..... subgenus *Gymnopilus*

**Gymnopilus** subgenus **Annulati** Hesler, subgen. nov.

[*Fulvidula* Romagn. (sect.?) *Annulatae* Romagn., Bull. Soc. Mycol. France **58:** 89. 1942, *nom. nud.*]

[*Gymnopilus* Karst. sect. *Annulati* Romagn, in Singer, Lilloa **22:** 560. 1951, *nom. nud.*]

Velum membraneum demum dense fibrillosum, permanenten annulum fingit.

Veil forming a membranous to densely fibrillose, persistent annulus.

Type species: *G. spectabilis* (Fr.) A. H. Smith

## Key to Species

1. Spores 5.5.–7(–8) $\mu$ long; pileus scaly ..... 2
1. Spores 7–12.5 $\mu$ long; pileus surface variable: glabrous, fibrillose, or scaly ..... 3
   2. Pileus umbilicate to infundibuliform; spores dextrinoid .... 1. *G. hispidus*
   2. Pileus convex; spores non-dextrinoid ..... 2. *G. hispidellus*
3. Spores dextrinoid ..... 4
3. Spores non-dextrinoid ..... 14
   4. Pleurocystidia present ..... 5
   4. Pleurocystidia absent ..... 12
5. Pileus reddish-brown, minutely yellow-fibrillose to subglabrous; stipe 14-18 cm long, radicating ..... 3. *G. ventricosus*
5. Pileus yellowish or ochraceous; stipe not as above ..... 6
   6. Caulocystidia present ..... 7
   6. Caulocystidia absent ..... 10
7. Spores 9–12.5 $\times$ 6–7.5 $\mu$; pileus appressed squamulose ..... 4. *G. subspectabilis*
7. Spores either 6–8 or 8–10 $\mu$ long ..... 8
   8. Pileus large, up to 12–18 cm broad, silky or subglabrous, or rarely appressed-squamulose ..... 5. *G. spectabilis*
   8. Pileus 2.5–8 cm broad, scaly ..... 9

9. Pileus scales purplish; taste bitter or astringent; spores 4–4.5 $\mu$ broad ..... 6. *G. peliolepis*
9. Pileus scales tawny; taste mild; spores 5–5.5 $\mu$ broad 7. *G. fulvosquamulosus*
10. Taste of flesh mild; pileus ochraceous, squamulose ..... 8. *G. validipes*
10. Taste bitter ..... 11
11. Pileus 5–10 cm broad; lamellae medium narrow ..... 9. *G. luteus*
11. Pileus 2–5 cm broad; lamellae broad ..... 10. *G. palmicola*
12. Pileus glabrous, margin finally slightly sulcate .. 11. *G. chrysotrichioides*
12. Pileus squamulose, margin even ..... 13
13. Spores 7–9 $\times$ 4.5–5 $\mu$, ellipsoid; pileus up to 5 cm broad, with small red or orange scales ..... 12. *G. rufosquamulosus*
13. Spores 8–10 $\times$ 7–8.5 $\mu$, subglobose or broadly ellipsoid, warts very large; pileus 5–10 cm broad, scales not as above ..... 13. *G. imperialis*
14. Taste mild; pleurocystidia absent ..... 14. *G. pholiotoides*
14. Taste bitter or astringent; pleurocystidia present ..... 15
15. Pileus 2–6 cm broad, uniformly and densely clothed with large, conic, floccose warts ..... 15. *G. praefloccosus*
15. Pileus 5–10 cm broad, disc minutely scaly, elsewhere glabrous to subglabrous .....16. *G. armillatus*

**1. Gymnopilus hispidus** (Massee) Murr., Mycologia **5:** 24. 1913.

*Flammula hispida* Massee, Jour. Bot. **30:** 161. 1892.

ILLUSTRATION: FIG. 19.

Pileus 2.5 cm broad, umbilicate to somewhat infundibuliform, then explanate, ochraceous fulvous, dry, hispid with erect, acute squamules.

Lamellae subdecurrent, golden to fulvous-ferruginous, broad, close or crowded, edges paler and crenulate.

Stipe 2–2.5 cm long, pallid, fibrillose, hollow, attenuated above.

Spores 6–8 $\times$ 4–4.5(–5) $\mu$, ellipsoid in face view, slightly inequilateral in profile, verruculose, no germ pore, yellowish brown in KOH, faintly dextrinoid after eight hours. Basidia, pleurocystidia, and cheilocystidia collapsed. Gill trama of subparallel hyphae, 3–6 $\mu$ broad; subhymenium not distinctive. Pileus trama of interwoven hyphae. Cuticle a narrow layer of repent, brown hyphae, bearing scattered or numerous, erect, colorless, filamentous, subventricose pileocystidia, 23–42 $\times$ 3–5 $\mu$. Clamp connections present. Caulocystidia (no stipe material present).

HABIT, HABITAT, AND DISTRIBUTION—On rotten wood, West Indies, January.

MATERIAL STUDIED—WEST INDIES: Eliott 309, type (BM), from Chateau, Belair, St. Vincent, leg. W. R. Elliott, January 13, 1892.

OBSERVATIONS—Harding (**1952**) apparently was able to find basidia, pleurocystidia, and cheilocystidia in the type. It is distinctive in its umbilicate to infundibuliform pileus, its hollow stipe, and slightly dextrinoid spores. The type is on deposit at the British Museum of Natural History, London.

**2. Gymnopilus hispidellus** Murr., Myologia **5:** 24. 1913.

*Flammula hispidella* (Murr.) Murr., Mycologia **5:** 36. 1913.

Pileus 2–4 cm broad, convex, scattered or subcespitose, pale-ochraceous, fibrillose, often punctate-squamose, with erect ferruginous scales, margin not striate. Context slightly bitter.

Lamellae adnate, yellow to fuscous-ferruginous, close, varying in breadth.

Stipe 2–4 cm long, 2–4 mm thick, concolorous, base darker, cylindric, subfibrillose, solid. Veil yellowish, subannulate.

Spores 5.5–7(–7.5) × 4–5 μ, ellipsoid in face view, slightly inequilateral in profile, verruculose, no germ pore, not dextrinoid. Basidia 23–27 × 6–7 μ, 4-spored. Pleurocystidia 30–36 × 6–8 μ, colorless, projecting slightly, clavate and mucronate or appendiculate; basidioles 15–26 × 6–11 μ, brown, buried, clavate; cheilocystidia 23–32 × 6–9 μ, ventricose at times more or less capitate. Gill trama subparallel, hyphae 2–4 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle a turf of tangled hyphae, colorless or brownish, loosely-arranged, or in tufts; pileocystidia none. Clamp connections present. Caulocystidia rare, scattered, 25–38 × 5–7 μ, ventricose or clavate. Pileus and gill trama pallid brownish in KOH; rusty brown in Melezer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—Scattered or subcespitose, on logs, Cuba, March.

MATERIAL STUDIED—CUBA: Underwood and Earle, No. 429, type (NY), near Baracoa, March, 1903.

OBSERVATIONS—This species is characterized by its erect, ferruginous scales, non-dextrinoid spores, solid stipe, convex pileus, and radial pileus trama. It may be distinguished from *G. hispidus,* in which the spores are dextrinoid, pileus trama interwoven, pileus umbilicate to infundibuliform, and the stipe hollow.

**3. Gymnopilus ventricosus** (Earle) Hesler, comb. nov.

*Pholiota ventricosa* Earle, Bull. N.Y. Bot. Gard. **2:** 341. 1902.

ILLUSTRATION: FIG. 15.

Pileus 7–8 cm broad, gregarious or cespitose, convex, obtuse, reddish brown, disc often lighter, minutely yellow-fibrillose to subglabrous, subdry, margin even, subappendiculate from fibrous veil-remnants. Context pale yellow, unchanging; odor none, taste bitter.

Lamellae subsinuate, pale brown, becoming dark cinnamon, crowded, rather broad and subventricose, edges thin and entire.

Stipe 14–18 cm long, 20–30 mm thick, pale brownish, yellow-fibrillose to subglabrous, radicating and white mycelioid below, densely white-fibrillose at apex, solid, conspicuously ventricose. Veil forming an almost apical annulus which is persistent, thick, margin jagged and remaining erect, and also remnants clinging to pileus-margin.

Spores 7.5–9 × 4–5.5 μ, ellipsoid, ovoid or subamygdaliform in face view, inequilateral in profile, verruculose, no germ pore, slowly dextrinoid. Basidia 23–27 × 6–8 μ, 4-spored. Pleurocystidia 27–31 × 6–7 μ, fusoid-ventricose or

flask-shaped, often with a brown pigment; cheilocystidia 26–33 × 5–8 μ, flask-shaped with a neck, more or less capitate. Gill trama subparallel to parallel, hyphae 5–7 μ broad. Pileus trama interwoven. Cuticle of more or less repent hyphae bearing tufts of pallid to brownish hyphae. Clamp connections present.

HABIT, HABITAT, AND DISTRIBUTION—In a dense colony, base of living pine, California, December.

MATERIAL STUDIED—CALIFORNIA: Baker No. 122, type (NY), leg. C. F. Baker, Stanford University, December, 1901.

OBSERVATIONS—The distinctive features of *G. ventricosus* are its reddish brown pileus with minute yellow fibrils, its heavy, ventricose stipe, subsinuate gills, slightly dextrinoid spores, and interwoven pileus trama. (See remarks under *G. spectabilis and G. luteus.*)

**4. Gymnopilus subspectabilis** Hesler, sp. nov.

ILLUSTRATION: FIG. 10.

Pileus 5–8 cm latus, pallido-subflavo-furvus, fibrilloso-squamulosus. Contextus subflavus; gustu amarus. Lamellae adnata, "clay color", confertae, medio-angustae. Stipes 3.5–8 cm longus, 8–14 mm crassus, albidus. Velum annulum submembraneum fingit. Sporae (8.5–)9–12.5 × (5–)6–7.5 μ, ellipsoideae, dextriniodeae. Pleurocystidia 27–30 × 6–8 μ; cheilocystidia 17–27 × 3–8 μ. Specimen typicum in Herb. Univ. Mich., lectum prope Ann Arbor, Michigan, October 25, 1961, Smith 64755.

Pileus 5–8 cm broad, pale yellowish tawny, closely appressed-fibrillose-squamulose. Context yellowish, thick on disc, abruptly thin on margin; taste bitter; KOH on flesh orange-brown, $FeSO_4$ olive at gill-line.

Lamellae adnate, close, medium narrow, "clay color" to "tawny olive."

Stipe 3.5–8 cm long, 8–14 mm thick, equal, rarely ventricose, whitish. Veil forming a submembranous annulus.

Spores (8.5–)9–13 × (5–)6–7.5 μ, ellipsoid, fusoid to sublimoniform in face view, inequilateral in profile, coarsely verrucose, no germ pore, pale ferruginous (nearly yellow brown) in KOH, dextrinoid. Pleurocystidia 27–30 × 6–8 μ, ventricose; cheilocystidia 17–27 × 3–8 μ, flask-shaped, capitate. Gill trama of subparallel hyphae, 5–11 μ broad; subhymenium not distinctive. Pileus trama of loosely interwoven broad hyphae, 8–28 μ diameter. Cuticle of narrow pale brownish zone of repent hyphae, with bundles of brownish, more or less erect or repent hyphae (scales). Clamp connections present. Caulocystidia 30–53 × 5–7 μ, ventricose to subcylindric, capitate, as terminal elements on epicuticular hyphae. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On hardwood, California and Michigan, October.

MATERIAL STUDIED—CALIFORNIA: Smith 68785; Thiers 21275; MICHIGAN: Smith 64755, type, Ann Arbor, October 25, 1961.

OBSERVATIONS—This species is distinguished by its large, cortinarioid spores, and its appressed squamules. It has the general aspect of a pale yellowish or tawny *G. spectabilis,* in which the stipe is concolorous with the pileus, and the spores smaller (8–10 × 4.5–5.5 μ).

**5. Gymnopilus spectabilis** (Fr.) A. H. Smith, Mushrooms in Their Natural Habitats, p. 471. 1949.

*Agaricus spectabilis* Fr., Elench. Fung. **1:** 28. 1828.
*Pholiota spectabilis* (Fr.) Gill., Les Hymenomycetes, p. 443. 1878.
*Fulvidula spectabilis* (Fr.) Sing., Schweiz. Zeitschr. Pilzk. **17:** 99. 1939.

ILLUSTRATIONS: FIGS. 7, 101, 102, 109, 110, 111.
Bresadola, Icon. Myc. Tab. 698 (as *Pholiota*).
Lange, Flora Agar. Dan., pl. 108B.
Overholts, Ann. Missouri Bot. Gard. **14:** pls. 16–17 (as *Pholiota*).
Smith, A. H., Mushrooms in Nat. Habitats, Reel 23, No. 160.

Pileus cespitose, (5–)8–18 cm broad, convex, expanding to broadly convex or nearly plane, buff-yellow, or more rarely at first whitish, or "deep chrome," "xanthine orange," "antimony yellow," to "sudan brown" or "raw sienna," silky to fibrillose, sometimes in age appressed fibrillose-squamulose, or nearly glabrous, at times virgate when moist, often the disc minutely squamulose, the margin even. Context at first pale yellow, then "mustard yellow," reddish brown in 2% KOH, thin on the disc, firm; odor slight or rarely strong (of licorice in Bigelow 12254, from New Hampshire), taste bitter.

Lamellae adnate to decurrent, at first "ochraceous buff," then "mustard yellow" to "raw sienna," rather broad, crowded or close, at times the faces rugulose, edges fimbriate.

Stipe 3–10(–20) cm long, 8–10(–30) mm thick, concolorous, often darker and brownish below, streaked fibrillose from the veil, solid, hard, usually attenuated below, or sometimes ventricose, or the base bulbous. Veil pale yellow, submembranous and somewhat persistent, to fibrillose, leaving an indistinct, superior or apical, evanescent, fibrillose zone.

Spores in deposit: "zinc orange" or duller rusty brown ("ochraceous tawny"), (7–)8–10 × 4.5–5.5(–6) $\mu$, ellipsoid to ovoid in face view, slightly inequilateral in profile, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 22–34 × 6–7(–8) $\mu$, 2–4-spored. Pleurocystidia 21–33 × 6–7 $\mu$, ventricose, scattered, inconspicuous; basidioles brown, 20–30 × 6–8 $\mu$, clavate, buried, scattered; cheilocystidia 24–43 × 4–8 $\mu$, ventricose, subcapitate or not capitate. Gill trama subparallel, hyphae 6–10 $\mu$ broad. Pileus trama interwoven. Cuticle of repent hyphae, bearing clusters of more or less incrusted, brownish hyphae. Clamp connections present. Caulocystidia (20–)36–65(–107) × (2.5–)5–10 $\mu$, somewhat similar to cheilocystidia. Pileus and gill trama yellowish in KOH; dark yellowish brown in Melzer's reagent. A yellowish pigment dissolves out in KOH.

HABIT, HABITAT, AND DISTRIBUTION—On conifer and deciduous logs, stumps, living and dead trunks, or buried wood, throughout most of the United States and Canada, July-January.

MATERIAL STUDIED—ALABAMA: Burke 2079 (MICH); CALIFORNIA: Largent 27 (SFSC); Motta 188 (SFSC); Rea 1308, 1397; Smith 8229, 8584, 56158, 56224; Thiers 8769, 9014, 9371, 14461, 14583, 17900, 18376; IDAHO: Andrews 89852 (MICH); Cooke 21415 (MICH); Smith 46480,

54696, 60600, 60765; MAINE: Bigelow 11034, 11161, 11360 (MASS); MASSACHUSETTS: Bigelow 3581 (MICH), 7720, 9794, 14572 (MASS); MICHIGAN: Smith 41706, 41759, 50251, 58269, 64696, 72862; Thiers 4048 (MICH); NEW HAMPSHIRE: Bigelow 12254 (MASS); Miller 555 (MICH); NEW MEXICO: Barrows 327, 471, 911, 1340 (MICH); NEW YORK: Deegan 31, 83 (MICH); Smith 760; NORTH CAROLINA: Hesler 10737, 19725, 20181; OHIO: Bigelow 243 (MASS); OREGON: Gruber 657; Sipe 397; Smith 27386, 28524, 28548, 74246; TENNESSEE: Hesler 17721; Smith 10603; VERMONT: Bigelow 12804, 13826 (MASS); WASHINGTON: Smith 3097, 30691, 47366; WYOMING: Solheim 51379 (MICH); ENGLAND: Custwick 396 (MICH); Reid (TENN-24033); ITALY: Lohwag 636 (MICH); NOVA SCOTIA: Smith 738; URUGUAY: Herter 818a (MICH).

OBSERVATIONS—This species is allied to *G. luteus,* and the differences are not great. In the latter, the hyphae of the pileus trama are radially disposed, and the gills adnexed and more narrow than in *G. spectabilis.* Its relationship to *G. junonius* (Fr.) Orton (*Agaricus junonius* Fr.) is not clear. Efforts have been made to study authentic collections of *A. junonius,* but material representing the Friesian concept has not been available to me. Further inquiry into the status of this entity is desirable; meantime, we are using the binomial *G. spectabilis.* This species has some resemblance to *G. ventricosus,* in which the pileus is reddish brown and the gills subsinuate. Peck's *Agaricus cerasinus* is described as hygrophanous, and may be distinct from *G. spectabilis,* but I have been unable to study this type. Singer (**1950**) has described *G. spectabilis pampeanus* (Speg.) Sing., which, he says, is distinguished by a moderately strongly thickened apex of the cheilocystidia (as against non-incrassate tip in *Pholiota ventricosa*), and very strongly capitate (the capitellum 4.3–7.3 $\mu$ broad) cheilocystidia of the European type form. He finds the spores slightly broader (8–11.5 × 5.8–6.6 $\mu$), pleurocystidia, the cheilocystidia 30–37 × 5.8–8 $\mu$, and with a long neck. We have seen Spegazzini's *pampeana,* but the material is not in condition suitable for critical study. Another species with large basidiocarps is *G. magnus,* in which the pileus is fibrillose and virgate, the veil fugacious, the spores 5.5–7 $\mu$ broad, and pleurocystidia absent.

Walters (Mycologia **57:** 837–838. 1965) states that, when eaten, this species is hallucinogenic.

**6. Gymnopilus peliolepis** (Speg.) Sing., Lilloa **22:** 561. 1951.

*Pholiota peliolepis* Speg., Bol. Acad. Nac. Ci. Cordoba **23:** 394. 1919.

Pileus 2–7 cm broad, hemispheric to convex and often umbonate, later applante and then concave or with a central depression, whitish yellow between the scales which are floccose to squarrose, dark purplish red or wine red to deep purple "burnt lake," "Hay's maroon," or "diamine brown," more densely scaly when young, later less densely scaly and less distinctly purple, especially toward the margin, which at first is covered with olive yellow fibrils, the margin

glabrescent, dry, margin involute then straight, with veil traces at first. Context white, becoming yellow; odor not distinctive, taste mild or slightly astringent or bitterish.

Lamellae sinuate-adnate to adnate-decurrent, "yellow ocher" to "raw sienna," becoming more golden yellow or bright rusty, narrow to medium broad, close.

Stipe 2.2–5 cm long, 2–8 mm thick, whitish ochraceous, becoming browner, dry, glabrous or coarsely fibrillose, tapering upward, becoming equal, sometimes slightly eccentric, stuffed then narrowly hollow. Veil cortinoid, concolorous, at first distinct, leaving a ring mark on the apex.

Spores 6–8(–9) × 4–4.5 μ, ellipsoid, inequilateral, verruculose, ferruginous in KOH, dextrinoid, no germ pore. Basidia 24–29 × 5–6 μ, 4-spored. Pleurocystidia 22–27 × 5–6 μ, ventricose; cheilocystidia 12–32 × 4–6 μ, flask-shaped to ventricose or subfusoid, non-capitate or sometimes subcapitate. Gill trama of subparallel hyphae, 5–12 μ broad; subhymenium of narrow hyphae, otherwise not distinctive. Pileus trama of distinctly interwoven, broad (7–22 μ diam.) hyphae. Cuticle of dingy brownish, more or less radial hyphae, bearing fascicles of pallid hyphae (scales), and scattered pileocystidia which are obclavate, ventricose, or clavate, 24–43 × 5–12 μ. Caulocystidia 33–73 × 5–12 μ, filamentous to subclavate, as terminal elements on surface hyphae. Clamp connections present.

HABIT, HABITAT, AND DISTRIBUTION—Fasciculate or gregarious on deciduous tree trunks, Florida, Brazil, Argentina; June (Florida), December (South America).

MATERIAL STUDIED—FLORIDA: Singer F-2175 (F), from near Gainesville, May 10, 1943; BRAZIL: Spegazzini 18270, type of *Pholiota peliolepis* (LPS), December, 1889, leg. J. Puiggari, No. 87.

OBSERVATIONS—The description of macroscopic characters above is based on that of Singer (**1951d**); and of the microscopic characters on my study of Singer's Florida collection (F-2175). In the type, all characters seemed to agree with Singer's Florida collection, except that in it I was unable to find either pleurocystidia or cheilocystidia. Apparently, these had collapsed.

This species is characterized by its dense, dark purplish red scales, white flesh, and arachnoid veil. It appears to be related to *G. luteofolius,* in which the flesh is red to lavender then yellowish, the stipe solid, the odor at times subalkaline, and the gills broad to medium broad. It seems a little more remotely related to *G. palmicola,* in which the pileus is pale ferruginous to ochraceous, the flesh pale or yellowish, the spores larger, and the veil subannulate.

### 7. **Gymnopilus fulvosquamulosus** Hesler, sp. nov.

Pileus 4–8 cm latus, "yellow ocher" vel clare flavus, squamas "tawny" fibrillosas gerens. Contextu flavus; gustu mitis. Lamellae adnotae demum decurrentes, flavae, confertae, latae. Stipes 3–6 cm longus, 7–12 mm crassus, flavus, brunneus infra tactus. Velum submembraneum demum fibrillosum, fugax. Sporae 7–9(–10) × 5–5.5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 22–27 × 5–7 μ; cheilocystidia 24–33 × 4–7 μ. Specimen typicum in Herb. Univ. Mich., lectum prope Wayne, Michigan, September 12, 1965, Smith 72586.

Pileus 4–8 cm broad, broadly convex in age, obtuse with an incurved margin, young, surface conspicuously covered with appressed to slightly recurved,

fibrillose, tawny scales on a "yellow ocher" to brighter yellow ground, not gelatinous. Context yellow, pliant; odor and taste none; $FeSO_4$ slowly olive.

Lamellae adnate to decurrent, broad, close, dull-yellow becoming dark rusty brown, edges crenulate.

Stipe 3–6 cm long, 7–12 mm thick, equal or base clavate, curved, slowly rusty brown without cut, rusty brown over base from handling, dingy yellow above. Veil forming a submembranous to fibrillose, fugacious ring.

Spores 7–9(–10) × 5–5.5 μ, ellipsoid, inequilateral, verrucose, no germ pore, ferruginous in KOH, dextrinoid at once. Basidia 23–26 × 5–6 μ, 4-spored. Pleurocystidia 22–27 × 5–7 μ, ventricose; cheilocystidia 24–33 × 4–7 μ, flask-shaped, capitate. Gill trama of subparallel hyphae, 5–11 μ broad; subhymenium not distinctive. Pileus trama of loosely interwoven hyphae. Cuticle of repent hyphae, bearing bundles of brown, incrusted hyphae, 5–15 μ broad (scales). Caulocystidia 28–54 × 5–7 μ, colorless, cylindric clavate, in tufts. Clamp connections rare.

HABIT, HABITAT, AND DISTRIBUTION—On hardwood logs, Michigan, September-October.

MATERIAL STUDIED—MICHIGAN: Harding 433, 441 (MICH); Smith 72586, type, from Wayne, leg. Sam Mazzer, September 12, 1965.

OBSERVATIONS—This species is distinguished by its tawny, fibrillose scales, mild odor and taste, broad, close gills, and rather broad, dextrinoid spores. It is near *G. praefloccosus,* in which the spores are non-dextrinoid, caulocystidia are lacking, the scales are with hardened dark points, and the taste astringent or bitter. It is distinguished from *G. peliolepis* in which characteristic purplish scales decorate the pileus. It may be related to *G. sapineus,* in which the scales are minute and inconspicuous, the taste bitter, and the pileus trama radial.

**8. Gymnopilus validipes** (PK.) Hesler, comb. nov.

*Cortinarius validipes* Pk., N.Y. State Mus. Bull. **116:** 20. 1907.

Pileus 7.5–15 cm broad, convex becoming nearly plane, ochraceous, squamulose of floccose-squamulose. Context white, tinged with yellow next to the lamellae; taste mild.

Lamellae adnate or decurrent with a tooth, yellowish white, becoming cinnamon, narrow, close, thin.

Stipe 10–13 cm long, 25–50 mm thick, yellowish white, striate at the top by the decurrent teeth of the lamellae, firm, solid, white within. Subannulate from remains of the veil.

Spores 7.5–10 × 4.5–5(–5.5) μ, ellipsoid, more rarely subovoid in face view, slightly inequilateral in profile, verrucose, ferruginous in KOH, a few dextrinoid at once and all dextrinoid after one hour. Basidia 23–28 × 5–7 μ, (2–)4-spored. Pleurocystidia 23–28 × 5–7 μ, ventricose, inconspicuous; cheilocystidia 23–30 × 3–7 μ, flask-shaped, capitate or subcapitate. Gill trama of subparallel hyphae, 5–9 μ broad; subhymenium not distinctive. Pileus trama of radial hyphae. Cuticle of repent hyphae, bearing toward the center, bundles of brown hyphae (scales). Pileocystidia and caulocystidia none.

HABIT, HABITAT, AND DISTRIBUTION—In a small excavation near a farmhouse, New York, September.

MATERIAL STUDIED—NEW YORK: Peck, type of *Cortinarius validipes* Pk., Coopers Plains, Steuben Co., September.

OBSERVATIONS—It is distinguished by its ochraceous pileus, mild taste, yellowish white stipe, radially arranged hyphae of the pileus trama, and the absence of both pileocystidia and caulocystidia. It is allied to the complex of *G. spectabilis, G. luteus, G. ventricosus,* and *G. armillatus*.

**9. Gymnopilus luteus** (Pk.) Hesler. comb. nov.

*Pholiota lutea* Pk., N.Y. State Mus. Ann. Rept. **51:** 288. 1898.

Pileus 5–10 cm broad, convex, buff-yellow, from "warm buff" to "antimony yellow," often little darker at the center, appressed floccose-fibrillose or silky, sometimes minutely floccose-squamulose toward the center, dry, margin incurved and slightly surpassing the lamellae. Context fleshy, firm, pale yellow; odor pleasant, taste bitter.

Lamellae adnexed, rounded behind, pale yellow, becoming dark ferruginous with age, thin, close, moderately narrow.

Stipe 4–7.5 cm long, 6–16 mm thick, concolorous with the pileus, becoming ferruginous yellowish on handling, fibrillose, solid, firm, thickened above or below. Veil forming a fibrillose to submembraneous annulus.

Spores 6–9 × 4–5(–5.5) $\mu$, ellipsoid, slightly inequilateral, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 22–25 × 5–6 $\mu$, 4-spored. Pleurocystidia 26–31 × 4–7 $\mu$, ventricose, scattered, inconspicuous; cheilocystidia 24–32 × 4–6 $\mu$, ventricose to flask-shaped, capitate or subcapitate. Gill trama of subparallel hyphae, 3–5 $\mu$ broad; subhymenium not distinctive. Pileus trama of radial hyphae. Cuticle a zone of dark brown, repent hyphae, with some mounds of brown, narrow (3–5 $\mu$), hyphae on the disc (the scales). Caulocystidia none. Clamp connections present. A yellowish brown to amber pigment, soluble in KOH, present in the gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On decaying wood, logs, and trunks of trees, New York and Tennessee, August-September.

MATERIAL STUDIED—NEW YORK: Peck, type, from North Elba, August, 1897 (as *Pholiota lutea* Pk.); TENNESSEE: Kauffman (MICH, Smith 68796).

OBSERVATIONS—This species has been thought to be related to, or even the same as, *G. spectabilis, G. armillatus, G. magnus,* and *G. ventricosus*. But, all these entities can be distinguished (see key to species). In *G. spectabilis,* the pileus trama is interwoven, and caulocystidia are present in tufts or palisades (see also comments on page 23). In *G. armillatus,* the spores are non-dextrinoid; in *G. magnus,* the veil is fugacious, and the pileus trama is interwoven; in *G. ventricosus,* the lamellae are pale-brown becoming dark-cinnamon, the stipe pale-brown, the pileus trama interwoven.

**10. Gymnopilus palmicola** Murr., Mycologia **5:** 23. 1913.

*Flammula palmicola* (Murr.) Murr., Mycologia **5:** 36. 1913.

ILLUSTRATION: Singer, Agar. Modern Taxonomy, 2nd ed., pl. I (Frontispiece, as *G. aculeatus*).

Pileus 2–5 cm broad, convex to expanded, at length depressed, pale-ferruginous to ochraceous, dry, floccose-squamose, then subglabrous, margin even. Context pallid to yellowish.

Lamellae adnate, ferruginous at maturity, broad, close, at length ventricose.

Stipe 3–5 cm long, 3–5 mm thick, yellowish or subconcolorous (paler), yellowish within, cylindric, solid, slightly fibrillose, veil strongly developed, pale yellowish, subannulate.

Spores 7–10 × 5–7(–7.5) μ, ellipsoid in face view, inequilateral in profile, verrucose, warts coarse, .04–.06 μ high, no germ pore, dextrinoid. Basidia 24–28 × 7–9 μ, 2–4-spored. Pleurocystidia 26–35 × 6–8 μ, colorless, clavate, at times mucronate; basidioles 20–23 × 5–9 μ, brown, clavate, buried; cheilocystidia 22–36 × 5–7 μ, clavate, often appendiculate, mostly flask-shaped, capitate. Gill trama of subparallel hyphae, 5–8 μ broad; subhymenium not distinctive. Pileus trama interwoven. Cuticle of repent brown hyphae, bearing more or less erect fascicles of brown, incrusted hyphae (scales), accompanied by pileocystidia, 36–54 × 8–12 μ, clavate. Clamp connections present. Pileus and gill trama pallid in KOH; reddish brown in Melzer's reagent. Caulocystidia none.

HABIT, HABITAT, AND DISTRIBUTION—On logs of palms, and on living orchids, Cuba, Mexico, and Florida, March and September.

MATERIAL STUDIED—FLORIDA: Singer F 545 (FH), as *G. aculeatus;* CUBA: Underwood and Earle 1134, type (NY), near Baracoa, March, 1903; MEXICO: Singer (FH), on orchid (developed in the greenhouse, Cambridge, Massachusetts), as *G. aculeatus*.

OBSERVATIONS—This appears related to *G. pholiotoides,* in which the cuticle breaks up into scales, the spores non-dextrinoid, pleurocystidia lacking, cheilocystidia ventricose and often capitate, and pileus trama radial. It seems to have been confused with *G. palmicola;* but the spores in *G. palmicola* are 7–10 × 5–7(–7.5) μ, and in *G. aculeatus* they measure 5.5–7 × 4–4.5 μ.

**11. Gymnopilus chrysotrichioides** Murr., Mycologia **5:** 21. 1913.

*Flammula chrysotrichioides* (Murr.) Murr., Mycologia **5:** 36. 1913.

Pileus reaching 7 cm broad, convex to subexpanded, ferruginous to fulvous, dry or moist, not viscid, glabrous, margin concolorous, slightly sulcate with age, inflexed on drying.

Lamellae adnate with a decurrent tooth, becoming ferruginous or fulvous, broad, crowded.

Stipe 4–6 cm long, 3–6 mm thick, pallid, glabrous, longitudinally furrowed, cylindric, equal, usually somewhat curved. Veil forming a rather large, yellowish, membranous, usually permanent ring.

Spores 7.5–10 × 5–6(–6.5) μ, ellipsoid in face view, verrucose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 24–30 × 7–8 μ, 4-spored. Pleurocystidia none; cheilocystidia 20–27 × 4–7 μ, ventricose-capitate, or clavate, rare and inconspicuous. Gill trama interwoven, hyphae 5–15 μ broad. Pileus trama

interwoven. Cuticle of repent hyphae. Clamp connections none. Caulocystidia none. Pileus and gill trama yellowish brown in KOH; brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On coconut log, Cuba, October.

MATERIAL STUDIED—CUBA: Earle 270, type (NY), Managua, October 2, 1904.

OBSERVATIONS—Murrill states that it is similar to *G. chrysotrichus* (= *G. chrysopellus*) in appearance, but *G. chrysotrichioides* has larger spores and a distinct annulus. The verrucose spores suggest *Cortinarius,* but Murrill has observed that they are ferruginous in deposits. Because of the habitat, the spore-color, and the character of the cheilocystidia, it is placed in *Gymnopilus* rather than in *Cortinarius*. Its distinguishing characters are its glabrous pileus, and lack of pleurocystidia and caulocystidia.

### 12. **Gymnopilus rufosquamulosus** Hesler, sp. nov.

Pileus 0.6–5 cm latus, coriaceus vel "tawny," parvas rufas demum aurantias squamas gerens. Contextu pallidoflavus; gustu amarus. Lamellae adiunctae, aurantiae, confertae, medio-latae. Stipes 4–5.5 cm longus, 3–4 mm crassus, furvo-subflavo-brunneus. Velum subpermanentum annulum fingit. Sporae 7–9 × 4.5–5(–5.5) $\mu$, ellipsoideae, dextrinoideae. Pleurocystidia desunt; cheilocystidia 18–26 × 4–8 $\mu$. Specimen typicum in Herb. Univ. Mich., lectum prope Rockport, Texas, August 25, 1966, Dean 70.

Pileus 0.6–5 cm broad, convex to plane, buff to tawny, with small red to orange scales, margin wavy, paler. Context thin, pale yellowish; odor pleasant, taste bitter.

Lamellae attached, seceding, orange, close, medium broad, unequal.

Stipe 4–5.5 cm long, 3–4 mm thick, dingy yellowish brown, striate, slightly fibrillose, tapering upward, fistulose. Veil leaving a somewhat persistent, upturned, superior annulus.

Spores 7–9 × 4.5–5(–5.5) $\mu$, ellipsoid, inequilateral, ferruginous in KOH, dextrinoid after two hours, verruculose, no germ pore. Basidia 23–28 × 6–7 $\mu$, 4-spored. Pleurocystidia none; cheilocystidia 18–26 × 4–8 $\mu$, 9-pin-shaped or ventricose, capitate to non-capitate. Gill trama of subparallel hyphae, 4–10 $\mu$ broad; subhymenium not distinctive. Pileus trama very loosely interwoven. Cuticle not distinctly differentiated, bearing bundles of brown, septate hyphae, the terminal elements as pileocystidia, 30–60 × 7–11 $\mu$, sometimes incrusted. Caulocystidia none. Clamp connections rare and inconspicuous. Yellowish brown pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On oak trees, Texas, August.

MATERIAL STUDIED—TEXAS: Dean 70 (MICH), the type, from Rockport, August 25, 1966.

OBSERVATIONS—The buff to tawny pileus with red or orange scales, lack of caulocystidia and pleurocystidia, and interwoven pileus trama are distinctive characters. The reddish scales recall those of *G. peliolepis,* but in that species both pleurocystidia and caulocystidia are present.

### 13. **Gymnopilus imperialis** (Speg.) Sing., Lilloa **22:** 561. 1950.

*Pholiota imperialis* Speg., Bol. Acad. Nac. Ci. Cordoba **11:** 38. 1889.

ILLUSTRATION: FIG. 30.

Pileus 5–10 cm broad, obtusely convex and with inrolled margin when young, becoming broadly convex to nearly plane, usually becoming somewhat depressed in the center, rufescent-saffron when young, soon becoming cinnamon-saffron, golden-ferruginous, golden-fulvous, orange-fulvous or fulvous, becoming fuliginous or blackish in age, non-viscid, glabrous when young but on expanding becoming very densely and minutely fibrillose-squamulose with appressed, imbricate, short, fine aggregations of fibrils. Context yellowish, thick on the disc, comparatively thin on the margin, spongy, absorbent, watery, with a bitter taste.

Lamellae adnate or sinuate, with a long decurrent tooth, seceding in age, luteous-fulvous when young, deep ferruginous in age, close to subdistant.

Stipe up to 12 cm long, 10–30 mm thick, luteous-cinnamon to fulvous, vivid orange-luteous at the apex, becoming fuliginous or blackish in age, enlarged below or clavate, with a somewhat radicating base which is covered with a bright citron-yellow mycelium where buried in the substratum, hollow, longitudinally furrowed to smooth, fibrillose to glabrous, context fleshy-fibrous, firm, luteous to brownish when fresh, hard and rigid and cinnamon-brown to blackish-brown in the dried material examined. Veil luteous-fulvous, membranous, thick, forming a large apical persistent annulus.

Spores 8–10 × 7–8.5 $\mu$, subglobose to broadly ellipsoid, large and conspicuously warty, lacking a germ pore, rich deep ferruginous in deposit, the inner part of the wall dark ferruginous and the exosporium yellowish in KOH under the microscope, dextrinoid. Basidia 25–30 × 7–8 $\mu$, 4-spored. Pleurocystidia none; cheilocystidia 30–40 × 7–10 $\mu$, abundant, fusoid-ventricose with narrow or filiform neck and capitate or sub-capitate apex, some filled with brown amorphorus material. Gill trama composed of parallel hyphae which are 4–8 $\mu$ in diameter; subhymenium not differentiated. Pileus trama composed of loosely interwoven hyphae which are 5–10 $\mu$ in diameter. Pileus cuticle of bundled subrepent hyphae with thickened walls which are incrusted with fulvous pigment, with hyaline content, septate. Clamp connections present.

HABIT, HABITAT, AND DISTRIBUTION—Cespitose on trunks or at the bases of living or dead frondose trees, especially *Eucalyptus;* April, October, and December; Jamaica and Brazil.

MATERIAL STUDIED—ARGENTINA: Spegazzini 21865, type of *P. imperialis* (LP).

OBSERVATIONS—Good diagnostic characters are the thick clavate, hollow stipe, the densely and minutely fibrillose-squamulose cuticle on mature pilei, the adnate or sinuate gills with a long decurrent tooth reaching down as far as the annulus, and the subglobose to broadly ellipsoid, very coarsely verrucose, dextrinoid spores. This species has not with certainty been found in North America, but is included for comparative purposes.

**14. Gymnopilus pholiotoides** Murr., Mycologia **5:** 24. 1913.

*Flammula pholiotoides* (Murr.) Murr., Mycologia **5:** 36. 1913.

Pileus scattered, 3 cm broad, convex, ochraceous, dry, the cuticle breaking into appressed, fibrillose scales, margin not striate. Context yellowish white; taste mild.

Lamellae short-decurrent, pale-ochraceous to bright ferruginous, medium broad, crowded.

Stipe 3 cm long, 5 mm thick, concolorous or paler, subcylindric, slightly fibrillose, solid. Veil thick, membranous, forming an annulus, at least when young.

Spores 7.5–9.5 × 4.5–5.5 μ, ferruginous in KOH and in Melzer's reagent, ellipsoid to subovoid in face view, inequilateral in profile, verruculose, no germ pore, not dextrinoid. Basidia 26–34 × 6–8 μ, 4-spored. Pleurocystidia none; cheilocystidia 24–38 × 4–7 μ, ventricose, with a neck, often capitate. Gill trama subparallel, hyphae 2–4 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of brown, repent hyphae, more or less incrusted, bearing clusters of brownish, incrusted, epicuticular hyphae. Clamp connections present. Pileus and gill trama yellowish brown in KOH; reddish brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On palm trunk, Cuba, May.

MATERIAL STUDIED—CUBA: Earle 527, type (NY), on dead royal palm trunk, Managua, leg. Baker, May 25, 1906.

OBSERVATIONS—The mild taste, behavior of the pileus cuticle, non-dextrinoid spores, lack of pleurocystidia, and radially disposed hyphae of the pileus trama, will distinguish *G. pholiotoides* from its relatives. The type specimen is somewhat fragmentary, and insufficient for study of the stipe; the presence or absence of caulocystidia could not be determined.

**15. Gymnopilus praefloccosus** Murr., Mycologia **33:** 280. 1941.

*Flammula praefloccosa* (Murr.) Murr., Mycologia **33:** 287. 1941.

Pileus solitary, 2–3 cm broad, convex to subexpanded, not at all umbonate, orange to yellow, uniformly and densely clothed with large, conic, floccose warts, which have dark, hardened points at the disc, margin even, incurved. Context firm, pale yellow, unchanging; odor none, taste slightly astringent.

Lamellae squarely adnate, pallid with a yellowish tint, becoming pale ferruginous, rather narrow, crowded, many times inserted.

Stipe 4 cm long, 7–8 mm thick, pallid with a cremeous tint, slightly tapering upward from a distinctly bulbous base, bulb 1 cm broad and high, fibrillose to subglabrous. Veil slight, but forming a very narrow, yellowish, membranous, fixed, subpersistent annulus.

Spores in mass fulvous (Murrill), 7–9 × 4–5.5 μ, ellipsoid in face view, inequilateral in profile, verruculose, no germ pore, yellowish brown in KOH, non-dextrinoid, wall thin, several collapsed. Basidia 22–26 × 5–7 μ, (2–)4-spored. Pleurocystidia 25–34 × 4–6 μ, ventricose or subcylindric, subcapitate, scattered, projecting only slightly or none; cheilocystidia 22–38 × 3–7 μ, cylindric-capitate, or more commonly more or less ventricose, sometimes with a brownish pigment. Gill trama subparallel, hyphae 4–9 μ broad. Pileus trama interwoven, in the lower area of the pileus trama there is a horizontal zone of brown hyphae. Cuticle of more or less erect tufts (scales) of broad (8–24 μ), brown, incrusted hyphae. Clamp connections rare. Caulocystidia none. Pileus and gill trama pale yellowish in KOH; reddish brown in Melzer's reagent. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On decayed sweetgum log, Florida, May.

MATERIAL STUDIED—FLORIDA: Murrill F-15620, type (FLAS), from Newnan's Lake, Alachua Co., May 1, 1938.

OBSERVATIONS—This is characterized by its orange or yellow pileus, dense, large, hispid, conic, brown, wart-like scales, its bulbous stipe, and its non-dextrinoid spores. This species is somewhat related to *G. fulvosquamulosus,* in which the scales are tawny and more or less appressed, the lamellae broad, the veil fugacious, and the spores dextrinoid.

**16. Gymnopilus armillatus** Murr., Bull. Torrey Club **67:** 280. 1940.

*Flammula armillata* (Murr.) Murr., Bull. Torrey Club **67:** 281. 1940.
ILLUSTRATION: FIG. 13.

Pileus 5–10 cm broad, convex to expanded, ochroleucous, pale-luteous on the disc, smooth, not viscid, disc minutely squamulose, elsewhere subglabrous to glabrous, margin even, entire. Context thick at the center, pale yellow; odorless, taste very bitter.

Lamellae sinuate with a decurrent tooth, luteous-flavous, becoming fulvous with age, broad, crowded, entire.

Stipe about 10 cm long, 10–15 mm thick, pale-yellow at the apex, darker below, brownish or blackish at the base, fibrillose, striate, equal, fleshy-tough. Annulus superior, ample, membranous, yellow, persistent.

Spores 8–10 × 4.5–6 $\mu$, ellipsoid to ovoid in face view, inequilateral in profile, ferruginous in KOH, non-dextrinoid, verruculose, no germ pore. Basidia 26–37 × 6–7 $\mu$, (2–)4-spored. Pleurocystidia 20–31 × 5–6 $\mu$, ventricose, more rarely flask-shaped, at times subcapitate; cheilocystidia 18–34 × 3–8 $\mu$, capitate, ventricose, or flask-shaped. Gill trama radial. Cuticle of repent hyphae, bearing scattered pileocystidia, 31–38 × 2.5–4 $\mu$, filamentous to subventricose. Caulocystidia 24–48 × 3–5 $\mu$, in pyramidal tufts, filamentous to clavate. Clamp connections present. Pileus and gill trama yellowish brown in KOH; reddish brown in Melzer's reagent. Pigment in the gill trama yellow-brown in KOH.

HABIT, HABITAT, AND DISTRIBUTION—On the root of a living sweetgum tree, Florida, December.

MATERIAL STUDIED—FLORIDA: Murrill F15731, type (FLAS) from Bithlo, Orange County, December 21, 1932.

OBSERVATIONS—The distinctive characteristics include its rather large size, minutely squamulose disc, very bitter taste, broad and crowded gills, membranous and persistent annulus, radially arranged hyphae of the pileus trama, and non-dextrinoid spores. It is distinguished from *G. spectabilis* in which the spores are dextrinoid, and the pileus trama of interwoven hyphae.

**Gymnopilus** subgenus **Gymnopilus**

*Agaricus* trib. *Flammulae* sect. *Sapinei* Fr., Epicr. Myc., p. 188. 1838.
*Gymnopilus* Karst. sect. *Sapinei* (Fr.) Sing., Lilloa **22:** 561. 1951.
[*Fulvidula* Romagn. (sect. ?) *Cortinatae* Romagn., Bull. Soc. Mycol. France **58:** 89. 1942, *nom. nud.*]

Veil absent, or present and fugacious, not forming a persistent annulus.
Lectotype species: *G. liquiritiae* (Pers. ex Fr.) Karst.

## Key to Sections

1. Spores 3.5–7 $\mu$ long; if 6–8 $\mu$ long, take next choice ..... sect. *Microspori*
1. Spores (6–)7–9 $\mu$ long ..... sect. *Gymnopilus*

**Gymnopilus** sect. **Microspori** Hesler, sect. nov.

Sporae 3.5–7 $\mu$ longae.

Type species: *Gymnopilus bellulus* (Pk.) Murr.

## Key to Species

1. Spores dextrinoid ..... 2
1. Spores non-dextrinoid ..... 12
   2. Pleurocystidia absent ..... 3
   2. Pleurocystidia present ..... 5
3. Cheilocystidia present; pileus scaly ..... 17. *G. underwoodii*
3. Cheilocystidia absent ..... 4
   4. Pileus glabrous; veil none; terrestrial ..... 18. *G. terrestris*
   4. Pileus minutely scaly; veil present; lignicolous .. 19. *G. parvisquamulosus*
5. Pileus dull-green with a bluish green bloom, or a mixture of green, blue, yellow; lamellae with yellow or ferruginous stains ..... 20. *G. punctifolius*
5. Pileus and lamellae not as above ..... 6
   6. Spores 3.5–5.5 × 2.5–3.5 $\mu$ ..... 21. *G. bellulus*
   6. Spores 5–7.5 × 3.5–4.5 $\mu$ ..... 7
7. Pileus 4–10 cm broad, "Hays russet" to "ochraceous-orange"; stipe concolorous, darkening upward from the base ..... 22. *G. sordidostipes*
7. Pileus 1–4(–7) cm broad, yellow to ferruginous; stipe not as above ..... 8
   8. Pileus uniformly ferruginous ..... 23. *G. bryophilus*
   8. Pileus brown, yellow, or yellow-brown ..... 9
9. Pleurocystidia spathulate; caulocystidia in tufts ..... 24. *G. pacificus*
9. Pleurocystidia ventricose or obclavate; caulocystidia more or less scattered, at times rare ..... 10
   10. Pileus trama of radially arranged hyphae ..... 25. *G. lepidotus*
   10. Pileus trama of interwoven hyphae ..... 11
11. Pileus yellow; stipe yellow above, tawny and clavate-enlarged below .... ..... 26. *G. subtropicus*
11. Pileus brown; stipe dark above, pallid below, equal ..... 27. *G. obscurus*
   12. Pleurocystidia none; cheilocystidia present ..... 13
   12. Pleurocystidia and cheilocystidia both present ..... 17
13. Pileus glabrous, uniformly fulvous ..... 28. *G. fulvicolor*

13. Pileus fibrillose or scaly, yellowish or brownish ..... 14
    14. Pileus with erect, pointed scales, martin striate; lamellae narrow .... ..... 29. *G. parvulus*
    14. Pileus fibrillose or tomentose, margin not striate; lamellae broad, at least behind ..... 15
15. Caulocystidia and pileocystidia present; pileus 2–5 cm broad ..... ..... 30. *G. aureobrunneus*
15. Caulocystidia and pileocystidia absent; pileus 1–2 cm broad ..... 16
    16. Pileus olive or brownish; spores 4–5 $\mu$ long ..... 31. *G. naucorioides*
    16. Pileus golden-yellow; spores 5.5–7.5 $\mu$ long ..... 32. *G. chrysopellus*
17. Spores 3.5–5(–5.5) $\times$ 2.4–3.5 $\mu$ ..... 18
17. Spores (5.5–)6–7 $\times$ (3.5–)4–4.5(–5) $\mu$ ..... 19
    18. Pileus furfuraceous; taste mild; lamellae narrow .... 33. *G. sub-bellulus*
    18. Pileus glabrous; taste bitter; lamellae broad ..... 34. *G. rufescens*
19. Taste mild; pileus pale flavous or darker ..... 35. *G. dryophilus*
19. Taste distinctive; pileus yellowish, at least at first ..... 20
    20. Taste astringent to farinaceous; pileus trama interwoven ..... ..... 36. *G. praelaeticolor*
    20. Taste bitter; pileus trama radial ..... 21
21. Pileus with ochraceous tawny scales toward the margin, olivaceous scales on the disc; basidiocarp greenish on drying ..... 37. *G. luteoviridis*
21. Pileus scales brown; basidiocarp not drying greenish ..... 22
    22. Pileus 8–10 cm broad, deeply depressed, yellowish, becoming rusty brown ..... 38. *G. depressus*
    22. Pileus 3–7 cm broad, convex, disc areolate, dingy orange-yellow ..... 39. *G. areolatus*

**17. Gymnopilus underwoodi** (Pk.) Murr. North Amer. Flora **10:** 205. 1917.

*Flammula underwoodii* Pk., Bull. Torrey Club **23:** 415. 1896.

Pileus densely cespitose, 6–10 cm broad, convex or nearly plane, often irregular, yellowish brown, squamulose or furfuraceous.

Lamellae adnate or slightly decurrent, yellow, crowded, rather broad.

Stipe 5–10 cm long, 6–12 mm thick, apex yellow, longitudinally streaked brownish, tapering downward, radicate.

Spores 6–7 $\times$ 4–4.5 $\mu$, ellipsoid to subovoid in face view, inequilateral in profile, verruculose, no germ pore, dextrinoid. Basidia 22–28 $\times$ 5–6 $\mu$, 4-spored. Pleurocystidia none; cheilocystidia 20–30 $\times$ 3–5 $\mu$, flask-shaped or ventricose, sometimes capitate, rare and inconspicuous. Gill trama interwoven—undulating. Pileus trama interwoven. Cuticle repent, epicuticular hyphae, forming surface squamules, brown. Clamp connections present. Caulocystidia 33–53 $\times$ 4–7 $\mu$, filamentous, clavate, or ventricose, as terminal elements of hyphae in tufts.

HABIT, HABITAT, AND DISTRIBUTION—On pine logs and trunks, Virginia to Alabama and Florida, November-December.

MATERIAL STUDIED—ALABAMA: Peck, type (NYS), leg. L. M. Underwood, Auburn, November 28, 1895.

OBSERVATIONS—Although the spores are said to be ochraceous, the type specimen shows other valid characters of *Gymnopilus*. It is a rather large, densely cespitose species, with a yellowish brown, scaly pileus, broad and crowded gills, tapering and radicate stipe, and the pileus trama of interwoven hyphae.

**18. Gymnopilus terrestris** Hesler, sp. nov.

ILLUSTRATIONS: FIGS. 26, 112.

Pileus 3–7(–10) cm latus, "amber-brown" vel "Sanford brown" demum "xanthine orange," glabrosus. Contextu concolor; gustu mitis. Lamellae adnatae demum sinuatae, "ochraceous tawny" demum "ferruginous," confertae, mediolatae. Stipes 6–12 cm longus, 5–10 mm crassus, albidus demum brunneus vel ferrugineus. Velum nullum. Sporae (5–)5.5–7 × (4–)4.5–5.5(–6) $\mu$, ellipsoideae vel sublobosae, dextrinoideae. Pleurocystidia et cheilocystidia desunt. Specimen typicum in Herb. Univ. Mich., lectum prope Longmire, Washington, September 22, 1952, Smith 40156.

Pileus 3–7(–10) cm broad, convex to subplane, umbonate when young, sometimes depressed in age, "amber-brown" or "Sanford's brown" to "xanthine-orange," ferruginous, or fulvous, somewhat paler on drying, glabrous, moist or at times subviscid, sometimes the margin translucent-striate. Context watery and concolorous with the pileus, fading to warm-buff, disc thick, margin thin, fragile; odor and taste mild.

Lamellae adnate to sinuate with a slight decurrent tooth, often seceding, ochraceous-tawny, rusty brown, to ferruginous, close, broad to medium broad.

Stipe (4–)6–12(–14) cm long, (3–)5–10(–13) mm thick, whitish or rusty brown to ferruginous, equal or base enlarged, or tapering slightly downward, glabrous, hollow. Veil none.

Spores (5–)5.5–7 × (4–)4.5–5.5(–6) $\mu$, ellipsoid, short-ellipsoid to subglobose, or ovoid in face view, slightly inequilateral in profile, verruculose, no germ pore, ferruginous in KOH, slightly dextrinoid at first, then entirely so after one hour. Basidia 30–36 × 6–7 $\mu$, 4-spored. Pleurocystidia and cheilocystidia none. Gill trama of subparallel hyphae, 4–10 $\mu$ broad; subhymenium not distinctive. Pileus trama of radial hyphae. Cuticle a zone of repent, colorless hyphae, sometimes incrusted, and with occasional uplifted elements, the terminal cells of which are clavate or fusoid pileocystidia, 33–50 × 6–10 $\mu$. Clamp connections present. Caulocystidia 42–52 × 6–13 $\mu$, cylindric, ventricose, to subclavate, usually as terminal elements of tangled hyphae. No yellow pigment in gill trama, in KOH.

HABIT, HABITAT, AND DISTRIBUTION—On soil and humus, under conifers, Michigan, Colorado, Idaho, Washington, and Oregon, June-October.

MATERIAL STUDIED—COLORADO: Smith 51390, 53121; IDAHO: Bigelow 1657 (MASS); Shafer 1201; Smith 44204, 44205, 44239, 44253, 44275, 44382, 44422, 44715, 45301, 46087, 53810, 55186, 58812, 59452, 65297, 69705, 70207, 74247; MICHIGAN: Smith 37101, 42352, 42956, 43523, 66649; Thiers 1112 (SFSC); OREGON: Smith 19668; WASHINGTON:

Smith 3121, 3312, 17452, 39986, 40156 (type, from Longmire, September 22, 1952), 47369, 48274.

OBSERVATIONS—The distinguishing characteristics of this species include its lack of pleurocystidia and cheilocystidia, the presence of pileocystidia and caulocystidia, its terrestrial habitat, and mild taste. The cuticle is a narrow zone of colorless hyphae in which at times there is slight gelatinization. *Gymnopilus terrestris* is somewhat related to *G. fulvicolor,* which grows on leaf-mold in Florida, but the latter is generally smaller, its spores non-dextrinoid, pileus trama interwoven, and cheilocystidia present.

**19. Gymnopilus parvisquamulosus** Hesler, sp. nov.

ILLUSTRATIONS FIG. 23.

Pileus 5–9 cm latus, "ochraceous tawny," squamosus. Contextu "ochraceous buff"; gustu mitis. Lamellae adantae vel adnexae, ferrungineae, conferte vel subdistantes. Stipes 5–7 cm longus, 10–15 mm crassus, paene "warm buff," obscurior tractatus, fibrillosus vel squamosus. Velum arachnoideum, fugax. Sporae 6–7.5 × (4–)5–5.5(–6) $\mu$ ovoideae vel brevi-ellipsoideae, dextrinoideae. Pleurocystidia et cheilocystidia desunt. Specumen typicum in Herb. San Francisco State College, lectum in Stanaislaus Nat. Forest, June 13, 1964, Theirs 11238.

Pileus 5–9 cm broad, plane to plano-convex to plane with a shallow depression on the disc, moist to dry, appressed fibrillose on margin, but becoming conspicuously appressed-scaly to fibrillose-scaly on the disc, scales small, abundant, giving a squarrose to squamulose appearance, background color "ochraceous tawny," sometimes approaching "buckthorn brown," the scales considerably darker-colored (near blackish brown), dense on the disc, more widely separated on the margin, margin plane to decurved, frequently eroded with age, rimose to split. Context 0.5–1 cm thick, colored near "ochraceous buff," unchanging; taste and odor mild.

Lamellae notched to adnate, sometimes seceding, often strongly ventricose, at maturity cinnamon rufous to ferruginous to approaching "Sanford brown," close to subdistant, lamellulae numerous, margin entire, concolorous.

Stipe 5–7 cm long, 10–15 mm thick, near warm buff to "ochraceous buff" to "light buff," but darkening to near "buckthorn brown" to "ochraceous tawny" when handled, equal or tapering slightly toward the base, stuffed, appressed fibrillose, sometimes the fibrils form scales. Veil, in most instances, forming an annular, median or slightly basal zone, more or less fugacious.

Spores 6–7.5 × (4–)5–5.5(–6) $\mu$, short-ellipsoid, often ovoid, ferruginous in KOH, dextrinoid, verrucose-wrinkled, no germ pore. Basidia 26–30 × 6–7(–8) $\mu$, 4-spored. Pleurocystidia and cheilocystidia none. Gill trama of subparallel hyphae, 4–10 $\mu$ broad; subhymenium not distinctive. Pileus trama of radial hyphae. Cuticle of repent hyphae, a distinct zone, bearing hyphae which are more or less erect, or tufts of hyphae forming erect scales. Clamps not found. Pileocystidia and caulocystidia none.

HABIT, HABITAT, AND DISTRIBUTION—Gregarious on conifer log, California and Maine, June and August.

MATERIAL STUDIED—CALIFORNIA: Thiers 11238 (SFSC), type, Stanislaus National Forest, June 13, 1964; MAINE: Bigelow 10987 (MASS).

OBSERVATIONS—This species is characterized chiefly by its rather large pileus with numerous, minute, blackish brown scales, buff flesh, numerous lamellulae, buff and fibrillose stipe, rather small, often ovoid, dextrinoid spores, and the absence of both pleurocystidia and cheilocystidia. Its nearest relative appears to be *G. terrestris,* which is terrestrial, has a glabrous pileus, and lacks a veil.

**20. Gymnopilus punctifolius** (Pk.) Sing., Lilloa **22:** 561. 1951.

*Cortinarius punctifolius* Pk., Bull. Torrey Club **30:** 96. 1903.

*Flammula punctifolia* (Pk.) A. H. Smith, Amer. Midl. Nat. **32:** 695. 1944.

*Gymnopilus subviridis* Murr. *apud* House, N.Y. State Mus. Bull. **179:** 33. 1915.

*Flammula subviridis* (Murr.) Murr. *apud* House, N.Y. State Mus. Bull. **179:** 33. 1915.

ILLUSTRATIONS: FIGS. 21, 22, 97, 98, 113.

Pileus 2.5–10 cm broad, convex to nearly plane, buttons lilac-vinaceous, then dull-green with a bluish green bloom, or variable, green, blue and yellow mixed (dried pilei olivaceous to near "Isabella color"), often fibrillose and squamulose around the disc, becoming glabrous with age, dry, margin involute. Context thin on the margin, greenish yellow; odor agreeable or not distinctive, taste very bitter.

Lamellae adnate or sinuate to deeply emarginate, "yellowish olive" when young, becoming "Isabella," dotted with yellow or ferruginous stains, finally cinnamon, broad, inserted, close to subdistant, edges often stained yellowish tawny or ferruginous.

Stipe (2.5–)10–15 cm long, 5–10(–14) mm thick, concolorous, staining brownish yellow or olive-ochre within, flexuous, striate, stuffed then hollow. Veil none.

Spores 4–5.5(–6.5) × 3.5–4(–5) μ, mostly ovoid or subovoid, some short-ellipsoid in face view, slightly inequilateral in profile, verruculose to somewhat asperulate, with an apiculate hilum, no germ pore, dextrinoid. Basidia 27–34 × 5–7 μ, 4-spored. Pleurocystidia 27–43 × 3–5 μ, slender-ventricose, color-less, capitate; basidioles 23–30 × 3–5 μ, clavate, brown; cheilocystidia 20–30 × 3–4 μ, ventricose, capitate, more rarely filiform. Gill trama subparallel, hyphae 4–8 μ broad. Pileus trama radial. Cuticle a repent zone of brown hyphae, bearing a turf of slender, erect, filamentous to subventricose, capitate pileocystidia 36–57 × 1.5–3 μ. Clamp connections present. Pileus and gill trama reddish brown in KOH, and in Melzer's reagent; hymenium dark-red in KOH. Caulocystidia 18–42 × 4–7 μ, flask-shaped, or ventricose, neck often slender, capitate or more commonly non-capitate, forming a turf. Yellow pig-ment, soluble in KOH, present in the gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On coniferous wood, débris, and rich humus, Idaho, Washington, Oregon, and California, August-December.

MATERIAL STUDIED—CALIFORNIA: Parchim 27 (SFSC); Smith 3793, 9016, 9160, 55911, 56125; Thiers 8400, 10024, 10980, 17647; IDAHO:

Largent 751 (SFSC); Peck, type of *Cortinarius punctifolius* (NYS), from the base of the Moscow Mountains; Smith 46554, 59835, 60546, 69558; Thiers 11617, 11671; OREGON: Smith 19122, 24929, 26959, 27801, 28259, 28474; WASHINGTON: Bigelow 2135 (MASS); Imshaug 2114; Murrill, type of *G. subviridis* (NY), on decayed fir stump, Olympia, November 27, 1914; Smith 16914, 17140, 17222, 17429, 17553, 17905, 17989, 24735, 30802, 31221, 31260, 31635, 40469, 40558, 47391, 47835, 47899, 48958; WYOMING: McKnight F-7499 (MICH).

OBSERVATIONS—The description of microscopic characters is based on a study of the type of *Cortinarius punctifolius* Pk. Smith (**1944**) recognized that this species and Murrill's *Flammula subviridis* were one and the same. The pileus colors, the dotted gills, and filiform pileocystidia are distinctive. Many of the dried basidiocarps retain blue-green to green tints.

**21. Gymnopilus bellulus** (Pk.) Murr., North Amer. Flora **10:** 200. 1917.

*Agaricus bellulus* Pk., Bull. Buffalo Soc. Nat. Sci. **1:** 51. 1873.
*Naucoria bellula* (Pk.) Sacc., Syll. Fung. **5:** 841. 1887.
*Fulvidula bellula* (Pk.) Joss., Bull. Soc. Mycol. France **64:** 23. 1948.

ILLUSTRATIONS: FIGS. 17, 45, 46, 47, 114.

Pileus sometimes cespitose, 1–2.5 cm broad, convex, obtuse, "Kaiser brown," deep-tawny, orange-brown, bright-watery-cinnamon, or rusty fulvous, glabrous or minutely scurfy, margin even, sometimes extending beyond the pileus-margin. Context thin on margin, tawny to ochraceous; odor mild, taste bitter.

Lamellae adnate-seceding, sometimes emarginate with a tooth, bright-yellow, then dull-yellow, or rusty yellow, finally ferruginous and spotted, edges sometimes staining brown, close to crowded, narrow.

Stipe 1.5–3 cm long, 1.5–3 cm thick, reddish brown or rusty bay, darker below, apex scurfy, sometimes throughout, equal, solid or stuffed then hollow. Veil none.

Spores 3.5–5.5 × 2.6–3.5 μ, ellipsoid to ovoid, verrucose, often with a suprahilar depression, no germ pore, ferruginous in KOH, dextrinoid. Bright rusty yellow in deposit. Basidia 17–22 × 4–5 μ, 4-spored. Lactiferous basidioles scattered to abundant on sides, with brown amorphous contents, 16–19 × 4–5 μ. Pleurocystidia 20–24 × 5–6 μ, fusoid-ventricose with a filiform neck, capitate to subcapitate; cheilocystidia 14–26 × 3–5 μ, flask-shaped, capitate or subcapitate. Gill trama parallel, hyphae 5–10 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of upright or subrepent hyphae, irregularly scattered or tufted, the terminal elements as pileocystidia, 28–35(–50) × 5–15 μ, clavate to saccate, more or less in a palisade or in tufts. Clamp connections present. Caulocystidia 20–37 × 5–10 μ, brownish, clavate, spathulate, ellipsoid, at times subcapitate.

HABIT, HABITAT, AND DISTRIBUTION—On conifer stumps and logs, Northern United States, Tennessee, and Canada, June-January.

MATERIAL STUDIED—CALIFORNIA: Largent 713 (SFSC); Thiers 18432 (SFSC); Smith 9395, 55146, 56337, 56507, 56601, 56701, 56751, 56924;

COLORADO: Smith 50354; CONNECTICUT: Bigelow 7662 (MASS); IDAHO: Bigelow 1957 (MASS); Smith 47324, 50359, 70210, 70215; Thiers 11610 (SFSC); MAINE: Bigelow 4460, 4547 (MICH); MASSACHUSETTS: Bigelow 6589, 9204 (MASS); MICHIGAN: Harding 387 (MICH); Imshaug 4784 (MICH); Smith 21440, 26236, 33–898, 42215, 57904, 63388, 33–1119; NEW YORK: Smith 288; OHIO: Walters 110 (MICH); OREGON: Smith 3539, 74232; TENNESSEE: Smith 10876; WASHINGTON: Smith 13961, 41129, 47934, 49255.

OBSERVATIONS—The distinctive characters of this species are its small stature, and its small, ellipsoid to ovoid spores. There is no veil in American material of *G. bellulus*. On the other hand, Josserand (**1948**) reports an agaric under this name from France and states that there is a veil in the young stage.

Peck's type is confusing. It appears that the labels of the type and of a collection of another species have been interchanged. In the collection marked type and which we examined, the spores are 8–9.5 × 5–5.5 $\mu$—much too large for *G. bellulus*.

This species is related to *G. picreus,* but the latter has much larger spores.

**22. Gymnopilus sordidostipes** Hesler, sp. nov.

ILLUSTRATIONS: FIGS. 11, 116.

Pileus 4–10 cm latus, "Hays russet," deinde "ochraceous orange," leviter squamulosus. Contextu concolor; gustu amarus. Lamellae adnatae demum adnexae, subflavo-aurantiae, confertae; medio-latae. Stipes 4–10 cm longus, 5–12 mm crassus, cum pileo subconcolor, a basi sursam se obscurans. Velum arachnoideum, fugax. Sporae (5.5–)6–7.5 × 3.5–4.5 $\mu$, ellipsoideae, dextrinoideae. Pleurocystidia 23–27 × 5–6 $\mu$; cheilocystidia 17–28 × 4–6 $\mu$. Specimen typicum in Herb. Univ. Mich., lectum in Grants Pass, Oregon, November 18, 1956, Smith 55808.

Pileus 4–10 cm broad, obtuse to convex, expanding to plane, "Hays russet" fading to "ochraceous orange," margin opaque at all times, incurved at first, surface hygrophanous, minutely squamulose under a lens, more distinctly so when faded. Context concolor with surface; odor none, taste bitter.

Lamellae adnate to adnexed, close, medium broad, yellowish orange.

Stipe 4–10 cm long, 5–12 mm thick, at apex, equal to clavate, narrowed below (in clusters) almost concolorous with the cap and darkening from base up, at first with a thin coating of orange-buff veil remnants. Veil arachnoid, yellowish, leaving an evanescent zone.

Spores (5.5–)6–7.5 × 3.5–4.5 $\mu$, ellipsoid, slightly inequilateral, verruculose (appearing wrinkled), ferruginous in KOH, dextrinoid, no germ pore. Basidia 22–25 × 5–6 $\mu$, 4-spored. Pleurocystidia 23–27 × 5–6 $\mu$, ventricose, sometimes more or less capitate; cheilocystidia 17–28 × 4–6 $\mu$, ventricose, flask-shaped, capitate to non-capitate. Gill trama of subparallel hyphae, 4–9 $\mu$ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of repent, brown hyphae, with bundles of brown, frequently incrusted hyphae (scales). Pileocystidia of two types: (1) 13–24 × 5–7 $\mu$, colorless, clavate, scattered, rare; (2) 35–48 × 6–10 $\mu$, clavate, brown, sometimes incrusted, often forming mounds. Caulocystidia 24–38 × 3–7 $\mu$, colorless, clavate, in tufts. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—Cespitose on sawdust, Oregon, November.

MATERIAL STUDIED—OREGON: Smith 55808, type, from Grants Pass, November 18, 1956.

OBSERVATIONS—This species is somewhat similar to *G. lepidotus* through its dextrinoid spores, but there the resemblance seems to cease. It is a rather large agaric, with a rusty red pileus in the button-stage, an ochraceous orange stipe which darkens from the base up, and two types of pileocystidia—a rather unique situation in *Gymnopilus*.

**23. Gymnopilus bryophilus** Murr., Mycologia **5:** 22. 1913.

*Flammula bryophila* (Murr.) Murr., Mycologia **5:** 36. 1913.

Pileus 2–5 cm broad, convex, uniformly ferruginous, densely appressed-fibrillose, dry, margin not striate.

Lamellae sinuate with a decurrent tooth, concolorous, broad, crowded, plane.

Stipe 2–4 cm long, 3–4 mm thick, pale-fuscous, yellow within, cylindric, often eccentric, fibrillose, solid.

Spores 5–7 × 4–4.5 μ, ellipsoid to subovoid in face view, slightly inequilateral in profile, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 23–27 × 5–6 μ, 4-spored. Pleurocystidia 21–27 × 4–7 μ, ventricose-capitate, buried; cheilocystidia 22–30 × 4–8 μ, ventricose-capitate, inconspicuous. Gill trama subparallel, hyphae 5–14 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle a thick zone of dark-brown hyphae, bearing more or less erect epicuticular, brown, lightly incrusted hyphae; pileocystidia none. Clamp connections present. Pileus and gill trama yellowish brown in KOH; reddish brown in Melzer's reagent. Stipe surface densely fibrillose, the hyphae brownish, frequently with clamps, the terminal elements as caulocystidia, 33–40 × 5–7 μ, clavate, apices sometimes mucronate.

HABIT, HABITAT, AND DISTRIBUTION—On decayed mossy log, Jamaica, November.

MATERIAL STUDIED—JAMAICA: Earle 613, type (NY), Port Antonio, November 24, 1902.

OBSERVATIONS—The chief distinguishing features of this species include the uniformly ferruginous color of its pileus, its moderately small, dextrinoid spores, radially arranged hyphae of the pileus trama, and lack of pileocystidia. It has some relationship to *G. sapineus,* which, however, has pileocystidia, much larger spores, and a yellow pileus.

**24. Gymnopilus pacificus** Hesler, sp. nov.

ILLUSTRATIONS: FIGS. 86, 87, 88, 89.

Pileus 12–18 mm latus, aurantio-flavus, fibrilloso-squamosus. Lamelle adnato-decurrentes, flavae, confertae, latae. Stipes 1.5–2 cm longus, 3–4 mm crassus, subflavus, fibrillosus. Velum arachnoideum, fugax. Sporae 5.5–7(–7.5) × 4–5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 24–37 × 7–10 μ; cheilocystidia 14–24 × 4–6 μ, biformia: (1) ampullacea; (2) ventricosa vel subfusoidea. Specimen typicum in Herb. Mich., lectum in Oahu, Hawaii, May 20, 1940, Bessey 722.

Pileus 12–18 mm broad, convex, more or less expanding, orange-yellow, not viscid, fibrillose-scaly, margin incurved, even. Context pallid.

Lamellae adnate-decurrent, yellowish, close, broad.

Stipe 1.5–2 cm long, 3–4 mm thick, slightly fibrillose, striate, yellowish. Veil arachnoid, fugacious.

Spores 5.5–7(–7.5) × 4–5 μ, ellipsoid, slightly in-equilateral, verruculose, ferruginous in KOH, dextrinoid, no germ pore. Basidia 23–26 × 6–7 μ, 4-spored. Pleurocystidia 24–37 × 7–10 μ, clavate-spathulate, scattered, rather inconspicuous; cheilocystidia 14–24 × 4–6 μ, flask-shaped, ventricose, or sub-fusoid. Gill trama of subparallel hyphae, 5–12 μ broad; subhymenium not distinctive. Pileus trama interwoven. Cuticle of repent, colorless hyphae, scarcely differentiated from the trama, bearing bundles of erect, pale-brownish hyphae (scales). Pileocystidia none. Caulocystidia 25–40 × 3–5 μ, cylindric or clavate, often filamentous, in rather large, erect tufts, or fascicles, more or less septate. Clamp connections present, obscure. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On wood, Mississippi and Hawaii, May-June.

MATERIAL STUDIED—HAWAII: Bessey 722 (MICH), type, on fence-post of *Metrosideros collina polymorpha,* Oahu, leg. Ernest Akamine, May 20, 1940; MISSISSIPPI: Thiers 6268 (SFSC).

OBSERVATIONS—The distinctive characters include the small pileus and its colors, the spathulate pleurocystidia, two morphological types of cheilocystidia, and the large tufts of caulocystidia, which may be septate. It is near *G. sub-tropicus,* which has ventricose pleurocystidia, and broader caulocystidia, and is less conspicuously scaly.

### 25. **Gymnopilus lepidotus** Hesler, sp. nov.

Pileus 4–8 mm latus, "antimony yellow," fibrilloso-squamosus. Contextu clare flavus; gustu amarus. Lamellae adnatae, "zinc orange," confertae, latae. Stipes 2–4 cm longus, 2–4 mm crassus, pallidus demum fuscus. Velum arachnoideum, flavum, fugax. Sporae 5.5–7(–7.5) × 4.5–5 μ, ellipsoideae demum ovoideae, dextrinoideae. Pleurocystidia 28–40 × 5–6 μ; cheilocystidia 18–23 × 4–7 μ. Specimen typicum in Herb. Univ. Tenn., lectum prope Natural Bridge, Florida, July 31, 1954, Hesler 21453.

Pileus 4–8 mm broad, convex, expanding-convex, "antimony yellow," fibril-lose-scaly, scales tufted-erect, dry, margin even. Context thick, firm, pale-yellow; odor mild, taste promptly bitter.

Lamellae adnate to rounded-adnate, zinc-orange, broad, many lamellulae numerous, close, edges fimbriate.

Stipe 2–4 cm long, 2–4 mm thick, dingy or pallid, apex pruinose, elsewhere glabrous, equal or slightly enlarged at apex, solid. Veil webby, yellowish, fugacious.

Spores 5.5–7(–7.5) × 4.5–5 μ, ellipsoid to ovoid in face view, inequilateral in profile, verruculose, ferruginous in KOH, dextrinoid, no germ pore. Basidia 21–25 × 5–6 μ, 2–4-spored. Pleurocystidia 28–40 × 5–6 μ, colorless, obcla-vate, subventricose, rare, inconspicuous; basidioles 24–28 × 5–6 μ, brown, flask-shaped; cheilocystidia 18–23 × 4–7 μ, ventricose or flask-shaped, colorless or brown, non-capitate. Gill trama parallel, hyphae 5–8 μ broad; subhymenium

not distinctive. Pileus trama radial. Cuticle not sharply differentiated, the surface bearing a turf of tangled, brown hyphae. Pileocystidia none. Clamp connections present. Caulocystidia 35–60 × 7–8 μ, cylindric-clavate or ventricose, scattered. A yellow pigment is dissolved out in KOH.

HABIT, HABITAT, AND DISTRIBUTION—On gum log, Florida, July.

MATERIAL STUDIED—FLORIDA: Hesler 21453, type, from Natural Bridge, leg. T. H. Campbell, July 31, 1954.

OBSERVATIONS—This species is distinguished by its small, yellow pileus with erect scales. It is related to *G. hispidus* in which the pileus is umbilicate to infundibuliform, and the spores larger (7.5–9 × 5.5–6 μ); to *G. aureobrunneus* in which the cuticle of the pileus is a distinct, thick, brown zone of repent hyphae, and in which the surface of the pileus is appressed-fibrillose (not scaly), and which has a much more robust stipe. It is also related to *G. hispidellus* in which the spores are non-dextrinoid, and the pleurocystidia clavate, and either mucronate or appendiculate; and to *G. subtropicus* in which the pileus is much larger, the stipe fibrillose, and the pileus trama of interwoven hyphae.

**26. Gymnopilus subtropicus** Hesler, sp. nov.

ILLUSTRATIONS FIG. 14.

Pileus 1–4.5 cm latus, paene "antimony yellow," fibrillosus, saepe squamosus. Contextu subflavus. Lamellae adnato-decurrentes, confertae, latae. Stipes 3.5–4 cm longus, 3–5 mm crassus, supra subflavus, infra furvus, clavatus. Velum arachnoideum, fugax. Sporae (5–)5.5–7 × 4–4.5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 23–30 × 5–8 μ; cheilocystidia 12–30 × 3–6 μ. Specimen typicum in Herb. San Francisco State College, lectum prope Biloxi, Mississippi, June 5, 1959, Thiers 6345.

Pileus 1–4.5 cm broad, convex, yellowish (near "antimony yellow"), densely brownish fibrillose, fibrils often in fascicles to form fibrillose scales, other fibrils more or less repent, dry. Context thin, yellowish, reddish brown in 2% KOH.

Lamellae adnate-decurrent, close, broad, edges obscurely pale.

Stipe 3.5–4 cm long, 3–5 mm thick, yellowish above, tawny below, fibrillose, striate, solid, clavate-enlarged at base. Veil arachnoid, fugacious, remnants on the stipe forming an indistinct ring.

Spores (5–)5.5–7 × 4–4.5 μ, ellipsoid in face view, slightly inequilateral in profile, wrinkled-verruculose, ferruginous in KOH, dextrinoid, no germ pore. Basidia 24–28 × 6–7 μ, 4-spored. Pleurocystidia 23–30 × 5–8 μ, ventricose; basidioles 20–30 × 5–9 μ, clavate or ventricose, at times capitate, brown; cheilocystidia 12–30 × 3–6 μ, flask-shaped or ventricose, non-capitate, more rarely subcapitate. Gill trama of subparallel hyphae, 5–12 μ broad; subhymenium not distinctive. Pileus trama of interwoven hyphae. Cuticle of repent, brownish hyphae, scarcely differentiated from the trama, the surface bearing pallid-brown hyphae which are often in erect or semi-erect fascicles (fibrillose scales), these hyphae 5–18 μ broad. Pileocystidia none. Caulocystidia 22–26 × 4–9 μ, ventricose, cylindric, or clavate, at times capitate. Clamp connections present. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On oak and palm logs, Florida, Mississippi, Louisiana, Hawaii, March and June-August.

MATERIAL STUDIED—FLORIDA: Thiers 4754, 4766, 5238, 5239, 5312, 5358 (SFSC); HAWAII: Bessey 497, 607 (MICH); LOUISIANA: Thiers 7831, 7899, 7913 (SFSC); MISSISSIPPI: Thiers 6345, type, on oak log, Biloxi, June 5, 1959; 6428 (SFSC).

OBSERVATIONS—The distinctive characters of this species include the yellow pileus with distinct, more or less erect fascicles of fibrillose scales, or with dense fibrils over the margin, the arachnoid fugacious veil, the small, dextrinoid spores, the interwoven trama of the pileus, and the presence of caulocystidia. It might suggest *G. hispidellus,* in which the spores are non-dextrinoid, the veil subannulate, and the pileus trama radial. It appears more closely related to *G. lepidotus,* in which the basidiocarp is decidedly smaller, the pileus trama radial, and which has different pleurocystidia. It is also rather near *G. pacificus,* in which the pileocystidia are spathulate to subclavate.

## 27. **Gymnopilus obscurus** Hesler, sp. nov.

Pileus 3.5–7 cm latus, brunneus, fibrilloso-squamulosus. Lamellae adnato-subdecurrentes, brunneae, confertae, medio-latae. Stipes 4.5 cm longus, 8 mm crassus, supra obscurus, infra pallidus. Velum nullum. Sporae 5.5–7.5 × 4–4.5 $\mu$, ellipsoideae, dextrinoideae. Pleurocystidia 24–26 × 4–5 $\mu$; cheilocystidia biformia: (1) 18–28 × 4–6 $\mu$, cylindrica, sine colore; (2) 25–30 × 4–7 $\mu$, ampullacea, brunnea. Specimen typicum in Herb. San Francisco State College, lectum prope Mendocino, California, December 1, 1962, Thiers 9677.

Pileus 3.5–7 cm broad, convex, then plane or slightly depressed, brown, densely appressed, fibrillose-squamulose, center slightly hispid. Context thin.

Lamellae adnate-subdecurrent, brown, close, medium broad.

Stipe 4.5 cm long, 8 mm thick, dark above, pallid below, equal, slightly fibrillose. Veil none.

Spores 5.5–7.5 × 4–4.5 $\mu$, ellipsoid, inequilateral, ferruginous in KOH, dextrinoid, verruculose, no germ pore. Basidia 16–20 × 4–5 $\mu$, 4-spored. Pleurocystidia 24–26 × 4–5 $\mu$, colorless, ventricose; basidioles clavate to ventricose, brown, capitate or non-capitate; cheilocystidia 18–30 × 4–7 $\mu$, flask-shaped to cylindric, capitate or non-capitate. Gill trama of subparallel hyphae, 5–9 $\mu$ broad; subhymenium not distinctive. Pileus trama of loosely interwoven hyphae. Cuticle of brown, repent hyphae, bearing tufts (bundles) of brown, incrusted hyphae (fibrillose-scales). Pileocystidia none. Caulocystidia 55–80 × 9–15 $\mu$, colorless, flask-shaped or clavate, rare. Clamp connections present.

HABIT, HABITAT, AND DISTRIBUTION—Scattered on log in mixed forest, California, December.

MATERIAL STUDIED—California: Thiers 9677 (SFSC), type, Jackson State Forest, near Mendocino, December 1, 1962.

OBSERVATIONS—This species is distinguished by its brown, appressed-squamulose pileus, brown lamellae, lack of a veil, rather small, dextrinoid spores, and strongly capitate cheilocystidia. It differs from *G. praefloccosus* which is orange or yellow, has a subpersistent annulus, and spores 7–9 × 4–5.5 $\mu$; from *G. subtropicus,* in which the pileus is yellow, and the veil forms an indistinct ring; from *G. sordiostipes,* in which a veil and pileocystidia are

present, and the stipe darkens from the base upward. Although it might be mistaken for *G. spectabilis,* it is clearly not that species.

**28. Gymnopilus fulvicolor** Murr., Mycologia **35:** 532. 1943.

*Flammula fulvicolor* (Murr.) Murr., Mycologia **35:** 537. 1943.

Pileus about 5 cm broad, convex to plane, gregarious, uniformly fulvous, glabrous, not viscid, margin even.

Lamellae adnate, ferruginous, rather broad, not crowded.

Stipe about 4 cm long, slender (about 3–4 mm thick), white, subglabrous. Veil apparently present and fugacious.

Spores ferruginous (Murrill) 5.5–7(–7.5) × (4–)4.5–5.5 μ, ellipsoid, subglobose, or ovoid in face view, slightly inequilateral in profile, verrucose or subechinulate, warts not crowded, with a hilum, no germ pore, brown in KOH, not dextrinoid. Basidia 24–30 × 5–6.5 μ, 4-spored. Pleurocystidia none; cheilocystidia 24–30 × 4–7 μ, clavate to ventricose, rare. Pileus trama of interwoven hyphae. Clamp connections present. Cuticle of repent hyphae, bearing a few more or less erect hyphae. Caulocystidia none. Pileus and gill trama yellowish brown in KOH; dark reddish brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On leaf-mold, among sticks, under pine, Florida, January.

MATERIAL STUDIED—FLORIDA: Murrill F-16005, type (FLAS), from Gainesville, January 8, 1938.

OBSERVATIONS—The terrestrial habitat, and the pale yellowish color of the spores in Melzer's reagent suggest that this species is near *Cortinarius.* Its precise generic relationship can best be determined through a study of fresh collections. Murrill makes no mention of a veil, but the type shows some fibrils on the stipe which appear to be velar.

**29. Gymnopilus parvulus** Murr., Mycologia **5:** 19. 1913.

*Flammula parvula* (Murr.) Murr., Mycologia **5:** 36. 1913.

Pileus reaching 2–4 cm broad, subcespitose, convex to nearly plane, not viscid, flavous-ochraceous, darker with age, with conspicuous, erect, pointed scales or fibrils which are isabelline to fulvous in color, margin striate, incurved on drying. Context pale-ochraceous, thin; taste slightly bitter.

Lamellae adnate, sometimes with a decurrent tooth, isabelline to ferruginous-fulvous, narrow, subcrowded.

Stipe 2–4 cm long, 3–5 mm thick, concolorous or darker, slightly blackish toward the base, especially on drying, fibrillose, solid, becoming hollow. Veil of yellow fibrils, fugacious.

Spores 5.5–7.5 × (3.5–)4–5(–5.5) μ, ellipsoid or subovoid in face view, slightly inequilateral in profile, verruculose, no germ pore, not dextrinoid. Basidia 22–26 × 4–5 μ, 4-spored. Pleurocystidia none; cheilocystidia 21–30 × 6–7 μ, flask-shaped or ventricose, not capitate, rare. Gill trama subparallel, hyphae 2–4 μ broad. Pileus trama interwoven. Cuticle of repent, brown hyphae, bearing fascicles of brown, incrusted hyphae (scales). Clamp connections pres-

ent. Caulocystidia none. Pileus and gill trama yellowish brown in KOH; reddish brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On logs, Jamaica, October-January.

MATERIAL STUDIED—JAMAICA: Earle 222, type (NY), Castleton Gardens, October 28, 1902.

OBSERVATIONS—The distinguishing characters of *G. parvulus* include its interwoven pileus trama, non-dextrinoid spores, lack of pleurocystidia, narrow lamellae, and its erect pointed scales on the pileus. It appears related to *G. hispidellus* in which the pileus margin is even, the pleurocystidia clavate-mucronate, and the pileus trama radial.

**30. Gymnopilus aureobrunneus** (Berk. & Curt.) Murr., Mycologia **5:** 19. 1913.

*Agaricus aureobrunneus* Berk. & Curt., Jour. Linn. Soc. **10:** 289. 1868.

*Flammula aureobrunnea* (Berk. & Curt.) Sacc., Syll. Fung. **5:** 813. 1887.

ILLUSTRATIONS: FIGS. 43, 44.

Pileus 2–5 cm broad, golden-yellow, appressed-fibrillose, not viscid, margin inflexed. Context yellowish, medium thick.

Lamellae adnate to adnexed, golden-yellow at first, then ferruginous, broad, close, unequal.

Stipe 4–8 cm long, 3–8 mm thick, pale-fuscous, appressed-pilose, equal or enlarged downward, solid. (Veil not reported by authors.)

Spores 5.5–7.5 × 4–4.5 μ, ellipsoid in face view, slightly inequilateral in profile, verruculose, no germ pore, not dextrinoid. Basidia 16–20 × 4–5 μ, (2–)4-spored. Pleurocystidia none; basidioles 23–27 × 5–6 μ, clavate, brown, rare; cheilocystidia 20–24 × 3–4 μ, flask-shaped, non-capitate. Gill trama loosely interwoven, hyphae 6–20 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle a zone of brown, repent hyphae, with some more or less erect brown incrusted hyphae, with scattered, colorless cylindric or flask-shaped pileocystidia, 22–26 × 4–5 μ. Clamp connections present. Caulocystidia 20–35 × 2–4 μ, slender flask-shaped, rare.

HABIT, HABITAT, AND DISTRIBUTION—On logs and stumps, Cuba.

MATERIAL STUDIED—CUBA: Wright, type (K).

OBSERVATIONS—This species is very closely related to *G. chrysopellus* in which pileocystidia and caulocystidia are lacking. It is better, however, to keep the two separate until further studies of fresh material are available. *Gymnopilus aureobrunneus* is also near *G. earlei* in which the pileus is pale-ferruginous, and pleurocystidia are present. See also remarks by Singer (**1955**) on the relationship between *G. chrysopellus* and *G. aureobrunneus*.

**31. Gymnopilus naucorioides** Hesler, sp. nov.

ILLUSTRATIONS: FIGS. 20, 82.

Pileus 2–5 cm latus, "tawny olive" demum "Dresden brown" siccus, "snuff brown" humidus, fibrillosus, interdum zonatus. Gustu mitis. Lamellae adnatae deinde adnexae,

"olivaceous" deinde "Dresden brown," confertae vel stipatae, pone latae. Stipes 2–6 cm longus, 3–6 mm crassus, pallidus demum olivaceo-brunneus. Velum nullum. Sporae 4–5 × 3–3.5 μ, ovoideae vel subglobosae demum ellipsoideae, non-dextrinoideae. Pleurocystidia desunt; cheilocystidia 37–55 × 4–6 μ. Specimen typicum in Herb. Univ. Tenn., lectum in Cades Cove, Great Smoky Mts. National Park, Tennessee, August 12, 1958, Hesler 23156.

Pileus 2–5 cm broad, hemispheric-convex, expanding plane or nearly so, hygrophanous, "tawny olive" to "Dresden brown" when dry, "snuff brown" when wet, disc often "ochraceous buff," densely and minutely fibrillose, fibrils more or less golden, azonate to distinctly zonate, margin at first involute, more or less crenate. Context medium thick on disc, thin elsewhere, pallid when dry, watery brown when wet; odor pungent, taste mild.

Lamellae adnate, then adnexed, at first olivaceous to pallid-brownish becoming "Dresden brown," "antique brown" to "sudan brown," finally "chestnut brown," lamellulae numerous, short ones of 5 or 6 ranks, crowded or close, broad behind, tapering and narrowed in front, edges fimbriate to serrulate.

Stipe 2–6 cm long, 3–6 mm thick, pallid to olive-brown or dingy, fibrillose-striate, slightly cartilaginous, equal or base slightly clavate, hollow. Veil none.

Spores 4–5 × 3–3.5 μ, ovoid or subglobose to ellipsoid, verruculose, ferruginous in KOH, non-dextrinoid (even after treatment with $NH_4OH$ then Melzer's), no germ pore. Basidia 16–22 × 3.5–4 μ, (2–)4-spored. Pleurocystidia none; cheilocystidia 37–55 × 4–6 μ, ventricose, with a long, capitate neck. Gill trama of subparallel hyphae, 4–7 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of repent hyphae, bearing some more or less erect hyphae; pileocystidia none. Caulocystidia none. Clamp connections not found. Gill trama without yellow pigment in KOH.

HABIT, HABITAT, AND DISTRIBUTION—On hemlock, Tennessee, August.

MATERIAL STUDIED—TENNESSEE: Hesler 23156, type, on hemlock stump, Cades Cove, GSMNP, August 12, 1958.

OBSERVATIONS—The distinguishing characters are its small non-dextrinoid spores, hygrophanous and often zonate pileus, pungent odor and mild taste, its lack of a veil, its olive gills when young, long cheilocystidia, and the absence of pleurocystidia. It may be related to *G. sub-bellulus,* in which the pileus is furfuraceous, lamellae subdistant and narrow, and pleurocystidia, pileocystidia, and caulocystidia are present. It has the general aspect of a *Naucoria,* but it lacks both pileocystidia and cuticular sphaerocysts.

**32. Gymnopilus chrysopellus** (Berk. & Curt.) Murr., Mycologia **5:** 23. 1913.

*Agaricus* (*Flammula*) *chrysopellus* Berk. & Curt., Jour. Linn. Soc. **10:** 290. 1868.
*Agaricus chrysotrichus* B. & C., Jour. Linn. Soc. **10:** 290. 1868.
*Flammula chrysopella* (B. & C.) Sacc., Syll. Fung. **5:** 813. 1887.
*Flammula chrysotricha* (B. & C.) Sacc., Syll. Fung. **5:** 813. 1887.
*Gymnopilus chrysotrichus* (B. & C.) Murr., Mycologia **5:** 21. 1913.

Pileus cespitose, 2.5–4 cm broad, convex then often depressed to umbilicate, golden-yellow, tomentose, fibrils sometimes appressed, dry, margin at times subsulcate. Context fleshy.

Lamellae adnexed to subdecurrent by a tooth, yellowish, close, broad.

Stipe 2.5–7.5 cm long, 4–8 mm thick, pale yellow, becoming fuscous, enlarged downward. Veil none.

Spores (5–)5.5–7.5 × 3.8–4.7 μ, ellipsoid, slightly inequilateral, verruculose, ferruginous in KOH, not dextrinoid, no germ pore. Basidia 20–25 × 4–6 μ, 4-spored. Pleurocystidia none; cheilocystidia 18–27 × 3–6 μ, flask-shaped, non-capitate. Gill trama of subparallel hyphae, 3–6(–9) μ broad; subhymenium not distinctive. Pileus trama of radial hyphae. Cuticle of brown, repent hyphae, bearing epicuticular, brown, incrusted hyphae. Clamp connections present. Pileocystidia and caulocystidia none.

HABIT, HABITAT, AND DISTRIBUTION—On dead wood, Cuba.

MATERIAL STUDIED—CUBA: Wright, type (K), on dead wood; Wright, type (K) of *Agaricus chrysotrichus* B. & C., from Cuba.

OBSERVATIONS—A comparison of both the microscopic and macroscopic characters of *G. chrysopellus* and *G. chrysotrichus* indicates no essential basis for their separation. The description of *G. chrysopellus* by Singer and Digilio (**1951**) gives the spores 6–9.5(–10.3) μ long, much too large for this species. It appears related to *G. aureobrunneus* in which pileocystidia and caulocystidia are present.

**33. Gymnopilus sub-bellulus** Hesler, sp. nov.

ILLUSTRATIONS: FIGS. 18, 103, 104, 105.

Pileus 10–20 mm latus, inter "yellow ocher" demum "ochraceous tawny," furfuraceus. Contextu obscuro-fulvobrunneus; gustu mitis. Lamellae adnatae demum adnexae, brunneae, angustae, subdistantes. Stipes 3–5 cm longus, 3–4 mm crassus, furvo-"ochraceous." Velum nullum. Sporae 3.5–5 × 2.4–3.8 μ, ovoideae vel subglobosae, non-dextrinoideae. Pleurocystidia 23–27 × 4–6 μ; cheilocystidia 23–32 × 3–6 μ. Specimen typicum in Herb. Univ. Mich., lectum in Tahquamenon State Park, Michigan, August 1, 1955, Smith 49838.

Pileus 10–20 mm broad, plane with an inrolled margin, rarely slightly umbonate, between "yellow ocher" and "ochraceous tawny," fading slightly and distinctly furfuraceous, opaque at all times. Context brittle, thin, dull watery yellow-brown; odor and taste mild.

Lamellae adnate to adnexed, between "buckthorn brown" and "cinnamon brown," when young, subdistant, narrow, edges even.

Stipe 3–5 cm long, 3–4 mm thick, equal or enlarged downward, evenly dingy ochraceous and unpolished from matted fibrils, not discolored below. Veil none.

Spores 3.5–5 × 2.4–3.8 μ, ellipsoid, ovoid, or subglobose, verruculose, ferruginous, not dextrinoid. Basidia 22–26 × 4–5 μ, (2–)4-spored, some scattered basidia with one sterigma, 10–15 μ long. Pleurocystidia 23–27 × 4–6 μ, ventricose, accompanied by flask-shaped, capitate pleurocystidia, 32–37 × 3–6 μ; cheilocystidia 23–32 × 3–6 μ, flask-shaped, neck long, slender, capitate (more rarely non-capitate), extending up the sides, 50–75 μ. Gill trama of subparallel hyphae, 2–5 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle densely fibrillose, fibrils often in tufts, the terminal elements as pileocystidia, 30–50 × 5–9 μ, clavate or ventricose, brown, or colorless, flask-shaped, capitate. Caulocystidia 27–42 × 4–5 μ, slender flask-shaped, capitate, scattered.

HABIT, HABITAT, AND DISTRIBUTION—On conifer log, Michigan, August.

MATERIAL STUDIED—CALIFORNIA: Smith 56336; MICHIGAN: Smith

49838, type (MICH), on old conifer log, Tahquamenon State Park, August 1, 1955.

OBSERVATIONS—This species is distinguished by its small furfuraceous pileus, brown young gills, mild odor and taste, and its very small, non-dextrinoid spores. It resembles *G. bellulus* which is distinguished by its bitter taste, bright yellow young gills, and dextrinoid spores.

**34. Gymnopilus rufescens** Hesler, sp. nov.

ILLUSTRATION: Fig. 115.

Pileus 10–15 mm latus, "Kaiser brown," deinde pallidorufus, glabrosus. Contextu concolor; gustu amarus. Lamellae alte adnexae, "cinnamon buff," stipatae, latae. Stipes 2–3 cm longus, 1.5–2 mm crassus, infra brunnaceus, supra "orange buff." Sporae 4–5.5 ×2.5–3.5 μ, ellipsoideae demum ovoideae, subasperulatae, non-dextrinoideae. Pleurocystidia 20–24 × 4–5 μ; cheilocystidia 18–25 × 2–5 μ. Specimen typicum in Herb. Univ. Mich., lectum in Prairie Creek Park, Orick, California, December 9, 1956, Smith 56468.

Pileus 10–15 mm broad, obtuse to convex, evenly "Kaiser brown" fading to paler rufous, and fading on disc first, surface glabrous, moist and hygrophanous, margin opaque, very faintly striatulate. Context thin, concolorous with surface; odor none, taste bitter.

Lamellae deeply adnexed to nearly free, bright "cinnamon buff" (not yellow), spotted orange brown in some, crowded, broad, edges even.

Stipe 2–3 cm long, 1.5–2 mm thick, concolorous with pileus below, paler orange buff above, equal, naked, apex faintly pruinose.

Spores 4–5.5 × 2.5–3.5 μ, ellipsoid to ovoid, at times sub-pip-shaped, in face view, inequilateral in profile, verruculose, sub-asperulate, ferruginous in KOH, non-dextrinoid, no germ pore. Basidia 22–35 × 3–4 μ, 4-spored. Pleurocystidia 20–24 × 4–5 μ, ventricose; cheilocystidia 18–25 × 2–5 μ, flask-shaped, with a slender neck, capitate or non-capitate. Gill trama of subparallel hyphae, 2–5 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of repent hyphae; pileocystidia none. Caulocystidia none. Yellow pigment, soluble in KOH, present in the gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On conifer wood, California, December.

MATERIAL STUDIED—CALIFORNIA: Smith 56468, type, from Prairie Creek Park, Orick, December 9, 1956.

OBSERVATIONS—This species, because of its pileus size and its spores, is suggestive of both *G. bellulus* and *G. sub-bellulus*. It differs from *G. bellulus*, in which the spores are dextrinoid, and caulocystidia and pileocystidia are present; and from *G. sub-bellulus*, in which the pileus color is between yellow-ocher and ochraceous tawny, the taste mild, the gills adnate to adnexed, and caulocystidia and pileocystidia are present.

**35. Gymnopilus dryophilus** Murr., Mycologia **35:** 531. 1943.

*Flammula dryophila* (Murr.) Murr., Mycologia **35:** 537. 1943.

Pileus 3–5 cm broad, cespitose, convex to subexpanded, pale flavous to darker, dry, hispid-squamulose, scales not conspicuous to the unaided eye,

especially at the center, becoming fibrillose or subsquamulose with age, margin even. Context pallid; taste mild.

Lamellae adnate with a decurrent tooth, pale luteous, broad, close, entire.

Stipe about 5–7 cm long, varying in thickness, pale luteous, opaque, dry, slightly fibrillose, equal or tapering upward. Veil arachnoid, sparse, fugacious.

Spores (5.5–)6–7.5 × 4–5 μ, ellipsoid in face view, inequilateral in profile, verruculose, no germ pore, non-dextrinoid. Basidia 22–27 × 5–7 μ, 4-spored. Pleurocystidia 25–33 × 4–8 μ, clavate, apices conical, buried; cheilocystidia 20–28 × 5–7 μ, ventricose, non-capitate, rare. Gill trama subparallel, hyphae 2–4 μ broad; subhymenium not distinctive. Pileus trama interwoven. Cuticle of repent hyphae, bearing tufts of brown hyphae (scales). Clamp connections present. Caulocystidia none. Pileus and gill trama rusty brown in KOH; dingy brown in Melzer's reagent. Yellow pigment, soluble in KOH, present in the gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On logs, Florida and Alabama, December and July.

MATERIAL STUDIED—ALABAMA: Hollis (TENN 20627); FLORIDA: Murrill F-15735, type (FLAS), collected by Arnold & West, on oak log, Gainesville, December 14, 1931.

OBSERVATIONS—This is related to *G. parvulus* through its non-dextrinoid spores, interwoven pileus trama, and surface characters of the pileus; but in *G. parvulus* the flesh is bitter, the stipe base is blackish, the pileus margin is striate, and the gills narrow. In *G. hispidus* the pileus is umbilicate to infundibuliform. It may be somewhat suggestive of *G. praelaeticolor*, in which the pileus colors are brighter, the taste distinctive (astringent and farinaceous), and the apices of the pleurocystidia rounded.

**36. Gymnopilus praelaeticolor** Murr., Jour. Florida Acad. Sci. **8:** 185. 1945.

*Flammula praelaeticolor* (Murr.) Murr., Jour. Florida Acad. Sci. **8:** 198. 1945.

Pileus cespitose, 6–8 cm broad, convex, not fully expanding, flavous, squamulose, with tufts of erect or recurved fibrils, dry, margin entire to undulate, even. Context cremeous; odor fragrant, taste astringent and farinaceous.

Lamellae adnate, becoming emarginate with age, luteous, orange from the spores, very close at the margin, at first plane, becoming broader behind, conspicuously notched with age.

Stipe 5–7 cm long, 10–18 mm thick, pallid, cremeous within, solid, fibrillose, streaked and ridged, subequal.

Spores (5–)6–7.5 × 3.5–4.5 μ, ellipsoid in face view, slightly inequilateral in profile, verruculose, no germ pore, ferruginous in KOH, not dextrinoid. Basidia 26–30 × 5–6 μ, 2–4-spored. Pleurocystidia 28–33 × 5–6 μ, colorless, subventricose, projecting none or slightly; basidioles 24–42 × 5–7 μ, brown, clavate or ventricose; cheilocystidia; (a) colorless, 28–42 × 5–7 μ, ventricose, (b) brown, 18–22 × 5–6 μ, clavate. Gill trama subparallel, hyphae 3–6 μ broad; subhymenium not distinctive. Pileus trama interwoven. Cuticle repent, not always sharply differentiated, the surface bearing brown hyphae tufts (scales), the hyphae sometimes incrusted. Clamp connections present. Caulo-

cystidia none. Brown lactifers in trama of both the pileus and gills. Pileus and gill trama pale yellowish in KOH; dark brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On laurel-oak stump, Florida, June.

MATERIAL STUDIED—FLORIDA: Murrill F-38861, type, (FLAS), June 17, 1944.

OBSERVATIONS—*Gymnopilus praelaeticolor* appears related to *G. depressus,* in which the pileus trama is radial, the cheilocystidia all non-capitate, and the taste bitter; and to *G. earlei,* in which the spores are larger, the taste mild, and the stipe apex lacks decurrent ridges.

**37. Gymnopilus luteoviridis** Thiers, Mycologia **51:** 533–534. 1959.

ILLUSTRATIONS: FIGS. 75, 76, 77.

Pileus 2.5–4 cm broad, convex to subconic when young becoming plane to plano-convex, margin incurved when young, remaining decurved with age, entire to occasionally appendiculate when young, becoming eroded with age, more or less evenly colored dull yellow ("straw yellow" to "mustard yellow") to occasionally yellow ("primuline yellow"), entire carpophore staining green and drying with greenish tints, dry, conspicuously fibrillose, forming small recurved scales when older, scales pale fulvous ("ochraceous tawny") along the margin, changing to olivaceous ("dark olive") near the disc. Context moderately thick (4–5 mm), concolorous with the surface; odor not distinctive, taste bitter.

Lamellae adnate to adnexed with a short decurrent tooth, close to subdistant, thin, 1–4 mm broad, buff to dark yellow ("cream buff" to "chamois") when young becoming tawny ("ochraceous tawny" to "buckthorn brown") with age, edges entire, concolorous with the gill faces; lamellulae of 1–2 lengths.

Stipe 4–6 cm long, 3–5 mm broad at the apex, tapering slightly toward the apex, stuffed to hollow; surface dry, glabrous, longitudinally striate, yellowish ("light buff" to "warm buff") during all stages of development, frequently staining greenish when old; annulus represented by a fibrillose zone near the apex.

Spores 5.5–7 × 4–5(–5.5) $\mu$, ellipsoid in face view, obscurely inequilateral in profile, wrinkled-rough, ornamentation 0.04–0.06 $\mu$ high, wall blackish in Melzer's reagent and cotton blue, cyanophilous, ferruginous in KOH, non-dextrinoid, no germ pore. Basidia 16–26 × 6–7 $\mu$, 4-spored. Pleurocystidia 22–32 × 5–7 $\mu$, ventricose, with or without a neck, non-capitate, apex at times conical; basidioles 22–30 × 6–10 $\mu$, flask-shaped or ventricose, with brown contents; cheilocystidia 20–24 × 4–6 $\mu$, flask-shaped or ventricose. Gill trama of subparallel hyphae, 5–9 $\mu$ broad, subhymenium not distinctive. Pileus trama radial. Cuticle of repent hyphae, bearing scattered, erect clusters of brown hyphae (scales). Pileocystidia and caulocystidia none. Clamp connections present.

HABIT, HABITAT, AND DISTRIBUTION—Gregarious to cespitose on oak stumps in dense hardwoods, Texas, May.

MATERIAL STUDIED—TEXAS: Thiers 1894, type (MICH) leg. near Bryan, May 22, 1953.

OBSERVATIONS—The green discolorations suggest a close relationship with *Gymnopilus aeruginosus* but the yellow pileus and the presence of pleurocystidia distinguish it.

**38. Gymnopilus depressus** Murr., Mycologia **5:** 20. 1913.

*Flammula depressa* (Murr.) Murr., Mycologia **5:** 36. 1913.

ILLUSTRATIONS: FIGS. 57, 58.

Pileus reaching 8–10 cm broad, convex to deeply depressed, gregarious or cespitose, dull-yellowish, at length dull-rusty brown, dry, densely floccose-scaly, becoming subglabrous, margin not striate, strongly inflexed on drying. Context yellowish; taste bitter.

Lamellae short-decurrent, yellow, then ferruginous, broad, subdistant.

Stipe 4–8 cm long, 6–10 mm thick, slightly paler than the pileus, yellowish above, yellow within, minutely scaly-fibrillose throughout, fleshy, subcylindric, solid, becoming fistulose with age. Veil delicate, of yellow fibrils, fugacious.

Spores 6–7.5 × 4–4.5 $\mu$, ferruginous, ellipsoid in face view, only slightly inequilateral in profile, verruculose, no germ pore, not dextrinoid. Basidia 20–25 × 5–6 $\mu$. Pleurocystidia 26–37 × 4–6 $\mu$, ventricose; cheilocystidia 24–40 × 5–7 $\mu$, ventricose, capitate to non-capitate. Gill trama of parallel, very broad hyphae, 12–25 $\mu$. Pileus trama radial. Cuticle repent, with tufts of brown, incrusted hyphae (scales). Clamp connections present. Caulocystidia none. Pileus and gill trama reddish brown in KOH; dark brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On log, Jamaica, November.

MATERIAL STUDIED—JAMAICA: Earle 499, type (NY), Hope Gardens, November 16, 1902.

OBSERVATIONS—It is distinguished by its deeply depressed pileus, broad and subdistant gills, its delicate, fugacious veil, radial pileus trama, and non-dextrinoid spores. It is related to *G. areolatus,* but in the latter the pleurocystidia have a conic apex, the stipe is subglabrous, the gills are closely spaced, and the pileus disc is areolate.

**39. Gymnopilus areolatus** Murr., Mycologia **5:** 24. 1913.

*Flammula areolata* (Murr.) Murr., Mycologia **5:** 36. 1913.

ILLUSTRATIONS: FIGS. 37, 38.

Pileus 3–7 cm broad, cespitose, convex, dingy orange-yellow, dry, imbricate-scaly, disc often areolate, margin entire. Context yellowish white; taste bitter.

Lamellae adnate, separating from the stipe, yellowish then ferruginous, broad, close, often notched.

Stipe 3–8 cm long, 4–10 mm thick, concolorous or paler, cylindric, often curved, subglabrous, solid to hollow. Veil fibrillose, yellow, fugacious.

Spores 6–7 × 4–4.5 $\mu$, ellipsoid in face view, slightly inequilateral in profile, verruculose, no germ pore, not dextrinoid. Basidia 22–27 × 5–7 $\mu$, 2–4-spored. Pleurocystidia 22–27 × 7–9 $\mu$, clavate, with a conic apex; cheilocystidia 18–30 × 4–6 $\mu$, ventricose to flask-shaped, sometimes capitate, inconspicuous. Gill trama wavy-subparallel, hyphae 3–5 $\mu$ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of repent hyphae, bearing on the central portion

tufts of fuscous to pale hyphae forming scales. Clamp connections present. Caulocystidia none. Pileus and gill trama pale yellowish in KOH; reddish brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—Cespitose on stumps, and logs of hardwoods and palms, Cuba, May and September.

MATERIAL STUDIED—CUBA: Earle 36, type (NY), on hardwood stump, Santiago de las Vegas, May 27, 1904.

OBSERVATIONS—The description of microscopic characters is based on a study of the type. Murrill (**1913**) gives the spores 9–11 × 6–7 $\mu$, which is clearly an error. The chief distinguishing characteristics include the orange-yellow color, imbricate scales, areolate disc, and the conic pleurocystidia.

**Gymnopilus** sect. **Gymnopilus**

Spores (6–)7–9 $\mu$ long.

Type species: *G. liquiritiae* (Pers. ex Fr.) Karst.

KEY TO SPECIES

1. Spores dextrinoid ..... 2
1. Spores non-dextrinoid ..... 38
2. Pileus glabrous (mounds or veil remnants sometimes present) ..... 3
2. Pileus fibrillose to scaly ..... 17
3. Pleurocystidia absent ..... 4
3. Pleurocystidia present ..... 5
4. Cheilocystidia absent; pileus reddish brown, striate (wet); terrestrial. ..... 40. *G. rufobrunneus*
4. Cheilocystidia present; pileus center ferruginous, even; lignicolous. ..... 41. *G. echinulisporus*
5. Veil present ..... 6
5. Veil absent ..... 14
6. Pileus yellowish red; caulocystidia none ..... 42. *G. geminellus*
6. Pileus of different colors ..... 7
7. Taste mild; pileus and veil fulvous to tawny ..... 43. *G. mitis*
7. Taste bitter; veil white or buff ..... 8
8. Veil cartridge buff; lamellae deeply sinuate, yellowish, becoming brown where bruised ..... 44. *G. melleus*
8. Veil pallid to white ..... 9
9. Lamellae at first yellow, then fulvescent, becoming neither spotted nor stained ..... 10
9. Lamellae at first yellow, becoming spotted or stained ..... 11
10. Lamellae adnate, broad; stipe light-ocher-yellow, becoming ferruginous; pileus trama interwoven ..... 45. *G. hybridus*
10. Lamellae emarginate, narrow; stipe pallid to white; pileus trama radial ..... 46. *G. subsapineus*

11. Lamellae at first light buff then darker, staining rusty orange where bruised; pileus "burnt sienna" then ferruginous ..... 47. *G. aurantiophyllus*
11. Lamellae at first yellowish, darkening in age, becoming brownish stained or spotted in age; pileus tawny or yellow ..... 12
12. Stipe yellowish, staining brownish; pileocystidia slender, capitate ..... 48. *G. flavidellus*
12. Stipe buff or pallid, unchanging; pileocystidia none ..... 13
13. Pileus chrome-yellow to golden-yellow; context white; veil white; lamellae rusty-spotted in age ..... 49. *G. penetrans*
13. Pileus at first tawny to ochraceous-tawny, at maturity, cinnamon-brown to near russet on the disc, yellowish or brown on the margin; context buff-colored; veil yellow; lamellae stained brown where bruised or in age ..... 50. *G. luteocarneus*
14. Basidiocarps among moss, on peaty or burned-over soil; pileus rufous or rusty, slight striate; lamellae rather distant, broad ..... 51. *G. fulgens*
14. Basidiocarps lignicolous; pileus and lamellae not as above ..... 15
15. Pileus dark-brick-red ..... 52. *G. oregonensis*
15. Pileus fulvous, buff, or orange ..... 16
16. Pileus hygrophanous, even; pileus trama interwoven ..... 53. *G. croceoluteus*
16. Pileus not hygrophanous, becoming striatulate; pileus trama radial ..... 54. *G. liquiritiae*
17. Basidiocarps terrestrial or humicolous ..... 18
17. Basidiocarps lignicolous ..... 21
18. Pileus gray-brown, with reddish brown fibrils or scales; pleurocystidia none ..... 55. *G. abramsii*
18. Pileus colors not as above; pleurocystidia present ..... 19
19. Lamellae and stipe yellowish, becoming brownish where bruised; in humus ..... 56. *G. humicola*
19. Lamellae and stipe unchanging; on soil ..... 20
20. Veil present; odor fragrant ..... 57. *G. angustifolius*
20. Veil absent; odor mild ..... 58. *G. arenicola*
21. Pileus large, 6–15 cm broad ..... 22
21. Pileus smaller, 1–5 (–7) cm broad ..... 24
22. Pileus at first green or variegated green and yellow, context white, tinged green ..... 59. *G. aeruginosus*
22. Pileus buff, yellow, or orange, more rarely pallid ..... 23
23. Spores 5.5–7.5 $\mu$ broad ..... 60. *G. magnus*
23. Spores 4.5–5.5 $\mu$ broad ..... 5. *G. spectabilis*
24. Pileus umbilicate, ochraceous-fulvous, with acute, erect scales ..... 1. *G. hispidus*
24. Pileus convex ..... 25
25. Pileus scaly, at least on the disc ..... 26

25. Pileus fibrillose, not scaly ..... 35
    26. Veil present ..... 27
    26. Veil none ..... 33
27. Pileus at first green or variegated green and yellow; context white, tinged green ..... 59. *G. aeruginosus*
27. Pileus otherwise colored ..... 28
    28. Caulocystidia present ..... 29
    28. Caulocystidia none ..... 31
29. Pileus golden-yellow or tawny, margin paler, minutely squamulose ..... 61. *G. sapineus*
29. Pileus purplish red from the conspicuous scales ..... 30
    30. Context at first reddish to lavender, fading to yellowish ..... 62. *G. luteofolius*
    30. Context at first white, becoming yellow ..... 6. *G. peliolepis*
31. Spores 7–10 × 5–6(–7) $\mu$; pileus pale ferruginous to ochraceous, context pallid or yellow ..... 10. *G. palmicola*
31. Spores 6–8 × 4–5 $\mu$; pileus pinkish, or becoming so, context white ..... 32
    32. Pileus purplish, becoming pink then yellow; pleurocystidia present ..... 63. *G. braendlei*
    32. Pileus center pinkish, margin paler; pleurocystidia absent ..... 64. *G. pulchrifolius*
33. Pileus rufous or bay-cinnamon; pileus trama radial ..... 65. *G. picreus*
33. Pileus orange, yellow, or pallid; pileus trama interwoven ..... 34
    34. Gills red-brown spotted; pileus pallid to yellowish ..... 66. *G. fuscosquamulosus*
    34. Gills not spotted; pileus orange-rufous ..... 67. *G. aurantiacus*
35. Lamellae very broad, decurrent, with lines extending down the stipe; pileus orange-brown ..... 68. *G. decurrens*
35. Lamellae and pileus not as above ..... 36
    36. Veil present; pileus, lamellae, and stipe becoming orange or yellowish where bruised; pileus not glabrescent ..... 69. *G. lutescens*
    36. Veil absent; color change, if any, only on the lamellae; pileus glabrescent ..... 37
37. Lamellae staining rusty orange where bruised; pileus "burnt sienna" when young, then ferruginous on the disc; pileus trama radial ..... 47. *G. aurantiophyllus*
37. Lamellae not staining; pileus fulvous; pileus trama interwoven ..... 70. *G. subdryophilus*
    38. Pileus ochraceous, becoming green-spotted where handled, with conspicuous light-bay scales ..... 71. *G. viridans*
    38. Pileus yellowish brown to ferruginous ..... 39
39. Pileus glabrous, uniformly ferruginous-fulvous; taste promptly very bitter; stipe pale, staining ferruginous where handled .... 72. *G. amarissimus*

39. Pileus fibrillose to scaly, yellowish or brownish; stipe more or less concolorous ..... 73. *G. earlei*

**40. Gymnopilus rufobrunneus** Hesler, sp. nov.

ILLUSTRATIONS FIG. 27.

Pileus 2–3 cm latus, "Hays russet," glabrosus, striatus humidus. Gustu amarus. Lamellae adnatae, ferrugineo-cinnamomeae, confertae, vel subdistantes, medio-latae. Stipes 4–6 cm longus, 2–2.5 mm crassus, ferrugineo-cinnamomeus, fibrillas cinereas gerens. Velum arachnoideum fugax. Sporae 7–9(–10) × 5–7 μ, ellipsoideae vel ovoideae, dextrinoideae. Pleurocystidia et cheilocystidia desunt. Specimen typicum in Herb. Univ. Mich., lectum ex humo, prope Priest River, Idaho, September 18, 1964, Smith 70514.

Pileus 2–3 cm broad, convex, expanding to plane, or with a low umbo, color "Hays russet" to dark rusty cinnamon, paler when faded, surface glabrous, moist and hygrophanous, margin striate when moist. Context thin, fragile; odor none, taste slowly bitterish; in KOH, the flesh quickly darker rusty brown; in $FeSO_4$, dark olivaceous.

Lamellae bluntly to depressed adnate, dark rusty cinnamon, brighter than cap, close to subdistant, moderately broad.

Stipe 4–6 cm long, 2–2.5 mm thick, equal, fragile, dark rusty cinnamon over all in age, fibrils grayish, base with thin layer of brownish fibrils. Veil leaving a faint evanescent fibrillose zone near the apex.

Spores 7–9(–10) × 5–7 μ, ellipsoid or ovoid, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 30–36 × 8–10 μ, 4-spored. Pleurocystidia and cheilocystidia none. Gill trama of subparallel hyphae 6–17 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of brown repent, dry hyphae; no pileocystidia. Clamp connections present. Caulocystidia 18–45 × 4–9 μ, cylindric-clavate, colorless, in tufts. Smoky brown pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—Cespitose on soil, Idaho, September.

MATERIAL STUDIED—IDAHO: Smith 70514, type, from Priest River, September 18, 1964.

OBSERVATIONS—Distinctive characters include the absence of pleurocystidia and cheilocystidia, rather slowly dextrinoid spores, radial pileus trama, gray fibrils over a dark-rusty stipe, and a reddish, rusty brown, glabrous, striate pileus. Its pileus colors suggest *G. sordidostipes,* in which the spores are smaller, and in which pleurocystidia and cheilocystidia are present. Its lack of pleurocystidia and cheilocystidia suggests *G. terrestris,* in which the pileus colors are different, the caulocystidia present as scattered terminal elements, and the spores smaller. In *G. echinulisporus,* cheilocystidia are present, and the pileus colors are different.

**41. Gymnopilus echinulisporus** Murr., Mycologia **4:** 255. 1912.

*Flammula echinulispora* (Murr.) Murr., Mycologia **4:** 262. 1912.

Pileus reaching 7 cm broad, convex to plane, at length depressed, slightly umbonate when young, ferruginous at the center, margin fulvous, glabrous, shining, margin strongly incurved on drying.

Lamellae sinuate-adnate with a tooth, ferruginous-isabelline to fulvous, broad, slightly ventricose.

Stipe about 6 cm long, 10–16 mm thick, whitish to isabelline-ferruginous, longitudinally striate, equal or base enlarged. Veil wanting, even in young basidiocarps.

Spores 6–8 × 5–6 μ, ellipsoid, ovoid, or subglobose, verrucose, no germ pore, ferruginous in deposit, dextrinoid. Basidia 28–40 × 6–7 μ, 4-spored. Pleurocystidia none; cheilocystidia 25–40 × 4–6 μ, filamentous, subcylindric, or subventricose, sometimes capitate. Gill trama subparallel, hyphae 6–10 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of repent hyphae, at times some of the surface hyphae loosen and become semi-erect. Clamp connections present. Caulocystidia none; sometimes tufts of erect hyphae are present. Pileus and gill trama yellowish brown in KOH; reddish brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On wood, Oregon, November.

MATERIAL STUDIED—OREGON: Murrill 815, type (NY), Mill City, November 9, 1911.

OBSERVATIONS—Although Kauffman (**1926**) places it in *Cortinarius,* the lignicolous habitat and ferruginous spores indicate a closer relationship to the genus *Gymnopilus*. It may be somewhat related to *G. terestris,* in which cheilocystidia are lacking, the pileus of different colors, and caulocystidia present.

**42. Gymnopilus geminellus** (Pk). Murr., North Amer. Flora **10:** 200. 1917.

*Agaricus geminellus* Pk., Bull. Buffalo Soc. Nat. Sci. **1:** 51. 1873.
*Naucoria geminella* (Pk.) Sacc., Syll. Fung. **5:** 841. 1887.
*Gymnopilus subpenetrans* Murr., Mycologia **5:** 20. 1913.
*Flammula subpenetrans* (Murr.) Murr., Mycologia **5:** 36. 1913.

Pileus 1–2 cm broad, convex, yellowish red, the margin paler, subfibrillose or glabrous, dry. Context white.

Lamellae emarginate, pale-yellow, crowded.

Stipe 2 cm or more long, concolorous, equal, stuffed with a white pith, or hollow. Veil white, fugacious (Smith 33976).

Spores 7–8.5(–9) × 4.5–5(–5.5) μ, ellipsoid in face view, inequilateral in profile, verruculose, no germ pore, dextrinoid. Basidia 25–30 × 6–7 μ, 4-spored. Pleurocystidia 18–30 × 4–7 μ, clavate, colorless, buried, rare; cheilocystidia 24–41 × 4–6 μ, ventricose-capitate to tibiiform, colorless or more rarely brown. Gill trama slightly interwoven, hyphae 3–5 μ broad. Pileus trama radial. Cuticle of repent hyphae, the surface bearing some brown, more or less incrusted epiculticular hyphae. Clamp connections present. Caulocystidia none. Yellow pigment, soluble in KOH, is present in the gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On decaying wood, New York, Michigan, and Cuba, summer and autumn.

MATERIAL STUDIED—MICHIGAN: Homola 941 (MICH); NEW YORK: Peck, type of *Naucoria geminella* (NYS), Crogan, Lewis Co., September

CUBA: Earle 526 (NY), type of *Flammula subpenetrans* Murr., Managua, May 25, 1906.

OBSERVATIONS—The chief characters of *G. geminellus* are its yellowish red, glabrous to subfibrillose pileus, its concolorous stipe, its radially arranged hyphae of the pileus trama, and its lack of pileocystidia and caulocystidia. It would appear from the collection records that it is a rare species. It may have been confused with such other related species as *G. bryophilus,* in which the spores are smaller; and *G. sapineus,* in which pileocystidia are present, and caulocystidia in rosettes and tufts. Its apparently disjunct geographical distribution is singular; further critical collecting and study might indicate a slightly more common occurrence.

**43. Gymnopilus mitis** Hesler, sp. nov.

ILLUSTRATIONS: FIGS. 78, 79, 80, 81.

Pileus 2–3 cm latus, "tawny," glabrosus. Gustu mitis. Lamellae adnexae vel sinuatae, "cinnamon-tawny," confertae, angustae. Stipes 4–5 cm longus, 3–5 mm crassus, "tawny," fibrilloso-striatus. Velum "tawny," fugax. Sporae 6.5–8(–8.5) × 4–5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 17–28 × 5–8 μ; cheilocystidia 23–30 × 6–8 μ. Specimen typicum in Herb. Univ. Mich., lectum prope Ithaca, Michigan, July 29, 1956, Potter 10941.

Pileus 2–3 cm broad, convex to subumbonate, fulvous or tawny, glabrous, but with traces of veil near the inrolled margin. Context odor fungoid, taste mild.

Lamellae adnexed to sinuate, cinnamon-tawny, moderately narrow, close, edges pale-fimbriate.

Stipe 4–5 cm long, 3–5 mm thick, tinged tawny, fibrous-striate, stuffed becoming hollow, somewhat pliant. Veil tawny, fugacious.

Spores 6.5–8(–8.5) × 4–5 μ, ellipsoid, slightly inequilateral, verruculose, ferruginous in KOH, dextrinoid. Basidia 23–27 × 5–6 μ, (2–)4-spored. Pleurocystidia 17–28 × 5–8 μ, ventricose, nine-pin-shaped (lecythiform); cheilocystidia 23–30 × 6–8 μ, similar, capitate, or rarely non-capitate. Gill trama of subparallel hyphae, 5–10 μ broad; subhymenium not distinctive. Pileus trama of interwoven hyphae. Cuticle not sharply differentiated, the surface bearing brown pileocystidia, 20–37 × 5–6 μ, ventricose, flask-shaped, lecythiform, obclavate, capitate or non-capitate, scattered. Caulocystidia 35–45 × 4–5 μ, filamentous, cylindric, ventricose, occasionally septate-clamped, in loose tufts. Clamp connections present. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On wood, Maine, Michigan, and California, July and December.

MATERIAL STUDIED—MAINE: Bigelow 3210; MICHIGAN: Potter 10941 (MICH), type, on decayed stick, Ithaca, July 29, 1956.

OBSERVATIONS—This species is distinguished by its mild taste, tawny veil, and caulocystidia in loose tufts. It may be closely allied to *G. geminellus,* in which the pileus is yellowish red, the veil white, and the pileus trama of radially disposed hyphae.

**44. Gymnopilus melleus** Hesler, sp. nov.

Pileus 2–3.5 cm latus, "honey yellow"; contextu "light buff," scissus "yellow ochre" et maculatus "ochraceous tawny." Lamellae alte sinuatae, "yellow ochre," "Mikado brown"

contusae, confertae, medio-latae. Stipes 2–3 cm longus, 5–10 mm crassus, "cream buff," "Mikado brown" vel "sayal brown" contusus, fibrillosus. Velum arachnoideum, "cartridge buff," fugax. Sporae 7–8.5 × 4–5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 25–28 × 3–5 μ; cheilocystidia 26–36 × 3–6 μ. Specimen typicum in Herb. Univ. Mich., lectum prope Montgomery, Alabama, December 13, 1942, Burke 74238.

Pileus 2–3.5 cm broad, "honey-yellow," roughened with minute, "verona brown" or "Mikado brown" mounds, cuticle separable half way to center, waxy, margin inrolled, not striate. Context near "warm buff" or "light buff," when cut becoming "yellow ochre," spotted "ochraceous tawny." Odor mild, taste strong, disagreeable, bitter.

Lamellae deeply sinuate, slightly toothed, at first "chamois" or paler, then "yellow ocher," not forked, close, medium broad, edges even, becoming "Mikado brown" where bruised.

Stipe 2–3 cm long, 5–10 mm thick, "cream buff," becoming "Mikado brown" to "sayal brown" where handled, apex yellow pruinose, striate-ridged, finely fibrillose, base white-mycelioid, solid. Veil arachnoid, "cartridge buff," well-developed at first, fugacious, no annulus.

Spores 7–8.5 × 4–5 μ, ellipsoid, inequilateral, verruculose to verrucose, ferruginous in KOH, dextrinoid, no germ pore. Basidia 23–26 × 5–6 μ, (2–)4-spored; hymenium dark-red in KOH. Pleurocystidia 25–28 × 3–5 μ, ventricose and subcapitate to non-capitate; cheilocystidia 26–36 × 3–6 μ, flask-shaped or rarely filamentous, capitate to subcapitate. Gill trama of subparallel hyphae, 3–7 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of repent hyphae, with bundles (forming minute mounds, or scales) of brown hyphae, the terminal elements as clavate, thin-walled, brown, sometimes incrusted pileocystidia, 30–52 × 4–7 μ. Caulocystidia none. Clamp connections present. Yellow pigment soluble in KOH in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—Subcespitose on pine stump, Alabama, December.

MATERIAL STUDIED—ALABAMA: Burke 74238 (MICH), type, from Fort Toulouse, near Montgomery, December 13, 1942.

OBSERVATIONS—The color-changes on bruising in the pileus-context, and on the lamellae and stipe are distinctive characteristics. There are color-changes in several other species of *Gymnopilus* (examples: *G. humicola, G. aurantiophyllus, G. viridans, G. punctifolius, G. sapineus, G. amarissimus*), but these are distinct in other characteristics.

**45. Gymnopilus hybridus** (Fr. ex Fr.) Maire, Treballs del Museo de Ciènces Naturals de Barcelona **15** (2): 96. 1933.

*Agaricus hybridus* Fr., Obs. Myc. **2:** 38. 1818.
*Agaricus hybridus* (Fr.) Fr., Epicr. Myc., p. 189. 1838.
*Flammula hybrida* (Fr. ex Fr.) Gill., Les Hymenomycetes, p. 532. 1874.
*Dryophila sapinea* var. *hybrida* (Fr. ex Fr.) Quél., Enchir. Fung., p. 71. 1886.
*Flammula sapinea* var. *hybrida* (Fr. ex Fr.) Konr. & Maubl., Icon. Sel. Fung. **6:** 108. 1928.

*Fulvidula hybrida* (Fr. ex Fr.) Singer, Rev. Mycol. II. **2:** 239. 1937.
*Gymnopilus sapineus* f. *hybridus* (Fr. ex Fr.) Kühn. & Romagn., Flore Anal. des Champ. Super., p. 322. 1953.

ILLUSTRATION: Bresadola, Icon. Myc., Tab. 781 (as *Flammula*).

Pileus 3.5–6 cm broad, hemispheric or convex, sometimes indistinctly umbonate, at first cinnamon-fulvous, then tinged orange to ferruginous, glabrous, hygrophanous, not viscid. Context pallid or yellow; odor slightly subnauseous, taste bitter.

Lamellae broadly adnate, subdecurrent or slightly emarginate, light yellow, fulvescent, not spotted, crowded, broad.

Stipe 3–4(–6) cm long, 4–7(–10) mm thick, at first light-ocher-yellow, becoming dusty ferruginous from the base up, apex whitish yellow, base white-tomentose, stuffed, equal or slightly attenuated upwards. Veil white, fibrillose, fugacious.

Spores 6–8 × 4–4.5(–5) μ, ellipsoid in face view, slightly inequilateral in profile, verruculose, ferruginous in KOH, dextrinoid. Basidia 20–24 × 5–6 μ, 4-spored. Pleurocystidia 27–44 × 6–10 μ, ventricose or flask-shaped, with a neck, capitate or subcapitate, often obscurely so, rather conspicuous; cheilocystidia 30–37 × 5–7 μ, similar, capitate. Gill trama of subparallel hyphae, 4–9 μ broad; subhymenium of narrow hyphae. Pileus trama of distinctly interwoven hyphae. Cuticle a zone of brown, repent, incrusted hyphae. Pileocystidia none. Caulocystidia 33–56 × 6–14 μ, in an extended palisade, chiefly ventricose to flask-shaped, capitate, subcapitate, or non-capitate, also scattered among these a few caulocystidia are pyriform to spathulate, 25–34 × 10–14 μ. Clamp connections not found. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On conifer wood, Europe.

MATERIAL STUDIED—SWEDEN: Romell 14445 (S), 14446 (S).

OBSERVATIONS—The above account of macroscopic characters is based on Lange (**1939**) and Bresadola (**1930**); and that of microscopic characters on a Romell collection (No. 14445) cited above. The species is characterized by its glabrous pileus, non-spotted lamellae, its white veil, pallid to yellow context, and presence of caulocystidia. *Gymnopilus hybridus* is near *G. penetrans* in which the lamellae become rusty-red spotted, the pileus color is yellow rather than ferruginous, and the pileus trama is of radially arranged hyphae. In *G. sapineus* the pileus is scaly, the veil yellowish, the spores very slightly larger, and its pileus has a radial trama.

To date, I have seen no North American material which I would refer to this species; its inclusion here is based on the possibility that it may eventually be found in North America.

### 46. **Gymnopilus subsapineus** Hesler, sp. nov.

Pileus 2–5 cm latus, "Mars yellow," glabrosus. Contextu flavus; gustu amarus. Lamellae emarginatae, flavae, confertae, angustae. Stipes 4–6 cm, 3–6 mm crassus, albus, sericus. Velum pallidum, arachnoideum, fugax. Sporae 6–8.5 × 4.5–5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 25–28 (–42) × 5–7 μ; cheilocystidia 23–27 × 4.6 μ. Specimen typicum in Herb. Univ. Mich., lectum in Oregon, October, 1959, Sipe 1271.

Pileus 2–5 cm broad, convex, expanding, "Mars yellow," not viscid, glabrous. Context yellowish; taste bitter.

Lamellae emarginate with a decurrent tooth, yellowish, close, narrow.

Stipe 4–6 cm long, 3–6 mm thick, white, silky-striate. Veil pallid, arachnoid, fugacious, remnants on the stipe.

Spores 6–8.5 × 4.5–5 μ, ellipsoid, inequilateral, verruculose, ferruginous in KOH, dextrinoid, no germ pore. Pleurocystidia 25–28(–42) × 5–7 μ, ventricose or flask-shaped, capitate or non-capitate, sometimes the apex acute. Gill trama of subparallel hyphae, 3–6 μ broad; subhymenium not distinctive. Pileus trama of radial hyphae. Cuticle fibrillose, the hyphae brown, incrusted; pileocystidia none. Clamp connections present, small. Caulocystidia 44–68 × 4–10 μ, more or less cylindric-capitate, at times ventricose, in distinct tufts. Pale yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On rotting wood, Oregon, October.

MATERIAL STUDIED—OREGON: Sipe 1271 (MICH), type, October, 1959.

OBSERVATIONS—The glabrous, yellow pileus, narrow gills, white stipe, and caulocystidia in tufts are among the distinctive characters of this species. It is distinguished from *G. sapineus* in which the pileus is floccose-squamulose, the lamellae adnate, the stipe yellow, and pileocystidia present; from *G. geminellus* by the colors; and from *G. penetrans* in which the pileus flesh is white, and the stipe yellowish.

**47. Gymnopilus aurantiophyllus** Hesler, sp. nov.

ILLUSTRATION: FIG. 117.

Pileus 4–8 cm latus, "burnt sienna" deinde disco "ferrugineus," margine "ochraceous buff." Contextu "olive buff" deinde flavus; gustu amarus. Lamellae adnexae demum subdecurrentes, "light buff" demum "warm buff," confertae, latae, ferrugineo-aurantiae contusae. Stipes 6–10 cm longus. 5–8 mm crassus, pallido-"orange buff." Velum album, arachnoideum, fugax. Sporae 6.5–8.5 × 4–5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 25–31 × 5–6 μ; cheilocystidia 28–48 × 4–7 μ. Specimen typicum in Herb. Univ. Mich., lectum prope Grants Pass, Oregon, November 18, 1956, Smith 55807.

Pileus 4–8 cm broad, broadly convex with an inrolled margin, expanding to plane, or with a very slight umbo, color "burnt sienna" young, in age ferruginous on disc and margin ochraceous buff, glabrous except the margin at first with a few fibrils from veil, in age often with minute moist darker spots (glabrous under a lens). Context watery olive-buff when moist, yellowish when faded, taste bitter.

Lamellae adnexed to subdecurrent, "light buff" to "warm buff," finally rusty from spores, close, broad, edges often eroded, staining rusty orange where bruised.

Stipe 6–10 cm long, 5–8(–12) mm thick, equal, pallid-orange-buff, at first paler from whitish veil fibrils, base white mycelioid, not darker, rhizomorphs numerous. Veil white, fugacious or leaving a slight evanescent zone.

Spores 6.5–8.5 × 4–5 μ, ellipsoid, slightly inequilateral, ferruginous in KOH, dextrinoid, no germ pore. Basidia 25–30 × 5–6 μ, 4-spored. Pleurocystidia 25–31 × 5–6 μ, ventricose; cheilocystidia 28–48 × 4–7 μ, flask-shaped, subcapitate to non-capitate. Gill trama of subparallel hyphae, 4–9 μ broad; subhymenium not distinctive. Pileus trama of radial hyphae. Cuticle a zone of

repent, brown, incrusted hyphae; pileocystidia none. Caulocystidia 36–62 × 4–5 μ, filamentous, subcapitate or non-capitate, in tufts. Clamp connections present. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—Cespitose on sawdust, Oregon, November.

MATERIAL STUDIED—OREGON: Smith 55807, type, from Grants Pass, November 18, 1956.

OBSERVATIONS—This is distinguished by its pileus color when young, olive-buff context, rusty-orange stained gills where bruised, and its caulocystidia arranged in tufts. It is near *G. penetrans* in which the pileus is yellow to golden, and the gills rusty spotted; and also near *G. hybridus* in which the pileus is cinnamon-fulvous, then fulvous-orange, the flesh lurid-white to pale-isabelline, gills not spotted nor changing color, the caulocystidia arranged in a palisade.

**48. Gymnopilus flavidellus** Murr., North Amer. Flora **10:** 201. 1917.

*Flammula flavidella* (Murr.) Murr., Mycologia **9:** 320. 1917.
ILLUSTRATIONS: FIGS. 4, 59, 60, 61, 118. Murrill, Mycologia **14:** pl. 8.

Pileus 2–5 cm broad, convex, gregarious to subcespitose, expanding plane or slightly depressed, "ochraceous buff," melleous, "ochraceous orange," or "antimony yellow," margin paler, darker in age, not viscid, hygrophanous, glabrous, margin even. Context yellowish or pallid, thin; odor not distinctive, or slightly aromatic to raphanoid, taste bitter.

Lamellae adnate or sinuate with a decurrent tooth, pale yellow at first, then concolorous to ferruginous, sometimes becoming stained or rust-spotted, narrow to medium broad, close or crowded.

Stipe 2–6 cm long, 2–6 mm thick, yellowish, usually staining fulvous-brown, slightly fibrillose, glabrescent, apex pruinose to mealy, equal or tapering downward, dark brown base, often white-mycelioid, stuffed then hollow, dry. Veil arachnoid, slight, pallid, fugacious.

Spores 7–9 × 4–5.5 μ, color in deposits: "cinnamon-rufous" to near "ochraceous tawny," ellipsoid to ovoid in face view, inequilateral in profile, verrucose to verruculose, no germ pore, dextrinoid. Basidia 20–26 × 5–7 μ, (2–)4-spored. Pleurocystidia 25–47 × 5–7 μ, scattered, more numerous near the edges, ampullaceous or ventricose, capitate to subcapitate; cheilocystidia 23–40 × 3–6 μ, similar to pleurocystidia, or flask-shaped, capitate to subcapitate. Gill trama subparallel to slightly interwoven, hyphae 3–6(–10) μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of the pileus of repent, brown, more or less incrusted hyphae. Pileocystidia 27–35 × 1.5–3 μ, filiform or slender-ventricose, more or less capitate, rare. Caulocystidia 25–65 × 3–6 μ, similar to cheilocystidia, scattered or in tufts. Clamp connections present. Yellow pigment, soluble in KOH, present in the stipe, and the tramae of the pileus and lamellae.

HABIT, HABITAT, AND DISTRIBUTION—On coniferous and deciduous wood (stump, buried wood, fallen limbs, sawdust) in most of temperate North America, autumn-winter.

MATERIAL STUDIED—CALIFORNIA: Malloch 355 (SFSC); Thiers 10740, 18035, 18236 (SFSC); COLORADO: Smith 50368; FLORIDA: Hesler 16153, 20250, 21077, 21589; ILLINOIS: Shafer 858 (MICH); MAINE: Bigelow 3211, 3212, 3213, 3663 (MICH); MASSACHUSETTS: Bigelow 7943 (MASS); MICHIGAN: Harding 437 (MICH); Homola 1170 (MICH); Smith 25780, 36882, 41555, 42220, 74233; NEW MEXICO: Barrows 247, 955 (MICH); NEW YORK: Murrill, type (NY), on chestnut stump, New York Botanical Garden, September 9, 1911; NORTH CAROLINA: Hesler 17145; OHIO: Walters 220 (MICH); SOUTH CAROLINA: Lyles 128 (TENN 29462); TENNESSEE: Hesler 14057, 14779, 23776, 24968; WYOMING: Solheim 4368, 4372 (MICH); CANADA (Ontario): Smith 26553.

OBSERVATIONS—This species is distinguished by the rather uniform morphology of its caulocystidia, pileocystidia, and cheilocystidia, its dextrinoid spores, its slight, pallid, fugacious veil, its yellow to ferruginous, narrow gills which may become stained or rusty spotted, the yellowish stipe which usually becomes stained brownish, its thin flesh and pileus colors. It is closely related to *G. sapineus* in which the pileus is floccose-scaly, and the cuticle of the pileus is composed of several layers of brown, incrusted, repent hyphae. Likewise, it is close to *G. penetrans*, in which pileocystidia are lacking, the odor mild, and the yellowish stipe unchanging. Singer (**1955**) places *G. amarissimus* var. *subdryophilus* in synonymy with *G. flavidellus* (see comments under *G. amarissimus* and *G. subdryophilus*). It resembles *G. liquiritiae* which lacks a veil.

**49. Gymnopilus penetrans** (Fr. ex Fr.) Murr. Mycologia **4:** 254. 1912.

*Agaricus penetrans* Fr., Obs. Myc., p. 23. 1815.
*Agaricus sapineus* f. *penetrans* Fr., Syst. Myc. **1:** 239. 1821.
*Agaricus penetrans* (Fr.) Fr., Epicr. Myc., p. 189. 1838.
*Flammula penetrans* (Fr. ex Fr.) Quél., Champ. Jura Vosg., p. 233. 1872.
*Dryophila* (*Flammula*) *penetrans* (Fr. ex Fr.) Quél., Enchir. Fung., p. 71. 1886.
*Fulvidula penetrans* (Fr. ex Fr.) Sing., Rev. Mycol. II. **2:** 239. 1937.

ILLUSTRATIONS: FIGS. 5, 91, 92, 93.

Pileus solitary or subcespitose, 3–5 cm broad, campanulate-convex then subplane, chrome-yellow to golden, fading flavescent, not viscid, glabrous, margin even. Context white or whitish; odor none or mild, taste bitter.

Lamellae adnate to sinuate, at first pale yellow or yellowish white, becoming rusty-spotted with age, close, medium broad.

Stipe 4–6 cm long, 4–7 mm thick, pallid, paler than the pileus, base white-tomentose, equal or enlarged downwards. Veil white, fibrillose, fugacious.

Spores (6.5–)7–9(–9.5) × 4–5.5 μ, ellipsoid in front view, subamygdaliform in profile, verrucose, no germ pore, dextrinoid. Basidia 24–31 × 6–7 μ, 4-spored. Pleurocystidia 25–33(–50) × 4–7 μ, ventricose; cheilocystidia 25–

34(–48) × 3–7 μ, flask-shaped, apices capitate or non-capitate, at times extending up the sides of the gills. Gill trama of subparallel hyphae, 4–7 μ broad. Pileus trama radial. Cuticle of repent, sometimes incrusted hyphae; pileocystidia none. Clamp connections present. Caulocystidia 30–50(–66) × (2–)6–8(–13) μ, flask-shaped to clavate, more or less capitate, gregarious or in tufts.

HABIT, HABITAT, AND DISTRIBUTION—On wood of conifers and hardwoods (oak, beech), at times on sawdust, widely scattered in the United States; also Jamaica and Europe; summer and autumn (winter in tropics).

MATERIAL STUDIED—CALIFORNIA: Rea H-42 (MICH); IDAHO: Largent 723 (SFSC); Smith 44605, 73772, 73915, 74096; MAINE: Murrill 2291 (NY); MICHIGAN: Harding 76 (MICH); Smith 50247, 72034, 72790, 73790; MISSOURI: Routien (13259); OREGON: Morton Peck (NY), Salem, January 1911; TENNESSEE: Hesler 10829, 18855; TEXAS: Thiers 1415 (MICH); WASHINGTON: Imshaug 2063 (MICH); Smith 3175; WYOMING: Robinson (NY), August; CANADA (Quebec): Bigelow 5369, 5371, 5372 (MASS); JAMAICA: Murrill 875 (NY); SWEDEN: Lundell 17(S); Lundell & Nannfeldt 2035; Murrill 4146 (S); Romell 9885 (S).

OBSERVATIONS—The distinctive characters of this species include a pileus which is glabrous, context white, lamellae becoming rusty spotted at maturity or in age, veil white, pileocystidia none, and caulocystidia gregarious or in tufts. It has been confused with *G. sapineus*, in which the pileus is scaly, the veil yellowish, and pileocystidia present. In *G. flavidellus*, pileocystidia are present, the veil pallid, and the odor sometimes aromatic or raphanoid. These three species are obviously very closely related.

**50. Gymnopilus luteocarneus** Hesler, sp. nov.

ILLUSTRATIONS: FIGS. 51, 52, 53.

Pileus 3–5 cm latus, "tawny" vel "ochraceous tawny," deinde disco "cinnamon-brown," glabrosus. Contextu concolor vel "light buff." Lamellae adnexae, "colonial buff" vel "primrose yellow," deinde obscuriores nonnumquam brunnaceae. Stipes 3–6 cm longus, 5–8 mm crassus, fibrillosus, subflavus. Velum arachnoideum, pallido-luteum, fugax. Sporae 7–8(–8.5) × 4–4.5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 34–44 × 5–6 μ; cheilocystidia 26–48 +5–8 μ. Specimen typicum in Herb. San Francisco State College, lectum prope Alpine Lake, California, November 30, 1964, Theirs 11815.

Pileus 3–5 cm broad, at first convex to subconic, then expanding convex or campanulate and umbonate, when young tawny to ochraceous tawny, the disc becoming cinnamon-brown to near russet, the margin becoming near yellow-ocher or buff or remaining brownish, surface moist, not viscid, glabrous, streaked on drying, margin strongly incurved at first, becoming decurved to plane in age. Context concolorous to light buff or warm buff; odor not distinctive, taste bitter.

Lamellae adnexed, sometimes subdecurrent or seceding, at first near colonial buff, ivory yellow to primrose yellow, becoming slightly darker yellow, sometimes in age staining brownish, edges even and concolorous, close to subdistant, relatively narrow and thin.

Stipe 3–6 cm long, 5–8 mm thick, concolorous with lamellae, not staining, base white-mycelioid, flesh concolorous and unchanging, apex appearing glabrous,

elsewhere fibrillose, equal or tapering either way. Veil arachnoid, pale yellow, fugacious, leaving a temporary annular zone.

Spores 7–8(–8.5) × 4–4.5 μ, ellipsoid, inequilateral, verruculose-wrinkled, ferruginous, dextrinoid, no germ pore. Basidia 25–29 × 5–6 μ, 4-spored. Pleurocystidia 34–44 × 5–6 μ, flask-shaped to ventricose, with a long neck, capitate or non-capitate; cheilocystidia 26–48 × 5–8 μ, similar. Gill trama of subparallel hyphae, 3–6 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of repent hyphae, with some surface, repent or suberect brown, incrusted hyphae. Clamp connections present. Pileocystidia none. Caulocystidia 38–47 × 5–7 μ, similar to cheilocystidia, in tufts or in a palisade.

HABIT, HABITAT, AND DISTRIBUTION—Solitary to scattered, on conifer logs, California, November.

MATERIAL STUDIED—CALIFORNIA: Thiers 11815 (SFSC), type, from Alpine Lake, Marin County, November 30, 1964.

OBSERVATIONS—This species is distinguished by its pileus and gill colors, its buff-colored context of the pileus, and its yellow veil. It is closely related to *G. penetrans,* in which the pileus is yellow, and the veil and context white.

**51. Gymnopilus fulgens** (Favre & Maire) Sing., Lilloa **22:** 561. 1951.

*Naucoria fulgens* Favre & Maire, Bull. Soc. Mycol. France **53:** 267. 1937.

*Flammula fulgens* (Favre & Maire) Lundell, Fungi Exsiccati Suecici, Lundell & Nannfeldt No. 2721.

*Fulvidula fulgens* (Favre & Maire) Kühner, Bull. Soc. Linn. Lyon **8**(2): 44. 1939.

ILLUSTRATIONS: FIGS. 29, 119.

Pileus 0.5–2.5(–5) cm broad, convex, then plane, not mammilliform, more or less hygrophanous, when wet, rusty brown to rufous, inclined toward orange, when dry, rusty fawn to orange fawn, cuticle adnate, glabrous, margin slightly striate when dry (not pellucid-striate). Context brownish orange when wet, ochraceous when dry; odor slight, taste sweet.

Lamellae adnate to sinuate, or more or less emarginate, ochre-cream in extreme youth, then yellow to ochraceous tawny or Mars orange, at length deep ferruginous, broad, distant or at least not very close.

Stipe 0.7–3(–4) cm long, 1–1.5(–2.5) mm thick, reddish brown, the flesh more or less ferruginous, glabrous to slightly fibrillose-striate, solid or stuffed, confluent with the pileus, subcylindric, straight or flexuous. Veil none.

Spores 7.5–10 × (5–)6–8 μ, or in some collections 8.5–11 × 5–7 μ (rarely 13 × 8 μ), ellipsoid, short-ellipsoid, to ovoid in face view, inequilateral in profile, often subamygdaliform, coarsely verrucose, dextrinoid. Basidia 24–30 × 6–8 μ, 4-spored, often constricted in the middle. Pleurocystidia 26–30 × 4–7 μ, flask-shaped, rare; basidioles 24–28 × 4–5 μ, brown, rare; cheilocystidia 15–30 × 3–7 μ ventricose-lageniform, or flask-shaped, numerous, more or less capitate. Gill trama of subparallel to parallel hyphae, 6–12 μ broad; subhymenium scarcely distinctive. Cuticle of pileus of radial, subrepent to suberect, hyphae brown, incrusted, at times the terminal elements as pileocystidia, 22–28 × 4–6 μ, clavate. Pileus trama radial. Clamp connections present. Caulo-

cystidia 24–35 × 2–4 μ, slender flask-shaped, subcapitate or non-capitate, in tufts.

HABIT, HABITAT, AND DISTRIBUTION—Among moss, on peaty soil, charred sphagnum, or burned-over soil. Michigan, also Europe, June and September.

MATERIAL STUDIED—MICHIGAN: Smith 12, 16, 989, 1329, 32–9, 32–32, 32–118, 32–243, 33–93, 33–103; SWEDEN: Lundell & Nannfeldt 2721.

OBSERVATIONS—This species is distinguished by its habitat, slightly striate pileus, its colors, lack of a veil, broadly ellipsoid and conspicuously and coarsely verrucose spores. Its relationship to other soil-humus species is outlined under *G. humicola*. Lange (**1939**) states that this species is, probably identical with *Naucoria cerodes* (Fr.) Kummer (Führer Pilzk., p. 77, 1871). This probability is conceded, on a basis of descriptions, but I have been unable to study an authentic collection of *N. cerodes*.

**52. Gymnopilus oregonensis** Murr., North Amer. Flora **10:** 207. 1917.

*Naucoria oregonensis* (Murr.) Kauff., Amer. Jour. Bot. **13:** 28. 1926.

ILLUSTRATIONS: FIGS. 16, 83, 84, 85.

Pileus 1.5–2.5 cm broad, conic to hemispheric-convex, not fully expanding, lateritious (dark brick red), margin concolorous, dry, glabrous, deflexed.

Lamellae adnexed, cremeous to fulvous, broad, close.

Stipe 2–3 cm long, 3–5 mm thick, lateritious or slightly paler, whitish-pulverulent throughout, more or less glabrescent with age, equal, hollow. Veil none.

Spores 7.5–9 × 5–5.5 μ, ellipsoid or irregularly ovoid in face view, inequilateral in profile, minutely verruculose, dextrinoid. Basidia 25–30 × 6–7 μ, 4-spored. Pleurocystidia 26–38 × 5–8 μ, flask-shaped or ventricose, capitate; cheilocystidia 25–38 × 6–8 μ, similar. Gill trama subparallel, hyphae 4–8 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of repent, brown, more or less incrusted hyphae. Clamp connections none. Pileus and gill trama yellowish brown in KOH; rusty brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On conifer logs, Oregon, November.

MATERIAL STUDIED—OREGON: Murrill 739, type (NY), on fir log, Glen Brook, November 7, 1911.

OBSERVATIONS—Murrill (**1917**) says the spores are pale-ferruginous, and they are so under the microscope. It is near *G. picreus,* in which pleocystidia are present, the pileus disc squamulose, the stipe tapering upward, and the lamellae narrow.

**53. Gymnopilus croceoluteus** Hesler, sp. nov.

ILLUSTRATIONS: FIGS. 25, 54, 55, 56.

Pileus 3–8 cm latus, "warm buff" demum "tawny orange," glabrosus. Contextu amarus. Lamellae adnatae, flavae, angustae, stipatae. Stipes 2–5 cm longus, 3–7 mm crassus, pallido-flavus. Velum nullum. Sporae (6.5–)7–8.5 × 4.5–5.5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 22–26 × 5–6 μ; cheilocystidia 18–35 × 5–8 μ. Specimen typicum in Herb. Univ. Mich., lectum prope Stinchfield, Michigan, November 3, 1955, Smith 51168.

Pileus 3–8 cm broad, glabrous, moist, hygrophanous, warm buff to tawny orange, margin inrolled. Context taste bitter.

Lamellae adnate, decurrent by a tooth, yellow then rusty, sometimes spotted, narrow, crowded.

Stipe 2–5 cm long, 2–7 mm thick at the apex, pallid yellowish or orange-buff, dingy below, glabrous but fibrous-striate. Veil none.

Spores (6.5–)7–8.5(–9) × 4.5–5.5 μ, ellipsoid, sometimes broadly so, slightly inequilateral, ferruginous in KOH, dextrinoid, no germ pore, at times conspicuously 1-guttulate. Basidia 23–26 × 6–7 μ, 4-spored. Pleurocystidia 22–37 × 5–7 μ, ventricose; cheilocystidia 18–40 × 3–8 μ, flask-shaped, subcapitate or capitate. Gill trama of subparallel hyphae, 5–10 μ broad; subhymenium of narrow compact hyphae, 2–3 μ broad. Pileus trama of loosely interwoven hyphae. Cuticle a narrow, compact zone of repent, brown hyphae; pileocystidia none. Caulocystidia 15–48 × 3–5(–11) μ, clavate, flask-shaped, ventricose, colorless, in tufts. Clamp connections present. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On conifers, Michigan (November), Florida (July), and Idaho (June).

MATERIAL STUDIED—FLORIDA: Thiers 4923 (SFSC); IDAHO: Smith 67935; MICHIGAN: Homola 980 (MICH); Smith 51168, type, on white pine debris, Stinchfield, November 3, 1955.

OBSERVATIONS—The distinctive characters include the buff to tawny orange pileus colors, bitter taste, narrow gills, lack of a veil, dextrinoid spores, and interwoven trama of the pileus. Its relationship to *G. subdryophilus* is described under that species. Its colors may suggest *G. liquiritiae,* in which the pileus trama is radial, the lamellae broad, and pileocystidia present.

**54. Gymnopilus liquiritiae** (Pers. ex. Fr.) Karst., Bidr. Finl. Nat. Folk **32:** 400. 1879.

*Agaricus liquiritiae* Pers., Syn. Method. Fung., p. 306. 1801.
*Agaricus liquiritiae* Pers. ex Fr., Epicr. Syst. Myc., p. 190. 1838.
*Flammula liquiritiae* (Pers. ex Fr.) Kummer, Der Führer in die Pilzk., p. 82. 1871.
*Dryophila* (*Flammula*) *liquiritiae* (Pers. ex Fr.) Quél., Enchir. Fung., p. 71. 1886.
*Fulvidula liquiritiae* (Pers. ex Fr.) Romagn., Rev. Mycol. II. **2:** 191. 1937.

ILLUSTRATIONS: FIGS. 2, 71, 72, 73, 74, 120. Bresadola, Icon. Myc., Tab. 783 (as *Flammula*).

Pileus more or less cespitose, 2–8 cm broad, convex then plane, sometimes subumbonate, fulvous, "ochraceous buff," "ochraceous tawny," "ochraceous orange," "zinc orange," or "Kaiser brown," disc often "tawny," glabrous, or with minute, brown, waxy dots, not viscid, margin even, at length striatulate. Context pale-orange to tawny-yellow; odor mild, or slightly aromatic, fragrant, or of raw potatoes, taste bitter.

Lamellae adnate then adnexed, seceding, at first "ochraceous buff," to "light orange yellow," finally "ochraceous orange" to "ochraceous tawny," to "zinc orange," at times reddish brown spotted, broad to medium broad, close or crowded, edges fimbriate.

Stipe (1–)3–7 cm long, (2–)3–8(–10) mm thick, pallid or dingy orange, often eccentric, fibrillose or subglabrous, apex whitish or yellowish scurfy, tapering either way, hollow. Veil none.

Spores in deposit: "raw sienna" to "antique brown," 7–8.5(–10) × 4–5.5 μ, ellipsoid, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia (20–)25–32 × 4–6 μ, 4-spored. Pleurocystidia 20–30 × 4–7 μ, inconspicuous, clavate, cylindric, or subventricose, capitate to non-capitate; cheilocystidia 20–40 × 3–6 μ, flask-shaped, capitate or non-capitate. Gill trama of subparallel hyphae, 5–10 μ broad; subhymenium of slender interwoven hyphae. Pileus trama radial. Cuticle of brown repent hyphae, a few incrusted; the surface at times bearing brown, erect hyphae. Pileocystidia 32–54 × 3–6 μ, clavate to cylindric. Caulocystidia 27–48(–105) × 3–7 μ, filamentous or ventricose, often in tufts. Clamp connections present. Yellow pigment, soluble in KOH, present in the gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On conifer wood and sawdust, occasionally also on hardwood, Maine, New Hampshire, Vermont, New York, North Carolina, Tennessee, Florida, Michigan, Idaho, Wyoming, California, Oregon, New Mexico, and Europe, summer and autumn.

MATERIAL STUDIED—CALIFORNIA: Thiers 953, 9560, 9809, 9839, 18044, 18227 (SFSC); FLORIDA: Thiers 5313 (SFSC); IDAHO: Solheim 4968, 4969 (MICH); Smith 55105, 62388, 67935, 68031, 68314, 73444; MAINE: Bigelow 3009, 3277 (MICH); MICHIGAN: Bartelli 215 (MICH); Harding 411, 423, 434 (MICH); Homola 980 (MICH); Potter 9057 (MICH); Smith 15226, 37046, 39114, 49554, 61266, 73040, 73250, 74239, 74242, 74243; NEW HAMPSHIRE: Bigelow 12250 (MASS); NEW MEXICO: Barrows 618, 1046 (MICH); NEW YORK: Deegan H-20, H-29, H-29a, H-30, 43 (MICH); Marsden 405 (MICH); NORTH CAROLINA: Hesler 10161; OREGON: Sipe 1023 (MICH); TENNESSEE: Hesler 9039, 9598, 10703, 17265, 17776, 20216, 26089; VERMONT: Bigelow 13692 (MASS); WYOMING: Solheim 4368, 5122, 5184, 5946 (MICH); SWEDEN: Nils Suber, Fungi Suecici, November 11, 1951.

OBSERVATIONS—The chief distinguishing characters include the glabrous, striatulate, distinctly colored pileus, its orange to tawny flesh, yellow lamellae, lack of a veil, and the presence of caulocystidia in tufts. It appears that *G. amarissimus* is related to *G. liquiritiae,* but in the former the spores are non-dextrinoid; and in *G. subdryophilus,* another relative, the pileus trama is interwoven, and the yellow stipe is unchanging where bruised. The odor of *G. liquiritiae* seems to vary from mild to aromatic, of raw potatoes, or even fragrant. At times, *G. liquiritiae* has been confused with *G. flavidellus,* but the latter has a veil. In *G. picreus* the pileus is rufous to bay or cinnamon-brown, disc squamulose, and generally smaller than in *G. liquiritiae.*

**55. Gymnopilus abramsii** Murr., North Amer. Flora **10:** 207. 1917.

*Flammula abramsii* (Murr.) Murr., Mycologia **9:** 320. 1917.

ILLUSTRATION: FIG. 31.

Pileus 4–6 cm broad, convex to subexpanded, dry, grayish brown, with reddish brown fibrils or scales, margin concolorous. Context white; odor and taste not distinctive.

Lamellae adnate or adnexed, creamy pink to ferruginous, crowded, ventricose.

Stipe 6–8 cm long, 6–10 mm thick, white, cylindric or slightly compressed, central, slightly arachnoid-fibrillose, smooth, solid. Veil cortinate.

Spores 6–8.5 × 4.5–5 μ, in mass bright ferruginous, ellipsoid in face view, slightly inequilateral in profile, verruculose, no germ pore, dextrinoid. Basidia 20–25 × 4–6 μ, 4-spored. Pleurocystidia none; cheilocystidia 24–43 × 3–8 μ, ventricose, capitate to subcapitate, rarely the apex forked. Gill trama of subparallel hyphae, 2–4 μ broad; subhymenium not distinctive. Pileus trama of interwoven hyphae. Cuticle of repent hyphae, bearing brown hyphae which may be disposed in bundles (scales), at times lightly incrusted. Clamp connections present. Pileus and gills trama yellowish brown in KOH; reddish brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On soil, California, November.

MATERIAL STUDIED—CALIFORNIA: Abrams and McMurphey No. 65, type (NY), among oak leaves, Stanford University, November 27, 1902.

OBSERVATIONS—This species is distinguished by its gray-brown pileus, reddish brown fibrils and scales, mild taste, white stipe, lack of pleurocystidia, and terrestrial habitat. Its terrestrial habitat suggests the possibility that it is not even a *Gymnopilus*; in fact, Kauffman (**1926:** 27) places it in *Cortinarius*. But, its bright-ferruginous spores, and the character of its cheilocystidia ally it more directly to *Gymnopilus* than to *Cortinarius*.

**56. Gymnopilus humicola** P. R. Harding ex Singer, Sydowia **15**: 76. 1961.

ILLUSTRATIONS: FIGS. 67, 68, 69, 70, 121.

Pileus 1–5 cm broad, convex and sometimes with wavy inrolled margin, expanding, pale-russet, tawny or auburn to ochraceous-tawny or "Sanford's brown," minutely and densely squamulose, plush-like to the naked eye, sometimes glabrescent. Context yellowish, thin; odor faintly aromatic, taste bitter.

Lamellae adnate to decurrent, at first bright yellow, staining rusty or tawny where bruised, becoming yellow-ocher, ochraceous-buff, orange-buff, then to ferruginous, close or crowded, narrow to medium-broad.

Stipe 2–9 cm long, 3–9 mm thick, pallid orange-buff to sordid-buff, staining brownish where handled or in age, especially at the base, longitudinally appressed-fibrillose and striatulate, apex scurfy or pruinose, glabrous below or often the base white-mycelioid. Veil none.

Spores (6–)7–8.5(–9) × 4–5 μ, ellipsoid, a few subovoid, slightly inequilateral, verruculose, ferruginous in KOH, dextrinoid, no germ pore. Basidia 23–27 × 6–7 μ, 4-spored. Pleurocystidia 24–30 × 5–6 μ, ventricose; cheilocystidia 23–28 × 4–5 μ, flask-shaped, capitate (rarely non-capitate). Gill trama

of subparallel hyphae, 3–6 $\mu$ broad; subhymenium not distinctive. Pileus trama radial. Cuticle fibrillose, with bundles of brown, incrusted hyphae, the terminal elements as pileocystidia, 28–53 $\times$ 7–12 $\mu$, cylindric or ventricose, colorless or pale-brown. Caulocystidia 26–37 $\times$ 4–6 $\mu$, flask-shaped, capitate, scattered. Clamp connections present. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On humus, in coniferous and deciduous woods, Michigan, Idaho, Tennessee, and Washington, June-September.

MATERIAL STUDIED—MICHIGAN: Smith 159a, 36430, 36462, 36690, 36880, 37093, 37801, 42604, 42669, 49695, 50101; IDAHO: Smith 46526; TENNESSEE: Smith 10427; WASHINGTON: Smith 73435.

OBSERVATIONS—This species is distinguished by its humicolous habitat, its colors, aromatic odor, and its characteristic color change to brown where the gills and pileus are bruised. Its habitat suggests other terrestrial species: in *G. terrestris,* the spores are smaller, and both pleurocystidia and cheilocystidia are lacking; in *G. abramsii* the pileus is gray-brown with reddish brown fibrils or scales, odor and taste mild, pleurocystidia lacking, the pileus trama interwoven; in *G. arenicola* the odor and taste are mild, the pileus smaller and differently colored, and pileocystidia are lacking; and in *G. fulgens,* which grows on peaty or burned-over soils, the spores are 7.5–10 $\times$ (5–)6–8 $\mu$ with very prominent warts, the pileus is glabrous, rusty brown or rufous and fading to rusty fawn or orange-fawn. The type, described from Michigan by Singer, is on deposit at the Farlow Herbarium at Harvard University. This species was described by Harding (**1952**); however, since his description was not published, Singer's (**1961**) account is valid.

### 57. **Gymnopilus angustifolius** Hesler, sp. nov.

Pileus 1.5–3 cm latus, aurantius, squamulas perparvas puniceo-brunneas gerens; odore fragrans. Lamellae adnatae, aurantio-brunneae, confertae, angustae. Stipes 2.5–3.5 cm longus, 3–4 mm crassus, aurantio-brunneus. Velum arachnoideum, fugax. Sporae 7–8.5 $\times$ 4.3–5 $\mu$, ellipsoideae, dextrinoideae. Pleurocystidia 25–32 $\times$5–6 $\mu$; cheilocystidia 22–32 $\times$ 4–7 $\mu$. Specimen typicum in Herb. Univ. Mich., lectum ex humo, prope Maple River, Michigan, July 2, 1961, Smith 63489.

Pileus 1.5–3 cm broad, convex-expanded, orange beneath minute reddish brown squamules (yellow on rusty brown in daylight). Context odor slightly fragrant, of *Cantharellus cibarius.*

Lamellae adnate, orange-brown, close, narrow.

Stipe 2.5–3.5 cm long, 3–4 mm thick, dull-orange-brown, with an obscure, fibrillose apical zone. Veil arachnoid, fugacious.

Spores 7–8.5 $\times$ 4.3–5 $\mu$, ellipsoid in face view, obscurely inequilateral in profile, verrucose, no germ pore, ferruginous in KOH, promptly dextrinoid. Basidia 25–30 $\times$ 6–7 $\mu$, 4-spored. Pleurocystidia 25–32 $\times$ 5–6 $\mu$, flask-shaped or ventricose, sometimes subcapitate, scattered; cheilocystidia 22–32 $\times$ 4–7 $\mu$ flask-shaped, not capitate. Gill trama of subparallel hyphae, 4–8 $\mu$ broad; subhymenium not distinctive. Pileus trama of radial hyphae. Cuticle of repent hyphae, bearing mounds of brown, incrusted hyphae, the terminal elements cylindric-clavate and subcapitate—as pileocystidia, 50–82 $\times$ 7–11 $\mu$. Caulo-

cystidia 25–35 × 3–5 μ, scattered, filamentous-subcapitate, brownish. Clamp connections present, rare. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On soil, Michigan, July.

MATERIAL STUDIED—MICHIGAN: Smith 63489, type, on soil near a conifer stump, West Branch, Maple River, July 2, 1961.

OBSERVATIONS—The distinctive features of *G. angustifolius* are its narrow gills, orange pileus with reddish brown squamules, its radial pileus trama, and its pileocystidia in mounds. The reddish brown scales on the pileus might suggest *G. rufosquamulosus,* in which a persistent annulus is present, the pileus trama loosely interwoven, the gills broad, and caulocystidia absent. It appears related to *G. sapineus,* in which the pileus is golden-yellow or tawny, the odor usually strong, the gills broader, the cheilocystidia subcapitate, the pileocystidia much shorter.

**58. Gymnopilus arenicola** Hesler, sp. nov.

ILLUSTRATION: FIG. 28.

Pileus 15–30 mm latus, "zinc orange" vel paene "tawny," deinde subflavus. Contextu pallidus; odore et gustu mitis. Lamellae adnatae vel adnexae, "burnt sienna," confertae, medio-latae. Stipes 2–3 cm longus, 1.5–2.5 mm crassus, brunneus, deinde obscurus. Velum nullum. Sporae 7–8 × 3.5–4.5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 20–27 × 4–5 μ; cheilocystidia 15–28 × 3–7 μ. Specimen typicum in Herb. Univ. Mich., lectum prope Longmire, Washington, September 13, 1954, Smith 47448.

Pileus 15–30 mm broad, obtuse, expanding to nearly plane or broadly umbonate, surface dull and unpolished or minutely fibrillose, color "zinc orange" or duller and near "tawny," evenly colored or disc finally paler and yellowish. Context pallid; odor and taste mild.

Lamellae adnate to slightly adnexed, close, moderately broad, "burnt sienna" at maturity, 2–3 tiers of lamellulae, edges even.

Stipe 2–3 cm long, 1.5–2.5 mm thick, surface dull brown, equal, solid, more or less fibrillose-striate, in age dingy over all but base not appreciably darker, brownish within. Veil none.

Spores 7–8 × 3.5–4.5 μ, ellipsoid to slightly pip-shaped, at times subfusoid, slightly inequilateral, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 24–28 × 5–6 μ, 2–4-spored. Pleurocystidia 20–27 × 4–5 μ, ventricose; cheilocystidia 15–28 × 3–7 μ, ventricose or flask-shaped, subcapitate or capitate. Gill trama of subparallel hyphae, 3–6 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle a dark-brown, conspicuous zone of repent hyphae, the surface hyphae brown, and often incrusted; pileocystidia none. Caulocystidia 14–22 × 3–5 μ, ventricose to clavate, mostly with a brown contents. Clamp connections present. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On soil, Washington, September.

MATERIAL STUDIED—WASHINGTON: Smith 47448, type, on sandy soil, along a trail, Longmire, September 13, 1954; 47449.

OBSERVATIONS—Its color, mild taste, terrestrial habitat, lack of a veil, and radially arranged pileus trama are the chief distinguishing characters. The

relationship of *G. arenicola* to other terrestrial species is described under *G. humicola.*

**59. Gymnopilus aeruginosus** (Pk.) Sing., Lilloa **22:** 560. 1951.

*Pholiota aeruginosa* Pk., N.Y. State Mus. Ann. Rept. **43:** 81 (35). 1890.

ILLUSTRATIONS: FIGS. 1, 32, 33, 122, 123. Overholts, Ann. Missouri Bot. Gard. 14; pl. 18 (as *Pholiota*).

Pileus cespitose, 2–5 (more rarely 6–23) cm broad, convex, dry, at first dull bluish gray-green, or aeruginous to variegated green and yellow, at times with patches of salmon or livid red, becoming "warm buff" to "pinkish buff," or at times brown or drab, especially when dried, fibrillose-scaly, becoming rimose-areolate, each areola with 2–8 cushion-like to fibrillose scales, or sometimes squamulose without areolae, the scales tawny or blackish, margin even. Context pallid or whitish, tinged greenish, or dull bluish green, when dry becoming yellowish to vinaceous; odor mild, taste bitter.

Lamellae adnexed to adnate, often at first decurrent by a line, frequently seceding, "cream-buff" to "pale ochraceous orange," broad to medium broad, crowded or close, lamellulae numerous, edges even to slightly rough.

Stipe (3–)5–12 cm long, (4–)10–15(–40) mm thick, concolorous, appressed-fibrillose or glabrous, dry, sometimes striate, solid, becoming more or less hollow, at times 3–8 connate at base, equal. Veil arachnoid, yellowish, slight, fugacious, leaving an apical evanescent zone.

Spores in deposit "orange-rufous," "ferruginous," "xanthine orange," or "cinnamon rufous;" spores 6–8.5(–9) × (3.5–)4–4.5 μ, ellipsoid in face view, inequilateral in profile, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 24–29 × 5–7 μ, 4-spored. Pleurocystidia 23–35 × 5–7 μ, ventricose, rare; basidioles sometimes present, 22–27 × 5–6 μ, clavate, brown; cheilocystidia 20–38 × (3–)5–7(–9) μ, flask-shaped to ventricose, capitate, subcapitate, more rarely non-capitate, sometimes extending up the sides to a short distant. Gill trama of subparallel hyphae, 5–12(–25) μ broad; subhymenium not distinctive. Pileus trama interwoven. Cuticle of repent hyphae, bearing tufts of brown, sometimes incrusted hyphae (the scales); pileocystidia none. Caulocystidia 34–60 × 3–7 μ, cylindric-clavate, scattered, or more rarely in tufts. Clamp connections present. Yellow pigment, soluble in KOH, present in the gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On hardwood and conifer wood (sawdust, timber, logs, stumps), of wide occurrence across the United States, May-November.

MATERIAL STUDIED—CALIFORNIA: Malloch 28 (SFSC); IDAHO: Smith 74234; MICHIGAN: Harding 429, 438; Smith 7–3, 397, 20770, 20890, 28714, 35829, 62524, 64698; OHIO: Cooke 33124; NORTH CAROLINA: Hesler 19147; PENNSYLVANIA: Peck, type (NYS), leg. William Herbst, on oak railroad ties, Trexlertown, October, 1889; Smith 74229; TENNESSEE: Hesler 9591, 15085; WASHINGTON: Smith 17883.

OBSERVATIONS—Some near relatives of *G. aeruginosus* include *G. luteofolius, G. braendlei,* and *G. pulchrifolius.* All of these species were originally named

by Peck. In 1875, Peck described *G. luteofolius,* as *Agaricus* (*Pholiota*) *luteofolius,* in which the distinctive macroscopic features were the dark-red or red-brown young pilei which became pinkish or pale-red to yellowish, and the pileus context red, becoming purple or lavender then yellow. A microscopic study of *G. luteofolius* reveals dextrinoid spores, an interwoven pileus trama, and the presence of caulocystidia, pleurocystidia, and cheilocystidia. Some years later (**1890**), Peck described *Pholiota aeruginosa,* now recognized as a *Gymnopilus*. Peck distinguished his *P. aeruginosus* by its green pileus which becomes areolate-scaly, its white tinged greenish pileus-context; a study of the type shows that its microscopic characters are basically similar to those of *G. luteofolius*. On a basis of pileus and flesh colors, Peck distinguished these two as separate species.

In 1904, Peck also described *Flammula braendlei,* a species now placed in *Gymnopilus*. The young pileus is purplish, but as it matures the color changes to pink in the center, pale pink or pallid on the margin, and finally yellowish. Sometimes, Peck states, the pileus shows greenish stains, a character suggesting *G. aeruginosus*. But, in *G. aeruginosus,* the pileus is distinctly larger, the developing color-patterns differ, the young gills are cream-buff, against white in *G. braendlei,* the stipe solid (hollow in *G. braendlei*), and caulocystidia are present in *G. aeruginosus,* and absent in *G. braendlei.*

Shortly thereafter in 1908, Peck next described *Flammula pulchrifolius,* now placed in *Gymnopilus*. This species, at maturity, exhibits pink colors, as in *G. luteofolius*, but the pileus flesh and young gills in *G. pulchrifolius* are white (in *G. luteofolius* the flesh is red, purple, lavender then yellow, and the young gills yellow). A microscopic study of *G. pulchrifolius* reveals a lack of both pleurocystidia and caulocystidia (both present in *G. luteofolius*).

It appears, then, that Peck regarded these four species (*G. aeruginosus, G. braendlei, G. luteofolius,* and *G. pulchrifolius*) as distinct entities. My comparative studies of both the macroscopic and microscopic characters substantiate Peck's interpretations. All four species have several characters in common, and are evidently closely related, but all should be kept distinct until strong evidence is adduced that one or more of these names can safely be placed in synonymy.

Two other species-names should be mentioned as a part of this discussion: (1) *G. viridans* Murrill, described in **1912,** in which the spores are non-dextrinoid, and pleurocystidia are absent; (2) *Agaricus harmoge* Fr., in which the pileus colors are mixed (aeruginous, with lilac to pinkish on the margin), a name, although used by Karsten (**1879**) as *Flammula harmoge* (Fr.) Karsten, has not generally been accepted by subsequent workers. Material under the name *Agaricus* (*Flammula*) *harmoge* is not available at Stockholm.

A good description from fresh material of *G. aeruginosus* from Washington is presented by Stuntz and Isaacs (**1962**). Full notes on colors of the various parts of the basidiocarps are given, and they also report an oily farinaceous odor

with a slight component of anise. Hongo (**1959**) reports *G. aeruginosus* from Japan.

**60. Gymnopilus magnus** (Pk.) Murr., North Amer. Flora **10:** 205. 1910.

*Flammula magna* Pk., N.Y. State Mus. Ann. Rept. **50:** 103. 1897.

ILLUSTRATION: FIG. 9.

Pileus 10–15 cm broad, cespitose, broadly convex, pale yellow or buff, not viscid, fibrillose and somewhat virgate, the margin commonly becoming revolute with age. Context soft, whitish or yellowish.

Lamellae adnate or slightly decurrent, ochraceous at maturity (probably yellow when young), close, about 6 mm broad, often crisped and wavy toward the stipe.

Stipe 7.5–10 cm long, 16–24 mm thick, concolorous, brighter yellow within, equal or thickened toward the base, fibrillose, solid. Veil arachnoid, fugacious.

Spores 7.5–10 × 5.5–7 $\mu$, ellipsoid in face view, inequilateral or subamygdaliform in profile, rough-warty, no germ pore, ferruginous in KOH, dextrinoid. Basidia 27–38 × 6–7 $\mu$, (2–)4-spored, sometimes brown. Pleurocystidia none; cheilocystidia 26–37 × 7–10 $\mu$, ventricose, usually with a neck and capitate, sometimes brown. Gill trama subparallel, hyphae 5–11 $\mu$ broad. Pileus trama interwoven. Cuticle repent. Clamp connections present. Pileus and gill trama yellowish brown in KOH; reddish brown in Melzer's reagent. Yellow pigment, soluble in KOH; present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—About the base of trees, New York, Washington, and Canada (British Columbia), August-October.

MATERIAL STUDIED—MICHIGAN: Imshaug 3944 (MICH); NEW YORK: Peck, type, from Westchester County, October; WASHINGTON: Smith 2750, 16338, 17373; BRITISH COLUMBIA: Foster V-4075, V-4194 (MICH).

OBSERVATIONS—The above account is based on a study of the type. Its distinctive characteristics are its arachnoid, more or less fugacious veil, its interwoven pileus trama, and its lack of pleurocystidia. It differs from *G. spectabilis*, in which pleurocystidia are present, and in which its veil develops a persistent, more or less membranous annulus, and which has narrower spores. Its color and larger spores separate it from *G. braendlei* and *G. aeruginosus*. It is distinguished from *G. validipes*, in which the pleurocystidia are present, the pileus trama radial, the spores more narrow, and the stipe context white.

**61. Gymnopilus sapineus** (Fr.) R. Maire, Treballs del Museo de Ciences Natural de Barcelona **15**(2): 96. 1933.

*Agaricus sapineus* Fr., Syst. Myc. **1:** 239. 1821.
*Flammula sapinea* (Fr.) Kummer, Der Führer in die Pilzk., p. 82. 1871.
*Dryophila sapinea* (Fr.) Quél., Enchir Fung., p. 71. 1886.
*Fulvidula sapinea* (Fr.) Romagn., Rev. Mycol. II. **2:** 191. 1937.

ILLUSTRATIONS: FIGS. 6, 99, 100, 124.

Bresadola, Icon. Myc., Tab. 782 (as *Flammula*).

Pileus (1–)3–5(–9) cm broad, subcespitose or gregarious to scattered, hemispheric then plano-convex, golden yellow to tawny, paler on the margin, minutely floccose-squamulose, at length fading and rimose. Context thick on disc, soft, yellow; odor strong, taste often bitter.

Lamellae adnate, chrome-yellow, then fulvous-cinnamon or rusty-yellow, broad, close, edges minutely fimbriate.

Stipe 3–7 cm long, 4–7(–12) mm thick, yellowish, brownish below when handled, innately fibrillose, solid or stuffed then hollow, equal or sub-attenuated downward. Veil yellowish, scanty, sometimes remnants present on the pileus margin, fugacious.

Spores in deposit: "hazel" or "amber brown," 7–9(–10) × 4–5.5 μ, ellipsoid in face view, inequilateral in profile, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 24–28 × 5–7 μ, 4-spored. Pleurocystidia 23–32 × 5–7 μ, inconspicuous, scattered, ventricose; cheilocystidia 22–40 × 5–7 μ, ventricose, capitate or subcapitate, more rarely non-capitate. Gill trama subparallel, hyphae 4–10 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle a zone of repent, brown, often incrusted hyphae, bearing fibrils which may be in fascicles (scales), and with scattered mounds of brown, ventricose to clavate pileocystidia, 24–30 × 5–8 μ. Caulocystidia 37–57 × 3–7 μ, with a slender neck, capitate, often in rosettes. Yellow pigment, soluble in KOH, present in the gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On wood of conifers and hardwood, and on sawdust, scattered over the United States, and Europe, throughout most of the year.

MATERIAL STUDIED—CALIFORNIA: Lucke 127 (NY); Smith 55936, 56203, 56223; COLORADO: Smith 51927, 52533; FLORIDA: Murrill F-18492 (FLAS); IDAHO: Bigelow 1734, 1744 (MASS); Largent 360, 437; Smith 44155, 44333, 44608, 44615, 44912, 45015, 45082, 45134, 45137, 45376, 45467, 45471, 45876, 46114, 46377, 47323, 53392, 53407, 53579, 53767, 55143, 58394, 59979, 65920; Thiers 11662; MAINE: Bigelow 3161, 3316, 3664 (MICH), 10516 (MASS); MASSACHUSETTS: Bigelow 8093 (MASS); MICHIGAN: Imshaug 4858 (MICH); Mazzer 4275 (MICH); Rea 1153 (MICH); Smith 990, 20825, 25429, 42048, 43233, 50119, 63384, 72720; Thiers 3292 (MICH); MISSOURI: Routien (TENN 13259); NEW HAMPSHIRE: Bigelow 12503 (MASS); OREGON: Sipe 1040b, 1272 (MICH); Smith 8212, 9302, 24507, 28261, 55464, 55631, 55658; TENNESSEE: Hesler 19740, 20052; TEXAS: Thiers 4455, 4688; VERMONT: Shafer 3505 (MICH); WASHINGTON: Flett 74245 (MICH); Smith 48159, 48540, 49183; WYOMING: Solheim 3853, 4344, 4892; CANADA (Quebec): Bigelow 5846 (MASS); DAOM—113242 (SFSC); ENGLAND: Murrill, October (NY); Reid, October 13, 1951 (K); Smith 63220.

OBSERVATIONS—The distinctive characteristics of this species include its yellow to tawny, floccose-squamulose pileus, which fades and becomes rimose; the color-change of the stipe from yellow to brown where handled; the yellow

veil; the rosettes of caulocystidia; and the mounds of pileocystidia. Usually the spores are dextrinoid at once; but in Tenn-19740, they were non-dextrinoid at first, only slightly dextrinoid after 2 hours, but entirely dextrinoid after 4 hours. For a comparison with *G. penetrans* and *G. flavidellus,* see discussion under each of these.

**62. Gymnopilus luteofolius** (Pk.) Sing., Lilloa **22:** 560. 1951.

*Agaricus (Pholiota) luteofolius* Pk., N.Y. State Mus. Ann. Rept. **27:** 94. 1875.

*Pholiota luteofolia* (Pk.) Sacc., Syll. Fung. **5:** 756. 1887.

ILLUSTRATIONS: FIGS. 3, 125.

Pileus 2–6(–8) cm broad, cespitose to subcespitose, convex, obtuse, young basidiocarps dark-red to reddish-brown from dense fasciculate scales, then fading to pinkish red or yellowish red, finally yellowish, margin fibrillose or appressed-scaly, dry, margin even. Context at first reddish, light purplish vinaceous, or lavender, fading to yellowish; odor mild to pungent (subalcaline), taste bitter.

Lamellae adnate or uncinate to emarginate, at first yellow ("antimony yellow" to "honey yellow"), then bright ferruginous, close or subdistant, broad or medium broad, edges serrate.

Stipe 3–9 cm long, 3–10 mm thick, concolorous, fibrillose, equal or enlarged downward, solid. Veil arachnoid to submembranous, yellowish, forming a fugacious annulus.

Spores bright ferruginous, (5.5–)6–8.5 × (3.5–)4–4.5 μ, ellipsoid to sub-ovoid in face view, slightly inequilateral in profile, verruculose, ferruginous in KOH, dextrinoid, no germ pore. Basidia 24–28 × 6–7 μ, 4-spored. Pleuro-cystidia 30–38 × 5–10 μ, colorless, fusoid to subventricose; basidioles brown, 21–30 × 5–8 μ, clavate, or more frequently ventricose and the apices acute, buried; cheilocystidia 23–28 × 4–7 μ, ventricose to flask-shaped, capitate to non-capitate. Gill trama more or less parallel, hyphae 5–12(–18) μ broad, rather frequently septate. Pileus trama interwoven. Cuticle not sharply differ-entiated, the surface bearing tufts of brown, incrusted hyphae (scales). Pileo-cystidia 44–53(–100) × 5–14(–17) μ, as clavate to cylindrical or ventricose terminal elements on tufts of hyphae forming the scales, rarely in mounds. Clamp connections present. Caulocystidia 20–63 × 3–10(–15) μ, clavate, ventricose, or flask-shaped, forming a turf. Pileus and gill trama pale yellowish brown in KOH; reddish brown in Melzer's reagent. In KOH, a yellowish pigment is dis-solved from the gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On wood (sawdust, logs, stumps of conifers, more rarely on oak and cottonwood), widely scattered over the United States, June-November.

MATERIAL STUDIED—FLORIDA: Smith 74248; IDAHO: Cooke 22240 (MICH); Wier 1108 (TENN, as *Pholiota aegerita*); MICHIGAN: Potter 13815 (MICH); Thiers 233 (SFSC); NEW MEXICO: Barrows 92, 144, 1133; 1143a, 1438, 2031, 3083, 3091 (MICH); NEW YORK: Peck, type of *Agaricus (Pholiota) luteofolius* (NYS), Forestburgh, September, 1874; NORTH CAROLINA: Hesler 21810; OHIO: Cooke 33125 (MICH); ORE-

GON: Sipe 1010, 1016 (MICH); TENNESSEE: Hesler 14755, 22130; TEXAS: Smith 74235; WASHINGTON: Smith 47489.

OBSERVATIONS—The chief distinctive characters of this species are its dark-red to reddish brown young pilei with the colors fading to pinkish red or yellowish red then yellow, the reddish or vinaceous pileus-context which fades to yellowish, the dextrinoid spores, and the caulocystidia. Its relationship to other closely allied species is discussed under *G. aeruginosus,* page 70.

**63. Gymnopilus braendlei** (Pk.) Hesler, comb. nov.

*Flammula braendlei* Pk., Bull. Torrey Club **31:** 180. 1904.

ILLUSTRATIONS: FIGS. 48, 49, 50.

Pileus singly or cespitose, 2.5–5 cm broad, hemispheric becoming convex, sometimes slightly umbilicate, hygrophanous, purplish when young, then pink in the center and pale pink or pallid on the margin, finally yellowish, sometimes with green stains, fibrillose, or, in large specimens, squamulose in the center and fibrillose on the margin. Context whitish, thin; taste bitter and unpleasant.

Lamellae adnate, sometimes slightly sinuate, whitish, soon bright tawny or Indian yellow ("mustard yellow" to almost "cadmium yellow"), becoming bright tawny ochraceous with age, broad, close.

Stipe 2.5–4 cm long, 3–4 mm thick, pallid, sometimes yellowish at the base, fibrillose at the top from the veil remains, stuffed or hollow, equal or nearly so. Veil fibrillose, at times leaving a silky zone on stipe, but not forming an annulus.

Spores bright tawny ochraceous in a thick deposit, ochraceous buff in a thin one (Peck), 6–8 × (4–)4.5–5 μ, ellipsoid to ovoid in face view, inequilateral in profile, ferruginous in KOH, dextrinoid, verruculose, no germ pore. Basidia 25–36 × 5–6 μ, 4-spored. Pleurocystidia 22–33 × 6–7 μ, clavate-ventricose; cheilocystidia 20–34 × 3–7 μ, ventricose or flask-shaped, subcapitate or capitate. Gill trama of subparallel or slightly interwoven hyphae 7–22 μ broad; subhymenium not distinctive. Pileus trama loosely interwoven. Cuticle of repent hyphae, bearing scattered mounds of brown hyphae, the terminal elements of which are pileocystidia, 40–62 × 7–16 μ. Clamp connections present. Caulocystidia none. Pileus and gill trama colorless in KOH; yellowish brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On decaying trunks, District of Columbia, November; also Missouri.

MATERIAL STUDIED—DISTRICT OF COLUMBIA: Peck, type of *Flammula braendlei* (NYS), from near Washington, November 1902, leg. F. J. Braendle.

OBSERVATIONS—This species is recognized by its pileus colors (purplish then pink, finally yellowish), bitter taste, white flesh, white young gills, loosely interwoven pileus trama, and the absence of caulocystidia. Its relationship to closely allied species is discussed under *G. aeruginosus,* page 70.

**64. Gymnopilus pulchrifolius** (Pk.) Murr., North Amer. Flora **10:** 202. 1917.

*Flammula pulchrifolia* Pk., N.Y. State Mus. Bull. **122:** 21. 1908.

Pileus 2.5–5 cm broad, hemispheric becoming convex, pink in the center, pale pink or pallid on the margin, slightly viscid when moist, hygrophanous,

fibrillose, or, in large specimens, squamulose in the center, fibrillose on the margin. Context white; taste bitter and unpleasant.

Lamellae adnate sometimes slightly sinuate, whitish, soon bright tawny or Indian yellow becoming bright tawny-ochraceous with age, close, broad or medium broad.

Stipe 2.5–4 cm long, 3–4 mm thick, pallid, sometimes yellowish at the base, fibrillose at the top from the remains of the veil.

Spores 6–8(–8.5) × 4–5 μ, ellipsoid to subovoid in face view, inequilateral in profile, verruculose, no germ pore, dextrinoid. Basidia 20–24 × 5–6 μ, 4-spored. Pleurocystidia none; cheilocystidia 28–37 × 6–9 μ, ventricose or flask-shaped, often capitate. Gill trama slightly interwoven, hyphae 3–6(–10) μ broad. Pileus trama interwoven. Cuticle of repent hyphae, bearing scattered mounds of brown hyphae (scales); pileocystidia none. Caulocystidia none. Clamp connections present. Pileus and gill trama colorless in KOH; yellowish brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On decaying wood of hemlock, New York (Murrill also gives Massachusetts, Minnesota, Indiana), July and September.

MATERIAL STUDIED—MICHIGAN: Thiers 2545 (SFSC); NEW YORK: Peck, type, on decaying hemlock wood, from Menands, Albany County, July and September, 1907.

OBSERVATIONS—Peck (**1908:** 21) states that this is a beautiful species easily recognized by the pink tint of the pileus, the bitter taste, and the peculiar bright colors of its lamellae and spores; further, that the fibrils at the top of the stipe when stained by the falling spores might be mistaken for a slight annulus.

A study of the type shows that the spores are dextrinoid, pleurocystidia are absent, the cheilocystidia flask-shaped and often capitate, the pileus trama interwoven, and pileocystidia and caulocystidia absent. It has been regarded by Kauffman (**1926**) as the same as *G. braendlei,* in which the young pileus is purplish, the lamellae at first white, and pleurocystidia and pileocystidia present. It is related to *G. aeruginosus,* in which the pileus is at first greenish and sometimes areolate, with each areola bearing 2–8 scales, the pileus context tinged greenish, the young gills yellow or cream-buff, pleurocystidia and caulocystidia present. (See also comments under *G. aeruginosus*).

**65. Gymnopilus picreus** (Fr.) Karst., Bidr. Finl. Nat. Folk **32:** 400. 1879.

*Agaricus picreus* Pers., Icon. Descr. Fung., p. 14. 1798.
*Agaricus picreus* Pers. ex Fr., Syst. Myc. **1:** 239. 1821.
*Flammula picrea* (Pers. ex Fr.) Kummer, Der Führer in die Pilzkunde, p. 82. 1871.
*Naucoria belluloides* Kauff., Papers Mich. Acad. Sci., Arts, and Letters **5:** 139. 1926.
*Fulvidula picrea* (Pers. ex Fr.) Sing., Rev. Mycol., II. **2:** 239. 1937.

ILLUSTRATIONS: FIGS. 8, 93, 94, 95, 96, 126.
Bresadola, Icon. Myc., Tab. 784 (as *Flammula*).

Pileus 1–2(–5) cm broad, convex to campanulate-convex, then expanded, scurfy, disc subsquamulose, rarely rimulose-papillate, moist, hygrophanous, not viscid, rufous to baybrown-cinnamon. Context concolorous, thin; taste mild or bitterish.

Lamellae adnate to decurrent, sometimes seceding, yellow to dull ochraceous, then ferruginous, sometimes staining rusty, narrow, close.

Stipe 5–8 cm long, 2–5 mm thick, umber to fulvous, darkening from the base up, and often blackish when dried, white-pulverulent when young, slightly attenuated upward, base slightly enlarged, fistulose, straight, glabrescent. Veil none.

Spores 7–9(–9.5) × 4.5–5.5(–6) $\mu$, ellipsoid or subovoid in face view, slightly inequilateral in profile, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 23–28 × 5–6 $\mu$, 2–4-spored. Pleurocystidia 27–35 × 6–8 $\mu$, ventricose; cheilocystidia 23–33 × 4–7 $\mu$, ventricose, capitate or non-capitate, at times with a brown pigment. Gill trama subparallel, hyphae 3–5 $\mu$ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of radially disposed, repent, brown, incrusted hyphae, at times more or less erect, the terminal elements as pileocystidia, 25–45(–76) × 6–20 $\mu$, clavate, and at intervals the surface with mounds of brown, clavate pileocystidia 24–32 × 5–9 $\mu$. Caulocystidia 30–62 × 5–17 $\mu$, flask-shaped, capitate, scattered, or in tufts, or forming a turf. Clamp connections present. Pileus and gill trama dark brown in KOH; reddish brown in Melzer's reagent. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On conifer wood and sometimes on hardwood, Northern United States and Canada, and Tennessee; also Europe; summer and autumn.

MATERIAL STUDIED—CALIFORNIA: Smith 3924, 8431, 8641, 9009, 9268, 56222; IDAHO: Cooke 22069, 22396 (MICH); Smith 53757, 53887, 54054, 54512, 54730, 54995, 73818; MAINE: Bigelow 4538 (MICH), 10768, 10988, 11383 (MASS); MICHIGAN: Mazzer 4276 (MICH); Smith 40678, 42856, 57601, 57965, 60921; NEW YORK: Smith 796; OREGON: Kauffman, type of *Naucoria belluloides* (MICH), leg. Wehmeyer, October 10, 1922; Smith 19907, 26750, 26751, 28275; TENNESSEE: Hesler 12702; VERMONT: Bigelow 13811, 13954, 14085 (MASS); WASHINGTON: Bigelow 2278 (MASS); Smith 3158, 17822, 17836, 40613, 40638, 40661, 40944, 40977, 41170, 41189, 41191, 47844, 48156, 48157, 48158, 49364, 73434; CANADA (Quebec): Smith 61704, 61708, 61710; ONTARIO: Smith 4542, 4805; SWEDEN: Lundell 2209 (MICH); von Post, Uppsala, det. Pilát (S), August 31, 1896.

OBSERVATIONS—This species is distinguished by its color, by its squamulose pileus, its narrow and rusty-staining lamellae, umber to fulvous stipe with white pulverulence, the absence of a veil, its caulocystidia usually arranged in tufts or palisades and its pileocystidia of two general types (as scattered terminal elements, and in mounds). It appears to be near *G. sapineus,* in which a yellow veil is present, and with which it may have been confused. It is occasionally confused with *G. liquiritiae,* in which the pileus is glabrous, paler (tawny), and often larger.

## 66. **Gymnopilus fuscosquamulosus** Hesler, sp. nov.

ILLUSTRATIONS: FIGS. 62, 63, 64, 65, 66.

Pileus 3–7 cm latus, pallidus demum flavus, squamas rubidas vel brunneas fibrillosas stipatas gerens. Contextu pallido-flavus; gustu amarus. Lamellae adnexae, flavae deinde rubido-brunneae maculatae, angustae, stipatae. Stipes 4–7 cm longus, 5–12 mm crassus, obscuro-brunnaceus. Velum nullum. Sporae 6–9.5 × 4.2–5 $\mu$, ellipsoideae vel ovoideae, dextrinoideae. Pleurocystidia 20–35 × 3–7 $\mu$; cheilocystidia 22–28 × 4–5 $\mu$. Specimen typicum in Herb. Univ. Tenn., lectum in Great Smoky Mts. National Park, North Carolina, June 22, 1954, Hesler 21398.

Pileus 3–7 cm broad, convex, finally plane, pallid to yellow, disc darker, densely covered with rusty reddish to brownish fibrillose-scales, tips of scales darker, dry, not hygrophanous, margin even, splitting. Context pliant, toughish, pale yellow; odor slight, taste slightly bitter.

Lamellae adnexed, yellow at first, finally densely reddish brown spotted, crowded, narrow, edges rough.

Stipe 4–7 cm long, 5–12 mm thick, dingy brownish, dry, fibrillose-striate, equal, solid, flesh yellow. Veil none.

Spores near "ochraceous-tawny" but tinged ferruginous, in deposit, 6–9.5 × 4.2–5 $\mu$, considerable variation in a given field, ellipsoid or ovoid, inequilateral, verruculose, ferruginous in KOH, dextrinoid, no germ pore. Basidia 24–27 × 5–7 $\mu$, 2–4-spored. Pleurocystidia 20–35 × 3–7 $\mu$, cylindric-clavate to slightly ventricose; cheilocystidia 22–28 × 4–5 $\mu$, slender-ventricose or flask-shaped, often subcapitate. Gill trama slightly interwoven, hyphae 5–11 $\mu$ broad; subhymenium not distinctive. Pileus trama loosely interwoven, hyphae 7–15 $\mu$ broad. Cuticle of brown, incrusted hyphae, frequently in fascicles forming scales. Caulocystidia and pileocystidia none. Clamp connections present.

HABIT, HABITAT, AND DISTRIBUTION—On roots of buckeye and rhododendron, North Carolina, June.

MATERIAL STUDIED—NORTH CAROLINA: Hesler 21398, type, from Wolf Laurel Gap, Great Smoky Mts. National Park, June 22, 1954; and No. 21686.

OBSERVATIONS—The distinctive characteristics are the rusty, black-tipped scales on the pale or yellow pileus, the narrow, densely reddish brown spotted gills, lack of a veil, interwoven pileus trama, dextrinoid spores, and the absence of both pileocystidia and caulocystidia. It differs from *G. praefloccosus* in which a veil is present and the spores non-dextrinoid. Its narrow gills and lack of a veil suggest *G. croceoluteus* in which the pileus is glabrous and caulocystidia are present.

## 67. **Gymnopilus aurantiacus** Hesler, sp. nov.

ILLUSTRATIONS: FIGS. 24, 39, 40, 41, 42.

Pileus 3 cm latus, aurantio-rufus, fibrilloso-squamosus. Contextu pallido-flavus. Lamellae adnatae demum adnexae, ferrugineae, confertae, angustae. Stipes 2 cm longus, 3 mm crassus, flavus, fibrillosus, solidus. Velum nullum. Sporae 6–8.5 × 4.5–5 $\mu$, ellipsoideae, dextrinoideae. Pleurocystidia 25–34 × 4–7 $\mu$; cheilocystidia 27–67 × 3–6 $\mu$, filamentocapitata, saepe brunnea. Specimen typicum in Herb. Univ. Mich., lectum prope Sinclair, Maine, July 17, 1956, Bigelow 3322.

Pileus 3 cm broad, convex, solitary, orange-rufous, fibrillose-scaly, margin incurved, even. Context pale-yellow.

Lamellae adnate to adnexed, close, narrow, ferruginous.

Stipe 2 cm long, 3 mm thick, yellow, fibrillose, tapering upward, solid. Veil none.

Spores 6–8.5 × 4.5–5 μ, ellipsoid, inequilateral, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 24–28 × 5–6 μ, 4-spored. Pleurocystidia 25–34 × 4–7 μ, ventricose; cheilocystidia 27–67 × 3–6 μ, filamentous-capitate, often with a brown pigment. Gill trama of subparallel hyphae, 3–6 μ broad; subhymenium not distinctive. Pileus trama of interwoven hyphae. Cuticle of interwoven hyphae, the surface densely fibrillose. Pileocystidia as clavate, terminal elements, 28–36 × 4–5 μ. Caulocystidia 45–125 × 3–9 μ, filamentous, more or less clavate, in tufts. Clamp connections present. Yellow pigment, soluble in KOH, present in the gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On conifer wood, Maine, July.

MATERIAL STUDIED—MAINE: Bigelow 3322, type (MICH), from near Mud Lake, Sinclair, July 17, 1956.

OBSERVATIONS—It is suggestive of *G. sapineus,* in which the pileus trama is radial, and the pileus with mounds of pileocystidia. It may have some affinity with *G. fuscosquamulosus,* in which the gills in age become densely brownish spotted, the stipe dingy brown, and pileocystidia and caulocystidia absent. Its chief characters include its scaly, orange-rufous pileus, narrow gills, yellow stipe, lack of a veil, slightly dextrinoid spores, filamentous cheilocystidia, interwoven pileus trama, and its tufts of caulocystidia.

## 68. **Gymnopilus decurrens** Hesler, sp. nov.

Pileus 2.5–6 cm latus, aurantio-brunneus, fibrillosus. Lamellae decurrentes, flavido-aurantius demum "burnt orange," confertae, latae demum latissimae. Stipes 3–5 cm longus, 4–7 mm crassus, pallidus, maculas albas basi gerens. Sporae 6–8 × 4.5–5 μ, ellipsoideae, dextrinoideae. Pleurocystidia 26–32 × 4–8 μ; cheilocystidia 24–30 × 4–7 μ. Specimen typicum in Herb. Univ. Mich., lectum in California, Hoxie 56.

Pileus 2.5–6 cm broad, convex, more or less expanding, orange-brown, fibrillose, not viscid, margin even. Context thin.

Lamellae decurrent, lines extending down the stipe, yellowish orange to "burnt orange," close, broad to very broad.

Stipe 3–5 cm long, 4–7 mm thick, apex brownish orange, elsewhere pallid, with white patches at the base, equal, hollow. Veil not observed.

Spores 6–8 × 4.5–5 μ, ellipsoid, slightly inequilateral, ferruginous in KOH, dextrinoid, verruculose, no germ pore. Basidia 24–28 × 5–6 μ, (2–)4-spored. Pleurocystidia 26–32 × 4–8 μ, somewhat variable: clavate-mucronate, ventricose, subcapitate to non-capitate; cheilocystidia 24–30 × 4–7 μ, clavate-capitate to ventricose. Gill trama of subparallel hyphae, 5–8 μ broad; subhymenium not distinctive. Pileus trama radial. Cuticle of repent hyphae, bearing small bundles or strands of brown, more or less incrusted hyphae (fibrils scarcely as scales). Clamp connections present. Caulocystidia 28–38 × 5–7 μ, ventricose, subcapitate to capitate. Yellow pigment, soluble in KOH, present in gill trama.

HABIT, HABITAT, AND DISTRIBUTION—On pine, California.

MATERIAL STUDIED—CALIFORNIA: Hoxie 56, type (MICH) on pine tree, California.

OBSERVATIONS—The colors, the decurrent and broad gills, and its caulocystidia, which resemble the cheilocystidia, are distinctive characters. It may be somewhat related to *G. geminellus* in which the pleurocystidia are different, and caulocystidia are absent.

**69. Gymnopilus lutescens** Hesler, sp. nov.

Pileus 4–6 cm latus, "light buff" vel "warm buff," deinde "pale orange yellow," aurantius contusus. Contextu pallido-flavus; gustu peramarus. Lamellae adnexae, pallido-flavae, confertae, latae. Stipes 4–9 cm longus, 8–12 mm crassus, subflavus, ferrugineo-aurantius tractatus. Velum flavum, fugax. Sporae 7–8.5 × (4.5-)5–5.5 $\mu$, ellipsoideae, dextrinoideae. Pleurocystidia 20–26 × 6–7 $\mu$; cheilocystidia 20–30 × 4–6 $\mu$. Specimen typicum in Herb. Univ. Mich., lectum prope Hulburt, Michigan, July 19, 1965, Smith 71811.

Pileus 4–6 cm broad, convex becoming broadly convex, the margin inrolled, surface dry and appressed-fibrillose, evenly "pale orange yellow," buttons "light buff" to "warm buff" from a superficial coating of appressed fibrils, becoming orange where bruised or cut. Context firm, pale yellow becoming brighter (sulphur) when cut, $FeSO_4$ pale olive, KOH pale cinnamon; odor none, taste very bitter.

Lamellae adnexed, when young pale yellow, becoming rusty-yellow and finally bright tawny, close, broad, thin, edges wavy.

Stipe 4–9 cm long, 8–12 mm thick at apex, enlarged downward to a bulb and tapered below that, concolorous with pileus, where handled soon rusty orange to orange-brown around base, becoming stuffed-hollow. Veil yellow, fibrillose, fugacious, leaving a fibrillose ring.

Spores in deposit orange-tawny, 7–8.5 × (4.5–)5–5.5 $\mu$, ellipsoid, often rather broadly so, slightly inequilateral, ferruginous, dextrinoid at once, no germ pore. Basidia 25–30 × 6–7 $\mu$, 4-spored. Pleurocystidia 20–26 × 6–7 $\mu$, ventricose; cheilocystidia 20–30 × 4–6 $\mu$, ventricose, subcapitate. Gill trama of subparallel hyphae, 4–8 $\mu$ broad; subhymenium not distinctive. Pileus trama interwoven. Cuticle of repent hyphae, with some superficial veil-fibrils. Clamp connections present. Caulocystidia 20–50 × 5–8 $\mu$, cylindric-clavate, in tufts.

HABIT, HABITAT, AND DISTRIBUTION—On hardwood, Michigan, July.

MATERIAL STUDIED—MICHIGAN: Smith 71811, type, from Hulburt, July 19, 1965.

OBSERVATIONS—The distinctive characters include its color changes of the pileus, context, and stipe where bruised, its yellow, ample, fugacious, fibrillose veil, its interwoven pileus trama, tufted caulocystidia, and fibrillose-appressed, non-scaly pileus. It is related to *G. spectabilis,* but the lack of a persistent, membraneous annulus excludes it from that species. Somewhat similar color-changes are noted in both *G. melleus* and *G. aurantiophyllus,* but in these species the pileus trama is of radial arrangement. In *G. flavidellus* the veil is slight and pallid, the pileus glabrous, and its pileus trama radial.

**70. Gymnopilus subdryophilus** Murr., Bull. Torrey Club **67:** 228. 1940.

*Flammula subdryophila* (Murr.) Murr., Bull. Torrey Club **67:** 235. 1940.

ILLUSTRATIONS: FIGS. 106, 107, 108.

Pileus 5–6 cm broad, cespitose, convex to subexpanded, fulvous, slightly fibrillose, becoming glabrous, margin even. Context very bitter at once.

Lamellae sinuate-decurrent, ochroleucous to ferruginous, at length fulvous, broad, rather crowded, inserted.

Stipe 4–6 cm long, 3–5 mm thick, (sometimes 10 mm at base), pale-yellowish, tapering upward, glabrous, base white-mycelioid. Veil none.

Spores 7–8.5 × 4–5 μ, ellipsoid in face view, slightly inequilateral in profile, verruculose, no germ pore, ferruginous in KOH, dextrinoid. Basidia 24–30 × 5–6 μ, (2–)4-spored. Pleurocystidia colorless, 23–30 × 5–6 μ, ventricose, projecting slightly; basidioles brown, 27–30 × 5–6 μ, clavate, buried or projecting; cheilocystidia 25–33 × 4–7 μ, ventricose, subcapitate or noncapitate. Gill trama subparallel, hyphae somewhat variable from section to section, 4–9 μ broad. Pileus trama interwoven. Cuticle repent, bearing brown, more or less erect hyphae, the terminal elements as pileocystidia, 32–38 × 6–7 μ, cylindric-capitate, ventricose, or clavate. Caulocystidia 22–28 × 3–7 μ, ventricose, scattered. Clamp connections present. Pileus and gill trama yellowish brown in KOH; reddish brown in Melzer's reagent.

HABIT, HABITAT, AND DISTRIBUTION—On oak log, Florida, April.

MATERIAL STUDIED—FLORIDA: Murrill F-16226, type (FLAS), collected by Murrill, near Magnesia Springs, May 27, 1938; MICHIGAN: Potter 12396, 13366 (MICH).

OBSERVATIONS—This species is distinguished by its bitter taste, lack of a veil, dextrinoid spores, interwoven pileus trama, and caulocystidia. The promptly very bitter taste might suggest a relationship to *G. amarissimus,* in which a veil is present, the spores not dextrinoid, and the pileus trama radial. It is distinct from *G. dryophilus,* in which the pileus is hispid-squamulose, pale yellow, the taste mild, and the spores non-dextrinoid. It is near *G. croceoluteus,* which also has a bitter taste, but in which the pileus colors are warm-buff to tawny orange, the lamellae narrow, and pileocystidia lacking.

**71. Gymnopilus viridans** Murr., Mycologia **4:** 257. 1912.

*Flammula viridans* (Murr.) Murr., Mycologia **4:** 262. 1912.

Pileus cespitose, reaching 8 cm broad, convex, with a large umbo, ochraceous, becoming green-spotted where handled, dry, with conspicuous light-bay scales sparse except at the center where they are rather close together.

Lamellae adnate, iasbelline to ferruginous, broad, crowded, edges undulate.

Stipe reaching 6 cm long and 2 cm thick, concolorous, longitudinally streaked, larger below.

Spores (6–)7–8.5 × (4–)4.5–5 μ, ellipsoid, inequilateral in profile, minutely verruculose, no germ pore, not dextrinoid. Basidia 20–24 × 6–7 μ, 4-spored. Pleurocystidia none; cheilocystidia 20–26 × 5–7 μ, fusoid-ventricose, neck filiform, capitate or subcapitate. Gill trama subparallel, hyphae 4–10 μ broad; subhymenium not distinctive. Pileus trama of interwoven hyphae. Cuticle of repent, brown, more or less incrusted hyphae. Clamp connections present. Pileocystidia none. Caulocystidia 35–43 × 4–7 μ, as terminal elements of more or less aerial hyphae, cylindric to flask-shaped, apices at times subcapitate.

HABIT, HABITAT, AND DISTRIBUTION—On coniferous log, Washington, October-November.

MATERIAL STUDIED—WASHINGTON: Murrill 657, type, on burnt coniferous log, near Seattle, October 20,-November 1, 1911.

OBSERVATIONS—The pileus is ochraceous and becomes green-spotted where handled. The green color might suggest a relationship to *G. aeruginosus,* in which the pileus is at first greenish, its scales may become blackish, the gills are yellow becoming ochraceous orange, the spores dextrinoid, and pleurocystidia present.

**72. Gymnopilus amarissimus** Murr., Mycologia **33:** 280. 1941.

*Flammula amarissima* (Murr.) Murr., Mycologia **33:** 287. 1941.

ILLUSTRATIONS: FIGS. 12, 34, 35, 36.

Pileus reaching 3–4 cm broad, convex to subexpanded, not umbonate, uniformly ferruginous-fulvous, glabrous, dry, at length shining, margin even, inflexed when young. Context thin, pale-yellow, darkening when bruised; odor none, promptly very bitter.

Lamellae sinuate with a decurrent tooth, pale-yellow to ferruginous, broad, crowded, inserted, entire.

Stipe about 4 cm long, and 4 mm thick, whitish to cremeous, staining ferruginous where bruised, darkening with age, soon glabrous, solid, equal or tapering upward. Veil fibrillose, very slight, soon vanishing.

Spores 7–8.5 × 4–5 $\mu$, ellipsoid to ovoid in face view, inequilateral in profile, verruculose no germ pore, yellowish brown in Melzer's reagent, not dextrinoid. Basidia 20–26 × 4–5 $\mu$, 4-spored. Pleurocystidia 24–30 × 5–6 $\mu$, filamentous to ventricose, apices rarely forked; cheilocystidia 25–32 × 4–6 $\mu$, ventricose-capitate, or more rarely not capitate. Gill trama parallel to subparallel, hyphae 5–8 $\mu$ broad. Pileus trama radial. Cuticle of repent, brownish hyphae, bearing scattered, very slender-ventricose pileocystidia, 22–30 × 2–3 $\mu$. Clamp connections present. Caulocystidia none. Pileus and gill trama yellowish brown in KOH; pale reddish brown in Melzer's reagent. A yellowish pigment exudes from the gill trama in KOH.

HABIT, HABITAT, AND DISTRIBUTION—On pine, Florida, April.

MATERIAL STUDIED—FLORIDA: Murrill F-16206, type (FLAS), on dead pine trunk, Magnesia Springs, April 12, 1938.

OBSERVATIONS—It is distinguished by its promptly very bitter taste, radial pileus trama, and non-dextrinoid spores. It is related to *G. subdryophilus;* in fact, Singer (**1951a**) places it in his key as *G. amarissimus* var. *subdryophilus.* Later, Singer (**1955**) placed it in synonymy with *G. flavidellus.* However, in *G. subdryophilus* the spores are dextrinoid, and the pileus trama interwoven. Its bitter taste, staining stipe, and radial pileus trama also suggest *G. flavidellus* in which the spores are dextrinoid. Likewise, in *G. liquiritiae* the spores are dextrinoid. Caulocystidia are present, and the pileus is scaly. Finally, in *G. earlei,* the flesh is mild, the pileus fibrillose to scaly, and the stipe somewhat of ferruginous color.

**73. Gymnopilus earlei** Murr., Mycologia **5:** 22. 1913.

*Flammula earlei* (Murr.) Murr., Mycologia **5:** 36. 1913.
*Gymnopilus tenuis* Murr., Mycologia **5:** 22. 1913.
*Flammula tenuis* (Murr.) Murr., Mycologia **5:** 36. 1913.

Pileus 3–10 cm broad, cespitose, convex to expanded, pale-yellow to pale-ferruginous, dry, fibrillose to floccose-squamose, margin somewhat fluted, not striate. Context then mild to taste, said to be edible when young.

Lamellae adnate or subdecurrent, yellow then ferruginous, darker than the pileus surface, medium broad, close or crowded.

Stipe 4–6 cm long, 4–8 mm thick, subconcolorous, base whitish, nearly black within, cylindric, densely ferruginous-fibrillose, horny, equal, solid, becoming hollow. Veil arachnoid, yellow, fugacious.

Spores 6–8.5 × 4–4.5(–5) μ, ellipsoid in face view, inequilateral in profile, verruculose, not dextrinoid, no germ pore. Basidia 23–30 × 5–6 μ, 4-spored. Pleurocystidia 23–28 × 5–8 μ, ventricose; basidioles 20–30 × 6–8 μ, clavate, with brown contents; cheilocystidia 18–25 × 3–7 μ, ventricose or conocyboid, subcapitate to non-capitate. Gill trama subparallel, hyphae broad, (3–)10–15 μ; subhymenium not distinctive. Pileus trama radial. Cuticle of repent hyphae, bearing repent to erect, sometimes incrusted hyphae (scales). Clamp connections present. Caulocystidia none. Pileus and gill trama yellowish brown in KOH; dark-brown in Melzer's reagent.

Habit, habitat, and distribution—On coconut logs, Jamaica, October-November.

Material studied—JAMAICA: Earle 9, type of *G. earlei* (NY), near Port Antonio, October 20, 1902; Earle 612, type of *G. tenuis* (NY), Port Antonio, November 24, 1902.

Observations—Its distinguishing characteristics include its pale-ferruginous, fibrillose or squamulose pileus, mild taste, broad and close gills, and non-dextrinoid spores. It is somewhat related to *G. amarissimus* in which the pileus is glabrous, taste very bitter, stipe whitish to cremeous and staining ferruginous where bruised. When sections of the pileus are mounted in 2% KOH, the context exudes a yellowish pigment. Singer (**1955**) interprets *Flammula elegantula* Massee (Kew Bull. **1914:** 359. 1914) as an older, washed out stage of *G. earlei* Murr. A comparative study of the types of *G. tenuis* and *G. earlei* shows that they are the same species.

## DOUBTFUL AND EXCLUDED SPECIES

*Gymnopilus aculeatus* (Bres. & Roumg.) Sing. Lilloa **22:** 561. 1951 (*Pholiota aculeata* Bres. & Roumg., Rev. Mycol. **12:** 28. 1890). A collection under this name from the Philippine Islands, determined by Singer, has been examined. It has spores 5.5–7 × 4–4.5 μ—dimensions which agree with those given in the original description of *P. aculeata.* But, in his description of an agaric under this name, Singer (Lilloa **25:** 505. 1951) gives the spore size as 6.8–11 × 4.8–6.8 μ. His Florida collection (F-545) called *G. aculeatus*, also has large

spores [7–10 × 5–6(–7) μ]. Finally, the spores of the type of *G. palmicola*, Underwood and Earle (No. 1134), from Cuba, are 7–10 × 5–6(–7) μ. Thus, Singer's Florida collection is *G. palmicola* and not *G. aculeatus*. It would appear, therefore, that *G. aculeatus* has not yet been reported from North America.

*Flammula aliena* Pk., Bull. Torrey Club **26:** 65. 1899 (*Gymnopilus alienus* (Pk.) Murr., North Amer. Flora **10:** 196. 1917). This seems to be neither a *Gymnopilus* nor a *Pholiota;* Kauffman (**1926:** 30) transferred it to *Paxillus alienus* (Pk.) Kauff., but its relationships are uncertain.

*Gymnopilus alabamensis* Murr., North Amer. Flora **10:** 199. 1917. This is a *Pholiota.*

*Gymnopilus alnicola* (Fr.) Murr., North Amer. Flora **10:** 202. 1917 (*Agaricus alnicola* Fr., Syst. Myc. **1:** 250. 1821). This is a *Pholiota.*

*Gymnopilus anomalus* (Pk.) Murr., North Amer. Flora **10:** 196. 1917 (*Flammula anomala* Pk., Bull. Torrey Club **22:** 202. 1895). This has rough, globose spores, and is not a *Gymnopilus.*

*Gymnopilus aromaticus* Murr., North Amer. Flora **10:** 203. 1917. This is *Pholiota murrillii* Sm. & Hes.

*Gymnopilus aureoviridis* (Pat.) Murr., Mycologia **5:** 19. 1913 (*Flammula aureoviridis* Pat., in Duss, Enum. Champ. Guad., p. 55. 1903). This is a *Pholiota.*

*Gymnopilus autumnalis* (Pk.) Murr., North Amer. Flora **10:** 200. 1917. This is *Galerina autumnalis* (Pk.) Sm. & Singer.

*Pholiota brittoniae* Murr., Mycologia **5:** 35. 1913. The type was collected in Jamaica by Elizabeth G. Britton, 1908. The material is now old, very hard, and not in satisfactory condition for critical study. The spores, however, were found to be 7–9.5 × 6–8 μ, ellipsoid or ovoid, sometimes sublimoniform, coarsely tuberculate, and occasionally calyptrate. These characters suggest the genus *Galerina.* Singer (**1950**) lists it as a synonym of *Gymnopilus spectabilis* subsp. *pampeanus* (Speg.) Sing., from Argentina, and suggests that other forms of it include *G. spectabilis, G. armillatus,* and *G. ventricosus.*

*Gymnopilus brunneodiscus* (Pk.) Murr., North Amer. Flora **10:** 199. 1917 (*Flammula brunneodisca* Pk., N.Y. State Mus. Mull. **167:** 42. 1913). This is a *Pholiota.*

*Gymnopilus californicus* (Earle) Murr., Mycologia **4:** 253. 1912 (*Flammula californica* Earle, Bull. N.Y. Bot. Gard. **2:** 342. 1902). This is a *Pholiota.*

*Gymnopilus castaneus* Murr., North Amer. Flora **10:** 199. 1917. This is a *Cortinarius,* near *C. phoenicius* (Bull.) Maire.

*Gymnopilus condensis* (Pk.) Murr., North Amer. Flora **10:** 198. 1917 (*Flammula condensa* Pk., Bull. Torrey Club **33:** 217. 1906). This is a *Pholiota.*

*Gymnopilus decoratus* Murr., Mycologia **4:** 251. 1912 (*Flammula decorata* (Murr.) Murr., Mycologia **4:** 262. 1912). This is a *Pholiota.*

*Gymnopilus eccentricus* (Pk.) Murr., North Amer. Flora **10:** 203. 1917 (*Flammula eccentrica* Pk., Bull. Torrey Club **31:** 179. 1904). Peck gives the

spores as 15–16 × 8 $\mu$; but in the material labelled type, I found them to measure 5.5–8.5 × 3.8–5 $\mu$. Thus there is confusion in the identity of the type.

*Gymnopilus edulis* (Pk.) Murr., North Amer. Flora **10:** 197. 1917 (*Flammula edulis* Pk., Bull. Torrey Club **24:** 142. 1897; *Hebeloma edule* (Pk.) Kauff., Amer. Jour. Bot. **13:** 28. 1926). This is an *Agrocybe.*

*Flammula expansa* Pk., N.Y. state Mus. Bull. **116:** 24. 1907. This is a *Pholiota,* related to *F. multifolia* Pk., but separable from it.

*Gymnopilus fagicola* Murr., North Amer. Flora **10:** 201. 1917. This is *Pholiota fagicola* (Murr.) Kauffman, Amer. Jour. Bot. **13:** 28. 1926.

*Gymnopilus farinaceus* Murr., Mycologia **7:** 222. 1915 (*Flammula farinacea* (Murr.) Murr., Mycologia **9:** 40. 1917; *Cortinarius farinaceus* (Murr.) Kauff., Amer. Jour. Bot. **13:** 28. 1926). This is an *Agrocybe.*

*Gymnopilus fibrillosipes* Murr., North Amer. Flora **10:** 199. 1917. This is a *Pholiota.*

*Gymnopilus flavifolius* Murr., Lloydia **8:** 285. 1945. This seems to be a *Cortinarius.*

*Gymnopilus foedatus* (Pk.) Murr., Mycologia **4:** 257. 1912 (*Hebeloma foedatum* Pk., Bull. Torrey Club **22:** 202. 1895; *Cortinarius foedatus* (Pk.) Kauff., Amer. Jour. Bot. **13:** 28. 1926). This is a *Pholiota.*

*Gymnopilus fulvellus* (Pk.) Murr., Mycologia **4:** 253. 1912 (*Flammula fulvella* Pk. *apud* J. M. Macoun & D. S. Jordan, Fur Seals N. Pacif. **3:** 584. 1899). This is a *Pholiota.*

*Gymnopilus fulviconicus* Murr., Proc. Florida Acad. Sci. **7:** 120. 1945. This is a *Pholiota.*

*Flammula fusa* Batsch ex Gill., Champ. Fr., p. 535. 1876. Material collected by M. E. Hard, in Ohio, now on file at Albany, was examined, and it proved inadequate for study; no spores were found, and the single basidiocarp was unsuitable for sectioning.

*Gymnopilus granulosus* (Pk.) Murr., North Amer. Flora **10:** 203. 1917 (*Flammula granulosa* Pk. *apud* V. White, Bull. Torrey Club **29:** 561. 1902). This is a *Pholiota granulosa* (Pk.) Sm. & Hes.

*Gymnopilus graveolens* (Pk.) Murr., North Amer. Flora **10:** 119. 1917 (*Flammula graveolens* Pk., N.Y. State Mus. Bull. **150:** 54. 1911). This is a *Pholiota.*

*Gymnopilus hallianus* (Pk.) Murr., North Amer. Flora **10:** 197. 1917 (*Agaricus hallianus* Pk., N.Y. State Cab. Ann. Rept. **23:** 90. 1872; *Flammula halliana* (Pk.) Sacc., Syll. Fung. **5:** 822. 1887). The relationship of this species could be better understood through a study of fresh material. Meantime, it is being referred to the genus *Cortinarius.*

*Gymnopilus helvoliceps* (B. & C.) Murr., Mycologia **5:** 20. 1913 (*Agaricus helvoliceps* B. & C., Jour. Linn. Soc. **10:** 290. 1868; *Flammula helvoliceps* (B. & C.) Sacc., Syll. Fung. **5:** 813. 1887). This is *Galerina helvoliceps* (B. & C.) Sing., Lilloa **22:** 572. 1951.

*Gymnopilus highlandensis* (Pk.) Murr., North Amer. Flora **10:** 197. 1917 (*Flammula highlandensis* (Pk.) Pk., N.Y. State Mus. Ann. Rept. **50:** 138. 1897). This is a *Pholiota.*

*Gymnopilus hillii* Murr., Mycologia **4:** 253. 1912. This has the characteristics of *Kuehneromyces vernalis* including smooth spores.

*Gymnopilus hypholomoides* Murr., Mycologia **5:** 26. 1913 (*Flammula hypholomoides* (Murr.) Murr., Mycologia **5:** 36.

*Gymnopilus jalapensis* Murr., Mycologia **5:** 25. 1913 (*Flammula jalapensis* (Murr.) Murr., Mycologia **5:** 36. 1913). This is a *Pholiota.*

*Gymnopilus laeticolor* Murr., Mycologia **4:** 251. 1912 (*Flammula laeticolor* (Murr.) Murr., Mycologia **4:** 262. 1912). This is a *Pholiota.*

*Gymnopilus lateritius* (Pat.) Murr., Mycologia **5:** 19. 1913 (*Flammula lateritia* Pat., Bull. Soc. Mycol. France **16:** 176. 1900; *Cortinarius lateritius* (Pat.) Sing., Lilloa **22:** 549. 1951). It is described as a dark, brick-colored species with a brown-scaly pileus, and red-brick-colored lamellae. We have been unable to study the type; but have seen a collection by Duss (No. 1681). In this collection, pleurocystidia were absent. Cheilocystidia were found collapsed against the gill-edges, clavate, and not typical of *Gymnopilus*. Until the type is studied, Singer's assignment of it to *Cortinarius* is accepted.

*Gymnopilus latus* Murr., Mycologia **4:** 257. 1912 (*Flammula lata* (Murr.) Murr., Mycologia **4:** 262. 1912). This is a *Pholiota.*

*Gymnopilus lentus* (Pers.) Murr., North Amer. Flora **10:** 204. 1917 (*Flammula betulina* Pk., Bull. Torrey Club **34:** 100. 1907). This is a *Pholiota.*

*Gymnopilus longisporus* Murr., North Amer. Flora **10:** 207. 1917. This has oblong-fusoid spores which are smooth and colorless in 2% KOH; Kauffman calls it *Paxillus longisporus* (Murr.) Kauff., Amer. Jour. Bot. **13:** 28. 1926, but it seems not to be a *Paxillus.*

*Gymnopilus ludovicianus* Murr., North Amer. Flora **10:** 204. 1917. This is a *Conocybe.*

*Gymnopilus multifolius* (Pk.) Murr., North Amer. Flora **10:** 204. 1917 (*Flammula multifolia* Pk., Bull. Torrey Club **32:** 79. 1905). This is a *Pholiota* (see *F. expansa,* above).

*Gymnopilus nashii* Murr., Mycologia **5:** 23. 1913 (*Flammula nashii* (Murr.) Murr., Mycologia **5:** 36. 1913). The type (NY) is inadequate for critical study.

*Gymnopilus olivaceus* (Pat.) Murr., Mycologia **5:** 18. 1913 (*Flammula olivacea* Pat. *apud* Duss, Enum. Champ. Guad., p. 55. 1903). This is a *Pholiota.*

*Gymnopilus ornatulus* Murr., Mycologia **4:** 251. 1912 (*Flammula ornatula* (Murr.) Murr., Mycologia **4:** 262. 1912). This seems to be a *Pholiota* (spores 5–6 × 3–3.5 $\mu$, ellipsoid, smooth, germ-pore minute), but the material is inadequate for a full critical study.

*Gymnopilus pallidus* Murr., Mycologia **4:** 252. 1912. (*Flammula pallida* (Murr.) Murr., Mycologia **4:** 262. 1912). This is an *Agrocybe.*

*Gymnopilus pampeanus* (Speg.) Singer, Lilloa **22:** 561. 1951 (*Flammula*

*pampeana* Speg., Anales Mus. Nac. Buenos Aires **6:** 130. 1899). The type is in an unsatisfactory condition for critical study.

*Gymnopilus permollis* Murr., Mycologia **4:** 252. 1912 (*Flammula permollis* (Murr.) Murr., Mycologia **4:** 262. 1912). This has smooth spores, and appears to be an *Hebeloma.*

*Gymnopilus piceinus* Murr., North Amer. Flora **10:** 202. 1917. This is a *Pholiota.*

*Gymnopilus polychrous* (Berk.) Murr., North Amer. Flora **10:** 204. 1917. (*Agaricus polychrous* Berk., London Jour. Bot. **6:** 313. 1847.) This is a *Pholiota.*

*Gymnopilus praecox* (Pk.) Murr., North Amer. Flora **10:** 201. 1917 (*Flammula praecox* Pk., Bull. Torrey Club **36:** 334. 1909). This is a *Pholiota.*

*Gymnopilus pseudocamerina* Singer, Index of Fungi **2:** 78. 1952, is a typographical inversion for *Galerina pseudocamerina* Singer.

*Gymnopilus pusillus* (Pk.) Murr., North Amer. Flora **10:** 200. 1917 (*Flammula pusilla* Pk., N.Y. State Mus. Bull. **67:** 26. 1903). This is a *Pholiota.*

*Gymnopilus rigidus* (Pk.) Murr., North Amer. Flora **10:** 196. 1917 (*Flammula* rigida Pk., N.Y. State Mus. Ann. Rept. **50:** 104. 1897). This is a *Pholiota.*

*Gymnopilus sphagnicola* (Pk.) Murr., North Amer. Flora **10:** 196. 1917 (*Flammula sphagnicola* Pk., N.Y. State Mus. Bull. **167:** 43. 1913). This is a *Pholiota.*

*Gymnopilus spinulifer* Murr., Mycologia **4:** 254. 1912 (*Flammula spinulifer* (Murr.) Murr., Mycologia **4:** 262. 1912). This is a *Pholiota.*

*Gymnopilus spumosus* (Fr.) Murr., Mycologia **4:** 254. 1912 (*Agaricus spumosus* Fr., Syst. Myc. **1:** 252. 1821). This is a *Pholiota.*

*Gymnopilus squalidus* (Pk.) Murr., North Amer. Flora **10:** 197. 1917. (*Flammula squalida* Pk., N.Y. State Mus. Ann. Rept. **44:** 131 (19). 1891). This is a *Pholiota.*

*Gymnopilus squamulosus* Murr., North Amer. Flora **10:** 201. 1917. This is *Pholiota squamulosus* (Murr.) Kauffman, Amer. Jour. Bot. **13:** 29. 1926.

*Gymnopilus subcarbonarius* Murr., Mycologia **4:** 256. 1912 (*Flammula subcarbonaria* (Murr.) Murr., Mycologia **4:** 262. 1912.) This is a *Pholiota.*

*Flammula subflavida* (Murr.) Murr., Mycologia **4:** 262. 1912 (*Gymnopilus subflavidus* Murr., Mycologia **4:** 252. 1912). This is a *Pholiota.*

*Gymnopilus subfulvus* (Pk.) Murr., North Amer. Flora **10:** 204. 1917 (*Flammula subfulva* Pk., N.Y. State Mus. Ann. Rept. **41:** 68. 1888). This is a *Pholiota.*

*Gymnopilus tricholoma* (A. & S.) Murr., North Amer. Flora **10:** 200. 1917 (*Agaricus tricholoma* A. & S., Consp. Fung., p. 188. 1805). Kauffman (**1926**) says this is *Paxillus tricholoma* (A. & S.) Fr.

*Gymnopilus unicolor* Murr., North Amer. Flora **10:** 202. 1917. The spores

are calyptrate, and warty to wrinkled, characters which indicate *Galerina.* It is different from *Galerina unicolor* (Fr.) Singer [*Pholiota unicolor* (Fr.) Gillet, as described by Smith and Singer (A Monograph on the Genus *Galerina* Earle, pp. 256–259. 1964).

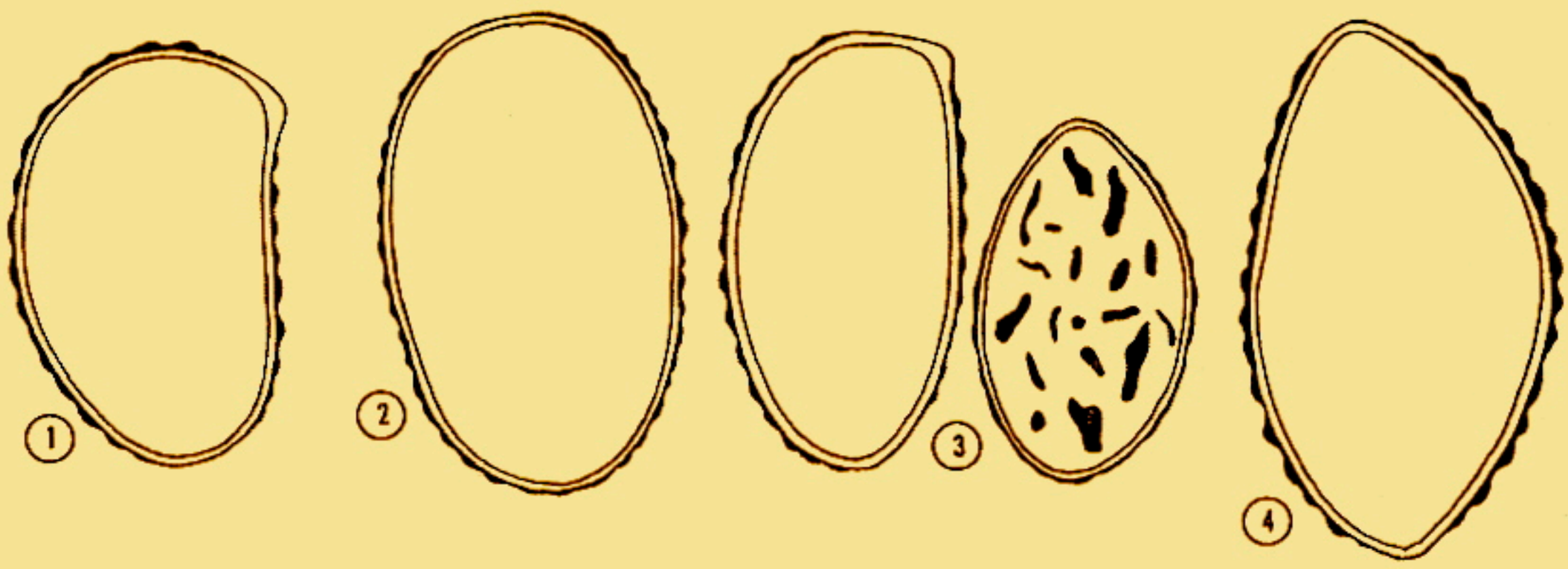
*Gymnopilus velatus* (Pk.) Murr., North Amer. Flora **10:** 196. 1917 (*Flammula velata* Pk., Bull. Torrey Club **30:** 96. 1903). This is a *Pholiota.*

*Gymnopilus vialis* Murr., Mycologia **4:** 255. 1912 (*Flammula vialis* (Murr.) Murr., Mycologia **4:** 262. 1912). This is a *Pholiota.*

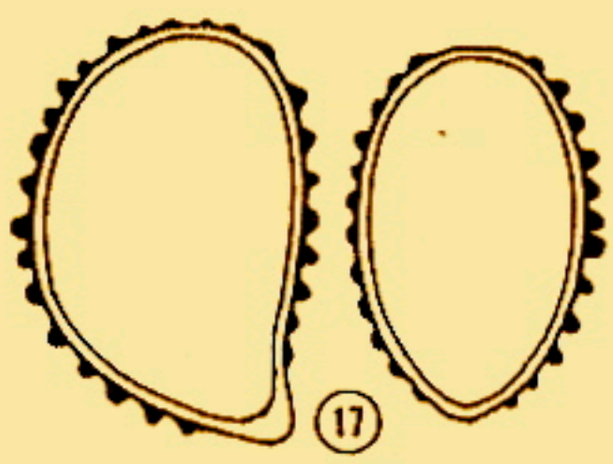
*Gymnopilus vinicolor* (Pat.) Murr., Mycologia **5:** 18. 1913 (*Flammula vinicolor* Pat., Jour. de Bot. **3:** 339. 1889). This is a *Pholiota.*

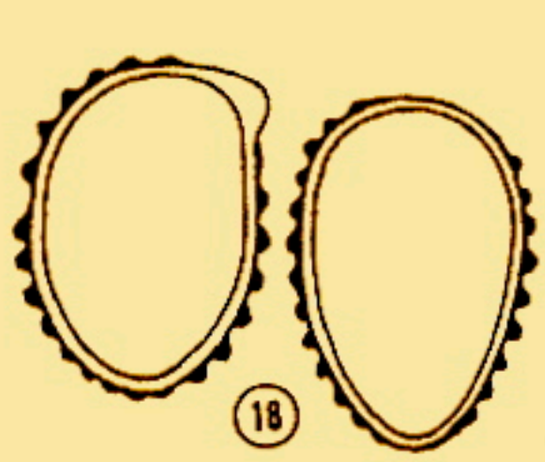
*Gymnopilus viscidissimus* Murr., Mycologia **4:** 256. 1912 (*Flammula viscidissima* (Murr.) Murr., Mycologia **4:** 262. 1912). The dark-tawny spores, the inconspicuous, clavate cheilocystidia, the lack of a veil, the gelatinous cuticle, and the habitat all suggest *Hebeloma.* Kauffman (**1926**) interprets it as a *Cortinarius.*

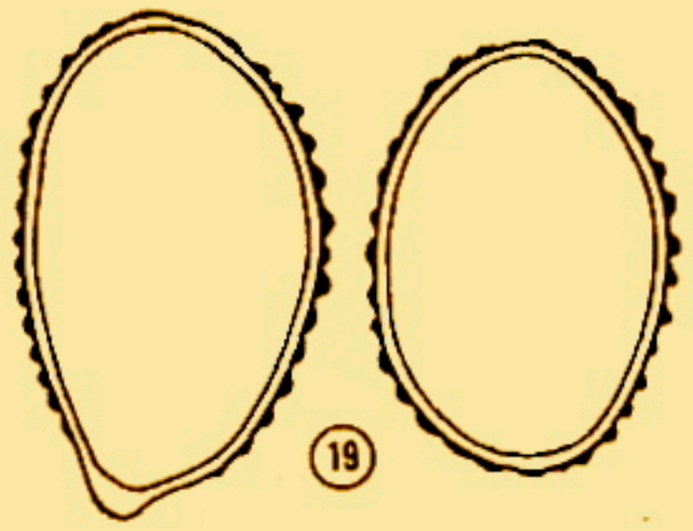
*Gymnopilus viscidus* (Pk.) Murr., North Amer. Flora **10:** 201. 1917 (*Flammula viscida* Pk., N.Y. State Mus. Ann. Rept. **51:** 290. 1898). This is *Galerina viscida* (Pk.) Smith & Singer.

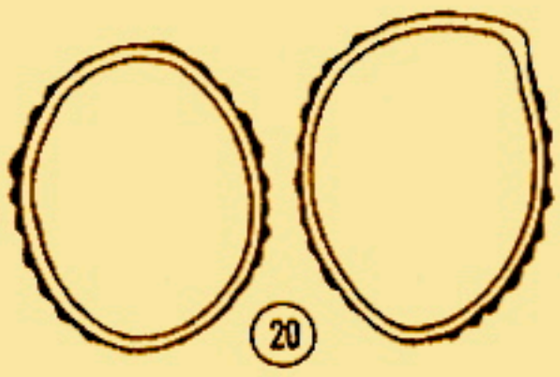


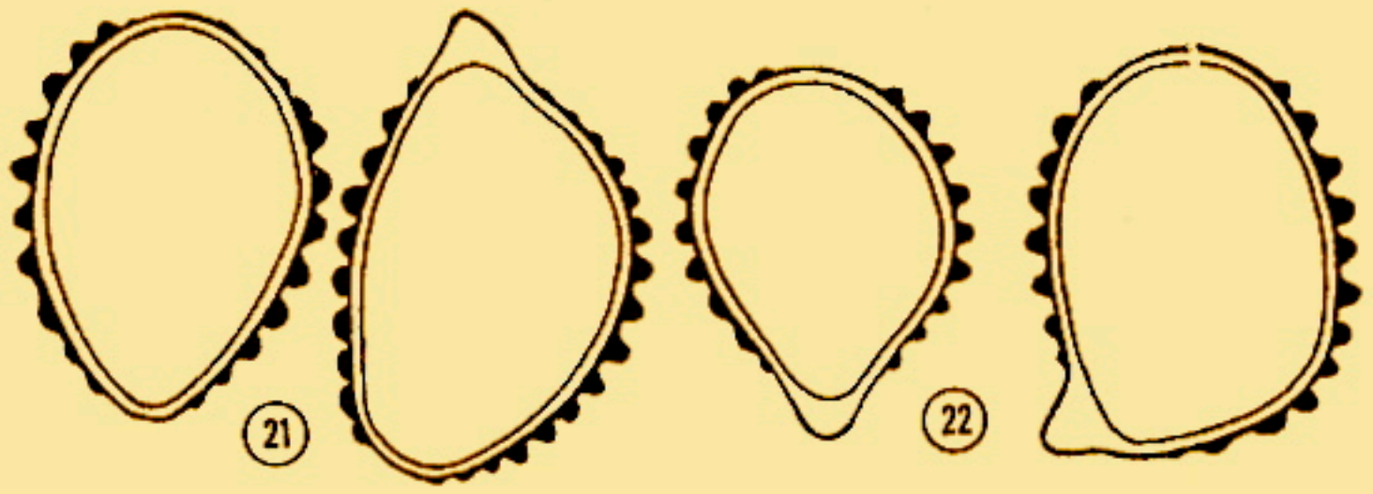

FIGS. 1–16. SPORES (drawings × 4000). 1. *G. aeruginosus,* type; 2. *G. liquiritiae,* Smith-64743; 3. *G. luteofolius,* Smith-2031; 4. *G. flavidellus,* type; 5. *G. penetrans,* Smith-50247; 6. *G. sapineus,* Smith-44155; 7. *G. spectabilis,* Miller-555; 8. *G. picreus,* Smith-57601; 9. *G. magnus,* type; 10. *G. subspectabilis,* type; 11. *G. sordidostipes,* type; 12. *G. amarissimus,* type; 13. *G. armillatus,* type; 14. *G. subtropicus,* Bessey-497; 15. *G. ventricosus,* type; 16. *G. oregonensis,* type.

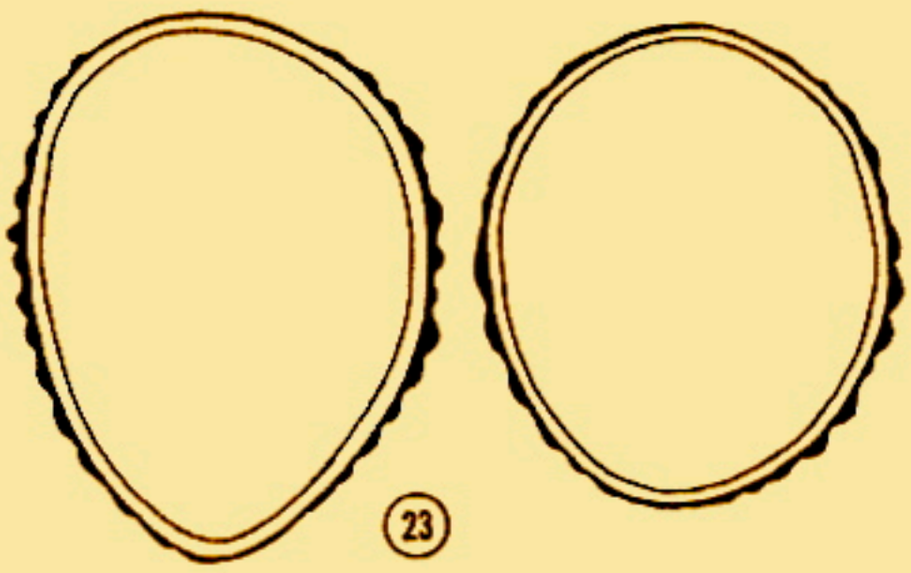


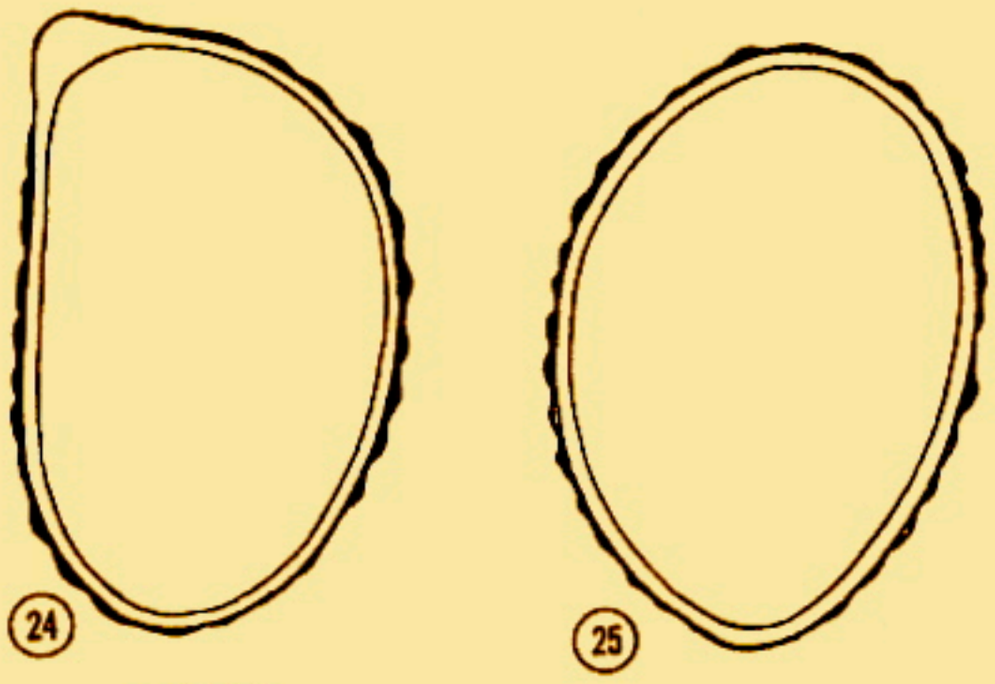



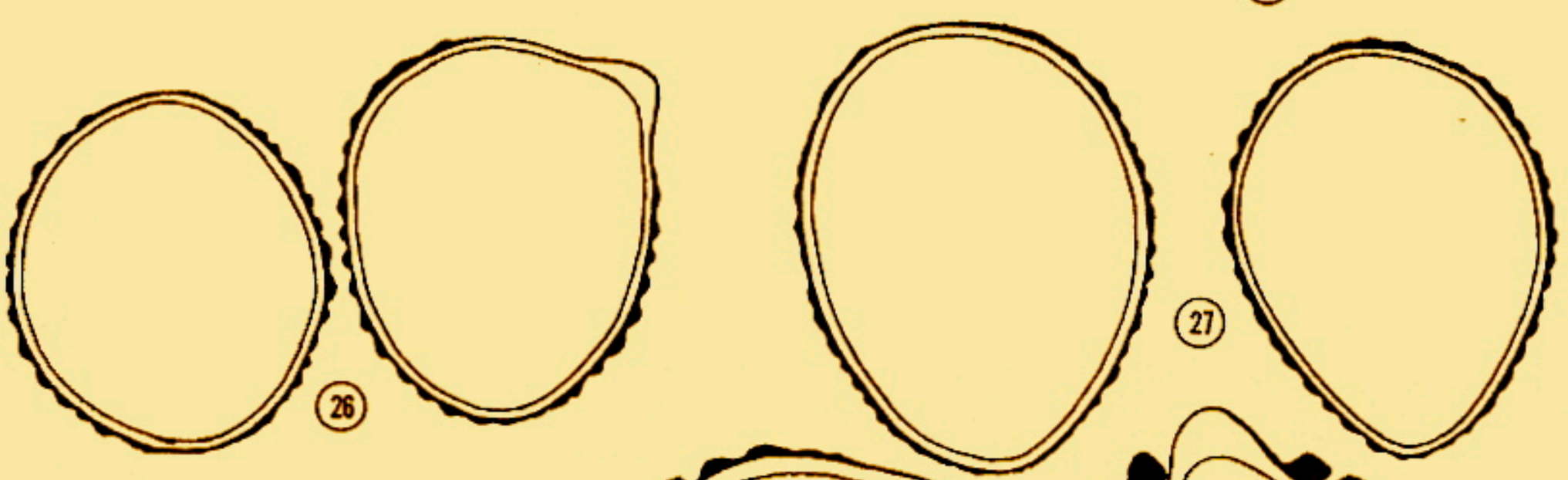



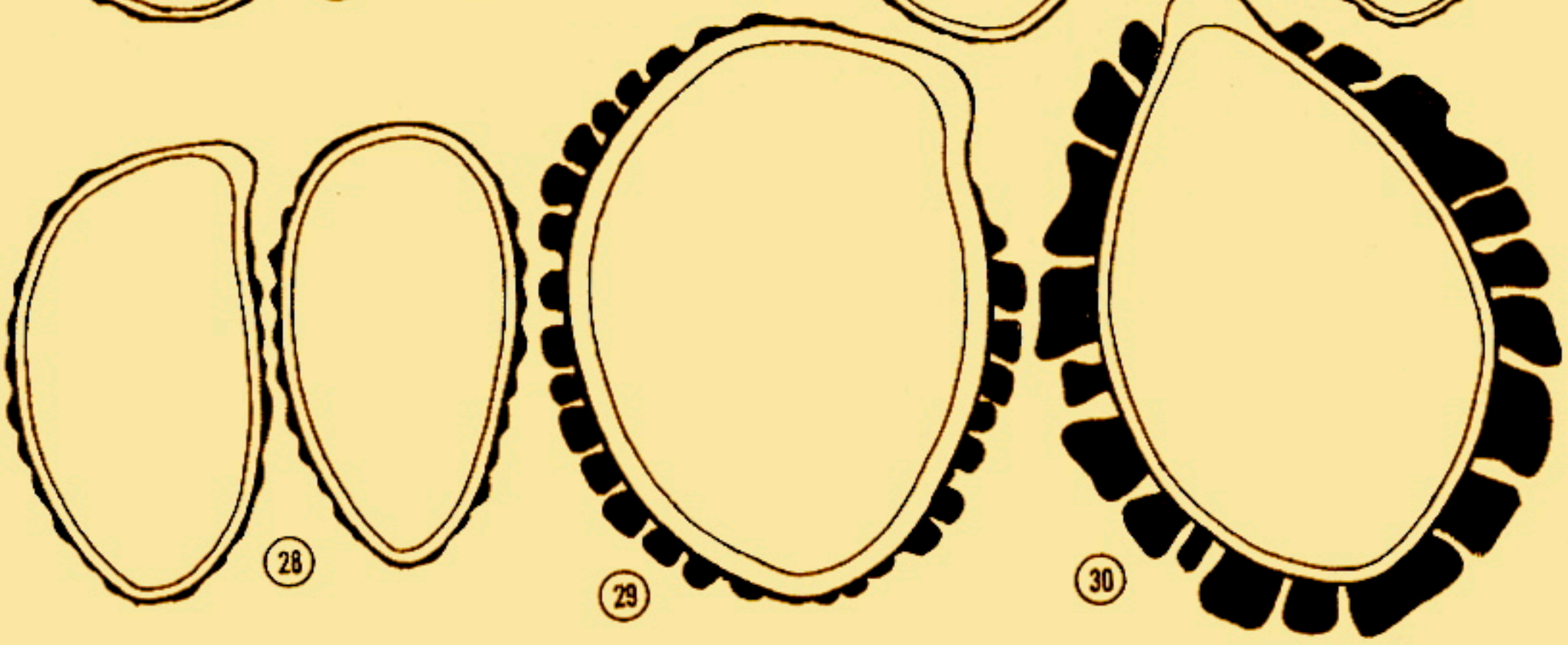



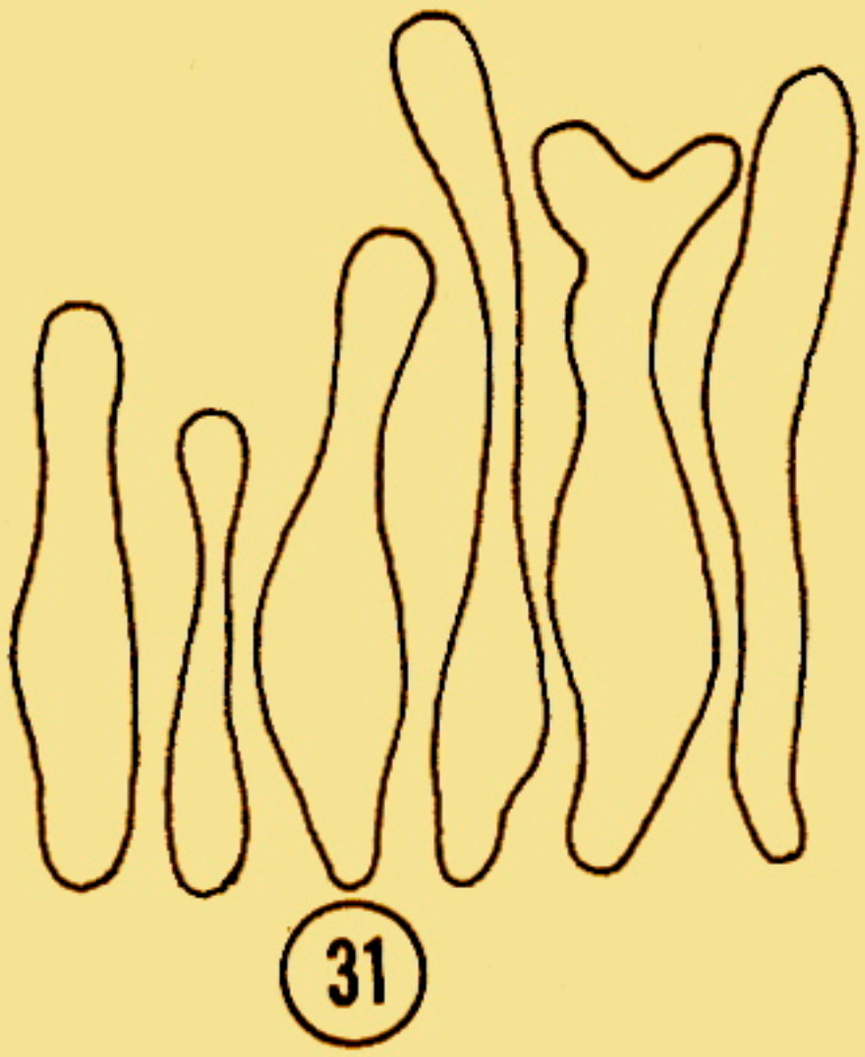



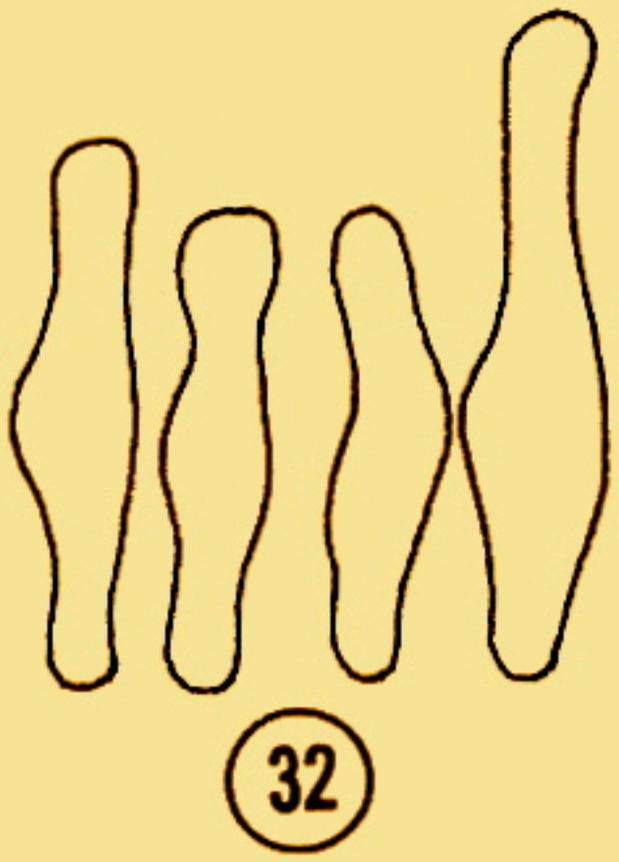



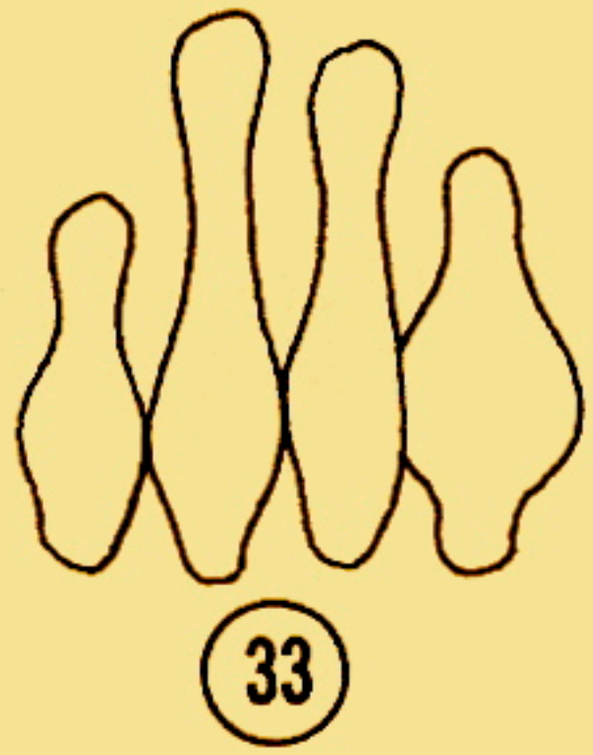



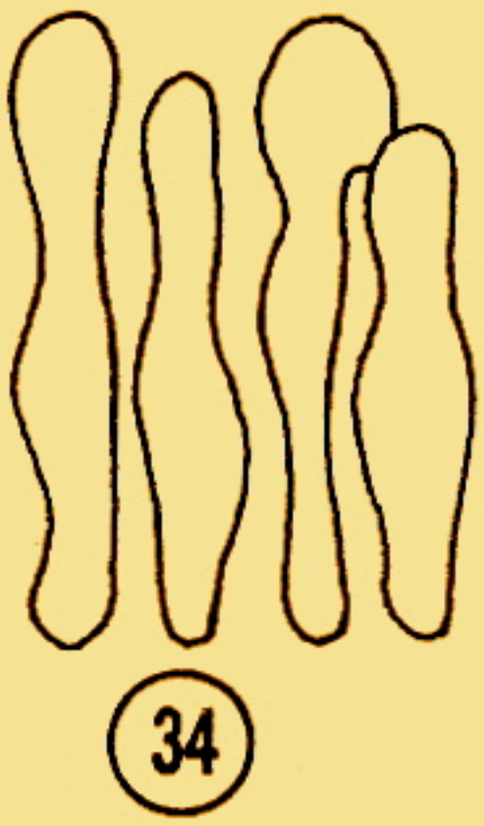



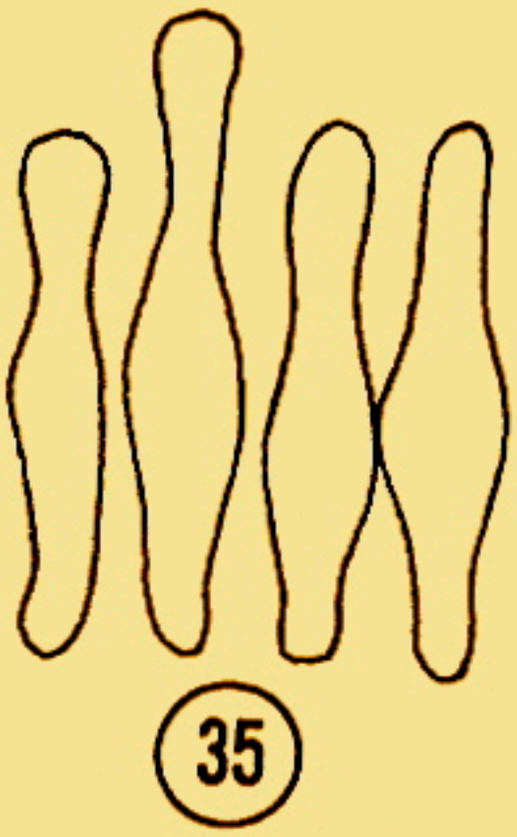

FIGS. 17–30. SPORES (drawings, × 4000). 17. *G. bellulus,* Smith-47324; 18. *G. sub-bellulus,* type; 19. *G. hispidus,* type; 20. *G. naucoriodes,* type; 21. *G. punctifolius,* Smith-40469; 22. *G. subviridis,* type; 23. *G. parvisquamulosus,* type; 24. *G. aurantiacus,* type; 25. *G. croceoluteus,* type; 26. *G. terrestris,* type 27. *G. rufobrunneus,* type; 28. *G. arenicola,* type; 29. *G. fulgens,* Smith-32–118; 30. *G. imperialis,* type.

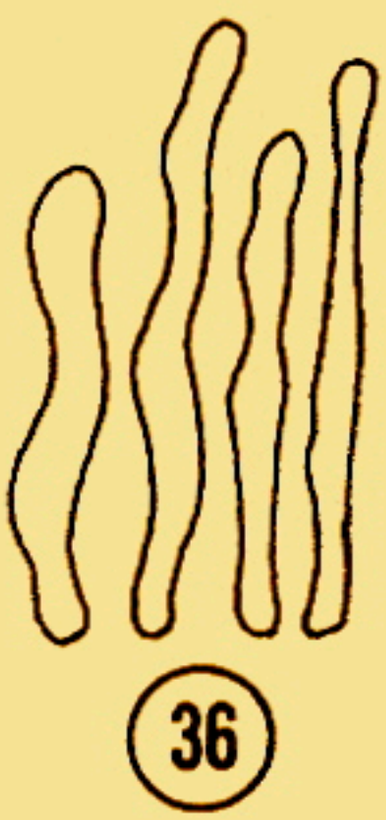


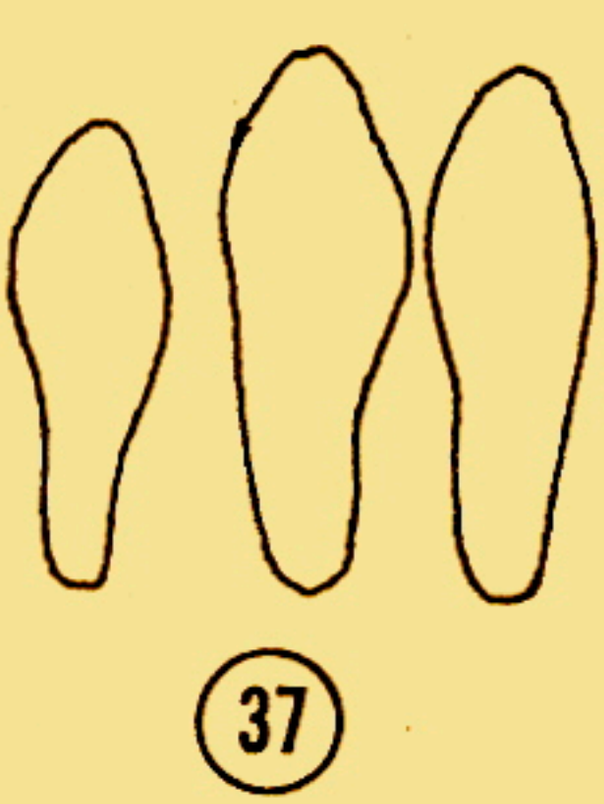



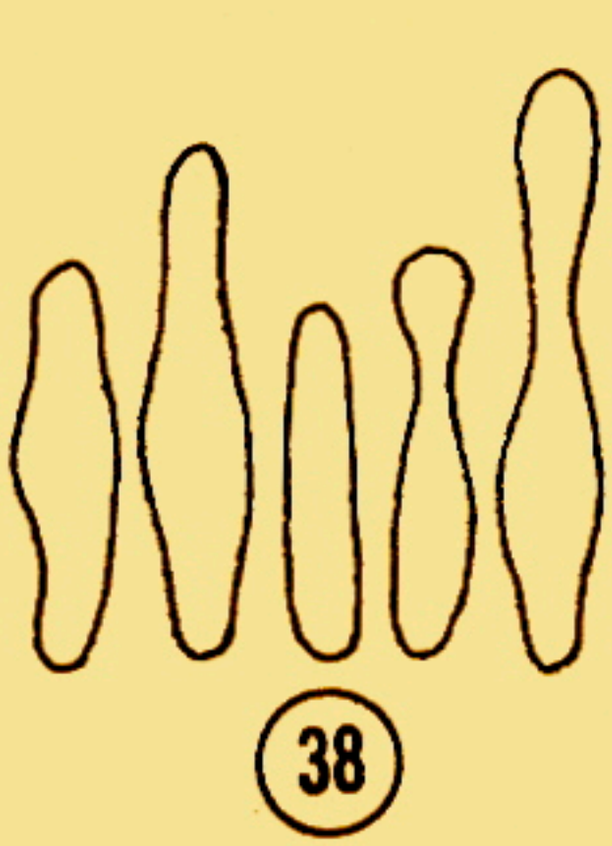



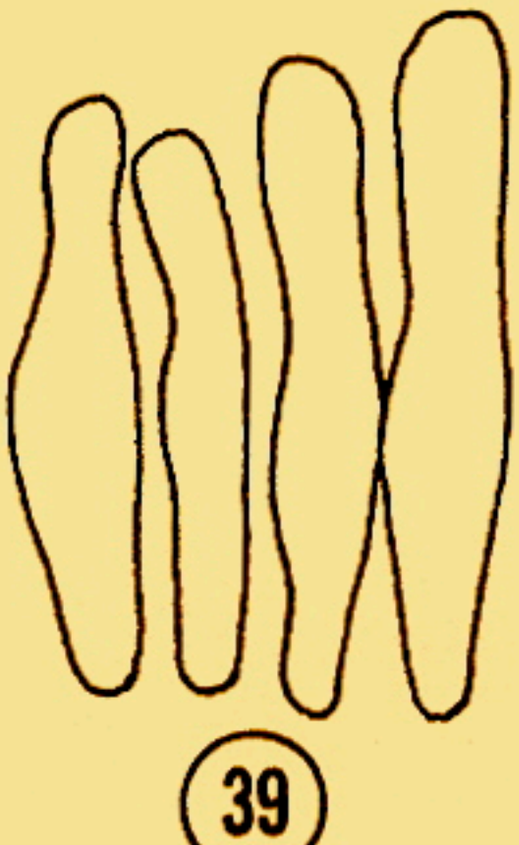



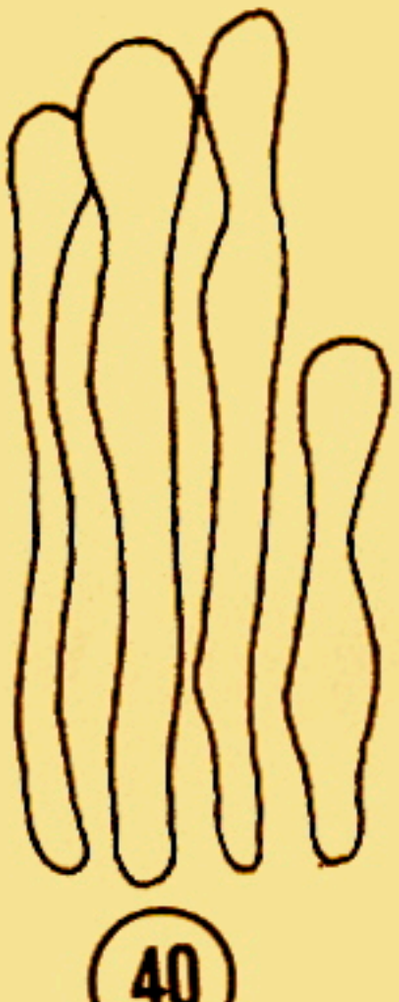



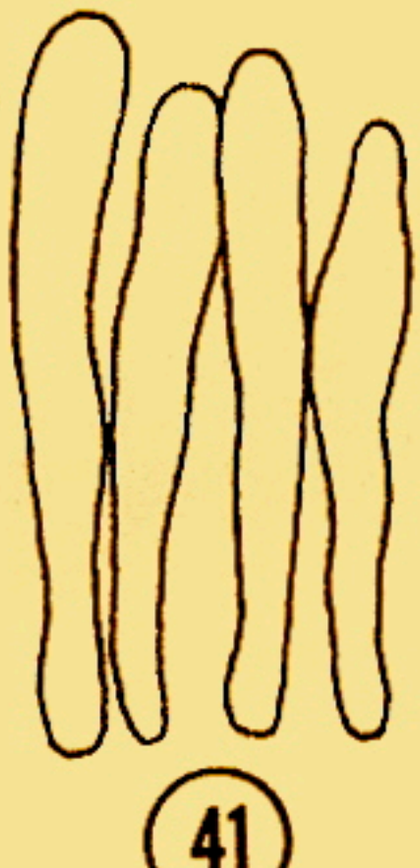



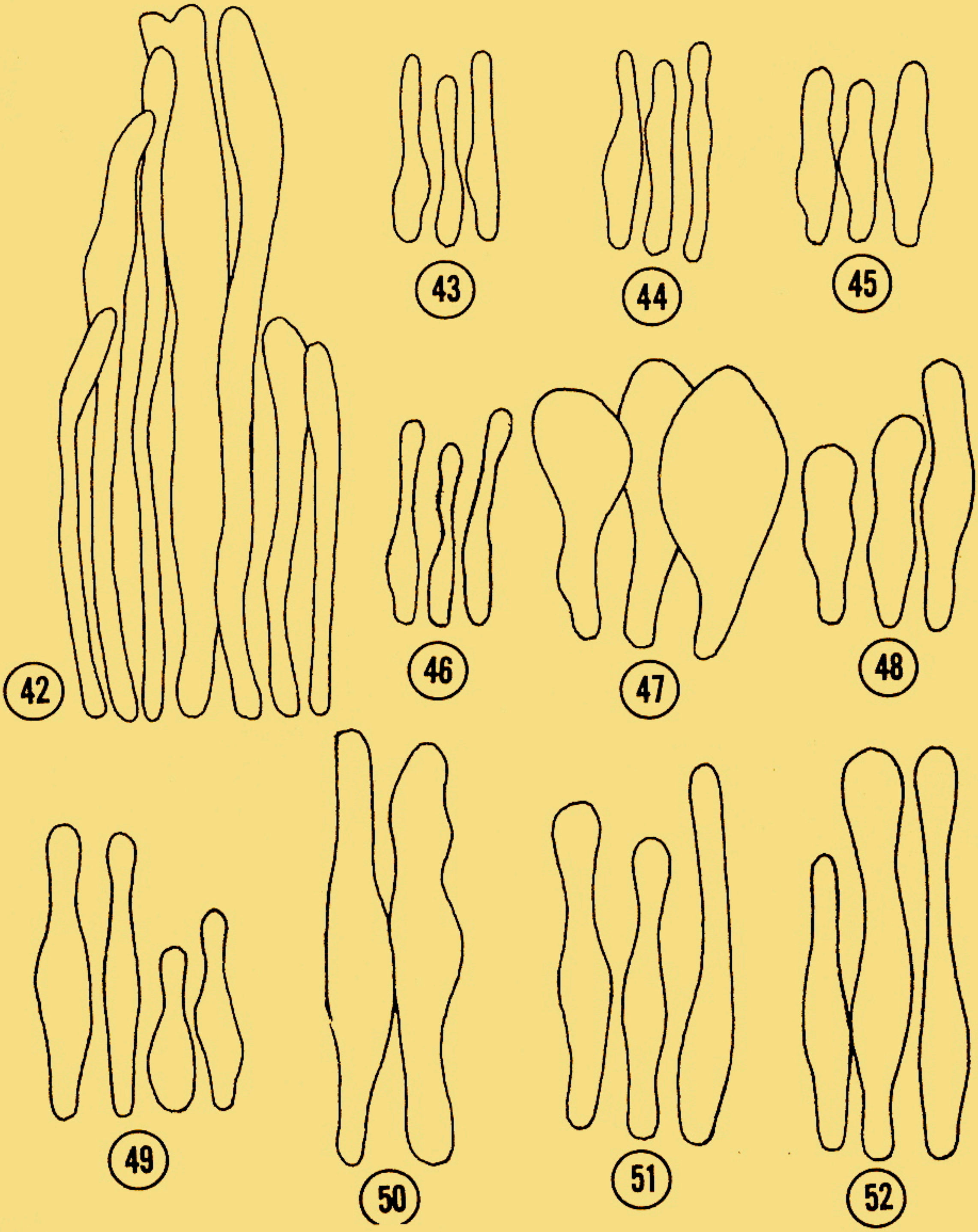



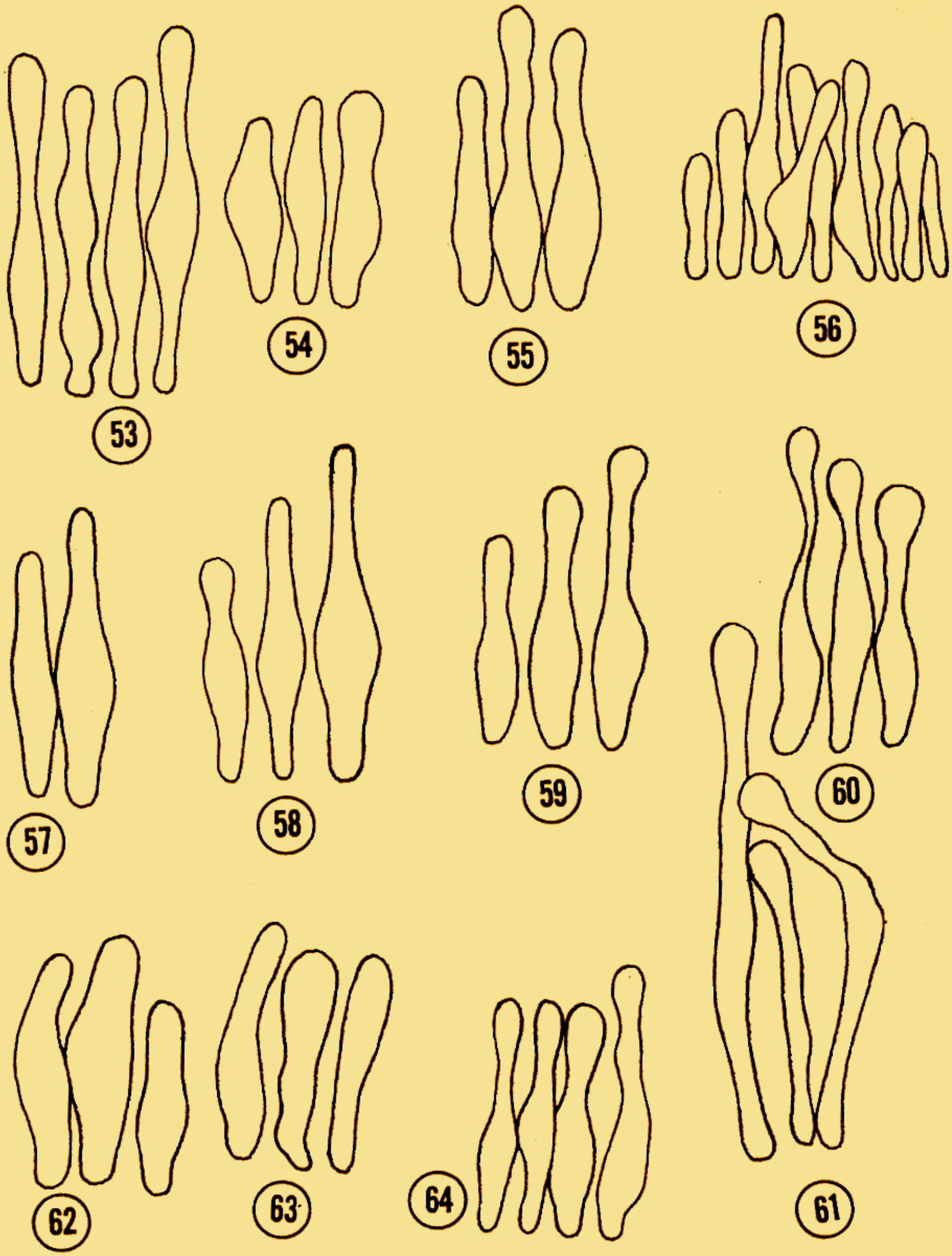



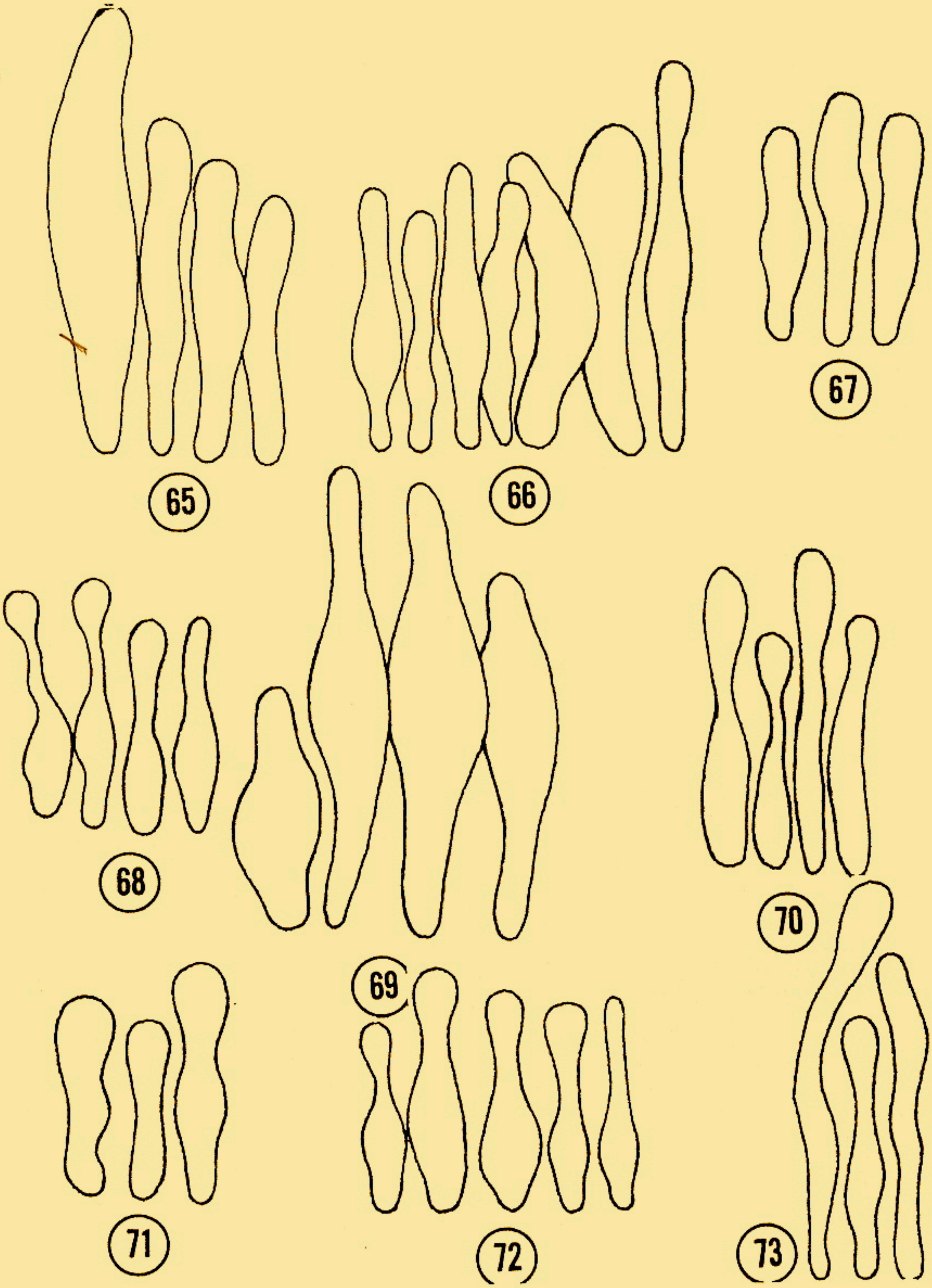

FIGS. 31–41. Cystidia (× 1000). 31. *G. abramsii,* ch, type; 32–33. *G. aeruginosus,* type: 32, pl; 33, ch; 34–36. *G. amarissimus,* type: 34, pl; 35, ch; 36, pileo; 37–38. *G. areolatus,* type: 37, pl; 38, ch; 39–41. *G. aurantiacus,* type: 39, pl; 40, ch; 41, pileo.



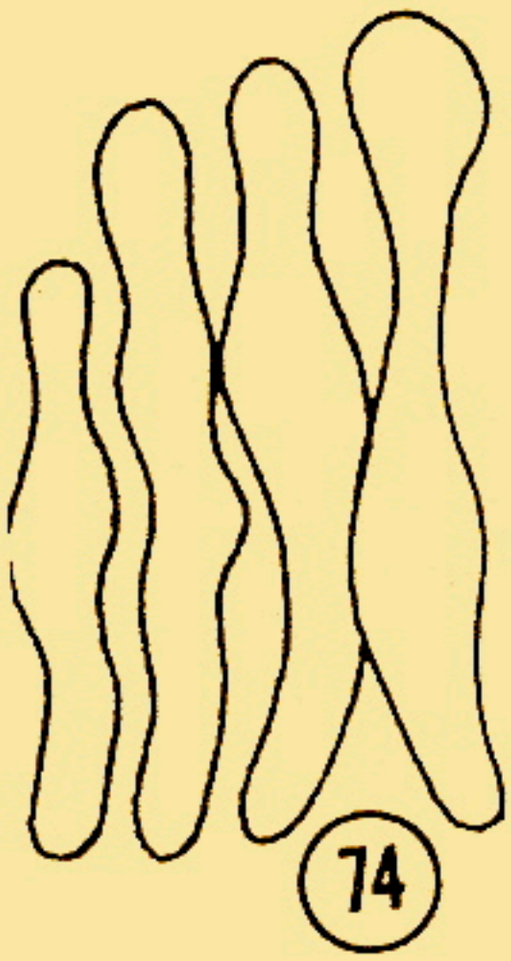

FIGS. 42–52. Cystidia (× 1000). 42. *G. aurantiacus,* type: caulo; *G. aureobrunneus,* type: 43, ch; 44, pileo; 45–47. *G. bellulus,* Smith-47324: 45, pl; 46, ch; 47, pileo; 48–50. *G. braendlei,* type: 48, pl; 49, ch; 50, pileo; 51–52. *G. luteocarneus,* type: 51, pl; 52, ch.

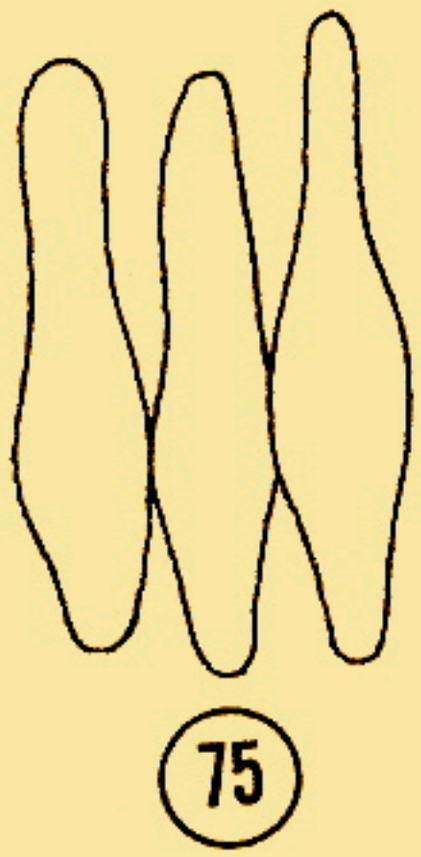


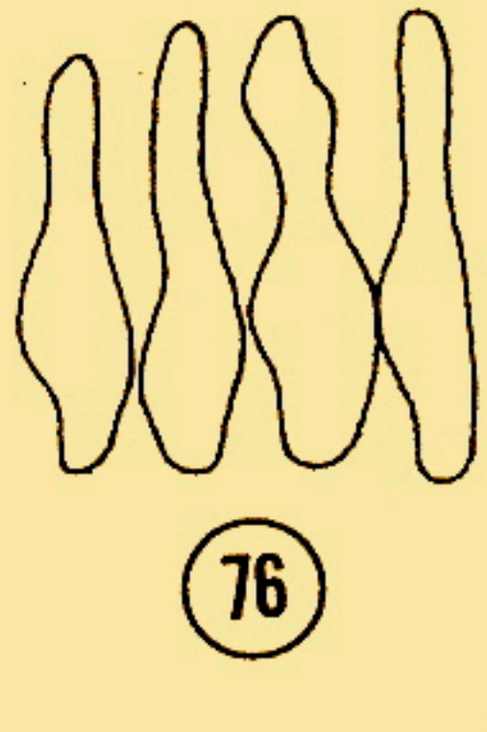

FIGS. 53–64. Cystidia (× 1000). 53. *G. luteocarneus*, type: caulo; 54–56. *G. croceoluteus*, type: 54, pl; 55, ch; 56, caulo; 57–58. *G. depressus*, type: 57, pl; 58, ch; 59–61. *G. flavidellus*, type: 59, pl; 60, ch; 61, caulo; 62–64. *G. fuscosquamulosus*, type: 62, pl; 63, basidioles; 64, ch.

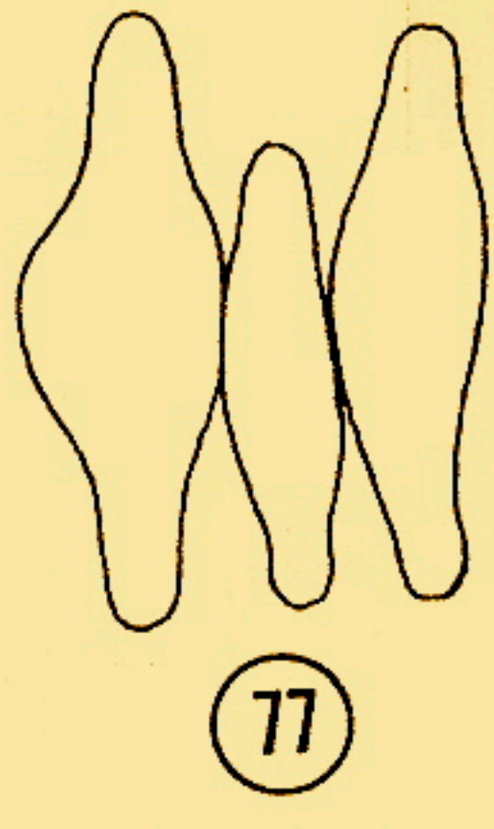


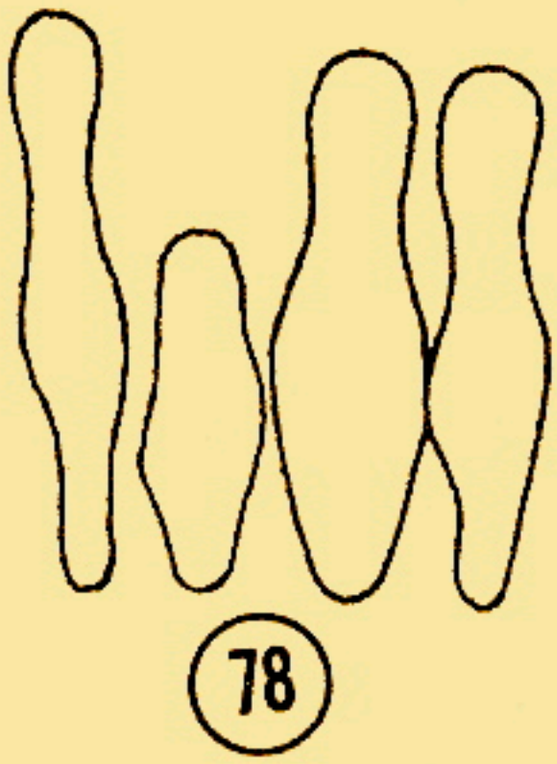

FIGS. 65–73. Cystidia (× 1000). *G. fuscosquamulosus,* type: 65, pileo; 66, caulo; 67–70. *G. humicola,* Smith-37429: 67, pl; 68, ch; 69, pileo; 70, caulo. 71–73. *G. liquiritiae,* Tenn-26089: 71, pl; 72, ch; 73, pileo.

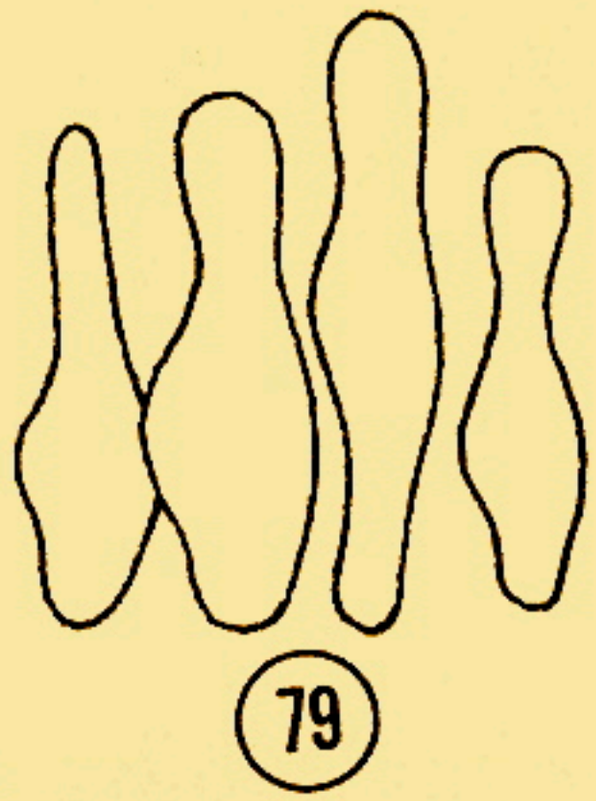


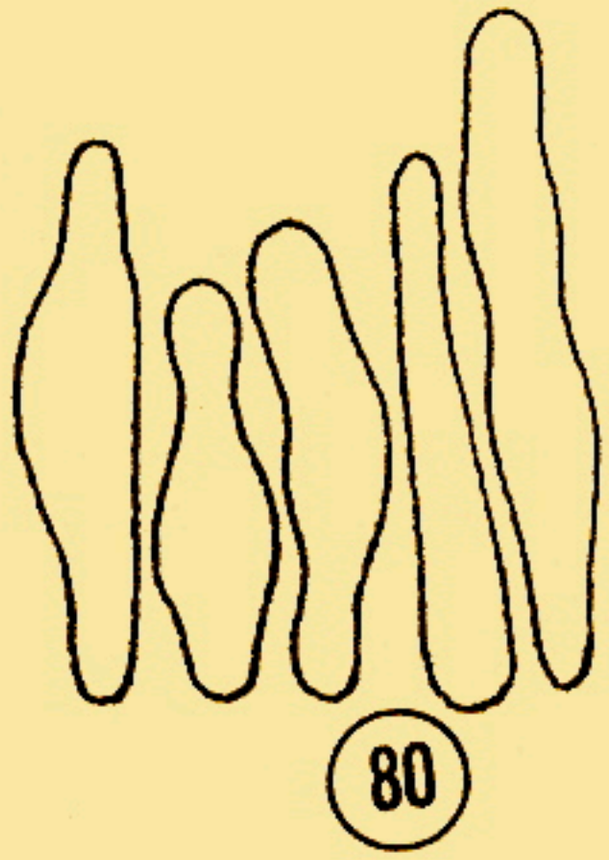



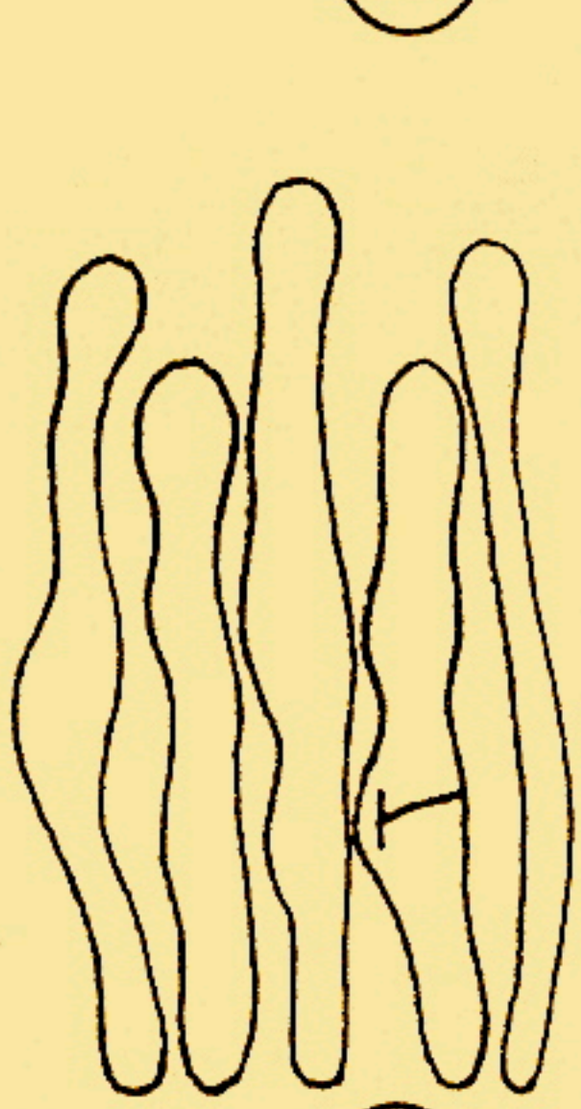



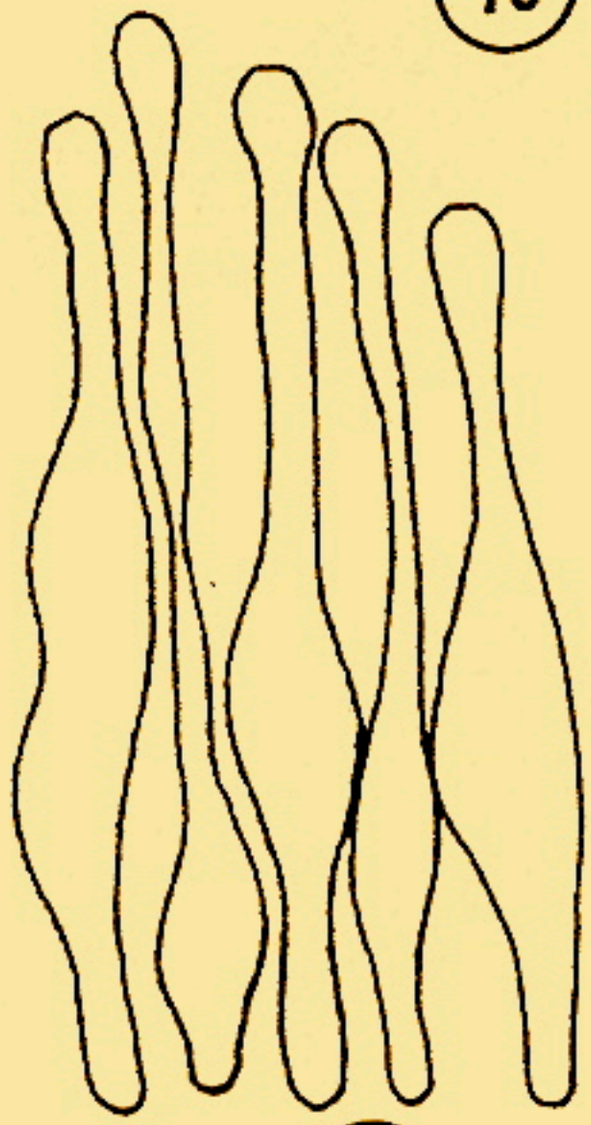



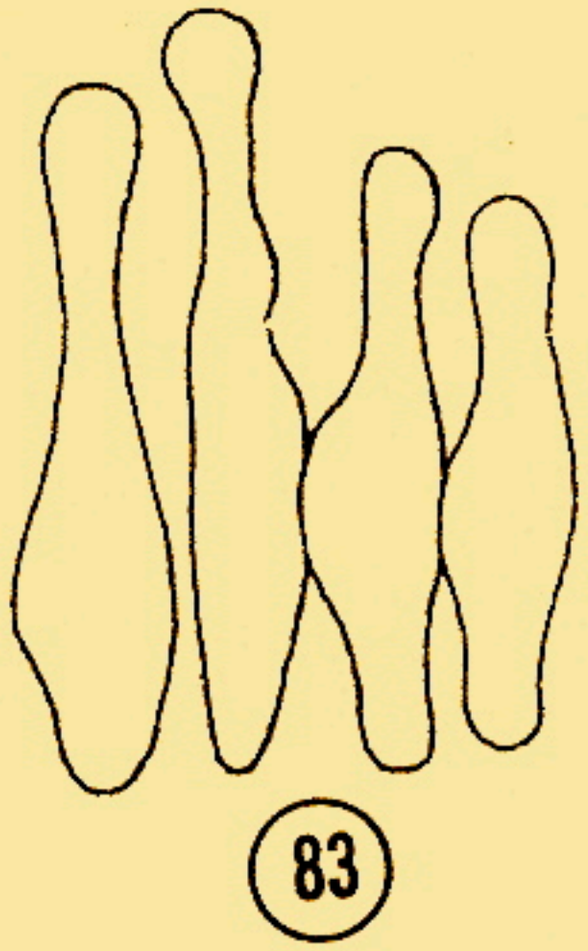



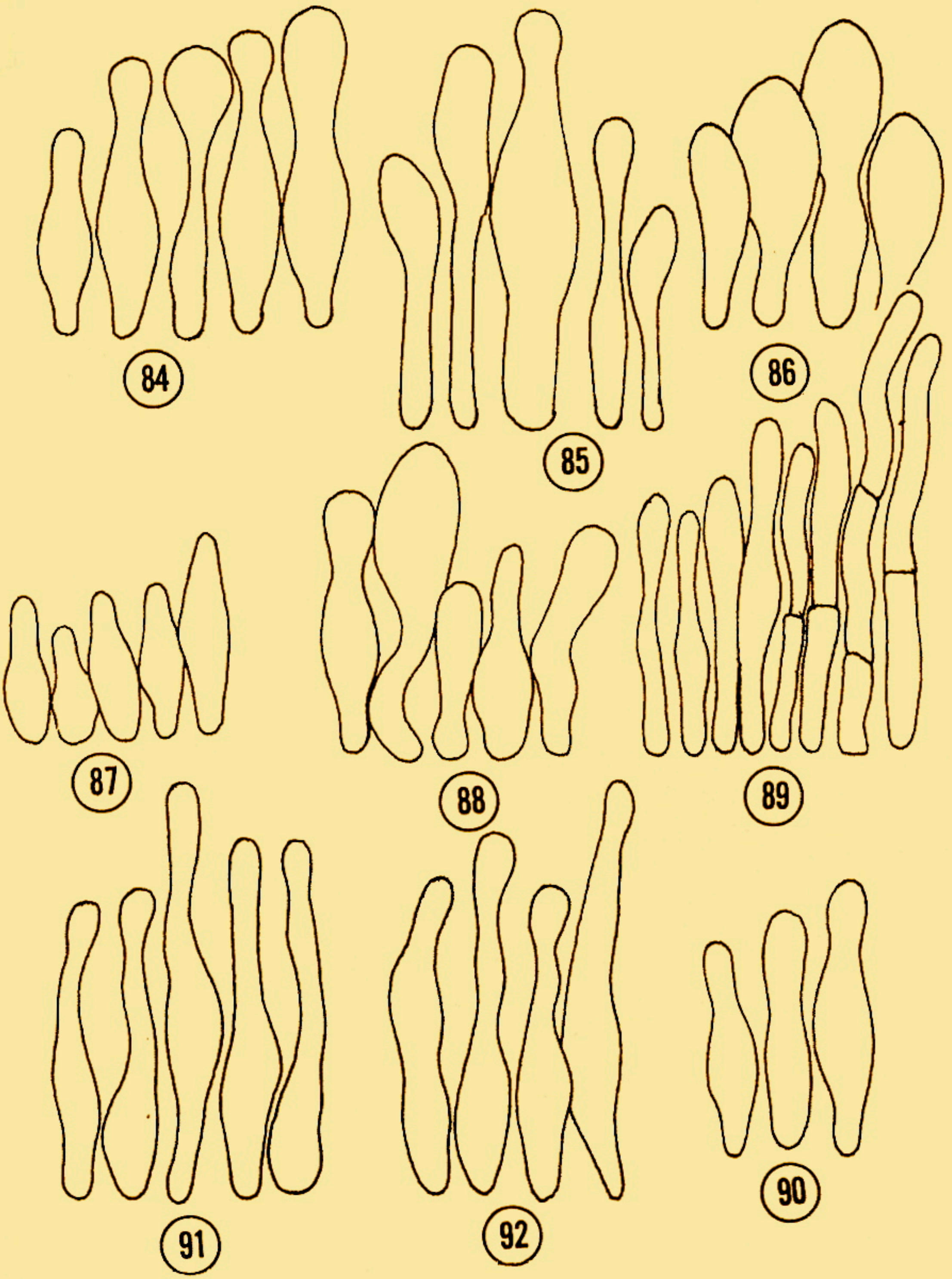



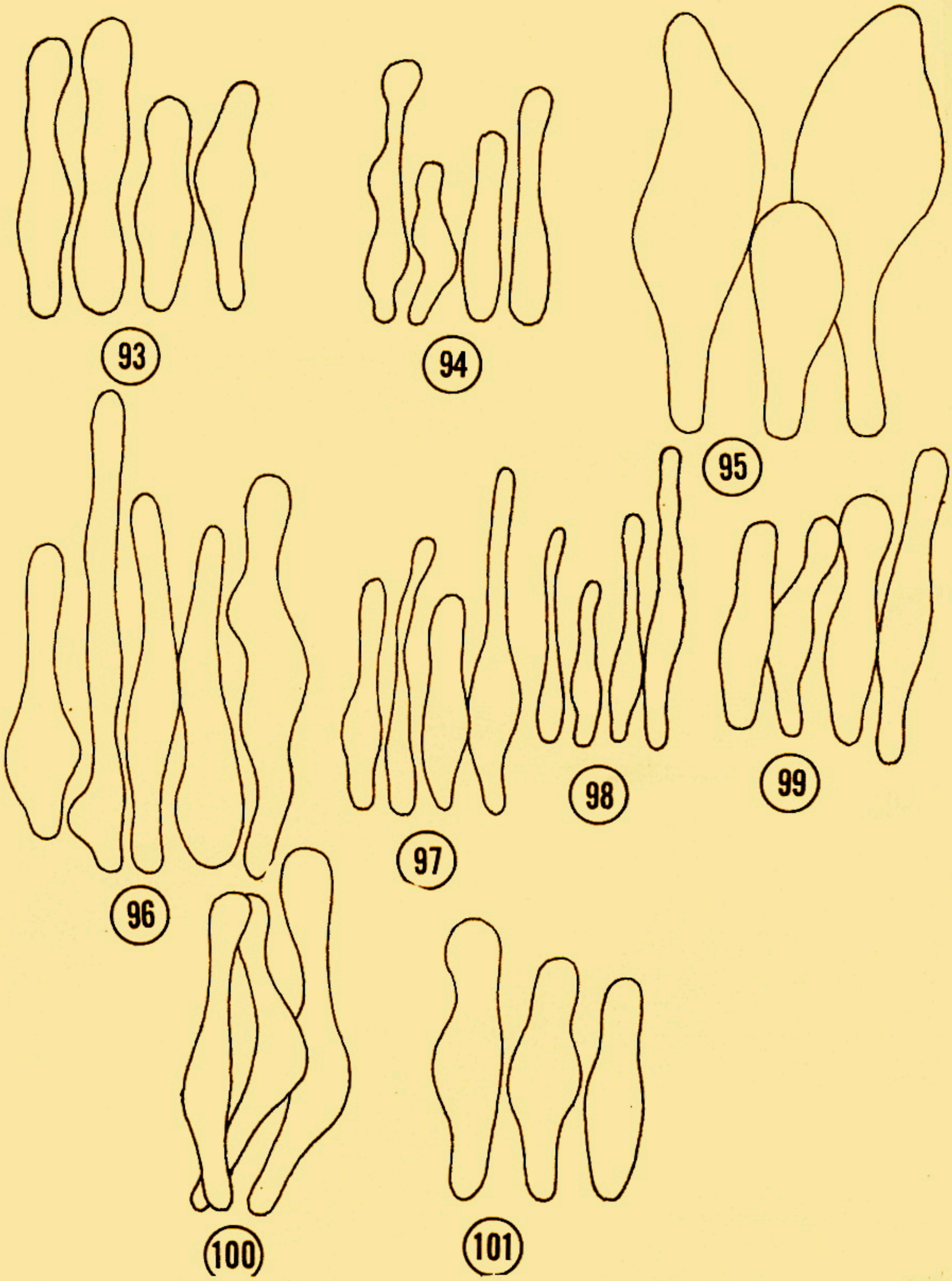



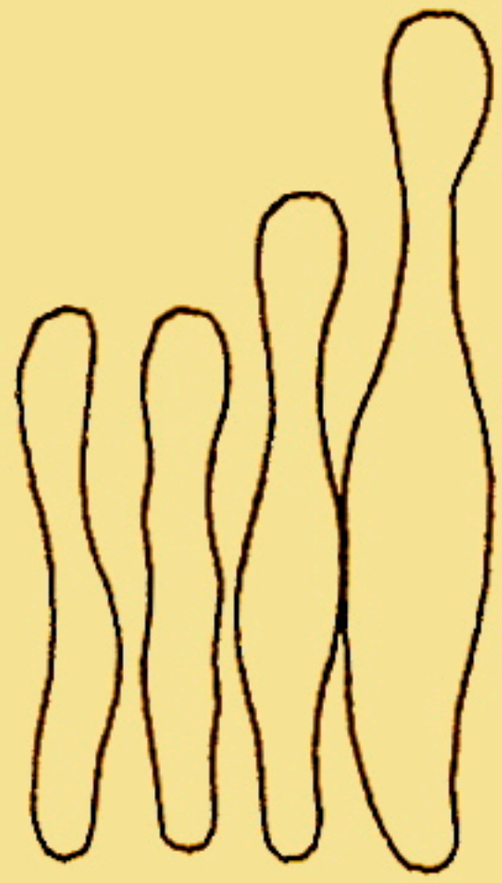

FIGS. 74–83. Cystidia (× 1000). *G. liquiritiae,* Tenn-26089: 74, caulo; 75–77. *G. luteoviridis,* type: 75, pl; 76, ch; 77, basidioles; 78–81. *G. mitis,* type: 78, pl; 79, ch; 80, pileo; 81, caulo; 82. *G. naucorioides,* type, ch; 83. *G. oregonensis,* type: pl.




FIGS. 84–92. Cystidia (× 1000). *G. oregonensis,* type: 84, ch; 85, pileo. 86–89. *G. pacificus,* type: 86, pl; 87, ch; 88, basidioles; 89, caulo; 90–92. *G. penetrans,* Lundell-17: 90, pl; 91, ch; 92, caulo.




FIGS. 93–101. Cystidia (× 1000). 93–96. *G. picreus,* Sm-73818: 93, pl; 94, ch; 95, pileo; 96, caulo; 97–98. *G. punctifolius,* type: 97, pl; 98, ch; 99–100. *G. sapineus,* Sm-44155: 99, pl; 100, ch; *G. spectabilis,* Sm-47366: 101, pl.



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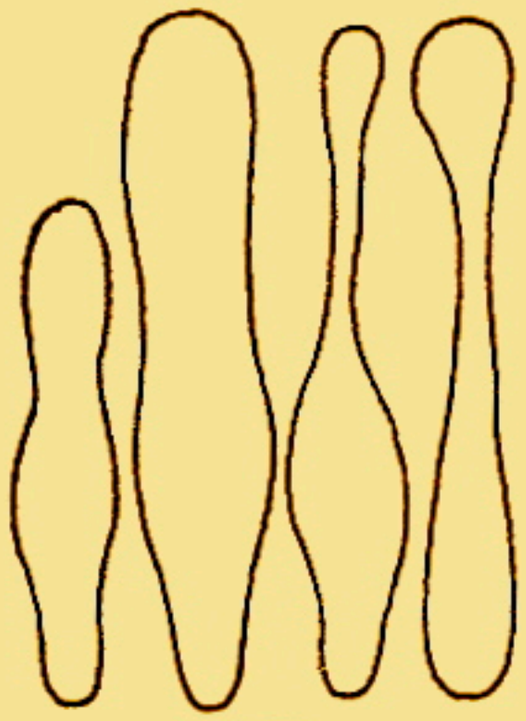

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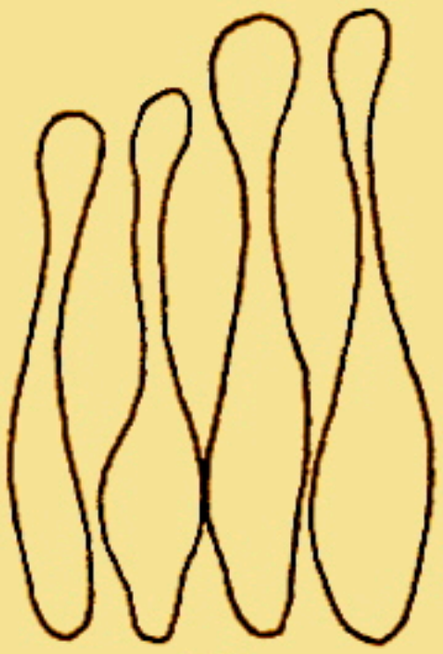

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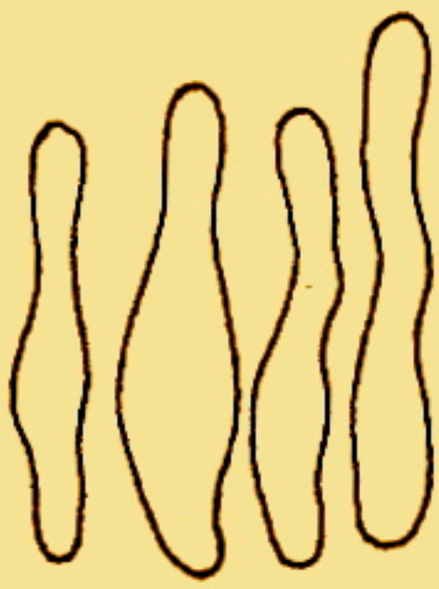

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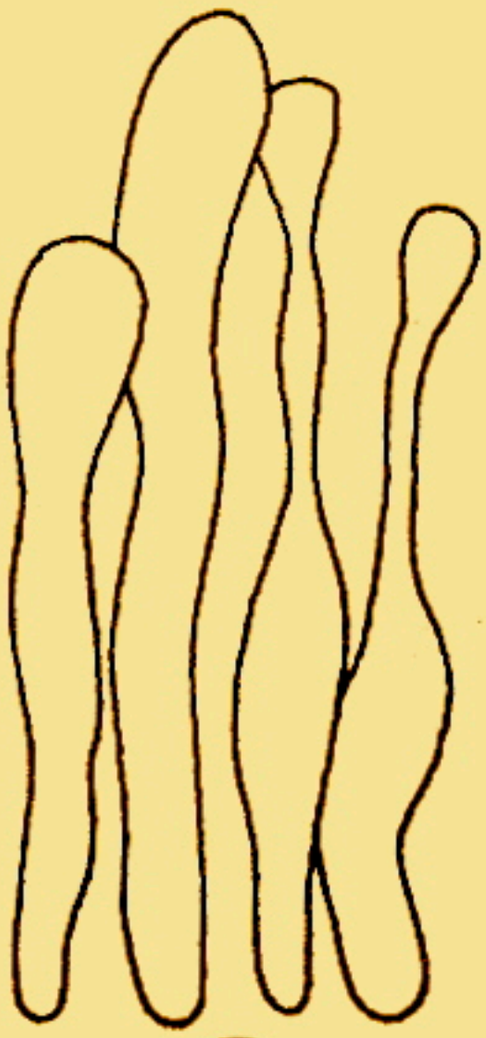

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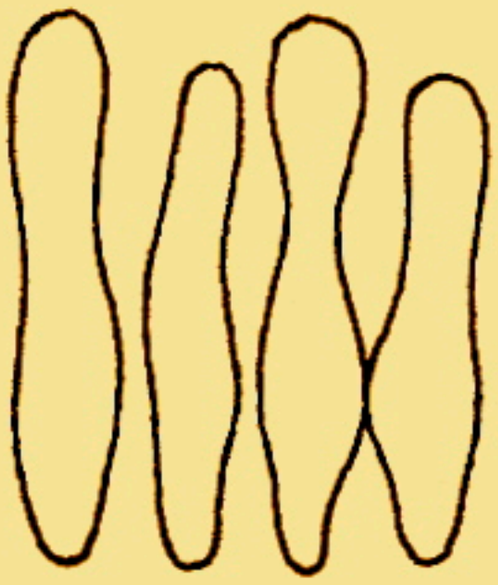

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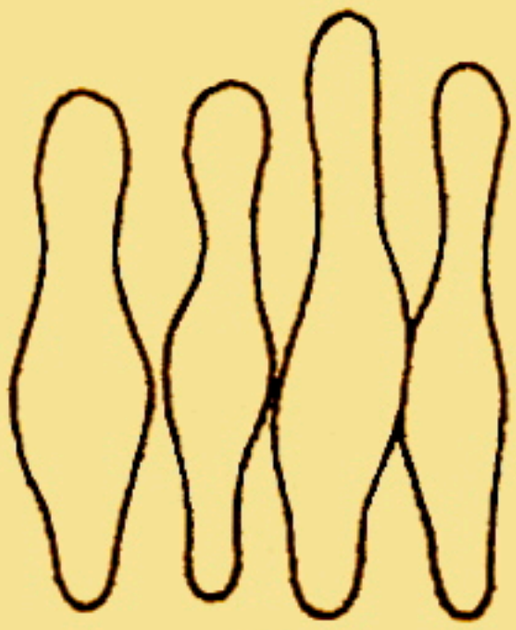

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FIGS. 102–108. Cystidia (× 1000). *G. spectabilis,* Sm-47366: 102, ch; 103–105. *G. sub-bellulus,* type: 103, pl; 104, ch; 105, pileo; 106–108. *G. subdryophilus,* type: 106, pl; 107, ch; 108, caulo.

FIG. 109. *Gymnopilus spectabilis* × ⅓. Photo by Smith.

FIG. 110. *Gymnopilus spectabilis* × ½. Photo by Smith.

FIG. 111. *Gymnopilus spectabilis* × ½. Photo by Smith.

FIG. 112. *Gymnopilus terrestris* × ½. Photo by Smith.

FIG. 113. *Gymnopilus punctifolius* × ¾. Photo by Smith.

FIGS. 114, 115. 114. *Gymnopilus bellulus* × ⅘. Photo by Smith. 115. *Gymnopilus rufescens* × 1. Photo by Smith.

FIG. 116. *Gymnopilus sordidostipes* × ¾. Photo by Smith.

FIG. 117. *Gymnopilus aurantiophyllus* × ¾. Photo by Smith.

FIGS. 118, 119. 118. *Gymnopilus flavidellus* × 5/6. 119. *Gymnopilus fulgens* × 1. Photo by Smith.

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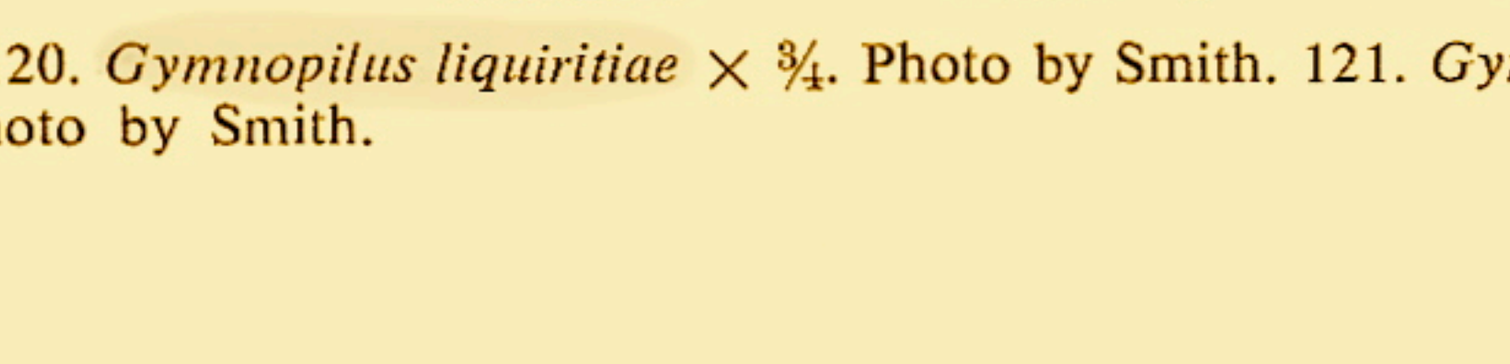

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FIGS. 120, 121. 120. *Gymnopilus liquiritiae* × ¾. Photo by Smith. 121. *Gymnopilus humicola* × 1. Photo by Smith.

FIG. 122. *Gymnopilus aeruginosus* × ⅝.

FIGS. 123, 124. 123. *Gymnopilus aeruginosus* × ½. Photo by Smith. 124. *Gymnopilus sapineus* × 1. Photo by Smith.

FIGS. 125, 126. 125. *Gymnopilus luteofolius* × ⅔. 126. *Gymnopilus picreus* × 1. Photo by Smith.

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